

A J O M C

Asian Journal of Organic & Medicinal Chemistry

Volume 7, Number 2

April - June 2022

ISSN: 2456-8937



<http://ajomc.asianpubs.org>



Asian Publication Corporation
Sahibabad (India)
<http://asianpubs.org>

Editor-in-Chief

Dr. Bimal K. Bainik

Vice President of Research & Education Development
Community Health Systems of South Texas
Edinburg, USA

Asian Journal of Organic & Medicinal Chemistry

Editor-in-Chief

Bimal Krishna Banik

Professor and Senior Researcher
Department of Mathematics and Natural Sciences
College of Sciences and Human Studies
Deanship of Research Development
Prince Mohammad Bin Fahd University, Kingdom of Saudi Arabia

Editorial Advisory Board

Prof. (Dr.) Doralyn S. Dalisay

Head, Department of Pharmacy

College of Pharmacy and Medical Technology University of San Agustin Iloilo City, Philippines

Prof. (Dr.) Hongchao Zheng

Center for Integrative Chemical Biology and Drug Discovery,

UNC-Chapel Hill, Chapel Hill, NC 27599

Prof. (Dr.) Marek Cyprian Chmielewski

Institute of Organic Chemistry

PASKasprzaka 44/5201 - 224 Warsaw 42,

P.O. Box 58 Poland

Prof. (Dr.) Joaquín Tamariz

Department of Organic Chemistry, National School of Biological Sciences,

National Polytechnic Institute. Prol. Carpio and Plan de Ayala, 11340 Mexico City, DF, Mexico

Dr. Biswa Mohan Sahoo

Department of Pharmaceutical Chemistry

Vikas College of Pharmacy, Vissannapeta, Krishna Dist.

Andhra Pradesh, India

Dr. Pranjal Baruah

Department of Applied Science

Gauhati University, Guwahati, India

Dr. Jhuma Ganguly

Department of Chemistry

Indian Institute of Engineering Science and Technology

Shibpur, India

Dr. Chittaranjan Sinha

Department of Chemistry

Jadavpur University, Kolkata, India

Dr. Aman Bhalla

Assistant Professor

Department of Chemistry & Center of Advanced Studies in Chemistry

Panjab University, Chandigarh

Dr. Hemant Vilas Chavan

Department of Chemistry

A.S.P. College, Devrukh, Ratnagiri, India

Dr. Seema P Mengshetti

Emory University, E469

Laboratory of Biochemical Pharmacology

Health Sciences Research Building

1760 Haygood Drive, Atlanta GA 30322

Dr. Shovan Mondal

Department of Chemistry

Syamsundar College, Shyamsundar, Purba Bardhaman, India

Asian Journal of Organic & Medicinal Chemistry

Special Issue

On

**Current Trend on Research in Applied Science,
Management and Technology**

CONTENTS

Research Papers

- Synthesis of Template Mediated Doped Complex with Thiourea and Phthalic Acid** 1 – 7
Priyashree Sindhu, Monika Chahar, Sushila Singhal and Anjali Ahlawat
- Bihar Ke Shekhpura Jile Kee Jalaapoorti Evan Jal Prabandhan Kee Ek Bhaugolik Adhyayan** 8 – 9
Sanjay Kumar Sinha
- Geographical Review of the Causes of Origin of India's Urban Slums** 10 – 12
Krishna Kumar Yadav
- Gramin Area Development for Government of Sikkim** 13 – 16
Nisha Balani and Aziz Sheikh
- A Design and Implementation of Space Educational Portal** 17 – 22
Nisha Balani and Farheen Sheikh
- Design of a Text Summarization Using Elephant Herd Optimization** 23 – 29
Sachin Chaudhary and Mahevash Madiha Sheikh
- IoT & Cloud Based Greenhouse Monitoring System** 30 – 36
Shubhangi Giripunje, Samata Talatule and Karishma B. Gondule
- IoT Based Real Time Potholes Detection System Using GPS and Ultrasonic Sensor** 37 – 40
Gaurav Sambhe and Chetana Gondane
- WSN and IoT Based Train Track Fault Monitoring System** 41 – 44
Narendra Bawane, Parinay Lawatre and Mrunal Thakre
- Highway Traffic Management System Using Wireless Sensor Network** 45 – 48
Narendra G. Bawane and Priyanka Sudhakar Raurale
- Analysis of 5 Different Gases in Air Using IoT (Internet of Things) and Cloud Computing With Air Condensed Purification System** 49 – 53
Anil Bavaskar and Prajwal Shende
- Recognition and Identification of Human Activity** 54 – 57
Sachin Chaudhary and Snehal Wankhede

Secure Data Transfer through Internet Using Image Steganography	58 – 63
<i>Kishor Peshwani and Nikita S. Jamgade</i>	
An Implementation on Prediction of Covid-19 Using Machine Learning Techniques	64 – 70
<i>Gaurav Sambhe and Shubham Gajbhiye</i>	
An Implementation on Fire Fighting Robot Using IoT (Internet of Things) and Cloud Computing	71 – 75
<i>Anil Bawaskar and Tejswini Kakde</i>	
Technology Adoption Models: A Study on Brick Kiln Firms in Punjab	76 – 81
<i>Ajay Kumar and Shamily Jaggi</i>	
Natural Language Processing For Medical Information Extraction	82 – 86
<i>B. Backiyalakshmi and M. Rajakumar</i>	
Formulation and Evaluation of Thermosensitive Dental Sol-Gel of Azadirachtin & Serratiopeptidase	87 – 96
<i>Piyush Raj Singh Chauhan and Upasana Sharma</i>	
Effect of Partially Purified Phenolic Rich Fractions of Acacia Nilotica on Enzymes of Spodoptera Litura	97 – 100
<i>Swati Gautam, Satwinder Kaur Sohal and Samiksha</i>	
Excess Molar Volumes, Excess Isentropic Compressibilities and Excess Refractive Indices of Binary Mixture Containing Ethyl Laurate (E.L) and 3-Methylbutan-1-Ol (3m1b) At Different Temperatures (298.15k, 303.15k, 308.15k, 313.15 K, 318.15k)	101 – 108
<i>Sunita Rani, Nisha Sangwan, Rajesh K. Siwach and Vimal Sinha</i>	
A Comparative Study of Ecocriticism in the Select Novels of Easterine Kire and Chinua Achebe	109 – 114
<i>Sonali Dudihalli and Pramod Kumar</i>	
Pathophysiological Changes in Cord Blood and Placenta in Anaemic and Hypertensive Pregnant Women	115 – 120
<i>Shahina Khan, Yogesh Tripathi, Rinku Garg, Dolly Rastogi and Yogesh Kumar Yadav</i>	
Sonicated Assisted Synthesis of 2-Aryl Benzimidazoles and 2-Aryl Benzoxazoles by Using Ammonium Copper Sulphate as A Catalyst in Aqueous Media	121 – 125
<i>Anil Solunke, Mahesh More, Sandip Agre and Tanuja Kadre</i>	
Cerium (III) Triflate Promoted Synthesis of 2-Substituted Quinazolin-4(3h)-Ones from 2-Amino Benzoic Acid and Benzoyl Chloride	126 - 131
<i>Mahesh More, Anil Solunke, Sandip Agare, Sandip Pardeshi, Jayant Sonar and Tanuja Kadre</i>	

User Satisfaction on Library Resources and Services: A Study of Government District Public Library	132 - 136
<i>Arun Kumar Pandey and Ashok Kumar Upadhyay</i>	
Synthesis and Pharmacological Activity of Phenylethylidene Derivatives	137 – 140
<i>Shivansh Mishra and Amit K Chaturvedi</i>	
Significance of Customer Feedback System as an Effective CRM Strategy in the Hospitality Industry	141 – 144
<i>Pushpa Gore and Atul Ramgade</i>	
Identification of Metabolites from an Active Fraction of Paracetamol 500 mg Tablet Sample by Gas Chromatography Mass Spectrometry	145 – 153
<i>Rohit S. Gupta and R R Deshmukh</i>	
Socio-Economic Issues and Work-Based Health Ailments among the Flower Farming Labourers - A Case Study in a Village of North 24 Parganas District, West Bengal	154 – 161
<i>Priyabrata Mondal, Suvankar Paul, Baishakhi Roy and Abhijit Das</i>	
Microwave Assisted Synthesis of 3, 4-Dihydropyrimidin-2(1h)- Ones/Thiones Under Solvent Free Condition by Using Ecofriendly Nanocrystalline AlCl₃ Loaded ZnO Catalyst'	162 – 169
<i>P. J. Unde, D. D. Anuse, S. D. Bhakare, L.P Sutar and L. R. Patil</i>	
Factors Affecting Utilization of Maternal Health Care Services: A Literature Review	170 – 172
<i>Dharaben P. Patel, K. K. Patel and Jignesh C. Patel</i>	
An Investigation into India's Financial Inclusion Status	173 – 180
<i>Manisha Badgujar and Shital V Thakare</i>	
Floristic and Phytosociological Studies of Weeds in Some State of India: A Review	181 – 188
<i>V.A. Jondhale and S.P. Giri</i>	
Beti Bachao Beti Padaho -An Effort by Government to Advance Gender Equality	189 – 191
<i>Prabha Singh Parihar and Waseem Ahmad Khan</i>	
Secure and High Performance Hybrid Socket Based Approach for Cloud Environment	192 – 203
<i>Radhika Garg and Kavita Mittal</i>	
Mild and Efficient Synthesis of 4,4'-(Arylmethylene) Bis(1h-Pyrazol-5-Ols) Catalyzed by Boric Acid in Water at Room Temperature	204 – 208
<i>Rupnar B. D., Shirsat A. J., Bhagat S. S., Jadhav S. B. and Pagore V. P.</i>	
Study on Gender Differences in Investment Patterns	209 – 215
<i>Yashoda Durge and Nitin Dongre</i>	

Secure Clustered Approach to Secure Big Data Transmission	216 – 229
<i>Sugandha and Kavita Mittal</i>	
Improvement of E-Healthcare System Using Advanced IoT Based Model	230 – 241
<i>Niyati Jain and Kavita Mittal</i>	
The Suffering of Subaltern in the Sub- Saharan Culture	242 - 245
<i>Angelitta Joanne Devika. A</i>	
Self- Efficacy, Burnout and Sex Roles among Women Employees: A Psychological Analysis	246 - 251
<i>Nirmala Kaushik and Ramnath</i>	
Glutamic Acid as an Efficient Catalyst Used for the Synthesis of 5-Arylidene-2, 4-Thiazolidinediones	252 – 254
<i>Prashant G. Kumdale and Nana V. Shitole</i>	
Cybercrime: Youth Awareness Survey in Mumbai, India	255 – 260
<i>Yogita A. Bhagwat and P. Dolly Diana</i>	
Emotional Intelligence in Indian Organizations	261 – 268
<i>Devika Suryavanshi and Rinkesh Chheda</i>	
The Decision-Making Capabilities of Women in Daily House-Hold Purchases	269 – 274
<i>Sayed Amjad Kadri and Devika Suryavanshi</i>	
Outbound Tourism and Trends in Online & Offline Bookings	275 – 279
<i>Gaurav Raman Arora and Kishor Bhanushali</i>	
A Comparative Analysis between Traditional and Online Shopping and Its Impact on Consumer Buying Behaviour	280 – 288
<i>Puja Ahuja Gupta and Rambhavan Yadav</i>	
An Analysis of the Changing Consumer Behaviour towards Different Brands with Special Reference to Telecommunication Industry	289 – 296
<i>Puja Ahuja Gupta and Deepti Sadvelkar</i>	
A Study on Sustainable Agriculture: Perception and Procedures to be Followed for Limitation of the Loss	297 – 305
<i>Sayed Amjad Kadri and Devika Suryavanshi</i>	
Chemical Characteristics of Carbonaceous Aerosol during Winter Season in Noida, India	306 – 311
<i>Aparna Rai and Rahasya Mani Mishra</i>	
Right to Information: An Instrument for Good Governance	312 – 316
<i>Bhavna Singh and Rupali Bhouradia</i>	

Analysis of Agriculture Soil Quality around Lalmatia Coalfield, Jharkhand, India by Various Physico-Chemical Parameters	317 - 321
<i>Shashi Kant Kumar and Niranjan Kumar Mandal</i>	
An Ayurvedic Approach In Female Pattern Hair Loss (~Khalitya) A Case Study	322 – 327
<i>Vijay Singh Yadav</i>	
A Study of Isolation of Marine Bacteria and Its Antimicrobial	328 – 332
<i>Ivo Romauld S and Satish Mohabe</i>	
An Empirical Approach to Develop A Punjabi Dialect Tool for Hearing Impairment Students through Indian Sign Language (ISL)	333 – 337
<i>Manpreet Singh and Rajesh Sharma</i>	
Food Colors: Types, Effects on the Human Health and Their Applications	338 – 341
<i>Ginni Rani and Amita Singh</i>	
Effect of Solvent Polarity on Viscosity of 2- Hydroxy Substituted 1, 3- Dipropanone	342 – 346
<i>Dongapure A. C, Bodkhe P. S and Choudhari P. P</i>	
Internet Dependency and Emotional Maturity: Theoretical Perspective	347 – 352
<i>Gyan Prakash Pandey, Haldhar and Anil Kumar Dixit</i>	
Psychosocial Development of Primary School Students: A Study of Parishadiya Schools of Lucknow District in Uttar Pradesh	353 - 356
<i>Niharika Srivastva, Sita Devi and Anil Kumar Dixit</i>	
Scaffolded Vee Diagram as an Instructional Strategy for Enhancing Scientific Inquiry among Learners	357 – 362
<i>Ismail Thamarasseri and Shejeena K. A</i>	
Extent of Precautionary Safety Measures Adopted by the Residents of Vadodara City While Travelling for Leisure during Pandemic Covid-19	363 – 369
<i>Vashima Veerkumar, Neerja Jaiswal and Keshu Solanki</i>	
Experimental Study of Non-Damaging Drilling Fluid Using Biodegradable Reagents for Shale Stability	370 – 377
<i>Sidharth Murali and Deepjyoti Mech</i>	
The Highly D_2 – Distance of Irregular Labeling Fuzzy Graphs	378 - 381
<i>R. Suja Kumari and K. Chithamparathanu Pillai</i>	
Synthetic Study of Ni, Cu and Pd Metal Complexes with Antibacterial Analysis	382 – 385
<i>Amit Kumar</i>	

Palladium (II) Catalysed Oxidation of Aspartic Acid by Quinolinium Dichromate (QDC) In Perchloric Acid Medium: A Kinetic and Mechanistic Approach	386 – 394
<i>Priyanka Meena, Dhan Raj, Kamini Meena and Manju Bala Yadav</i>	
Bimstec: India’s Prospective in Contemporary World Order	395 – 402
<i>Mohan Singh</i>	
Chemical Fractionation of Calcium, Iron, Copper, Cadmium, Zinc and Lead in Soils near in Vicinity of Coal Based KSTPS in Kota City, Rajasthan	403 – 410
<i>Manju Meena, Bharat Singh Meena, Aparna Yadav and Manju Bala Yadav</i>	
Resurfacing Myth: A Critical Analysis of Amish Tripathi’s Narrative Technique	411 – 413
<i>Pratibha Meena and Vinita Shukla</i>	
Phytochemical Qualitative and Quantitative Analysis of Euphorbia Hirta and Euphorbia Heterophylla	414 – 419
<i>Shameem A, Akilan P, Chandrasekaran V and Bhadusha N</i>	
Study on Effect of Concentration of Emulsifying Agents in Emulsion	420 – 426
<i>Swami Avinash B, Pathan Fiza Y, Nagdare Anirudha A, Patil Devpriya R, Nakhate Rohit C, Nagoba S. N, Kawdewar D. R, Zingade S. G and Bansode Prashant S</i>	
Seasonal Variation Analysis of Groundwater Quality of “Salt City” of Rajasthan, India, Using Water Quality Index (WQI) and Pearson Correlation Matrix	427 – 434
<i>Priya Tanwar and Pallavi Mishra</i>	
Contemporary Trends in Educational Institutions – A Descriptive Study	435 – 438
<i>Dhananjay Awasarikar</i>	
A Study of Cryptocurrencies and the Future: Specifically Looking at Bitcoin in Indian Markets	439 – 443
<i>Mr. Hardik Majithia and Hitesh G. Suthar</i>	
A Study on Moral and Ethical Leadership Post Covid-19	444 – 447
<i>Usha Kumar</i>	
A Study on Designing Organizations and Managing People	448 – 456
<i>Avishek Ganguly</i>	
Study of OTT Consumption Habits during the Pandemic	457 - 466
<i>Yashoda Durge, Rukmini Durge and Ashish Vijan</i>	
Analysis and Evaluation of Digitally Managed Social Welfare Schemes with Reference to Delhi NCR	467 - 476
<i>Deepika and Himanshu Kataria</i>	

IOT based Electronic Voting Machine	477 – 481
<i>Sudhir A Kadam A Y Prabhakar and Asit Kittur</i>	
Advertising on Electronic Media-An Analysis of Its Impact on Buying Behavior with Special Emphasis on Television and Internet Advertising	482 – 487
<i>Varsha Rahul Singh and Rajesh Mankani</i>	
A Study on the Effect of Brand Image on Consumer Preference with Reference to Youth in Mumbai City	488 – 494
<i>Sae Sawant and Sanjay G. Mishra</i>	
Unlocking Enigma for EDP Management for Sugar Factory in India Using Entity Model	495 – 500
<i>Pratibha Deshmukh</i>	
Business Sustainability and Technology Obsolescence	501 – 505
<i>Vivek Nerurkar</i>	
Covid-19 Machine Learning Based Data Analysis: A Literature Review	506 - 512
<i>Manisha Shinde Pawar, Deepali Gala, Bhaskar Patil and Rajesh Kathe</i>	
Synthesis and Characterisation of Pb (II) Complexes with Some New Mixed Thia-Aza-Oxo-Macrocyclic Schiff Base Ligands	513 - 520
<i>Arpit Srivastava, Ashish Rajak, Subhash Chandra Shrivastava and Shekhar Srivastava</i>	
Synthesis and Antifungal Study of Fe, Ru and Co Transition Metal Complexes	521 – 525
<i>Amit Kumar</i>	
The Antioxidant Profile of Two Traditionally Used Medicinal Liverworts, Marchantia Paleacea and Conocephalum Conicum Growing in District Kishtwar, Jammu and Kashmir	526 – 538
<i>Mamta Verma, Parul Parihar and Nitin Katoch</i>	
Review of Different Types of Redox Reactions and their Mechanisms	539 – 544
<i>Dipak Kumar Saha</i>	
Synthesis and Antifungal Evaluation of Sulfonamide-Based Metal Drug Complexes	545 - 548
<i>Amit Kumar</i>	
Role of Angel Investors in Development of Small and Medium Enterprise	549 – 551
<i>Kritika and Aditi</i>	
Potential Herbal Anti-Cancer Drug Formulations Using Modern Drug Delivery Methods	552 – 562
<i>Chirag Goda, Ashish Kandalkar, Manish Bhise, Vinod Kumar Tiwari, Sanjay Vasu, Sunny Pahuja, Sandip Hurlpade, Balaji Thakare and Satish Shelke</i>	

Development and Validation of High Performance Thin Layer Chromatographic Method for Estimation of Favipiravir API and Its Tablet Dosage Form Using Quality by Design Approach	563 – 572
<i>Jyoti Shinde, Pankaj Kumar Sharma, Jaya Sharma, Monika Dandwate and Madhuri Shelar</i>	
Synthesis of a New Series of Dyes from O–(3-Chloro 4-Hydroxy Benzoyl) Benzoic Acid	573 – 576
<i>Sharat Srivastava, Harsh Kumar Garg and Umesh Chandra Mishra</i>	
Critical Analysis of Legislative Framework of Women Empowerment in India	577 – 582
<i>Priti Sandesh Sodaye, Mrityunjai Pandey and Amin Kumar Singh</i>	
Social Media and Youth: A Study of Uses and Impacts	583 – 592
<i>Jinal Mehta and Sanjay G. Mishra</i>	
Effect of Social Media on Youngster’s Food Choices	593 – 598
<i>Palwinder Singh Bhatia and Ashima Sahni</i>	
Consumer’s Preference towards Online Shopping: A Case Study on College Students of Tinsukia Town	599 - 603
<i>Lipika Jyoti Dowarah</i>	
Antimicrobial Activity and Phytochemical Analysis of Lagerstroemia Microcarpa against Bacterial Pathogens	604 – 612
<i>Gunasekaran T, Akilan P, Chandrasekaran V and Kannan A</i>	
Biosynthesis of Silver Nanoparticles Using Euphorbia Hirta and Euphorbia Heterophylla Methanolic Leaf Extract and Their Synthesis, Characterization, Antibacterial and Antioxidant Activity	613 – 621
<i>Shameem A, Akilan P, Chandrasekaran V and Bhadusha N</i>	
Cybernetic Ischemic Stroke Spotting With Machine Learning	622 – 626
<i>Shravya Vasanth P and Pushpalatha R</i>	
Plants Genetic Resource Conservation in India: A Review Article	627 – 631
<i>Tambe S. S</i>	
Review on Different Synthetic Routes of Substituted Quinoline Moiety and Its Biological Utility	632 – 637
<i>Yogita Gulabrao Bodkhe and Jyotsna V. Khobragade</i>	
Role of Women in Labour Market in India	638 – 641
<i>Koel Roy Choudhury</i>	
Retail Banking Sector: Covid, Challenges & Indian Government Measures	642 – 650
<i>Archana Singh and Jyoti Chandel</i>	

Women in History Textbooks of West Bengal Board of Secondary Education and Central Board of Secondary Education	651 – 656
<i>Barsha Chhetri and Lalbiakdiki Hnamte</i>	
Patients's Attitude Regarding Satisfaction Level on Higher Health Service Quality in Public and Private Hospitals in Punjab	657 – 664
<i>Satpal and Munish Kumat Talwar</i>	
Studies of Bioethanol Production Using Saccharomyces Cerevisiae J-16	665 – 670
<i>Jyoti Kumari</i>	
Microwave Assisted Synthesis of Acid Activated Fly Ash Catalyst and Application in Esterification Reactions	671 – 679
<i>Kiran Parashar, Deepa Meena, Sakshi Kabra Malpani and Ashu Rani</i>	
Topical Application of Oil Gel Derived From N-(2-Aminoethyl)-Oleamide	680 – 685
<i>Joshi Narendra, Govinda Waghulde, Chandrakant Sarode and Gaurav Gupta</i>	
Patient Satisfaction: Impact on Public and Private Hospitals in Punjab	686 - 698
<i>Satpal and Munish Kumar Talwar</i>	
A Study of the Need & Adaptation of Corporate Accelerator in the Indian Startup Ecosystem	699 – 711
<i>Tinoo Ubale and Gurmeet Singh</i>	
Nonlinear Optical Response of Li⁺ - Cs⁺ Doped ZNS-PVP Nanocomposites	712 – 715
<i>Swarnalata Sunatkari</i>	
The Emergence and Development of Legal Safegaurds against the Violence of Indian Women	716 – 721
<i>Mahendra Kumar Sharma and Vinod Kumar Saroj</i>	
RP-HPLC Method for Simultaneous Estimation of (S)-Amlodipine Gentisate from Pharmaceutical Formula: Development and Validation	722 – 728
<i>Parvez Shaikh, Pradeep Shimpi and Raj Badekar</i>	
The Development and Validation of the RP-HPLC Method for the Newly Synthesized (R)-Amlodipine-DI-P-Toluidine-L- Tartaric Acid	729 - 735
<i>Chandrashekhar Kotkar, Parvez Shaikh and Raj Badekar</i>	
HR Analytics to Training Analytics: A Systematic Literature Review	736 – 749
<i>Ashutosh Shukla and Ankita Nagpal</i>	
Cloud Data Verification Using the Merkle Hash Tree	750 – 754
<i>Dharavath Nagesh, Harsh Lohiya and Laxmaiah Mettu</i>	

A Study of Perceptions of E-Library Use as Academic Library Services	755 – 759
<i>Ritesh kumar and Arun Modak</i>	
Cancer Prediction Using Asom Based Datamining Technique	760 – 765
<i>Prasad Bobbillapati, Narendra Sharma and Laxmaiah Mettu</i>	
A Study of Efficient Algorithm of Artificial Intelligence Used Towards Smart Machine Tools	766 – 772
<i>Snehasis Dey, Prabodh Khampariya and Manish Jain</i>	
Machine Learning Techniques to Extract the Information from Scientific Articles	773 – 778
<i>Sumanlatha G, Pankaj Kawadkar and Laxmaiah Mettu</i>	
Detection of Cyber Attacks Using Voice Recognition Technique	779 – 784
<i>Vijaya Babu Kuchipudi, Harsh Pratap Singh and Laxmaiah Mettu</i>	
Preparation, Optimization and Evaluation of Clobetasol-17- Propionate Loaded Carboxymethyl Chitosan Nanoparticle	785 – 797
<i>Mamta Yadav, Pankaj Aggarwal, Anand Singh and Deepika Yadav</i>	
Validation of the ‘DICE Test’ as a Measure of Information Processing Speed in People with Traumatic Brain Injury	798 – 804
<i>Srinivasan Jayaraman, R. Neelakandan, R. Rajendran and Jonathen Evans</i>	
Self-Esteem and its Impact on Academic Achievement among DDU Gorakhpur University Student (U.P.) India	805 – 812
<i>Rajesh Kumar Sharma and Sanad Kumar Gautam</i>	
Association Rule Mining and its Improved Approaches of Retail Sector: Data Mining Techniques	813 – 821
<i>Ashfaq Ahmed Khan and S Krishna Mohan Rao</i>	
Stratospheric Ozone Depletion, Ultraviolet Radiation and their Effect on Environment: A Review	822 – 827
<i>Dipak Kumar Saha</i>	
Preparation, Optimization and Evaluation of Voriconazole Loaded Tri-Methyl Chitosan Nanoparticles	828 - 840
<i>Deepika Yadav, Pankaj Aggarwal, Anand Singh and Mamta Yadav</i>	

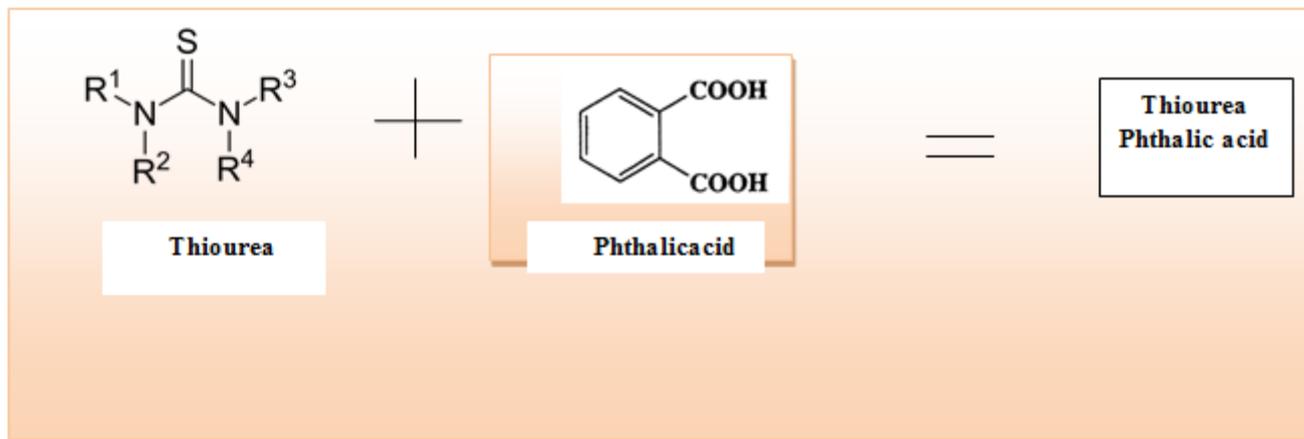
Synthesis of Template Mediated Doped Complex with Thiourea and Phthalic Acid

Priyashree Sindhu¹, Monika Chahar², Sushila Singhal^{2*} and Anjali Ahlawat³

^{1,2,3}Department of Chemistry, Baba Masth Nath University, Asthal Bohar Rohtak- 124021, India

^{2*}Deshbandhu College Delhi University, Kalkaji Delhi- 110019, India

GRAPHICAL ABSTRACT



ABSTRACT

In this experiment, there has been developed an organic “non-linear optical (NLO)” material of Thiourea-Phthalic acid (TP) was synthesized and using the slow evaporation method, the single crystals were. After that, by using the “NMR spectroscopy” and the single crystal “X-ray diffraction techniques”, the molecular structure of TG was explored. Within the compound, there was present the vibration mode of the functional group, which was identified with the FTIR spectroscopic techniques having absorbance spectrum of 1604.44cm⁻¹, 3203.11cm⁻¹, 3620cm⁻¹. The grown crystal from this experiment exhibited a very high optical transmittance approximately 63% within the range of 230-1000 nm.

Keywords: thiourea, phthalic acid, UV, NMR, xrd analysis, spectrophotometry, mass

INTRODUCTION

The topic “Template mediated synthesis of macrocycles containing succinimide and thiourea-applications to pharmaceuticals, photosystems and environment” basically is self-explanatory and has been devised to tackle problems related to drugs, solar energy and pollution. The issues often faced with drugs treating cancers are their low water solubility and toxicity affecting healthy tissues, thus for handling such problems targeted drug-delivery system is needed for higher therapeutic effects. Reducing environmental pollution has become a major challenge today as its ill effects are showing up as diseases in humans, animals and on the environment itself. Much concern is about the toxic heavy metals discharged by chemical, electronics and metallurgical industries polluting water bodies and soil, therefore methods are needed for their measurement and removal. Secondly volatile organic compounds giving out toxic gases cause several damaging health effects ranging from conjunctivital irritation to cancer, hence their sensing is of utmost importance to know their concentration. Such macrocycles can prove to be efficient in removing metals with good ligational features. Energy crisis have driven human kind towards the research of harvesting solar energy like photosynthesis. Thus the need of artificial photosynthesis is there which can be dealt by conjugated macrocycles like porphyrin.

Phthalic acid is known as the aromatic dicarboxylic acid, which can be used in the formation of anhydride. It can help to produce other chemicals such as different dyes, perfumes and other useful products. Based on the studies of previous years, it has been found as the most effective strategy to produce organic acid. In this sense, this study is known as green chemistry, which plays an important role in the formation of heterocyclic compounds. These compounds can be developed using a “non-toxic substrate and an environmental benign nature”. Thiourea refers to the type of organosulfur chemical and its structure is as similar to that of urea. This type of compound is used in the formation of pharmaceutical products (Fahadet al., 2019). Phthalic acid refers to the type of compound, that can easily be degradable and its nature is benign for the environment, as it can be degraded by the bacteria called Pseudomonas species. Based on these perspectives this study is going to discuss the process of making Phthalic acid (McGuire et al., 2021), which can be catalyzed by the “synthesis of 3,4-

dihydropyridine-2-(1H)-one derivative". In addition, this study has also focused on the production of the **"phthalate urea and phthalicthiourea"**. The primary focus of this study is to analyze the importance of both chemicals in the medical industry and for other purposes.

EXPERIMENTAL METHODS

Material Synthesis and Crystal Growth Method

ThioureaPhthalic (TP) compound was synthesized from the commercially available Thiourea and Phthalic acid. In this experiment, both the compounds were taken into their equimolar ratio and the compounds were dissolved into double distilled water as the solvent. According to fig 1, the homogeneous solution was prepared by stirring it continuously for 4 hours at room temperature and then the solution is successively filtered within the clean beaker using the **"Whatman grade-1 filter paper"**. In this context, the beaker was completely covered with transparent polythene paper however; five perforations were made to explore the slow process of evaporation. Within the 9 days span of the experiment, the crystalline substances of TP were taken from the solution. After that, using the recrystallization process (Al-Jubanawiet al., 2021), the obtained compound was purified. There has been prepared approximately 50 ml of the saturated solution using double distilled water (solvent) and filtered the solution using the cleaned beaker. The slow process of evaporation was encouraged using the tightly covered polythene paper. Within 1 week, an optically high-quality single crystal compound TP (ThioureaPhthalic) was harvested from the solution.

MATERIALS AND METHODS

In order to be continued with this study, the required materials are such as **"Phthalic acid, Thiourea, a Hot plate, Water Condenser, Double distilled water, and Ethanol and the temperature required for this process is approximately 70-80 degrees celsius"**.

The compound **Phthalic acid** is basically produced by the **"catalytic oxidation of naphthalene"**, which can be directly converted into the Phthalic anhydride. The rate of toxicity of the Phthalic acid is moderate with **"LD50 of 550 mg/kg"**. In addition, **Thiourea** refers to the organosulfur compound and the structure is similar to urea. This substance is normally in the process of manufacturing flame retardant raisins and it can act as the accelerator for vulcanization (Ménageret al., 2021). Moreover, the Water condemn refers to the heat exchanger, that can help to remove heat from the refrigerant vapour and can help to transfer the vapour to the water by running within the condenser. In addition, the double-distilled water is basically the purified water via distillation and then the water becomes condensed. As the double distilled water is more purified, it is used in the process of trace biochemical analysis (Pazzaglia, et al., 2019). Moreover, ethanol can be used as a chemical solvent and it can help to synthesize organic chemical compounds. This study required

Synthesis of Bis-Thiourea Phthalate Ni (II) Complex

The following procedure was used in the construction of the PTUNi complex. A solution of NiSO₄.6H₂O (10 g, 0.042 mol) in 100 mL ethanol was used as a starting point for the reaction. Thiourea (6.384 g, 0.084 mol) was added dropwise to the solution. After the solution was refluxed for nearly two hours, a mixture of phthalic anhydride (6.216 g, 0.042 mol) and sodium hydroxide (3.36 g, 0.084 mol) dissolved in water was used and placed in a volume of 40 ml. The mixture was continuously vortexed for a period of 18 hours. "After cooling the reaction mixture, the former green precipitate was filtered off and washed with distilled water, 100% pure ethanol and diethyl ether. The complex was purified by first dissolving the material in a trace of dichloromethane and then adding a significant amount of ethanol. The solution was left without stirring at room temperature for 24 hours, producing a green precipitate which was then dried in vacuo. The green substance dissolved between 160 and 162 degrees centigrade yielding 9 grams with a molecular weight of 374.693 grams per mole (57%). The complex formation process is shown in Scheme 1.

RESULT AND DISCUSSION

NMR Spectral Analysis

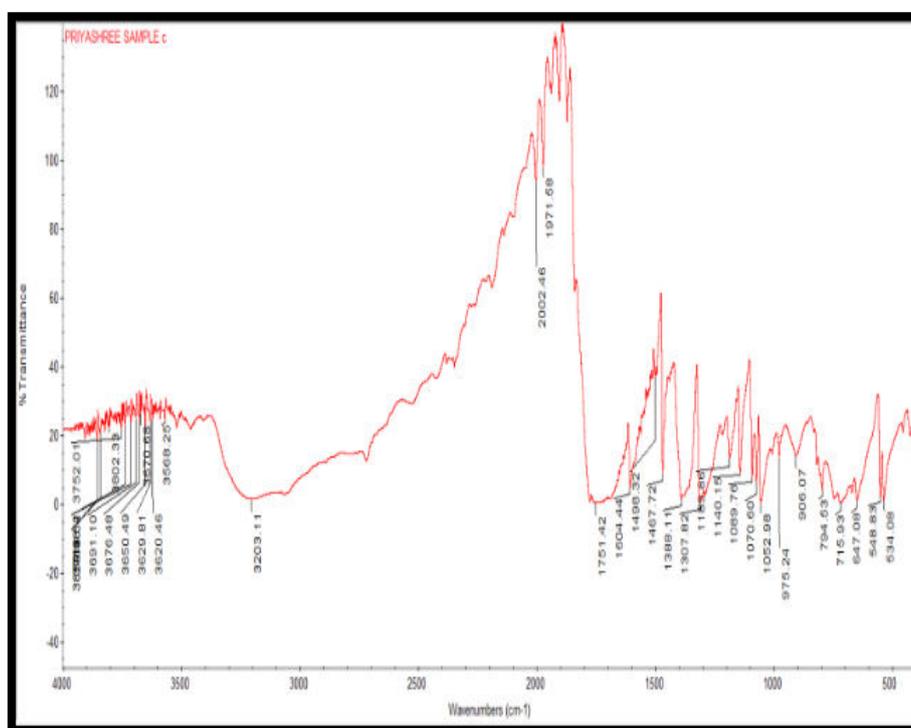
The synthesized compounds named **ThioureaPhthalic (TP)** have been characterized by the NMR spectroscopic techniques. This technique has helped to identify the molecular structure and the corresponding recorded spectrum (Al-Jubanawiet al., 2021). According to the NMR spectroscopy, it was proven the presence of 12 protons in the TP compounds and the exchangeable protons. C12 NMR spectrum shows the four numbers of the cartoon peaks corresponding to the TP compound

¹H NMR shows peaks at 7.29ppm (benzene ring) 7.25ppm, 0.87ppm CH₃, 8.70ppm, 5.41ppm, 5.16ppm ¹³C NMR shows peaks at 136.5ppm, 137.0ppm, 121.3ppm, 124.5ppm, 27.8ppm, 103.0ppm, 10.3ppm, 22.3ppm, 6.5ppm, 6.5ppm

The ^1H NMR spectroscopy is helpful in determining the total number of protons that are present in the given compound. This process also helps in determining the environmental properties of each of the atom that is depicted with the help of this spectroscopy. The different peak is seen to occur at different intensities and it gives detailed information about the formation of the hydrogen bond. The chemical shifts can be observed from the values of ppm that mainly depends on the type of solvent, temperature, and concentration (Emwas et al. 2019). The peak at 7.29ppm and 7.25 ppm depicts that the Hydrogen bond is present on the phenyl or the aromatic ring. The benzene has got a phenyl structure. The 0.87 ppm from the result of NMR spectroscopy of **ThioureaPhthalic (TP)** depicts that the hydrogen bond is present on the alkyl ring that is methyl. The 5.41 and 5.26 ppm depicts that the protons on the nitrogen is present on the amide ring.

The ^{13}C NMR spectroscopy is helpful in determining the structure of the chemical compound. The 136.5 ppm and 137 ppm 121.3ppm, 124.5ppm, 127.8ppm, 103.0 ppm depicts that the protons are shifted for a large area. This data depicts that the compound is mainly grouped under ketones and aldehydes. However, the data from the NMR spectroscopy of 22.3ppm,6.5ppm,6.5ppm depicts that the compound is mainly grouped under amino acid chain.

FTIR Spectralization

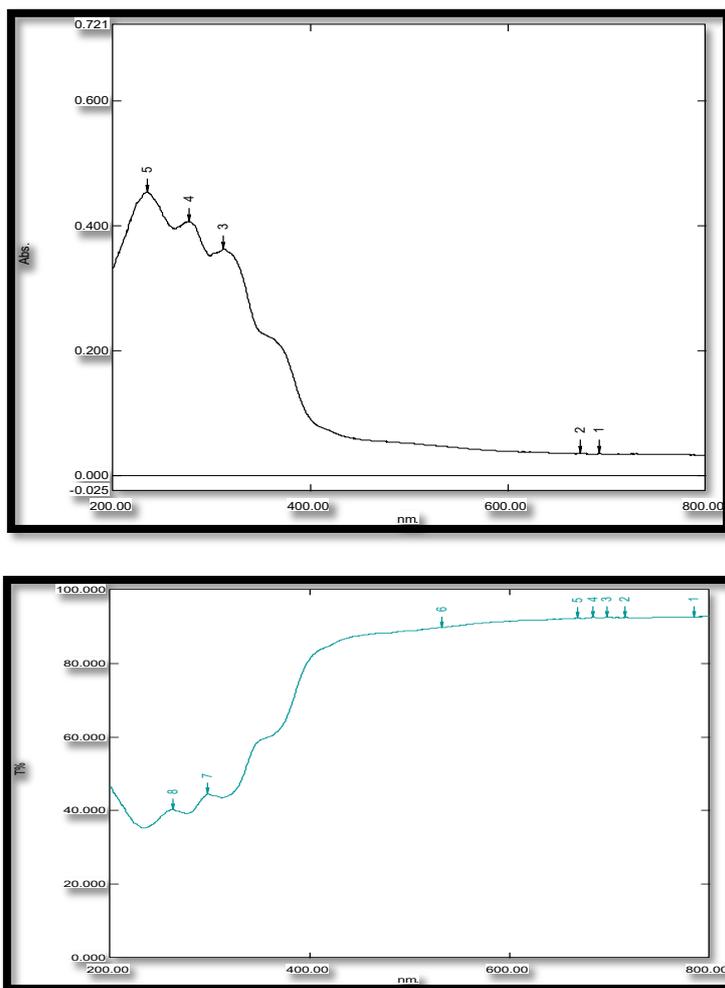


The FTIR spectralization of **ThioureaPhthalic (TP)** has been discussed that helps in determining the infrared radiation with the compound given. The % transmittance is depicted as 3203 when the wavelength is 3800 and as the compound was given a wavelength of 2000 the % transmittance is depicted as 2002. 46. The % transmittance is depicted as 1467 when the wavelength is 1500. Thus, from the following result it can be depicted that the as the wavelength is decreased the % transmittance is gets decreased (Hatzakis, 2019). This depicts that the power of absorbance gets increased with the amount of % transmittance that is depicted in **IR spectralization of ThioureaPhthalic (TP)**. The % transmittance is used to analyze the amount of the IR radiation that passes through the given sample. The light as it passes some of the light gets absorbed and that is predicated with the help of % transmittance. The total results depicts that as the wavelength is decreased the % transmittance is decreased that depicts that here the absorbance level is low with respect to the amount of light that is emitted. The result in the following in **IR spectralization of ThioureaPhthalic (TP)** depicts that at the absorbance level of 500 the % transmittance is depicted as 534 that depicts that the level of % transmittance is directly related to the amount of the light passed through the compound that is absorbed.

UV-Vis-NIR Spectral Analysis

This analytical technique has helped to measure the optical absorbance of the grown crystal. The optical absorbance was approximately higher than 65% with a range of 225-1100 n.

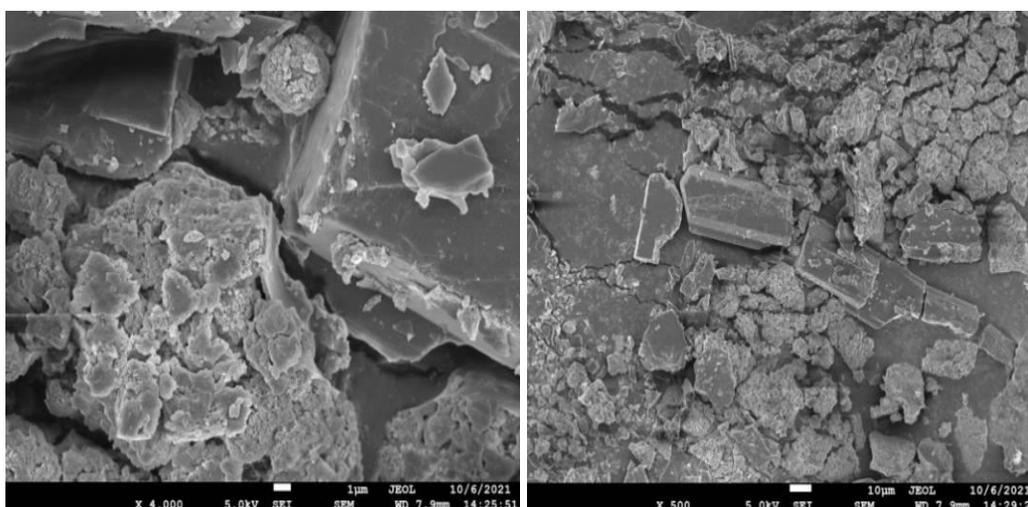
UV Graph

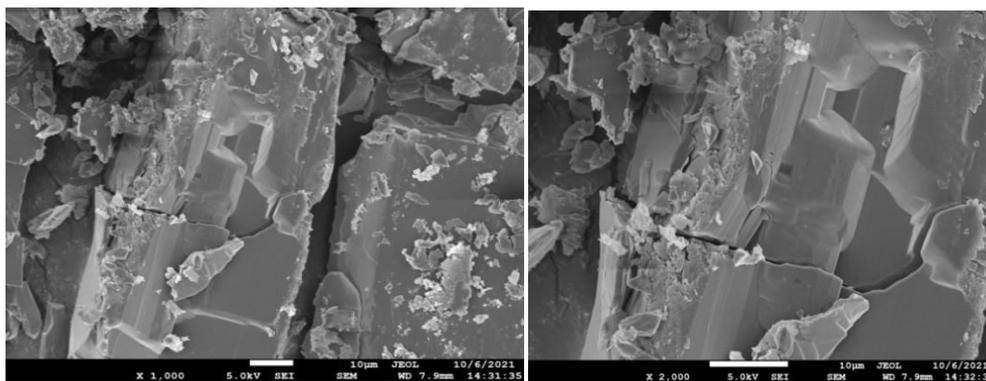


SEM Studies

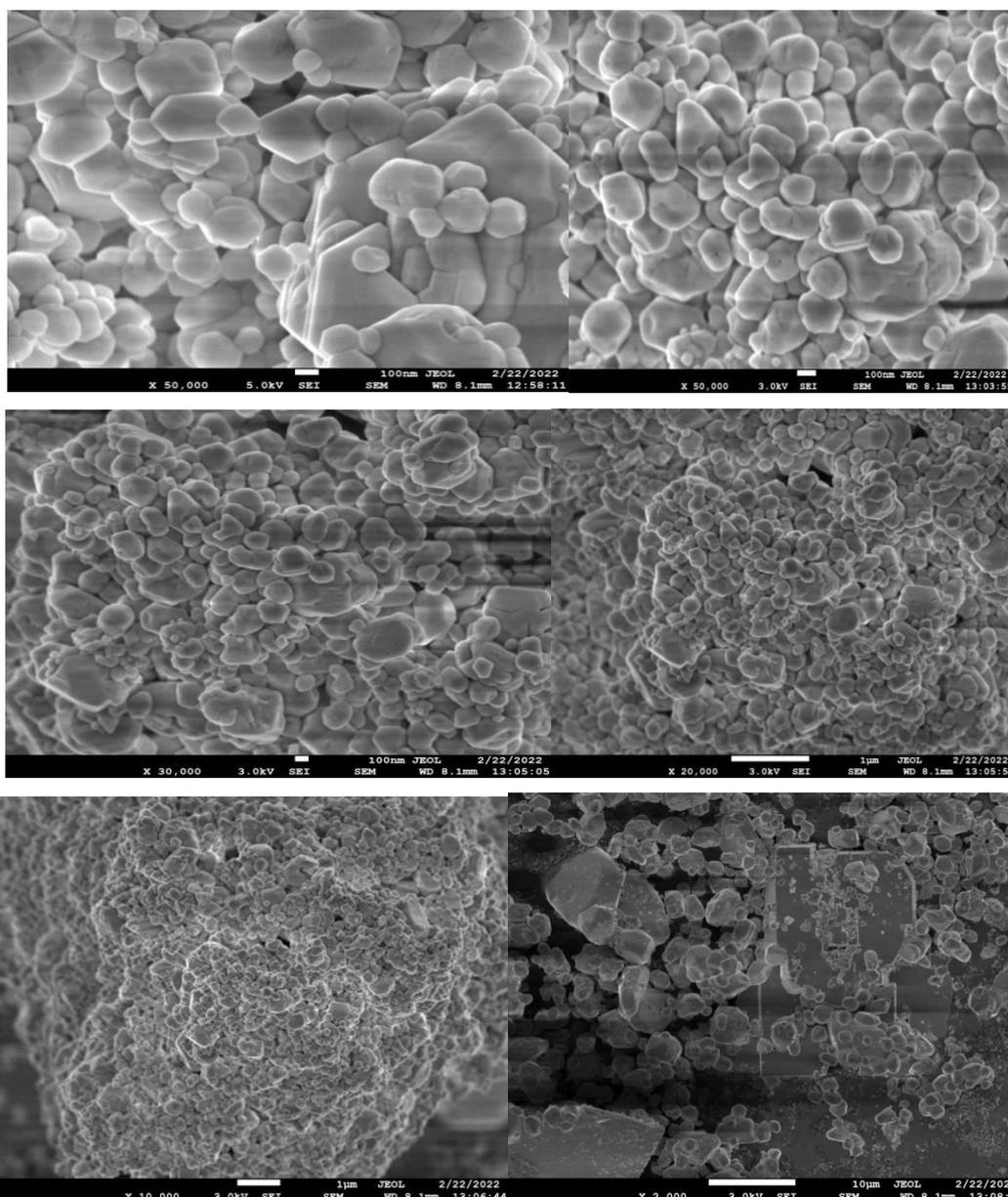
SEM can help to offer a clear as well as high-resolution process to identify the texture of the specific complex named PTUNi. These two spectroscopy results measured the molecular structure of the Pbsulphate from the process of making Theoria from the Phthalic acid. However, in this sense, this study has chosen the two techniques of SEM and EDS to produce the magnified image for analyzing the complex formed in this process of microanalysis based on the Phthalic acid from Theora. These two processes have helped to determine the presence of Lead sulphate from the complex formed from the Phthalic acid.

SEM Pictures





Before Pb Sulphates Absorption SEM Magnifications



After Pb Absorption SEM Magnification

CONCLUSION

The nickel complex known as PTUNi is capable of facilitating the exchange of two thiourea ligands with one phthalate ligand. The PTUNi“nickel complex can be used as a inhibitor in an environment composed of 0.1 M HCl at a very low concentration, 3 ppm, with an efficiency of 95.23% and acts as a mixed inhibitor”. This is possible because the complex contains both nickel and phosphorous. This overall experiment of making the

“template mediated doped” compound of Thiourea-Phthalic acid (TP) has shown the slow evaporation of crystal. This study has explored the molecular structure and dimensions of the Thiourea-Phthalic acid (TP). The grown crystal from this experiment exhibited a very high optical transmittance approximately 63% within the range of 230-1000 nm. Both the hydrogen evolution process at the cathode and the anodic dissolution can be modulated when this inhibitor is present.

eZAF Quant - analysis uncertainty: 7.99%						
element	Weight %	atomic%	Mistake %	r	A	F
okay	28.0	78.8	11.3	0.7428	0.1182	1,0000
PbM	61.7	13.4	57	0.8004	0.7046	1.0073

REFERENCES

1. Awad, M., Saad, AF, Shaaban, MR, Jahdaly AL, BA, et al., New insights into the mechanism of inhibition of mild steel by certain amino acids, *Int. J. Electrochemistry. Science*, 2017, Vol. 12, p. 1657.
2. Biswas, A., Das, D., Lgaz, H., Pal, S., et al., Dextrin biopolymer-based graft copolymer and polyvinyl acetate as an effective inhibitor for structural steel in hydrochloric acid: Electrochemical, Theoretical and Surface Morphological Studies, *J. Mol. Liq.*, 2019, Vol. 275, p. 867
3. Byju Classes "Thiourea - CH₄N₂S" <https://byjus.com/chemistry/thiourea/#:~:text=Thiourea%20is%20a%20organic%20sulfur%20in%20the%20construction%20of%20heterocycles.>
4. Dr Ricardo Heide "thiourea" in *Brydson's Plastic Materials (8th Edition)*, 2017 <https://www.sciencedirect.com/topics/chemistry/thiourea>
5. Emwas, A.H., Roy, R., McKay, R.T., Tenori, L., Saccenti, E., Gowda, G.N., Raftery, D., Alahmari, F., Jaremko, L., Jaremko, M. and Wishart, D.S., 2019. NMR spectroscopy for metabolomics research. *Metabolites*, 9(7), p.123.
6. Fahad, M., Sajad, A.L.I. and Iqbal, Y., 2019. Plasma diagnostics by optical emission spectroscopy on manganese ore in conjunction with XRD, XRF and SEM-EDS. *Plasma Science and Technology*, 21(8), p.085507.
7. FarzanehMohamadpour (2016) "Phthalic Acid: An Eco-Friendly, Biodegradable, Green Difunctional Brønsted Acid Catalyst for the One-Pot Synthesis of 3,4-Dihydropyrimidine-2-(1h)-one-Derivatives and Substituted Dihydro-2-Oxypyrrroles" *Journal of the Chemical Society of Chile Online version ISSN 0717-9707 Soc. Vol. 63 n.1 Concepción March 2018*
8. Fawzy, A., Abdallah, M., Zaafarny, IA, Ahmed, SA, et al., Thermodynamic, Kinetic, and Mechanistic Approach to Carbon Steel Inhibition by Novel Acid-Based Surfactants, Synthesized Amines as Inhibitors green in neutral and alkaline environments. aqueous media Were Media, *J. Mol. Liq.*, 2018, volume 265, p. 276
9. Fawzy, A., Zaafarny, IA, Ali, HM, and Abdallah, M., Novel synthesized amino acid surfactants as effective mild steel inhibitors in hydrochloric acid medium: a kinetic and thermodynamic approach, *Int. J. Electrochemistry. Science*, 2018, Vol. 13, no. 5, p. 4575.
10. Gul, I., Khan, S.M., Mehmood, T., Ahmad, Z., Badshah, H. and Shah, H., 2020. Characterization of cobalt oxide and calcium-aluminum oxide nano-catalyst through scanning electron microscopy, X-ray diffraction, and energy dispersive X-ray spectroscopy. *Microscopy Research and Technique*, 83(9), pp.1124-1131.
11. Hatzakis, E., 2019. Nuclear magnetic resonance (NMR) spectroscopy in food science: A comprehensive review. *Comprehensive Reviews in Food Science and Food Safety*, 18(1), pp.189-220.
12. Hazazi, OA, Fawzy, A., Shaaban, MR, and Awad, IM, Improved inhibition of mild steel with 4-amino-5-methyl-4H-1,2,4-triazole-3-thiol at 0.5 M Cu(II) H₂SO₄, *int. J. Electrochemistry. Science*, 2014, Vol. 9, p. 1378.
13. Ladeira, L.C.M., Dos Santos, E.C., Valente, G.E., da Silva, J., Santos, T.A. and dos Santos Costa Maldonado, I.R., 2020. Could biological tissue preservation methods change chemical elements proportion measured by energy dispersive X-ray spectroscopy?. *Biological trace element research*, 196(1), pp.168-172.

14. McGuire, S.C., Ebrahim, A.M., Hurley, N., Zhang, L., Frenkel, A.I. and Wong, S.S., 2021. Reconciling structure prediction of ultrathin nanowires with spectroscopy. *Chemical science*, 12(20), pp.7158-7173.
15. Ménager, M., Esquivel, P.F. and Conejo, P.S., 2021. The use of FT-IR spectroscopy and SEM/EDS characterization of slips and pigments to determine the provenances of archaeological ceramics: The case of Guanacaste ceramics (Costa Rica). *Microchemical Journal*, 162, p.105838.
16. Pazzaglia, A., Maffini, A., Dellasega, D., Lamperti, A. and Passoni, M., 2019. Reference-free evaluation of thin films mass thickness and composition through energy dispersive X-ray spectroscopy. *Materials Characterization*, 153, pp.92-102.
17. SenthilMuruganGanesan(2017) "Growth and characterization of a new organometallic crystal: bis-thiourea-cobalt chloride (BTCoC)" June 2008 *Materials Letters* 62 (17-18): 3087-3090 DOI: 10.1016 / j.matlet.2008.01.137
https://www.researchgate.net/publication/271614245_Growth_and_characterization_of_a_new_metal-organic_crystal_Bis-thiourea_cobalt_chloride_BTCo
18. Smith, Clayton S.; Little Horse, Chester J (2018). A study of some phthalylurea derivatives. *Journal of the American Chemical Society*, 61(8), 2218-2221. doi:10.1021/ja01877a069
19. Takroni, KM, El-Ghamry, HA and Fawzy, A., Evaluation of the catalytic activities of some synthesized divalent and trivalent metal complexes and their inhibitory efficiencies for mild steel in sulfuric acid medium, *J. Inorg. organometallic polymer Mater.*, 2019, vol.29, n.6, p. 1927
20. Al-Jubanawi, I.M., Al-Sawaad, H.Z. and AlWaaly, A.A., 2020. Bisthioureaphthalato Cobalt (II) complex: Synthesis and studying as inhibitors for carbon (C1010) in 0.1 M HCl. *J. Mater. Environ. Sci*, 11, pp.1386-1402.

Bihar Ke Shekhapura Jile Kee Jalaapoorti Evan Jal Prabandhan Kee Ek Bhaugolik Adhyayan

Sanjay Kumar Sinha

Department of Geography, Magadh University, Bodh Gaya, India

ABSTRACT

Many variations are found in the surface structure of the Sheikhpura district. These geologic variations affect the groundwater level. Along with this, the problem of water supply and water management of the districts works. There is a need to diagnose the problems related to water supply and water management according to the surface structure so that the problem can be solved in area-wise ways.

Keywords: Archean, Pine, Canal, Monsoon, Heritage, Ganga, Girihanda, Water level, Housepipe, Tall, Ahar.

INTRODUCTION

The participation of water is considered essential for all human needs. Man is an organism of complex activities of a simple nature. Whose frequency of activity is very wide. Especially in the activities of human beings which are basic activities. Like agricultural activities, industrial activities, and the daily activities of human beings, the frequency of use of water in these three activities is different. Humans consume about 65% of their total water in agricultural activities. While it uses 25% in industrial activities, the remaining 10% is used by humans for domestic activities and for drinking water. With the increase in the human population, the use of water is increasing and the supply of water is decreasing. Especially in the supply of clean and drinking water, great difficulties are arising. The geographical location of the study area is such that on one side there is less rainfall and on the other hand, the flow of rivers through this district is less. However, the district is situated on the banks of river Ganga and its tributaries Harhar and Kiul. But both these rivers pass through the border areas of this district. Although this district is endowed with a canal system, due to the abundance of agricultural activities in the district, it has to struggle with the problem of water every year. Here, in the month of April 2022, large reservoirs have been built around Khijrasarai, ahead of Rajgir, in the form of a huge pipe of river Ganga from Hathidah in the Patna district. Started from G and there is a provision to supply drinking water to Gaya, Nawada, Nalanda, and Sheikhpura districts in the future. The study area will also benefit from this scheme.

OBJECTIVES OF THE STUDY

The main objective of the present study is to show the water demand and water management activities in the Sheikhpura district, while other objectives of the study will also be how water management is done for agricultural activities in this low rainfall area.

RESEARCH HYPOTHESIS

1. No major river flows in the study area, but the study area is covered by a major river flow basin.
2. There are significant variations in the groundwater in the study area.
3. The demand for water in the study area is high for agricultural activities.

Importance and Utility of the Study: The importance of the study is high as it brings to light the demand and supply of water in the study area. On the other hand, the present research paper is useful because it sends a message to the time of Bihar government that there is a dire need for the development of water management in the district.

Research Methods and Data: No primary data has been given in the present research paper. But the study area is part of our botanical study. In the field of water supply and water management through fieldwork and survey, facts have been made through questionnaire research tools, and on the basis of the facts, research analysis has been prepared.

Research Area: The research area presented is the Sheikhpura district located in the Middle Eastern part of South Bihar. Which is called Nashik of Bihar. Along with the specialties of onion, potato, and other vegetables are produced and every year, especially some atmospheric disaster and dry, flooding is reached, (surface sheet) based on the study of the expansive and longitudinal extension of study district 24025 respectively. 'Latitude 250 to 250 and 85045' to 86045 'east longitude. This district is bounded by Nalanda and Patna in the north, Nawada and Jamui in the south, Lakhisarai in the east, and Nalanda and Nawada districts in the west. Under this, Sheikhpura, Barbigaha, Ariyari, Chevda, Shekhpur-Sarai and Ghat-Kusumbha divisions are included. The

area of this district is 689 sq km. And according to the 2011 census, it has a population of 636342. Which has a 527340 rural population and 109002 civil population. There are about 42 thousand Tenant Farmer and 65 thousand agricultural laborers in the entire district.

Various Forms of Study Analysis: The present research paper is devoted the water supply and water management of the Sheikhpura district. Obviously, here we will present analysis in the area of water consumption and demand. The entire district is an agricultural area with relatively high land. Considering the geological structure of the district, it is located in the marginal areas of the outer line of the North Chotanagpur plateau, due to which its geologic structure is rocky and hard. However, the upper part of the surface indicates the Bangar structure in some parts and the Khadar structure in some parts. In the Patna Lakhisarai frontier areas, this surface represents the Khadar formation and due to the flow of two rivers Harhar and Kiul, the groundwater level is high and agricultural activity is visible in these areas. Where there is a supply of water even though the demand for water is high.

However, when the frequency of monsoon decreases, there is a lack of water supply in the region, as both the Kiul and Harohar rivers have seasonal flows, originating in the Chota Nagpur plateau. Kiul originates from Giridih district, while Harohar originates from the Lohan River originating from Hazaribagh. However, both these rivers are tributaries of the Ganges and when there is a high flow in the Ganges, the water of the Ganges through the reverse flow penetrates deep into this river and provides water to the boundary area of the study area.

As far as the southwest Sheikhpura district is concerned, the geologic surface in this region is quite harsh, although the agricultural area of the Bangar formation is located in this area as well. But in the area, especially in the villages like Dakshin Samas, Dariyachak, Kewalbigaha, Khojagachi, Maur, Babbanbigaha, Shekhopur Sarai of Barbigaha block, water is supplied by small canals from the border districts like Nalanda. If truth be told, the actual form of this canal is in the form of Ahar and Pin. This area is also an agricultural area, which does agriculture work by mixing it with rain water and canal. The ground water level in this region is relatively low because the water table is affected greatly due to the rigidity of the lower geological structure.

The oldest Grihanda hill with Archean formation is found around the city of Sheikhpura, since the geologic structure of the area is made of extremely hard rocks, due to which there is a severe shortage of water around the whole city. It also costs more to dig a tube well, although water is also needed for human behavior in this area, and water is also needed for agriculture. As far as the surrounding area of the Kashichak block of Sheikhpura district is concerned, water for agriculture is supplied from local tube wells and monsoon support is available during the rainy season. As far as the industry in the districts is concerned, there is no water-consuming industry. The stone industry was working around the city of Sheikhpura for the last 100 years, but now it has also been managed. Presently this stone industry is completely closed.

The biggest problem in the Sheikhpura district, after agricultural water supply, if there is a water-related problem, then it is the problem of water used for domestic use. In the future, this problem needs to be completely resolved, because of an ambitious scheme of the Bihar government which is purely dedicated for drinking water supply in the Gaya, Nalanda, Nawada, and Sheikhpura districts. It is proposed to store water over a large geographical area around Khijrasarai Gelauhar on the way to Rajgir Gaya. Which will be used for the drinking water of the above four districts. This project has been implemented. This project has been launched in April 2022. Which water will be collected in two ways. 1. The water will be supplied by collecting rainwater and in another way by bringing Ganga water to this reservoir. High-capacity motors have also been installed along the way to draw water channels and many small stations have been built from where water can be supplied to other places. It is hoped that this water supply scheme will be helpful for the water supply and water management of the Sheikhpura district.

CONCLUSION

In the midst of the above analysis, it can be said as a conclusion that there is no flow of many big rivers in Sheikhpura district, but the main effect of Ganga and its two major tributaries flows from the side. With whose cooperation the future of water supply and water management in the district looks bright. In the areas where water is scarce in the district, dry crops can be planted, whereas in areas where there is excess water, crops with more water can also be planted. As far as the question of clean drinking water is concerned, its solution is going to be done in the near future, which has been discussed.

REFERENCES

1. Majid Hussain (2016) Agricultural Geography Rawat Publication Jaipur
2. Prof. Rashmi, Dr. Anil (2019) Agricultural Geography of Modern Bihar Rajesh Publication New Delhi.
3. Ministry of Agriculture and Water Resources Government of India.

Geographical Review of the Causes of Origin of India's Urban Slums

Krishna Kumar Yadav

Department of Geography, Magadh University, Bodh Gaya, India

ABSTRACT

The entire circumstances of nature have an impact on human endowment both directly and indirectly. Any settlement or settlement is determined on the basis of the basic nature of the circumstances of nature. Particularly, Indian monsoon, Indian resources and Indian agricultural activities have been responsible for the determination of urban slum pattern of India, whose in-depth analysis is presented.

Keywords: slum, settlement, slum, Dharavi, culture, trend, flood, drought, economic, crime, anti-sociality, museum

INTRODUCTION

Slums and slums generally devoid of human infrastructure in urban areas are commonly named as slums. It is born in unplanned, notified, uncontrolled and unnatural ways. Due to this, it looks different from other types of settlements in the city and is of a different nature. Many geographical facts work behind the creation of urban, slum. However, cultural factors are directly involved in the construction of the slum. But if a thorough evaluation of the above cultural facts is done, then the basic geographical facts also have a hand with it. As is evident in the context of India, almost all the big cities and metros have some form of Salaam Endowment. As we know that the Dharavi slum of Mumbai metropolis is one of the largest slum not only in India but in the world. Truth be told, Dharavi cannot be called a slum at the present time from the point of view of infrastructure. Or is the ideal form of the entire slums of India, but when it was developing 100 years ago, its overall nature and nature matched the definition of slum. The present research paper is devoted to the geographical reasons responsible for the formation of slums. An attempt has been made to present the reasons for the construction of the slum in good faith and in the Indian context.

RESEARCH OBJECTIVES

Lack of common basic civic amenities Indian slum is a shame in India's Navnirman, a stigma, whose construction is the main objective of the present research paper to analyze the facts. At the same time, if the facts of the construction of the slum are known, then it can be prevented from being constructed. The main objective is to bring this to the fore. Through the present research paper, we can also keep the problems of stigma in understanding the determinants of the country's output.

RESEARCH HYPOTHESIS

1. Geographic, cultural and economic root causes behind the formation of slums.
2. The slum lacks basic civic amenities.
3. Literacy and education of the slum take place at a very backward stage.
4. Almost all the residents of the slum belong to the B.P.L category.
5. Orthodox social customs, poverty and criminal tendencies are found in the slum.
6. The slum itself is an isolated geo-cultural zone.

Relevance Importance and Utility of Research

The relevance of the present research paper is in such a way that by keeping the underdeveloped nature of the slum in front of the nation, it should be inspired for development. The importance of the present research paper is in the form of finding out the root causes of the slum and finding a way to solve it. The usefulness of the present research paper will also be in such a way that the messages of the slum will be sent among the people responsible for the development of the country and the problem of slum will be resolved.

RESEARCH AREA

The research areas of the present research paper have been kept confined to India only in such an Indian perspective. But the explanation of the reason for the formation of slums has been analyzed in the whole world perspective. No specific primary and secondary data has been included in the present research paper. Rather a general explanation of slum formation has been given on the basis of various data.

RESEARCH METHOD

Since we did our P.h.D. at the slum of Prayagraj. Thesis was prepared and awarded by Magadh University. In the meantime, during its field work, we studied the reasons for the birth of selected slums of Prayagraj and on the basis of the same facts, with the help of questionnaire, interview and schedule, we have prepared research facts and finally presented research analysis.

Different Forms of Research Analysis

There is a saying prevalent in the Magadha region of Bihar, "Jote Sot Base Gotra" means to say that the land i.e. agricultural land should be bought only or the source of irrigation i.e. water is available. Whereas the other side of the proverb says that a person should settle where their gotra or human being is settled. This proverb holds true even on slum settlements, only then the formation of slums takes place close to the already settled human communities and human agglomerations, which are formed by the living human beings from different geographical areas. Many reasons and many stories work together behind the construction of the slum. An analysis of some of the major geographical reasons selected from these causes will be required here.

As it has been written earlier that human beings migrate from other geographical areas and come to cities to fulfill their basic needs and naturally a lacking human agglomeration is formed, which is called slum. Now the problem arises that why humans migrated to the cities, since India is an agricultural country and the original soul of India resides in the villages, where agricultural activity is the main reason for the creation of life. Agriculture is directly related to the Indian monsoon and the Indian monsoon tends to be erratic and chaotic. Even if the Indian monsoon rains heavily, the standing crop will be submerged in the flood waters. If the trend of Indian monsoon turns towards drought, even then the standing crops in the fields will dry up due to lack of water and the situation of famine will arise. In this way, both in the event of flood and in the event of drought, the farmer becomes a victim of starvation and in search of employment, this farmer will leave the village and migrate to the big cities looking for life in his eyes. . Where will be ready to work on any remuneration and in the absence of basic facilities will start living by making slums. The collective result of which will be the development of the slum. There are many employment options available in fully developed cities and the remuneration for working is higher than in villages. On the other hand, hidden unemployment and seasonal unemployment are found in the agriculture sector. The enormous human burden on agriculture cannot be tolerated and due to hidden unemployment and seasonal unemployment, rural residents turn to urban in search of employment. Due to which the population of slums of cities increases during floods or droughts.

The city is a special attraction of modern civilization and education, because education is based on civilizational development and civilizations are the museum of civic infrastructure. This is the only attraction of education, the attraction of civic amenities is the convenience of the cities, especially in the villages, while it becomes a mirror of the people and it becomes a part of the slum. This is how the slum develops.

Who does not like economic prosperity, there is an abundance of economic prosperity and economic resources in cities. Which is easily acquired by human beings, whereas in remote geographical areas there is a lack of easy form of abundance of economic resources. Economic prosperity is the fact that by nurturing all the dimensions of the human being, it is capable of making him easy, happy, prosperous and blissful. This is the reason why the needy human beings reach the big cities in an unplanned and uncontrolled way in the quest for happy happiness and joy and eventually slum is formed.

As the population of the slum increases, the frequency of the resource decreases and the value of consumption increases. The result is that the value of the service goes down. Every human becomes ready to commit any immoral, criminal, anti-social act even at the level of anti-sociality. Due to which the real nature of the slum becomes criminal. On the one hand, due to lack of civic amenities and lack of facilities, the settlements become dirty. From above the human of these slums turn into duty and dirty deeds. Ultimately human becomes a model of antisocialism. Due to which crime activities increase in other Paush areas of the city and the city is in the lap of chaos. The law and order of the city begins to inform the jungle justice.

The white sheet of human civilization is cultural. Whereas the basis or basis of the sheet of culture is economic prosperity. As we know that economic poverty is prevalent all around in slums. This is the reason that the tendency of maladjustment is found more in the slums.

As it is said that a healthy mind resides in a healthy body and the whole ideal human being is created from a healthy mind. But in the slum there is complete filth and poverty all around. Due to which the personality formation of the people of the slum is not done in a balanced manner, which in future becomes fatal for the city, society and nation. The polluted geographical environment of the city makes the people of the city slum

stereotyped. When the human is struggling by standing on the threshold of lack of meaning, then in that state the possibility of development of the ideal personality of the future of the human being is less. Whereas at this point man becomes fatalistic and gets absorbed in the discipline of destiny or becomes a criminal. Which breaks the discipline of destiny. Both these situations become dangerous for the future of human beings.

EVALUATION

As the above analysis of the research paper shows that the development of slums in the cities of India is fundamentally and causally due to various forms of trends. Due to nature, on the basis of nature, cultural, economic and social facts are created in the society. Thus, it can be said that all the facts of the construction of the slum are related to the geographical facts in one way or the other. The famous geographer Kumari Ellen Churchill Sample has said that man is the slave of instinct, man is a wax effigy, which nature creates, nurtures, changes it and destroys it when it is time.

REFERENCES

1. Yadav K.K (2022), Slum Rajesh Publication of Prayagraj New Delhi.
2. Kumari A. (2019), Geography of Dalits Rajesh Publication New Delhi.
3. Department of Social and Labor Welfare, Government of India, New Delhi.

Gramin Area Development for Government of Sikkim

Nisha Balani and Aziz Sheikh

Department of Computer Science, Jhulelal Institute of Technology, Nagpur, Maharashtra, India

ABSTRACT

Rural development is the process of enhancing the quality of life and economic well-being of individuals who live in rural areas that are relatively isolated and sparsely inhabited. MGNREGA (Mahatma Gandhi National Rural Employment Guarantee Act) is regarded as a "Silver Bullet" for reducing rural poverty and unemployment by creating demand for productive labour in villages. It provides an alternative source of income, minimising migration, limiting child labour, alleviating poverty, and making villages self-sufficient through the production of productive assets like as road building, water tank cleaning, soil and water conservation work, and so on. As a result, it has been dubbed the world's largest anti-poverty programme. On the basis of secondary data, an attempt has been made in this study to gain a full understanding of the development effort to rebuild rural life and livelihood.

1. INTRODUCTION

India's economy is primarily based on agriculture. 5.89 lakh villages house almost 75% of the country's inhabitants. A solid road infrastructure serving rural areas is a prerequisite for: socioeconomic transformation, rural development, and rural development. Village communities are being broken out of their isolation. Bringing about urban-rural integration and national integration by eliminating the imbalance between rural and urban populations. Area Development in Gramin Government of Sikkim is for the inhabitants of gramian regions in Sikkim, and this project is used by the government of Sikkim to allot land and authorise loans for house construction. There is no monitoring system in this application to track the progress of house construction under Rural Housing programmes. To create a real-time statistical report on the construction projects that are now underway. Create a web-based dashboard for monitoring and a native mobile application to track building progress simply by capturing a photo with the app. An allocation letter is an important document in the real estate industry in India when purchasing a home. The builder will offer an allocation letter to the prospective buyer if they are purchasing an under-

Construction property. It is issued once the buyer pays the developer 15% of the property's value. The significance of the allotment letter. The facts and figures about the property, as well as its numerous characteristics, are included in this letter. The building specifics and plans, architectural elements, and the amount of money to be given to the function Object() [native code] are all detailed in this letter. It is the sole document that serves as proof of property dealing for an incomplete property. It is necessary when applying for a bank loan since the letter specifies the amount of money that must be paid to the builder in order for the bank to finance the remaining amount. The bank finances the remaining sum based on this letter. Even though the selling agreement is the most important document in the transaction, an allotment letter might be useful as documentation when promised amenities aren't delivered as promised by the builder. The contents of the allotment letter include the following information: Various payment alternatives, The flat's specifications, Construction terms, construction timeline, The developer's stated amenities, such as a clubhouse, parks, and a gym, The total sum owing to the buyer, taxes included, The completion date and the builder's liability in the event of a late completion There is agreement, according to Section 2 (c) of the RERA Act of 2016, a "agreement for sale" is a contract entered into between the promoter and the allottee. A sale agreement is a contract to sell a property in the future. It contains the terms and conditions of any potential sale contract. Any violation of the terms of a sale agreement can only result in a lawsuit for damages. Some of the key clauses in a sale agreement are defined below: The names of both parties, their ages, and their respective addresses. The date and location of the agreement's execution. The amount of consideration, the mode of payment, and the time of payment. Penalty and forfeiture clauses in the event of noncompliance (varies case to case). The terms under which possession will be delivered. Each party's rights, obligations, and liabilities. The percentage of expenses to be borne by each party. The execution of a sale agreement must be witnessed by two people who are legally capable of entering into a contract. Witnesses from both parties are permitted: one from the purchaser's side and one from the seller's side. Deed of Conveyance: A conveyance deed is one such document that is required when property ownership is transferred from one person to another. The term deed refers to a written legal contract that binds the parties to its terms and can be used as evidence in court. Although the terms conveyance deed and sale deed are used interchangeably, there is a slight distinction between them. Conveyance deeds include all sale deeds, but they can also include gift, exchange, mortgage, and lease deeds. The Value of a Conveyance Deed

The absence of a conveyance deed can land us in a variety of sticky situations. To avoid them, one must first understand their significance: A conveyance deed is required to become the absolute owner of the property. The presence of a valid conveyance deed can protect us from fraudulent property transfers. This document can be easily used as evidence to prove property ownership rights. A conveyance deed is required to register the property in the government's records. Documents Required for a Conveyance Deed, Both parties' PAN cards, Proof of stamp duty paid, Registration fees, Copies of electricity bills and paid property taxes, The final conveyance deed copy, Certificates of authorization and occupancy, Contract between the builder and the buyer.

2. LITERATURE SURVEY

Several studies on various aspects of rural settlements have been conducted in various parts of the country and abroad. The interest of social scientists in various aspects of settlement pattern dates back to the 1920s, when philosophers such as Paul, Vidal de la Blache, Ahlmann, Aurorseau, Demangeon, Brunches, and others laid the groundwork for various branches of settlement geography. The Rural Development and Poverty Alleviation Programmes of the Government of India have been evaluated by various Government organisations, including the Planning Commission's Programme Evaluation Organization, Concurrent Evaluations carried out by the Ministry of Rural Development with the assistance of reputed institutions located at the regional level, RBI, NABARD, IFMR, NIUA, NIRD, and other organisations such as Universities, Research Institutes, NGOs, and Individuals. Their approaches, conceptualization, and methodology are all unique.

Various studies conducted by eminent scholars have broadened our understanding of the issues at hand. Hanumantha Rao (1994), for example, linked the five themes of agricultural growth, rural poverty, environmental degradation, participatory rural development, and economic reforms to agriculture. Both growth and poverty interact with the environment in complex ways, with each having an impact on the other. The author assesses the participatory processes as well as some recent reforms, which have implications for both poverty and the environment. Manikkumaran (1997) conducted a similar study in the state of Tamil Nadu. He examined secondary data from the last 30 years, from 1960 to 1990, and discovered that agricultural growth is inversely related to rural poverty and directly related to environmental quality in the state of Tamil Nadu. The remaining plots in Industrial Areas will be auctioned off. In the plottable land that is still available, Plots can be obtained from the Planning Department (Competent Authority) and then allotted through auction. For this purpose, an offset price may be considered take into account the current Industrial Rate + 10% Additional Rate + Road Width Charges (if applicable). National Newspapers will publish regular advertisements. In Industrial Areas where less than 80% of plots / plottable land has been allotted, the remaining plots and plots carved out from plottable land by the Planning Department (Competent Authority) will be allotted by direct procedure. National Newspapers will publish regular advertisements.

History & Current Problems: A number of directives were issued regarding the norms for allotment of government lands for public use as well as to private organisations and individuals. The following are the issues that must be addressed in the management of government lands: Various departments and agencies are requisitioning land for development purposes (Industries, Energy, IT, Tourism, Education, Housing, etc.) and for social purposes (Welfare Depts., NGOs, Associations, Trusts, etc.), There are no uniform guidelines for determining the cost of allotted land, There is no established mechanism to effectively monitor whether the land is used for the purpose for which it was allotted within the time frame specified, Land allotment has been used in recent years for resource mobilisation through the sale / auction of government lands. The collective result is the rapid depletion / alienation of a scarce natural resource such as public, which has a negative impact on the community's future needs.

Existing Machinery: The Empowered Committee, comprised of the following members, is tasked with scrutinising proposals for alienation of Government land to various industries, educational institutions, religious / charitable institutions, NGOs, private persons, and so on, under BSO-24 for market value or at a concessional rate.

3. AIM & OBJECTIVE

India's economy is primarily based on agriculture. 5.89 lakh villages house approximately 75% of the country's population. A dependable road system serving rural areas is a basic requirement for: socioeconomic transformation. Breaking the isolation of village communities. Eliminating the disparity between rural and urban populations and bringing about urban-rural integration. National integration. These two platforms are used to deploy a monitoring system for house construction under Sikkim rural housing schemes: On-Site Verification Using a Mobile Application and a Web Portal

4. METHODOLOGY

- set target(web portal)
- Manual survey (of beneficiaries)
- Add beneficiary (on web portal)
- Inspection (on android app)
- Fund distribution to beneficiaries (through web portal)

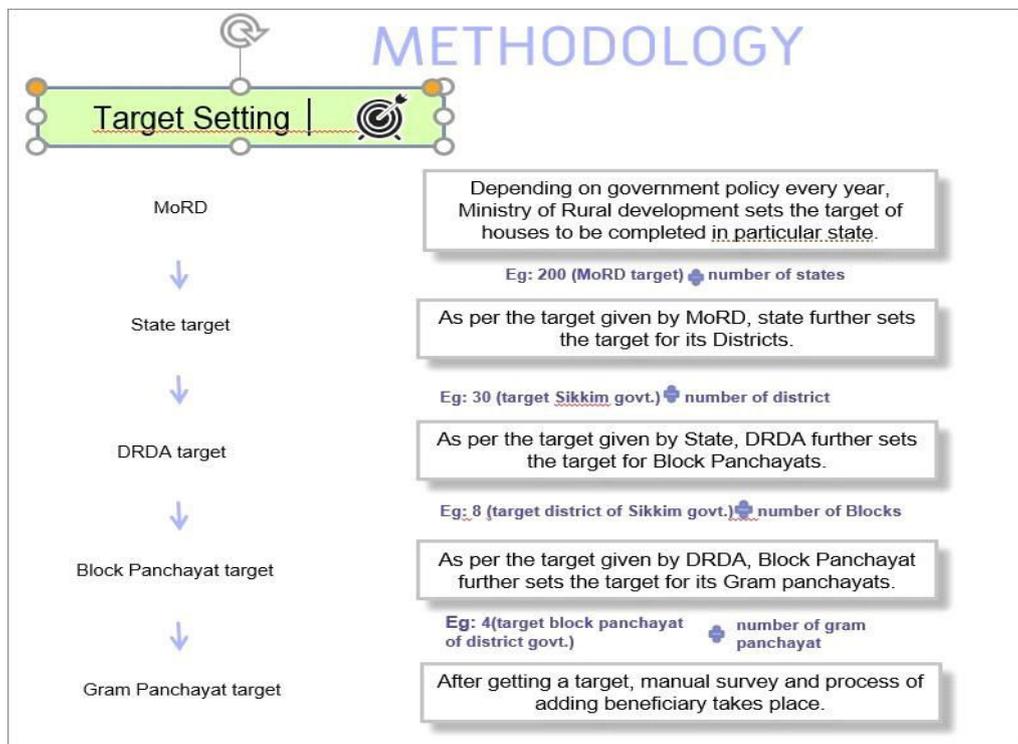


Fig.1: Methodology

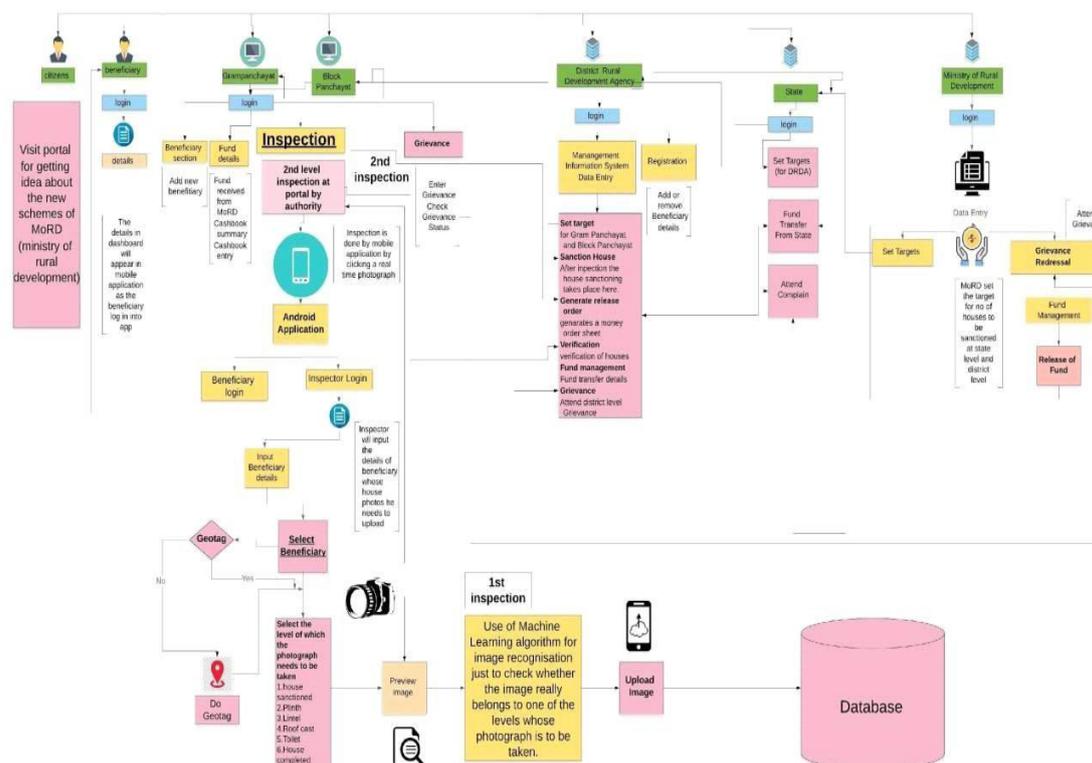


Fig.2: System Architecture

5. FUTURE SCOPE

- I. For image comparison, we will use thousands of images.
- II. Application can also be used for the entire country.
- III. This app is also applicable to the entire country.

6. CONCLUSION

Several programmes (e.g., IRDP, JRY) have been implemented by the Government of India and state governments to eradicate poverty in India. While the goals of these programmes are admirable, they are based on the assumption that spending money is a necessary and sufficient condition for poverty alleviation. This belief underpins the role of non-monetary policies and the impact they have on people's lives. Many grassroots workers have found that certain government policies frequently harm the poor far more than they benefit from money-oriented schemes like the IRDP.

7. REFERENCES

1. C. Benzing, H.M. Chu, and B. Szabo (2005). Hungarian and Romanian Entrepreneurs in Romania: Motivation, Issues, and Distinctions *Journal of Global Business*, vol. 16, pp. 77-87.
2. D. Bobera, B. Lekovi, and N. Berber (2014). Findings from Serbia and Montenegro in a Comparative Analysis of Entrepreneurship Barriers *Engineering Economics*, vol. 25, no. 2, pp. 167-176.3. Bobera, D., Marić, S., & Leković, B. (2015). Entrepreneurship as a Consequence of External Stimuli and/or Internal Incentives. *Economic Themes*, 53(1), 83101.
3. N. Bogdanov (2008). *Small Rural Households and the Rural Non-Farm Economy in Serbia* (2nd edition). United Nations Development Programme Serbia, Belgrade.
4. A. Carsrud and M. Brannbact (2011). What Do We Need to Know About Entrepreneurial Motivations? 9-26 in *Journal of Small Business Management*, 49(1).
5. H.M. Chu and M. Katsioloude (2001). The Cultural Context of Vietnamese-American Entrepreneurship *Transnational Development*, 7(2), pp. 37-46.

A Design and Implementation of Space Educational Portal

Nisha Balani and Farheen Sheikh

Department of Computer Science, Jhulelal Institute of Technology, Nagpur, Maharashtra, India

ABSTRACT

Learning space research is a relatively young field of study that aims to inform learning environment design, evaluation, and management. This research examines a fragmented and dispersed body of knowledge about the linkages between university learning spaces and student learning activities. The report draws on this review to identify a number of key concerns and gaps in the literature. One of its main objectives is to pave the way for the creation of learning environment models that can be utilized by instructors, architects, interior designers, IT managers, educational leaders, and students who are participating in the design and evaluation of new learning spaces. Another purpose is to assist those involved in learning space research in locating and understanding each other's contributions. This portal investigates how recent research has revealed the impacts of virtual environment on learning, with the goal of presenting both a comprehensive picture of the current state of study and fascinating options for future work. It outlines five important themes that make up research in virtual space and learning, based on a multidisciplinary review: similarities between the study of physical space and learning; socio-cultural constructivist viewpoints; practical and theoretical pedagogy; architecture; and aesthetics. The current state of knowledge about how virtual space influences learning is patchy, to say the least. The key issue for the future is to build a research infrastructure that can take use of the diversity of present studies while also driving, focusing, and connecting future research endeavors.

Keywords: evaluation, fragmented, multidisciplinary, knowledge, space, influences

1. INTRODUCTION

Space Education Portal promise to be an integrated point of entry that provides all stakeholders of an education body, frequently referred to as campus or university, with a single, personalized Web interface to all information and application resources in a secure, consistent, and customizable way (Kiviak, 2002) through multiple devices and multiple access methods that can be utilized to retrieve all appropriate information and learning resources anytime, anywhere, with anything. Hence, they allow more interaction and collaboration among students, faculty, staff, and alumni (Barratt, 2003). Properly implemented, portals can be a strategic asset for the institution. In that sense, they do far more than a traditional Web site of static information ever could (Strauss, 2002).

The promising opportunities notwithstanding, developing a Space Education Portal can be a key strategic technology decision since it can impact the entire campus community in the way it learns, teaches, communicates, and interacts. Therefore, the primary challenge for educational institutions in prior to the implementation of a portal solution is to develop a deliberate portal strategy based on a careful analysis of long term and short term needs and a clear vision with concrete strategic goals (Katz, 2000, 2002).

However, the international portal experience in the educational sector over the past decade shows that various strategies have been pursued in very different institutional environments and with very different objectives (Perraton, 2000). This has been driven to some extent by the fact that the portal concept as other technologies in open and distance learning (ODL) has been first applied and adapted to higher education and professional training environments, but also establishes gradually in primary and secondary education institutions (Owston, 1997; UNESCO, 2000). Humans have always wondered about the nature of the objects seen in the night sky when they gazed up at the heavens. The development of rockets, as well as advances in electronics and other technologies in the twentieth century, made it possible to send machines, animals, and eventually humans above Earth's atmosphere into outer space. However, long before technology made these accomplishments possible, space exploration had captured the imaginations of many people, including not only aircraft pilots and scientists, but also writers and artists.

The strong hold that space travel has always had on the imagination may well explain why, in the words of Tom Wolfe in *The Right Stuff* (1979), professional astronauts and laypeople alike consent to sit "on top of an enormous Roman candle, such as a Redstone, Atlas, Titan, or Saturn rocket, and wait for someone to light the fuse." It may also explain why space exploration has been such a popular and enduring theme in literature and art.

As centuries of speculative fiction in books and, more recently, films demonstrate, the human spirit took "one small step for a man, one giant leap for mankind" many times and in many ways before Neil Armstrong stamped humankind's first footprint on the Moon.

The country's space science research is still being supported by the space programme. The National Mesosphere – Stratosphere – Troposphere Radar Facility (NMRF) near Tirupati is now fully operational, with the commissioning of the remaining portion of the antenna array and associated transmitters for Mesospheric measurements. It is a useful tool for atmospheric scientists. Several space science experiments continue to use sounding rockets and balloon flights. The detection of a few Gamma-ray bursts by the SROSS-C satellite has given such experiments a boost.

The study of cosmic rays, astronomical investigation using space and ground-based systems, study of meteorites and lunar samples, and physical observations of the sun are all part of space science research. Another major area of interest is the study of the Earth's atmospheric system using rockets, balloons, and orbiting space systems.

There has been significant progress in the commercialization of the country's space capabilities. Antrix Corporation Ltd., founded in September 1992, has demonstrated promising results by securing orders for the study of satellite communication systems for

INMARSAT, providing training to ARABSAT and Korean engineers, and supplying space hardware to the Brazilian space agency.

Therefore, looking at the development approaches, lessons, comments, and concerns from concrete projects, it is primarily the diversity that stands out. This article sheds light on those aspects that can serve as a common basis for an integrated, generic approach toward portal strategy. It understands the four directions of impacts on learning, teaching, communication, and interaction of education portals as strategic dimensions along which strategic goals are set and embedded in an institutional context.

2. LITERATURE REVIEW

NASA gathers a lot of data - over 15 Terabytes per day! And by a White House mandate this data is free to the public - in a format useful to you. This is where the APIs come into play.

Figuring out the best way to distribute, use, and reuse NASA's data is a problem. NASA's APIs provide a solution by lowering the barrier of entry to people outside NASA to easily manipulate and access the public information.

Learning space research is a relatively new field of study that seeks to inform the design, evaluation and management of learning spaces. This paper reviews a dispersed and fragmented literature relevant to understanding connections between university learning spaces and student learning activities. From this review, the paper distils a number of core concerns and identifies some gaps in the literature. One of its primary goals is to clear the ground for the construction of models of learning space that can be used by the various parties involved in the design and evaluation of new learning spaces: teachers, architects, interior designers, IT managers, educational leaders and students. A closely related goal is to help those participating in learning space research locate and understand each other's contributions.

NASA is an abbreviation for the National Aeronautics and Space Administration. NASA is a United States government agency in charge of air and space science and technology. With the launch of the Soviet satellite Sputnik in 1957, the Space Age began.

NASA began operations on October 1, 1958. The agency was established to oversee space exploration and aeronautics research in the United States.

NASA is managed by the administrator. The president appoints the NASA administrator, who is then confirmed by a vote in the Senate.

Many people are familiar with NASA's work. But they have no idea how many different things the agency does. In space, astronauts conduct scientific research. Satellites assist scientists in learning more about the Earth. Space probes conduct research in the solar system and beyond. New innovations enhance air travel and other aspects of flight. NASA is also launching a new programme to send humans to the Moon and Mars to explore. Aside from those major missions, NASA is involved in a variety of other activities. The agency shares what it learns so that its knowledge can benefit people all over the world. Companies, for example, can use NASA discoveries to develop new spinoff products. NASA assists teachers in preparing students who will work as

engineers, scientists, astronauts, and other NASA employees in the future. They will be the explorers who will continue to explore the solar system and the universe. NASA has a long history of investing in programmes and activities that engage students, educators, families, and communities in the wonder and excitement of exploration. NASA provides training to teachers in order to help them learn new ways to teach science, technology, engineering, and mathematics. Students are also involved in NASA missions to help them become more interested in learning.

NASA's headquarters are located in Washington, D.C. The agency operates nine centers, the Jet Propulsion Laboratory, and seven test and research facilities across the country. NASA employs over 17,000 people. Many more people work as government contractors for the agency. These individuals are employed by companies that are paid by NASA to perform work. The combined workforce includes a wide range of occupations. Astronauts are the most well-known NASA employees, but they only make up a small portion of the total workforce. Scientists and engineers make up a large portion of the NASA workforce. However, there are many other jobs available, ranging from secretaries to writers to lawyers to teachers.

NASA began a human spaceflight programme when it was founded. The Mercury, Gemini, and Apollo programmes assisted NASA in learning about space flight, culminating in the first human landing on the Moon in 1969. At the moment, NASA astronauts are living and working on the International Space Station.

NASA's robotic space probes have visited every planet in our solar system as well as a number of other celestial bodies. Telescopes have enabled scientists to peer into the farthest reaches of space. Satellites have revealed a wealth of information about the Earth, resulting in valuable information such as a better understanding of weather patterns.

NASA has assisted in the development and testing of a number of cutting-edge aircraft. Among these planes are those that have set new records. These tests have helped engineers improve air transportation, among other things. NASA technology has influenced a wide range of everyday items, from smoke detectors to medical tests.

NASA celebrated its 60th anniversary in 2018.

An application programming interface (API) is a connection that allows computers or computer programmers to communicate with one another. It is a type of software interface that provides a service to other programmers. An API specification is a document or standard that describes how to build or use such a connection or interface. An API is said to be implemented or exposed by a computer system that meets this standard. API can refer to either the specification or the implementation.

Web APIs, which allow communication between computers linked by the internet, are frequently referred to as APIs. APIs for programming languages, software libraries, computer operating systems, and computer hardware are also available. APIs were invented in the 1940s, but the term didn't catch on until the 1960s and 1970s.

In 2000, Roy Fielding's dissertation

Architectural Styles and the Design of Networkbased Software Architectures at UC Irvine outlined REST and described the concept of a "network-based Application Programming Interface," which Fielding contrasted with traditional "library-based" APIs. Beginning in 2000 and continuing through 2021, XML and JSON web APIs saw widespread commercial adoption. The web API is now the most commonly used definition of the term API.

Tim Berners-Lee's 2001 proposal for the Semantic Web included "semantic APIs," which recast the API as an open, distributed data interface rather than a software behavior interface. Although proprietary interfaces and agents became more common than open ones, the concept of the API as a data interface gained traction. API has become a broad term describing much of the communication on the internet because web APIs are widely used to exchange data of all types online. When used in this context, the terms API and communication procedure have overlapping meanings.

The interface between an application and the operating system can be specified by an API. POSIX, for example, defines a set of common APIs that allow an application written for one POSIX-compliant operating system to be compiled for another POSIX-compliant operating system.

Operating systems that implement the POSIX APIs include Linux and Berkeley Software Distribution.

Microsoft has demonstrated a strong commitment to backward compatibility, particularly within its Windows API (Win32) library, allowing older applications to run on newer versions of Windows via an executable specific setting known as "Compatibility Mode."

An API differs from an application binary interface (ABI) in that an API is based on source code, whereas an ABI is based on binary data. POSIX, for example, provides APIs, whereas the Linux Standard Base provides an ABI.

Web APIs are defined interfaces through which interactions occur between an enterprise and applications that use its assets, and they also serve as a service-level agreement (SLA) to specify the functional provider and expose the service path or URL for its API users. An API approach is a design strategy that revolves around providing a programme interface to a set of services to various applications serving various types of consumers.

3. PROPOSED PLAN OF WORK

The proposed plan of work initially includes selection where VueJs , Vuex, Axios frameworks for various works such as requesting API to NASA server then response fetching will be done after that data will be consumed in the application and finally UI based data will be updated. Then JavaScript will be used as a primary language for the related work. Vue (pronounced /vju/, like view) is a progressive user interface framework. Vue, in contrast to other monolithic frameworks, is built from the ground up to be incrementally adoptable. The core library is limited to the view layer and is simple to integrate with other libraries or existing projects. When combined with modern tooling and supporting libraries, Vue, on the other hand, is perfectly capable of powering sophisticated Single-Page app.

If you want to learn more about Vue before diving in, we made a video that walks you through the core principles and a sample project.

If you are a seasoned frontend developer interested in learning how Vue compares to other libraries/frameworks, see the Comparison with Other Frameworks.

Vuex is a Vue.js application state management pattern and library. It acts as a centralized storage location for all of the components in an application, with rules ensuring that the state can only be mutated in a predictable manner. It also works with Vue's official devtools extension (opens in new window) to provide advanced features like zero-config time-travel debugging and state snapshot export / import.

Axios is a JavaScript Promise-based HTTP client that can be used in both your front-end application and your Node.js backend.

It is simple to send asynchronous HTTP requests to REST endpoints and perform CRUD operations with Axios. The Axios library can be used in a simple JavaScript application or in conjunction with more advanced frameworks such as Vue.js.

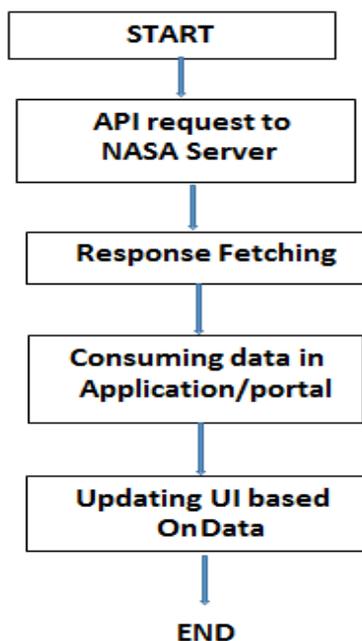
JavaScript is a scripting or programming language that allows you to implement complex features on web pages — whenever a web page does more than just sit there and display static information for you to look at — such as displaying timely content updates, interactive maps, animated 2D/3D graphics, scrolling video jukeboxes, and so on — you can bet that

JavaScript is involved. It is the third layer of a layer cake of standard web technologies, the first two of which (HTML and CSS) have been covered in much greater depth in other parts of the Learning Area.

UI and UX design are two of the most frequently misunderstood and conflated terms in web and app design. And it's understandable. They're usually grouped together in a single term, UI/UX design, and on the surface, they appear to describe the same thing. It's often difficult to find solid descriptions of the two that don't devolve into jargon.

"UI" stands for "user interface" in UI design. The user interface of an application is its graphical layout. It consists of the buttons that users click, the text that they read, the images, sliders, text entry fields, and all of the other items with which the user interacts. This includes the layout of the screen, transitions, interface animations, and each and every microinteraction. Every visual element, interaction, and animation must be designed.

Flowchart: -



4. AIM & OBJECTIVE

APIs provide an interface for machines to talk with each other. NASA's APIs allow developers to use NASA's data, such as imagery, for application development.

Will provide a framework which will give the information about planets, satellites, moon, rockets, and asteroids.

Will integrate all the data related to space in one portal which will be beneficial for students to gather the notes from one point.

Navigating all of NASA's APIs, on the other hand, is a little difficult. NASA has 62 (!) public APIs, according to Programmable Web.

While NASA's API developer portal and articles like this are helpful, we decided to create a NASA API package that combines some of the coolest API features into a single wrapper.

With our NASA API package, you can call the API directly from your browser and then export the code snippet in your preferred language. Check it out for yourself if you're eager to start coding. Otherwise, here's a rundown of some of its features:

With the `getPictureOfTheDay` endpoint, you can get a picture of the day with a description from a NASA astronomer. You can also hear sounds from space with the `getSpaceSounds` endpoint. Image retrieval from the Mars Rover Find and track asteroids based on your location, a date in time, or a combination of these criteria. Retrieve NASA patents by category.

Return NASA Earth imagery by location

Using NASA's EONET, you can track natural events such as storms (Earth Observatory Natural Event Tracker)

One of our favorite aspects of NASA's API is how open it is. The majority of its functions do not even necessitate the use of an API key. If you want to use a function that requires an API key, simply fill out this form with your name and email address.

We'll use the `getPictureOfTheDay` endpoint today. One of NASA's most popular public API calls is Astronomy Picture of the Day (or APOD). In fact, with 3.5 million views per month, NASA's website displaying the APOD is consistently one of the most popular in the federal government.

Click the `getPictureOfTheDay` link, then "Test Function" to see the picture of the day for today. The Indian space programme, which aims to provide self-sufficient space-based services to the country, reached an important milestone on October 15, 1994, when the 283-tonne, 44meter-tall Polar Satellite Launch Vehicle (PSLV-D2) successfully completed its mission by placing the 804-kg Indian remote sensing satellite, IRS-P2, in

the intended polar sunsynchronous orbit. As a result, India has joined an exclusive group of only six nations in the world to accomplish this multidisciplinary, technologically complex feat. Even as PSLV-D2 unequivocally demonstrated India's capability to launch indigenously built remote sensing satellites, the mission also demonstrated in flight a number of systems that will be used in the Geosynchronous Satellite Launch Vehicle (GSLV), bringing the country closer to achieving the capability of launching INSAT class communication satellites as well.

The INSAT-2C and IRS-1C satellites were successfully launched and placed in orbit in 1995. The PSLV-next D3's development flight is scheduled for 1996.

On May 4, 1994, the fourth developmental flight of the Augmented Satellite Launch Vehicle (ASLV-D4) successfully completed its mission by launching the 113 kg SROSS-C2 scientific satellite into a near-Earth orbit. With this success, all of the ASLV project's objectives, including proving in flight a number of complex vehicle systems used for PSLV and GSLV, have been fully realized.

Significant progress has also been made in the development of the GSLV, with a number of advanced technologies being qualified and the fabrication of the majority of the vehicle hardware having begun. Another significant accomplishment is the successful development and qualification of the silicon phenolic throat for the GSLV liquid propellant engine. The GSLV's L-40 liquid propulsion stage is now preparing for qualification.

5. FUTURE SCOPE

The following are the expected outcomes,

- Get a picture of the day with a description from a NASA astronomer
- Hear sounds from space
- Find and track asteroids based on your location, a date in time or more
- Track natural events (ex. Storms)

6. REFERENCES

1. S. Abrams, 2009. "A gaming frame of mind: Digital contexts and academic implications," *Educational Media International*, volume 46, number 4, pp. 335– 347. [http:// dx. doi. org/ 10. 1080/ 095239809033874](http://dx.doi.org/10.1080/095239809033874) at http://www.unoosa.org/res/oosadoc/data/documents/2018/stspace/stspace71_0_html/st_space_71E.pdf. 80
2. K. Andreas, T. Tsiatsos, T. Terzidou, and A. Pomportsis, 2010. "Fostering collaborative learning in Second Life: Metaphors and affordances," *Computers and Education*, volume 55, number 2, pp. 603– 615. [http:// dx.doi.org/10.1016/j.compedu.2010.02.021](http://dx.doi.org/10.1016/j.compedu.2010.02.021)
3. F. Abbattista, F. Calefato, A. De Lucia, R. Francese, F. Lanubile, I. Passero, and G. Tortora, 2009. "Virtual worlds: Do we really need the third dimension to support collaborative learning?" paper presented at the Workshop on Virtual Worlds for Academic, Organizational, and Life-Long Learning (Aachen, Germany), at http://www.iicm.tugraz.at/home/cguetl/Conferences/ViWo/ViWo2009Workshop/finalpapers/ViWo2009Workshop_03.pdf, accessed 8 March 2011.
4. www.egsa-space-technology-portal.com/
5. R. Walker, M. Cross, "The European Student Moon Orbiter (ESMO): A lunar mission for education, outreach and science", *Acta Astronautica*, In Press, print in preparation, Available online 18 November 2009. [2] H. Heidt, J. Puig-Suari, A. S. Moore, S. Nakasuka, R. J.
6. H. Heidt, J. Puig-Suari, A. S. Moore, S. Nakasuka, R. J. Twiggs, "CubeSat: A new Generation of Picosatellite for Education and Industry Low-Cost Space Experimentation", *AIAA/USU Conference on Small Satellites*, paper SSC00-V-5, Aug. 21-24, 2000.
7. United Nations Office for Outer Space Affairs, *European Global Navigation Satellite System and Copernicus: Supporting the Sustainable Development Goals*, ST/SPACE/71 (Vienna, United Nations, January 2018), p. 2. Available

Design of a Text Summarization Using Elephant Herd Optimization

Sachin Chaudhary¹ and Mahevash Madiha Sheikh²

Department of Computer Science, Jhulelal Institute of Technology, Nagpur, Maharashtra, India

ABSTRACT

Due to the exponential increase of the number of documents generated per unit time, there has been an information explosion in both tech and non-tech fields. Due to this, readers from different genres are unable to gather information at a fast-paced rate. To resolve this issue, researchers have modelled document summarization techniques, which allow the readers to get complete understanding about the written document using lesser number of words, thereby reducing the read-time needed for the user to understand the document. Document summarization techniques are generally abstractive or extractive, with extractive summarization techniques keep the document information as it is and retains only most important points, while abstractive summarization analyses the document, and finds abstractive sentences which can cover-up multiple lines of text. Due to the inherent complexities in abstractive summarization, it is used only in specialized cases, while extractive summarization is used in all domains of summarization. In this text, we propose an elephant herding optimization (EHO) algorithm which performs high quality extractive document summarization when compared with other state-of-the-art techniques. The proposed approach is computationally complex, and has more than 85% accuracy on standard summarized datasets.

Keywords: Summarization, extractive, abstractive, elephant, herding, machine learning

1. INTRODUCTION

Document summarization is a computationally expensive process, and requires careful planning and execution in order to generate a proper summary of the input document. The process of extractive summary generation can be generalized using the following diagram shown in figure 1. While abstractive summary generation process is very complicated, and is not relevant to this text, and thereby is not described here. From the figure, we can observe that the input document is first collected in fulltext form, and given to the feature extraction unit. This unit applies complex natural language processing (NLP) techniques to the document, such as evaluating n-grams, removing stop words via parts-of-speech (POS) tagging & chunking, lemmatization of the document and other processes.

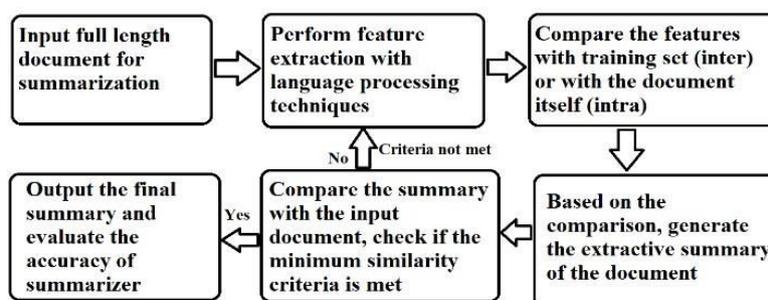


Figure 1: General extractive summarization process

These strategies ensure that the whole document is defined using assistive features, which can then be utilized in the next step of the process to aid with document summary. As a result, accurate feature extraction from the input document is essential, and this block should be properly built in order for the summarizer to achieve high accuracy.

Once the almost correct features are extracted, then there is one out of 2 processes which is generally followed,

- Comparison of the features internally within the document (intra-summarization)
- Comparison of the features with other documents(classification-based summarization or inter-summarization)

In the first case of intra-summarization, the features extracted per line are compared to other lines in order to evaluate the degree of similarity between them, and based on the algorithm's internal working; this similarity is used in direct or indirect correlation with the document in order to generate the output summary. This mainly uses mathematical equations and some identities in order to make sure that the output summary is generated with utmost accuracy.

For inter-summarization or classification, the process is a little complicated. In this process, the features of the input document are compared with standard dataset features, and these features are mapped according to the position or relevance in the standard dataset. Then based on these features, there are certain classification approaches like k-Nearest Neighbors, neural networks, support vector machines, etc. These classifiers basically use the input feature patterns and generate output patterns in order to generate a proper output summary of the document. The main problem with the intersummarization approach is the dependency on the input dataset, and only works if the input dataset and the input full-text document are of the same domain. We cannot use medical dataset papers with technical input full-text document for summary, as that would inarguably give improper extractive summaries. Also, if the number of input documents is not sufficiently large, then there will be reduced accuracy in this case. Thus, in most of the cases intra-summarization is used for extractive summarization.

The output summary is checked for a special similarity criterion with the input full-text document, and if the similarity criterion is not met, then the algorithm (not necessarily) reevaluates the features and performs the entire process again. This is repeated until the criterion is met. Once the output summary is generated, then it is compared with the standard summary (if available), in order to evaluate the summarizer's accuracy. In the next section, we have described various extractive summarization techniques, and their performance. Followed by an in-detail discussion about the proposed method, and its performance. The obtained performance is compared with standard state-of-the-art algorithms, and finally conclusive observations are made. The paper concludes by suggesting some more ways in which the overall system performance can be improved.

2. LITERATURE REVIEW

Extractive summarization is a simpler process of document summarization when compared to abstractive document summarization, due to the fact that abstractive summarization needs to develop new sentences which combined multiple input document sentences, while extractive summarization only needs to extract sentences from the input document directly. But in order to do so, there are multiple steps needed, which are computationally complex, and needs careful designing in order to generate a proper summary of the input document. Like the work done in [1], where authors have defined a hierarchical method for summarization, this method proves to be good for smaller document sizes, but has a limited accuracy of less than 30%, which makes the method unusable for real-time document summarizations. Other researchers in [2], tried to use convolutional neural networks (CNNs) for summarization, which gives better accuracy than the hierarchical method, but has a limitation, that the overall accuracy is lower than 50%. Thus, the algorithm can be used for some cases, where summarization quality is not that important, but the legacy systems are optimized for neural network processing. A corpus-based method is given in [3], wherein researchers claim to have used already stored corpora for extraction of output summary. The accuracy is again limited to less than 35%, but the method is computationally easy, and thus can be extended by adding more entries to the corpus, and thereby improve the accuracy of the system to more than 60%, but this is not claimed by the researchers, and is our observation from the algorithm's structure. This fact needs to be evaluated by any researcher who needs to develop a corpus based easy to compute system.

Another field of study that has recently gained traction is deep learning. The authors of [4] claim to have created a Restricted Boltzmann Machine (RBM)-based technique for improving extractive summarization accuracy. They claim to have increased the accuracy to more than 85%. This accuracy needs to be evaluated before using the algorithm for any of the real-time summarization purposes. The overall accuracy of the RBM algorithm is determined by the content of the text and how the network is trained using the input information. Similar implementation based on rule-based extraction is done in [5], where the overall accuracy is around 35%, and thus needs a lot of re-work for better accuracy. In this work the authors are using multiple rules for design of the summarizer, which might give good results for some specific documents, but most of the rules might not be true for most of the documents, and thus the algorithm must be used with extreme caution. Clustering is also one of the techniques which can be used for summarization, researchers have used k-Means clustering in [6] for performing extractive summarization. The algorithm claims to have a highest accuracy of 44%, which is moderate to low for real time application of summarization.

Some researchers have used summarization which is language dependent, like in [7], where researchers have used Malayalam language documents for summarization. They have used Recall-Oriented Understudy for Gisting Evaluation (ROUGE) features for performing this task, and claim to have an accuracy of around 57%, which is a good enough value when it comes to document summarization. For Bengali text, the authors in [8], have used language processing with heuristic metrics and adaptive approach, which combined with clustering gives a good level of accuracy of around 54%. Another work in [9-10], uses Marathi language using a graph-

based model, combined with the same ROUGE features used in [7]. The proposed system claims to have an accuracy of 86%, which is the highest among most of the language specific summarization systems. A language independent system is mentioned in [9], which uses ROUGE features, and also uses sentence re-ranking to obtain an accuracy of 68%. As a result, ROUGE may be utilised in both language-dependent and language-independent situations..

Aspects and queries are two different sides of extractive document summarization. As mentioned in [11] and [12] respectively. The aspect-based method is dependent on multi-document summarization, and uses a clustering algorithm for similarity matrix generation, which finally performs summarization. There is no mention of the accuracy for the system, but they claim to have achieved a good level of it, which might be in the range of 40% to 60% from our observation. Query oriented method as mentioned in [12], uses user input queries to perform summarization. They also use ROUGE features combined with sentence re-ranking in order to perform the task of summarization. From the results we can observe that this method gives a good accuracy of around 80% which is good enough for real-time document summarization. Some comparisons in [13] and [14], show that the supervised learning methods are better for summarization process, and thus can be used for improvement in the performance of the extractive summarization process. So, in this work we are also using the supervised learning-based machine learning method for summarization, which is described in the next section.

3. PROPOSED EHO ALGORITHM

In order to extract summaries with high accuracy the EHO model is proposed. The model can be described using the following mathematical model,

Step 1: Let the input document be named as D Let the number of lines for the input document be 'n', and each of the lines be named as L1, L2, ..., Ln

Define a speedup factor Suf, which will control the speed and accuracy of the algorithm

Step 2: Initialize the input parameters of the algorithm as follows, No of clans Nc

No of generation Ng

No of output lines expected No_L

Step 4: For each generation in 1 to Ng

a) Go to each clan in 1 to Nc

b) Generate a random solution with N_{ol} number of lines from the input document and mark it as P_{ls}, then find the fitness of the solution using the following process,

a. Find the Jaccard distance & term frequency of all the lines in the P_{LS}, with the whole document

b. Use the following equation to find the fitness,

$$f = \sum_{i=1}^{PLs} TF(PLSi, D)$$

c) Find the mean of all fitness of all

Solutions (NC)

$$M.F = \sum_{i=1}^{Nc} f / Nc$$

e) Evaluate the learning threshold using the following formula,

$$\text{Learning Threshold (M}_{TH}) = M.F. * \text{Suf}$$

d) If the fitness of a particular solution (Fs)

Satisfies the following equation,

$$F_s > MTH$$

Then, store solution at output Else, remove solution & change it in the next iteration

Step 5: Find the solution with maximum fitness it is the output summary

From the above steps, we can observe that the proposed algorithm uses EHO process. The EHO process is controlled using speed up factor. A low value of this parameter indicates, that the solutions will be created slowly, but the solution quality will be good, as the similarity between the selected lines in a solution will be low, while a high value might reduce the quality of the solution, but improve the speed of summarization. As this is a supervised learning algorithm, thus the user might need to manually check the value of speed up factor and decide the best value based on the output summary and the expected summary of the document. In simulations, it is observed that the values between 0.2 and 0.4, for speed-up factor are good for the overall quality of summarization. In the next section, we compared different summarization algorithms and their accuracies on different datasets, and observed that the proposed algorithm outperforms them in most of the cases.

4. RESULTS AND OBSERVATIONS

We evaluated the performance of the proposed algorithm using the DUC 2002 dataset, REUTERS dataset, and some of the manually generated datasets. Very few of the previous comparisons were made using these datasets, and there were limited comparison options which can give the exact comparison on the datasets which we have used for our extensive analysis. But we observed that the changes in the input dataset become irrelevant, when we take a large number of documents for summarization, and evaluate the mean of these results. We evaluated the results in terms of precision, recall, f-measure, and compression ratio. Each of these parameters were evaluated by their usual formulas. The following values were initialized to the parameters while performing the result analysis.

No of clans NC = 20

No of generations Ng = 100

Speed up factor (Suf) = 0.2

No of output lines expected $No_L = 50\%$ of the input lines

The following table 1 shows the comparison of precision between the various algorithms.

Algorithm Name	Precision
Lead 3 [1]	21.8
LReg [1]	18.6
TSERNN [1]	26.5
Cssnsa [2]	48.05
Wpdv [2]	47.75
ULeth [2]	46.51
CNN-rand [2]	47.64
CNN-word2vec [2]	48.62
Corpus Based [3]	32
RBM Method [4]	82
Improved RBM [4]	88
Proposed EHO	98

Table 1: Comparison of precision between different algorithms

As we can observe from table 1, the results of the proposed EHO in terms of accuracy/precision are much better than any of the previous algorithms. Similar comparison of recall is done in table 2. Similar to precision, recall is also better for the proposed machine learning based algorithm. Due to the improvement in precision and recall parameters, the f-measure parameter, which is a combination of both precision and recall, is also improved for the proposed EHO algorithm. Compression results are different for different algorithms due to the different sizes of the dataset used, and thus are not discussed here.

Algorithm Name	Recall
Lead 3 [1]	16.2
LReg [1]	12.6
TSERNN [1]	13.25
Cssnsa [2]	40.3
Wpdv [2]	39.6
ULeth [2]	37.7
CNN-rand [2]	41.2
CNN-word2vec [2]	42.6
Corpus Based [3]	28
RBM Method [4]	77
Improved RBM [4]	80
Proposed EHO	91

Table 2: Comparison of recall for different algorithms

The compression ratio for the proposed algorithm is controllable by the parameter No_L and thus can be varied based on the user's requirement. In our case, we had kept $No_L = 25\%$ of the input lines, which makes the algorithm's output to be adaptive in terms of the actual number of output lines.

5. CONCLUSION

From the result analysis, we can observe that the overall precision, recall, f-measure is better when compared with the state-of-the-art algorithms like CNN and RBM. These machine learning methods are very good when it comes to small sized documents, but they are literally not good in terms of the output summary quality when it comes to moderate to large sized documents. By moderate sized we are referring to documents which have more than 1000 lines. Even though the previous algorithms are good for smaller length documents, but it defeats the whole purpose of summarization when it is applied to small sized documents, because generally speaking, summarization is not needed for such documents. The proposed algorithm, due to its machine learning intelligence is able to accurately find out the repetitive sentences, and remove them from the input document, thereby giving a very accurate extractive summary. This can be observed from the precision graph as shown in figure 2.

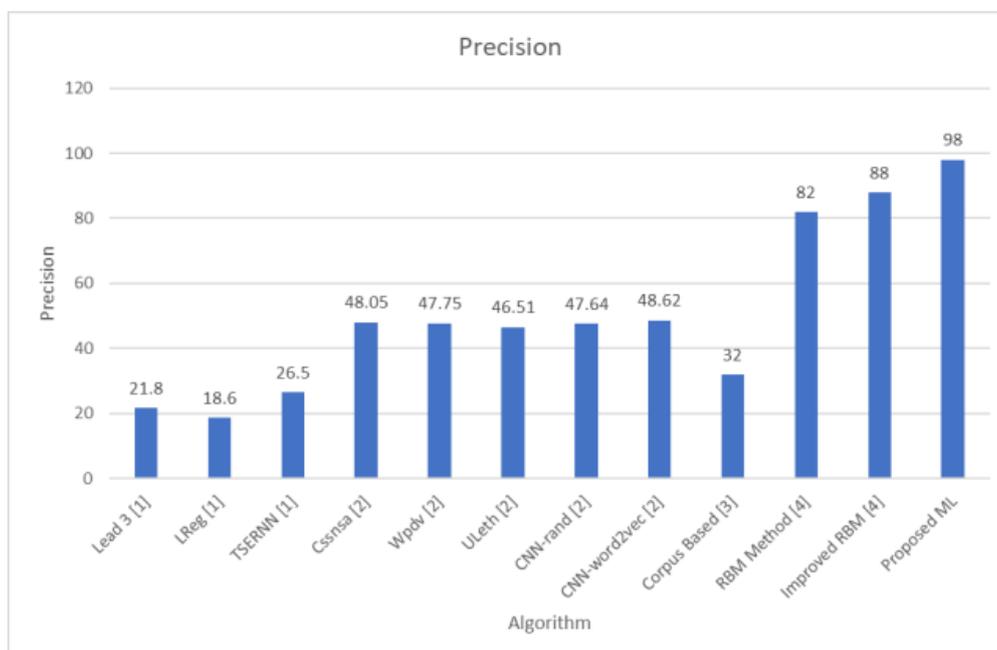


Figure 2: Precision graph

Similarly, the recall can be compared using the recall graph shown in figure 3.

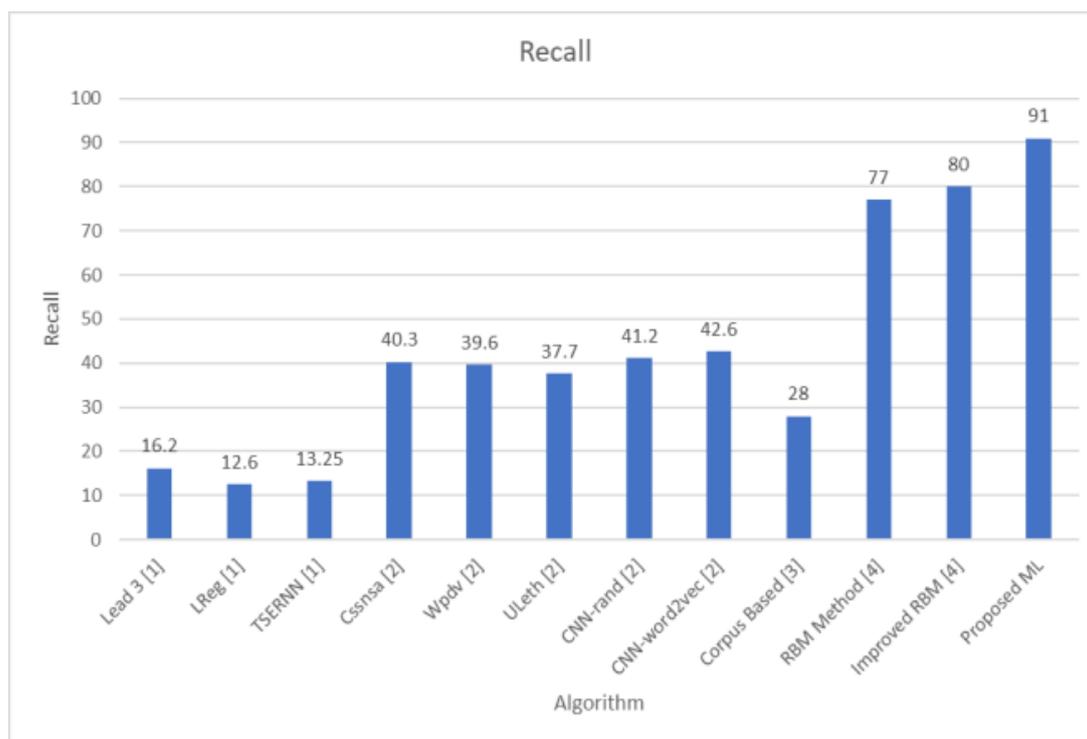


Figure 3: Recall comparison for the algorithms

From figure 2 and 3 we can observe that the proposed algorithm outperforms other standard techniques in terms of both precision and recall values.

FUTURE SCOPE

The current work describes the design of a machine learning based algorithm for abstractive summarization. In future, we can use the same concept for extractive summarization with the help of a document crawler. The crawler will search for the documents and data which match a particular paragraph in the input document, and combine all the contents together. These combined contents can be given to the proposed algorithm, and the abstraction can be tested.

6. REFERENCES

1. H. Xu, Z. Wang and X. Weng, "Scientific Literature Summarization Using Document Structure and Hierarchical Attention Model," in IEEE Access, vol. 7, pp. 185290-185300, 2019. <https://ieeexplore.ieee.org/document/8937799>
2. Saini N, Saha S, Chakraborty D, Bhattacharyya P (2019) Extractive single document summarization using binary differential evolution: Optimization of different sentence quality measures. PLOS ONE 14(11): e0223477.
3. Li, Yuhua & McLean, David & Bandar, Zuhair & O'Shea, James & Crockett, Keeley. (2006). Sentence Similarity Based on Semantic Nets and Corpus Statistics. IEEE Transactions on Knowledge and Data Engineering. 18. 11381150. 10.1109/TKDE.2006.130.
4. PadmaPriya, G. and K. Duraiswamy. "An Approach for Text Summarization using Deep Learning Algorithm." JCS 10 (2014): 1-9.
5. K. Srinivasa Rao, D.S. R. Murthy, Gangadhara Rao Kancherla, "Semantic Similarity Based Automatic Document Summarization Method", International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-8 Issue-6, August 2019
6. X. Cai and W. Li, "Ranking Through Clustering: An Integrated Approach to Multi- Document Summarization," in IEEE Transactions on Audio, Speech, and Language Processing, vol. 21, no. 7, pp. 1424-1433, July 2013.
7. C. Sunitha, A. Jaya, Amal Ganesh, A Study on Abstractive Summarization Techniques in Indian Languages, Procedia Computer Science, Volume 87, 2016, Pages 25-31, ISSN 1877- 0509

8. Masum, Abu Kaisar Mohammad, Sheikh Abujar, Raja Tariqul Hasan Tusher, Fahad Faisal and Syed Akther Hossain. "Sentence Similarity Measurement for Bengali Abstractive Text Summarization." 2019 10th International Conference on Computing, Communication and Networking Technologies (ICCCNT) (2019):1- 5.
9. DAKULGE, Umakant; DHARMADHIKARI, S. C.. Automated Text Summarization: A Case Study for Marathi Language. Data Mining and Knowledge Engineering, [S.l.], v. 6, n. 3, p. 99-105, May. 2014. ISSN 0974 – 9578.
10. Dhawale A.D., Kulkarni S.B., Kumbhakarna V. (2020) Survey of Progressive Era of Text Summarization for Indian and Foreign Languages Using Natural Language Processing. In: Raj J., Bashir A., Ramson S. (Eds) Innovative Data Communication Technologies and Application. ICIDCA 2019. Lecture Notes on Data Engineering and Communications Technologies, vol 46. Springer, Cham
11. Berkovsky S., Baldwin T., Zukerman I. (2008) Aspect-Based Personalized Text Summarization. In: Nejdl W., Kay J., Pu P., Herder E. (eds) Adaptive Hypermedia and Adaptive Web-Based Systems. AH 2008. Lecture Notes in Computer Science, vol 5149. Springer, Berlin, Heidelberg
12. Huang L., Li H., Huang L. (2013) Comments-Oriented Document Summarization Based on Multi-aspect Co-feedback Ranking. In: Wang J., Xiong H., Ishikawa Y., Xu J., Zhou J. (eds) Web-Age Information Management. WAIM 2013. Lecture Notes in Computer Science, vol 7923. Springer, Berlin, Heidelberg
13. Lamsiyah S., El Mahdaouy A., El Alaoui S.O., Espinasse B. (2020) A Supervised Method for Extractive Single Document Summarization Based on Sentence Embeddings and Neural Networks. In: Ezziyyani M. (Eds) Advanced Intelligent Systems for Sustainable Development (AI2SD'2019). AI2SD 2019. Advances in Intelligent Systems and Computing, vol 1105. Springer, Cham
14. Deepa Anand, Rupali Wagh, Effective deep learning approaches for summarization of legal texts, Journal of King Saud University - Computer and Information Sciences, 2019, ISSN 1319-1578, [https:// doi.org/ 10.1016/ j.jksuci.2019.11.015](https://doi.org/10.1016/j.jksuci.2019.11.015)

IoT & Cloud Based Greenhouse Monitoring System

Shubhangi Giripunje, Samata Talatule and Karishma B. Gondule

Department of Electronics and Telecommunication, Jhulelal Institute of Technology, Nagpur, Maharashtra, India

ABSTRACT

The desire to practice agriculture with the fusion of technology has become a necessity as a result of industrialization and constantly changing climatic conditions. In the era of the Internet of Things, where everyone is watching the evolution of machine-to-machine interaction, there is also a lack of clarity when it comes to deciding which protocol to use when building a system like Green House.

A green house is a controlled environment for agriculture in which critical parameters such as temperature, light, humidity, and soil ph. level can be monitored using sensor systems and Internet of Things protocols. In the experiment, the IOT protocol was chosen over the Constrained Application Protocol and the Extensible Messaging and Presence Protocol due to its light weight transmission, resource consumption, and effectiveness in providing different quality of services to detect temperature and humidity as well as gas leaks in a greenhouse environment.

Greenhouses are environment structures with specially designed walls and roofs for growing plants in the off-season. Most greenhouse systems rely on manual temperature and humidity monitoring, which can be inconvenient for workers who are required to visit the greenhouse every day and manually control the conditions. Also, because the temperature and humidity must be constantly monitored to ensure the plant's good yield, many problems can arise, affecting the production rate.

Keywords: IOT, Cloud Monitoring, Greenhouse

INTRODUCTION

A greenhouse is a structure with walls and roof primarily made of transparent material, such as glass, in which plants that require controlled climatic conditions are grown. A more scientific definition is a covered structure that protects plants from harsh external climate conditions and diseases, creates an optimal growth microenvironment, and provides a flexible solution for year-round cultivation that is both sustainable and efficient. Because a modern greenhouse works as a system, it's also known as controlled environment agriculture [1].

Plant production system in a controlled environment. Many commercial glass greenhouses or hothouses are high-tech vegetable or flower production facilities. The glass greenhouses are equipped with screening systems, heating, cooling, and lighting, all of which can be controlled by a computer to optimise plant growth conditions [2]. Different techniques are then used to assess optimality- degrees [3] and the comfort ratio of the greenhouse micro-climate (i.e., air temperature, relative humidity, and vapour pressure deficit) in order to reduce production risk prior to crop cultivation [4].

A greenhouse can be built for almost any property, from large freestanding structures to small window-mounted structures. Although working in an outdoor garden allows you to soak up the sun, many people prefer the controlled indoor environment that greenhouses provide. This allows you to stay productive in the garden even if it rains unexpectedly. Plants also grow better in greenhouses than they do outside. There are a few key atmospheric parameters to consider. [5]

PROBLEM STATEMENT

One of the most difficult problems is the unequal distribution of rain water, which makes it difficult for farm owners to manage the water equally to all crops across the farm. This necessitates the use of an irrigation method that is suitable for any weather condition, soil type, and crop variety. The best solution for all of this is a greenhouse, but this farmer requires continuous tracing of a greenhouse to maintain all environmental conditions that are required for different crops. If there is a change in the system, it should be changed or maintained in accordance with farmer instructions.

LITERATURE SURVEY

Kim et al. [1] recognized the need for personalized IoT management at home. In addition, the fundamental and powerful approaches to overseeing various machines and gadgets. As a result, the home environment requires a door that allows for dynamic device enrollment and disclosure via the lightweight MQTT protocol. The proposed system made it possible to create an energy-saving system.

Hunkeler et al. [2] put the MQTT-S to the test over wireless networks. The client side, or publisher, was written in C and transmitted over the Zigbee network. The Client API, on the other hand, was discovered to send keep-alive messages even when a device had failed and was no longer sending messages; the Client API continued to ping requests. It was also impossible to trigger the "will message" in the event of a node failure, and sending the message from the broker to the clients became impossible with QoS 1 or 2.

Stankovic [3] examines the various research-oriented concerns surrounding the evolution of the Internet of Things (IOT). The need to equip networks and ensure concerns like massive scaling using techniques like IPv6 and Low Powered Wide Area Networks arises for the full fledge running of future IOT devices (LPWAN). The devices' and sensor devices' reliability will be determined by their sensing and parameters such as sleep/wake schedules using connectivity.

In a greenhouse application on the capsicum crop, Hemraj and Sukesha [4] proposed the Adaptive on Demand Transmission Power Control protocol with a threshold temperature range of 18-25°C. In wireless networks, it was observed to improve battery efficiency, but the results were hardware dependent.

Luzuriaga et al. [5] provide an overview of the Message Query Telemetry Transport protocol (MQTT). The various levels of Quality of Service (QOS) are discussed and classified into three types – (QoS = 0), (Qos = 1), and (Qos = 2), with messages sent only once, at least once, and exactly once, respectively. Using the intermediate buffering technique, a solution was also proposed that guaranteed no information loss. However, when the buffer capacity was full and overloaded, memory leaks occurred.

PROPOSED WORK

The most critical parameter for a greenhouse is humidity. The greenhouses humidity is thus measured in terms of the relative humidity which is a mixture of ratios of water vapor (H₂O) P_w in the mixture to the saturated vapor pressure of water P_s at a given temperature.

In Flow chart, relative temperature and Soil Moisture is expressed in percentage of the actual vapor density by the saturation vapor density. The temperature inside the greenhouse is yet critical as it directly affects the Fan and Water pump which connected.

Similarly, Fan and soil moisture sensors in the surrounding greenhouse environment and indicate the peak rise in readings when a temperature is greater than 27 deg and when moisture sensor is less than 50deg then controller alerting the user with an alarm signal to take the necessary action. The transmission of information takes place from the sensor publishing the readings on cloud dashboard

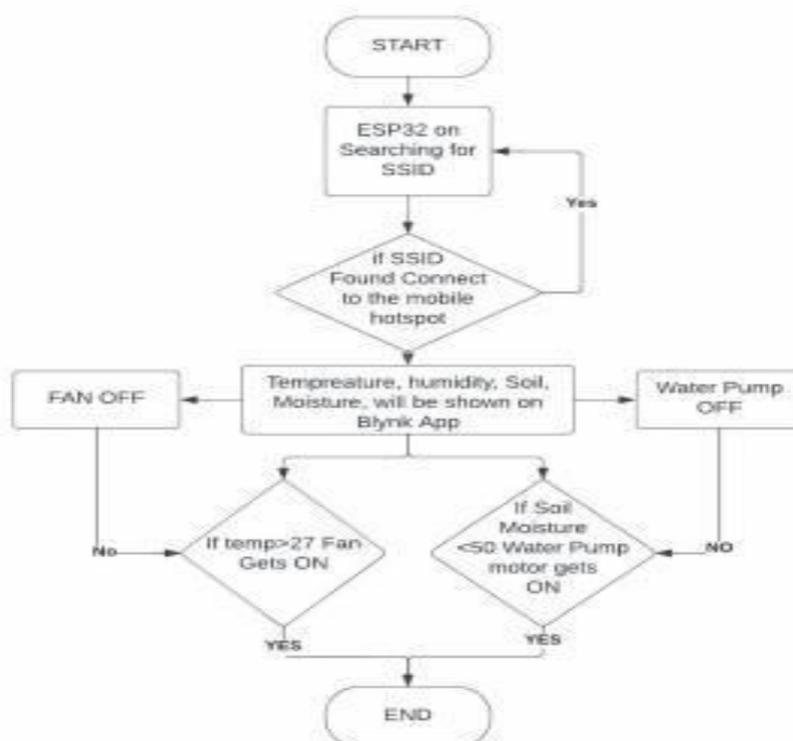


Fig: Flow chart

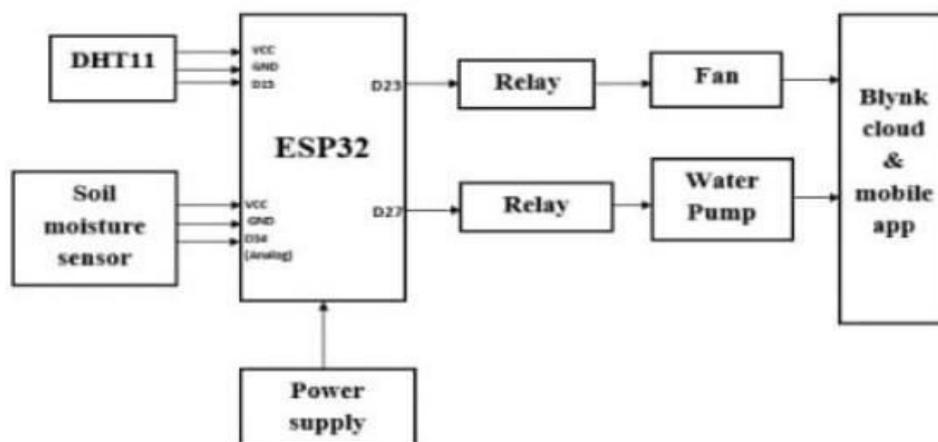


Fig P: Block Diagram

represents a microcontroller-based circuit which monitors and records the values of temperature, humidity, soil moisture and sunlight of the natural environment that are continuously updated as a log in order to optimize them to achieve maximum plant growth and yield. The greenhouse's internal temperature is measured using a temperature sensor.

The ESP receives a reading from the sensor. Various relays are connected to the ESP. A fan is connected to one of the relays. The ESP would send signals to turn ON the Fan depending on whether the temperature was above or below the threshold value. A second relay is similarly connected to a water pump. The ESP will send a signal to the IOT module. ESP receives data related to these parameters at the same time. No matter whether a threshold mismatch is discovered, the data is sent to the IOT at regular intervals.

The ESP module is used to establish TCP/IP connections with controllers, send data, and connect them to wireless networks. These sensors collect data, which is then transmitted to the IOT. The Wi-Fi module must be linked to a hotspot or Wi-Fi zone in order to complete this project. Water pump to turn on whether the soil moisture is above or below the threshold value.



Fig Q: Hardware Setup

The parameters are saved in the "Blynk" opensource webserver. The data acquired from the various sensors and the status of the various devices are also displayed in real time on an integrated Liquid crystal display (LCD). The system is constantly changing monitors the various sensors' digitized parameters. Sensing is used to monitor and control the greenhouse environment.

The changes that take place inside it, which can affect the rate at which plants grow. The temperature inside is one of the most important factors. The greenhouse has an impact on the photosynthetic and transpiration processes, humidity, soil moisture content, and lighting.

The design of the proposed collects data (such as temperature, humidity, and moisture) from environments (such as greenhouses) and transmits it to a remote server via modem over an internet connection, as well as allowing remote commands to be executed. Both the web and a smart phone could be used to access data on the remote server.

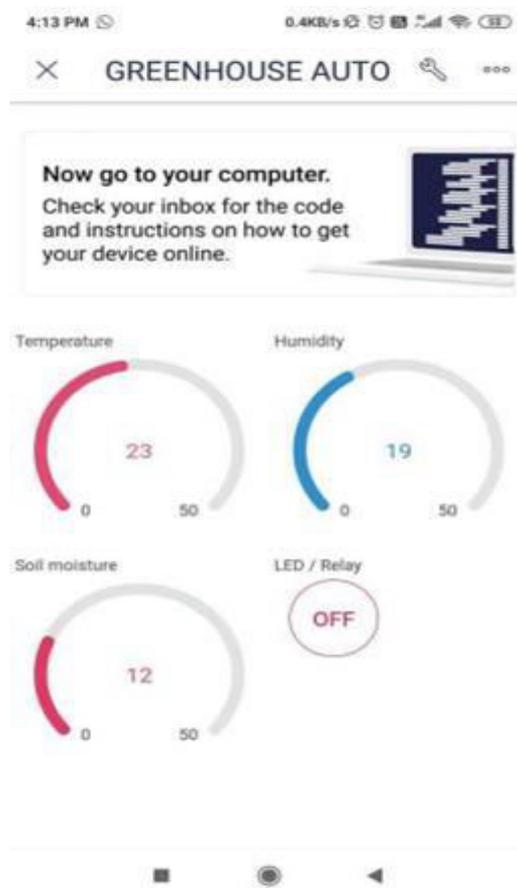


Fig R: Webpage Output

These stations may also serve as distance management centers. A database should be kept track of throughputs and measurement times. We're using two WIFI modules here, one for uploading records to the cloud and the other for controlling. Furthermore, the remote server should keep track of records to ensure that values are within acceptable limits.

When a value exceeds the bounds, such as when the temperature rises dramatically, the remote server should send an alert to the subscriber's phone and automatically turn on the cooling fan. When a user receives an alert, he has the option to manually intervene and prevent an emergency situation.

Mode selection buttons, sensed values, and GPIO access are all part of the controlling webserver. The system will function as an intelligent system once the device is switched to automatic mode. That is, if the parameter value exceeds the limit, an event will be triggered automatically. When manual mode is selected, we must manually turn on and off each device.

ADVANTAGES:

- User Friendly
- Easily implementable
- Focuses on main parameters
- Uses GSM because of their availability
- Easy network coverage
- Cloud computing provides Increased storage
- Easier group collaboration
- Resource continuity

RESULTS & ANALYSIS OF RESULT/ DISCUSSION:

In the experiment conducted with the IOT protocol on the Node MCU ESP with the various sensor systems we attained the following results:

Table1: DHT11 Reading

Humidity (%)	Temperature
32	29
33	28
34	27
34	27
36	19
38	18
39	15

The values of DHT11 sensor readings are recorded for over 30 trials in Table 1, and the average is used to plot a graph as shown in the below figure. Temperature and Humidity

We designed an automatic temperature control and irrigation system by monitoring the parameters temperature, humidity, and soil moisture content using temperature & humidity sensors and moisture sensors to always maintain a suitable climate inside the greenhouse and to retain appropriate moisture content in the soil. Each section of the greenhouse is divided into several sections, with one moisture sensor in each section.

The output of these moisture sensors is sent to the Node MCU's GPIO pins 2, 3, and 4. The serial output of the DHT11 sensor is connected to ESP's GPIO pin 17. Using the formula below, we arrived at a threshold value.

(Threshold value) idx =

$$\text{Temperature} + (\text{Humidity} * 0.1) = 25 + (14 * 0.1) = 26.4 \text{ I}$$

When the temperature and humidity value exceed the threshold, the cooling fan and sliding windows connected to the I293d IC are automatically turned on, ensuring that the humidity and temperature in the closed green House system are maintained. Wi-Fi connectivity is used to send the collected temperature and humidity data to the Blynk cloud.

Humidity is the most important parameter in a greenhouse. The humidity of the greenhouse is thus measured in terms of relative humidity, which is a mixture of ratios of water vapour (H_2O) P_w in the mixture to the saturated vapour pressure of water P_s at a given temperature. Generally speaking, The saturation vapour density is used to calculate relative humidity as a percentage of the actual vapour density.

The temperature inside the greenhouse is still important because it has a direct impact on the photosynthetic and transpiration processes of the plants. Similarly, gas sensors absorb gases in the surrounding greenhouse environment and indicate a peak rise in readings when a gas leak or incident is detected, alerting the user with an alarm signal to take action.

CHALLENGES

Energy-efficient technology will rely heavily on green IoT technologies. There are a slew of serious issues that must be addressed. The author summarizes them here and highlights the key issues that need to be addressed further.

- Green Infrastructure: Providing energy-efficient infrastructure is seen as a critical issue on the road to greening. However, because deploying significant new infrastructure is difficult, this area of research is less focused and requires additional attention.
- Green Security and QoS: Algorithm execution places an additional load on IoT devices, resulting in excessive energy and power consumption. When it comes to green IoT, safety and security are top priorities. Along with security, we must look into excellent mechanisms that take into account both power consumption and the required QoS.
- Green IoT Architectures for IoT: IoT architecture is still a work in progress. The standardization committees are attempting to allow connections between heterogeneous networks and other devices with a wide range of capabilities. The goal is to think about protocols as a way to save energy while performing other tasks.

- Green Communication: The Internet of Things (IoT) has many important components, one of which is communication, which has a number of issues and challenges.

CONCLUSION

This paper describes the design of a greenhouse monitoring system based on Cloud IoT. Agriculture projects have recently increased in number and variety, even in urban areas. The agricultural sector is rapidly expanding as a result of technological advancement, which in this case is enabled by Cloud IoT.

The Internet of Things will have a significant impact on how we live our daily lives and how information about us is stored. You can use cloud computing at any time and from any location as long as your computer is connected to the Internet. Sensors, GSM, and the cloud are used in this monitoring system to provide updates on various parameters inside the greenhouse. Because it optimizes greenhouse resources, the developed system has the potential to be profitable.

The entire module is low-cost and low-power, allowing it to be used by anyone. This paper presents a basic concept in greenhouse research, but technologically, there is still much more to be discovered. This study only added a minor improvement to the traditional method of monitoring plant parameters such as humidity, temperature, soil moisture, and lighting within the plant premises, automating them, and monitoring them from afar using IoT.

However, in the future, we will be able to use image processing to monitor not only plant parameters but also the plant's internal health conditioning. It means we can see which parts of the plant are healthy and which have dead cells. Using various technologies, we will be able to determine how much chemical is required for specific plant growth in the future.

FUTURE SCOPE

Green IoT has the potential to transform our future, making it greener and healthier in both economic and environmental terms. Green IoT services, integrated RFIDs, energy-efficient models and planning are among the recent research projects aimed at closing the gap in green

IOT Localization. As a result, researchers must find solutions.



Solution of Green House IoT

REFERENCES:

1. Kim, S.M., H.S. Choi and W.S. Rhee, 2015. IoT Home Gateway for Auto- Configuration and Management of MQTT devices. Proceedings of the IEEE Conference on Wireless Sensors, Aug. 24-26, IEEE Xplore press, Melaka, Malaysia..
2. Hunkeler, U., H.L. Truong and A. Stanford-Clark, 2008. MQTT-S – a publish/subscribe protocol for wireless sensor networks. Proceedings of the 3rd International Conference on Communication Systems Software and Middleware and Workshops, Jan. 6- 10, IEEE Xplore press, Bangalore. DOI: 10.1109/COMSWA.2008.455451

3. Stankovic, J.A., 2014. Research directions for the internet of things. *IEEE Internet Things J.*, 1: 3-9. DOI: 10.1109/JIOT.2014.2312291
4. Hemraj and Suksha, 2014. Power estimation and automation of green house using wireless sensor network. *Proceedings of the 5th International Conference-Confluence the Next Generation Information Technology Summit*, Sept. 25-26, IEEE Xplore press, Noida, India
5. Luzuriaga, J.E., J.C. Cano, C. Calafate, P. Manzoni and M. Perez et al., 2015. Handling mobility in IOT applications using the MQTT protocol. *Proceedings of the Internet Technologies and Applications*, Sept. 8- 11, IEEE Xplore press, Wrexham, UK. DOI: 10.1109/ITechA.2015.7317403
6. Remya Koshy , “Greenhouse monitoring and controlling based on iot using wsn”, *ITSI Transactions on Electrical and Electronics Engineering (ITSI-TEEE) ISSN (PRINT) : 2320 – 8945, Volume -4, Issue -3, 2016.*
7. El Harzli M., 2009. “Study and realization of a multifunctional sensor, heat flux, temperature and humidity. Application to the greenhouse control”, National PhD ,Faculty of Sciences, Meknes, Moulay Ismail University, Morocco
8. Shamshiri (2017), "Dynamic Assessment of Air Temperature for Tomato (*Lycopersicon esculentum* Mill) Cultivation in a Naturally Ventilated Net-Screen Greenhouse under Tropical Lowlands Climate", *Journal of Agricultural Science and Technology*. 19 (1): 59–72.
9. Keerthi.v, “Cloud based green house monitoring system” ,*Int. Journal of Engineering Research and Applications* ISSN: 2248- 9622, Vol. 5, Issue 10, (Part - 3) October 2015, pp.35-41
10. Mohammed Juned1, Srija Unnikrishnan, “Journal of Basic and Applied Engineering Research”, *Print ISSN: 2350-0077 Online ISSN: 2350-0255; Volume 1, Number 8; October, 2014 pp. 108- 111.*

IoT Based Real Time Potholes Detection System Using GPS and Ultrasonic Sensor

Gaurav Sambhe and Chetana Gondane

Department of Electronics & Telecommunication Engineering, Jhulelal Institute of Technology, Nagpur, India

ABSTRACT

A corona virus has contaminated more than 36,087,836 human beings and 1,055,387 deaths due to the fact December 2019. As it unexpectedly spreads throughout the planet, scientists and public -health experts are racing to slow down the spreading and trying to find methodologies to observe it. To do that, they need to apprehend the new virus. It's known as severe acute respiratory syndrome corona virus 2, or SARS-CoV-2. There are different approaches to diagnose COVID-19, but they are not pricey and time consuming, by the usage of chest x-ray; we can limit price and result in time. But to diagnose x-ray's we need professional radiotherapists. Thus, we developed a mannequin that mechanically become aware of COVID and non-COVID X-rays. These days Deep Learning algorithms shows the important consequences in Disease classification. Also, aspects discovered with the aid of pre - trained Convolution Neural Networks (CNN) fashions on large - scale datasets are useful in photo classification tasks. We train and test our model to analyze the pictures as COVID or normal, also we analytically decide the ultimate CNN mannequin for the purpose. The accuracy metrics are used to validate the classification of the model. The important aim of this thesis is to enhance a computer studying model that should predict whether or not a patient's suffering from COVID-19. To increase such a model, a literature find out about alongside a scan is set to become aware of an appropriate algorithm. To assess the elements that influences the prediction model.

Keywords COVID-19, Chest-X ray Images, Machine Learning, Deep Learning, CNN.

1. INTRODUCTION

In this couple of decades, the automobile industries have put tremendous effects to make the vehicles much safer and reliable. All the efforts have only one similar type of goal and that is to reduce the number of accidents, and one of the major reasons of accidents are potholes. A pothole is defined as irregularities on the surface of the road. With the climate change such as heavy rain and other factors like cheap quality of material used, poor maintenance of road leads to the increase of the potholes. Humps, which are usually laid on the road to reduce the speed of the vehicles can also damage the vehicles if the driver is not attentive enough. Here, we will make a prototype model which will help the driver of the vehicle to avoid or reduce speed when the pothole or hump is in its proximity.

This is done by alerting the driver of the vehicle by a buzzer. We will be using ultrasonic sensors to detect pothole or hump because in rainy season or at night time they are not clearly visible. If not all at least few accidents can be avoided using this.

Vehicle population has tremendously increased over the last two decades. Nowadays traffic congestion and road accidents are increasing mainly due to the proliferation of vehicles. Roads make up to the majority of means of transportation used as of today in India, regular maintenance of these roads is crucial as they are filled with unexpected hurdles such as potholes and humps. Potholes are basically areas of road surface that have ruptured, worn away, or eventually formed a hole. Potholes leads to unbalance while driving which can eventually lead to accident. According to the report of Global Road Safety, released by the World Health Organization (WHO), India reports for more than 200,000 deaths because of road accidents. These accidents can be due to over speeding, drunk and driving, jumping traffic signals and also due to humps, speed-breakers and potholes. [1] The solution to this problem must be designed wherein it ensures the systematic and safe flow of traffic on Indian roadways. This can be achieved by maintaining the equality of roads. The regular monitoring of these roads will help the government to be aware of the possible threats of fatal accidents on road. To achieve this, we wish to have a government vehicle which runs through the entire paths and collects the information about potholes at different locations. Depending upon the depth and the soil structure below the pothole the emergency to fill the hole can be derived. The motive behind this project is to notify the Municipal Cooperation regarding potholes which will avoid accidents and make roads a better place to ride. This is achieved by establishing a detection system which employs an ultrasonic sensor to measure the area and depth of a pothole. This related information is then processed by the controller and the equivalent coordinates of the location obtained from a global positioning system, are sent via global system for module. After getting damage due to potholes vehicles require or seek for maintenance which in turn increases vehicle maintenance cost. Roads too require maintenance once affected by potholes.

LITERATURE REVIEW

[1] Pothole recognition and alert using ultra sonic, GPS and GSM Vaishnavi Kinderley, Chaitali Malode, Janvi Bhojwani, Sujata Chiwande International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 7, Issue 2, March 2018

Maintenance of roads is one tiresome re-constructual task that has to be carried out regularly. The inability to do the same has numerous consequences like fatal condition of highways which result in early need of servicing of domestic vehicles. If proper maintenance is not done, this further results in environmental pollution as well as life threats. Our proposal involves the identification of such potential threats and letting one know the urgency to take care of these threats. This is achieved with the help of a system that comprises of ultrasonic sensors, GSM and GPS module controlled by a processor. Ultrasonic sensors are used to measure pothole's depth in addition to identifying them. The geographical location i.e. the coordinates of potholes using a global positioning system can be obtained. This information inclusive of all the details regarding potholes i.e. depth, width and its location, is sent to municipal corporation with the help of GSM module. The Municipal Corporation further uses this information for maintaining a record.

[2] Prajakta Tanksali¹, Omkar Naik², Dhruv Desai³, Shubham Ranesardeai⁴, Saesha Zalmi⁵ DETECTION OF POTHOLE AND HUMPS International Research Journal of Engineering and Technology (IRJET)

Now a days many automobile companies are working on projects in the field of vehicular intelligence. They are working in the direction of providing driver with relevant information about the potholes and humps on the roads. In this paper, we propose an Arduino based module used for Pothole Detection and Warning System which assists the driver in avoiding potholes on the roads by giving prior warnings. The system consists of ultra-sonic sensors placed on the exterior of the vehicle for broadcasting data, which alerts the driver by raising an alarm and displaying the distance on the display (lcd panel). This will help the drive to take major decisions on going left or right. Avoiding any major damages or accidents.

There are number of researchers who have worked on detecting the potholes as well as humps using different methods. Pothole Detection and Inter Vehicle Communication [1]. In this they build a robot vehicle which will detect the potholes and then transfer this information to the nearby vehicles. They will detect potholes with minimum depth of 1 inch and will share this information to the other nearby vehicles within 100 m range using Zig Bee module. Obstacle Detection Using Ultrasonic Sensor for a Mobile Robot [4] this is an obstacle avoidance project using Ultrasonic Sensor for mobile robot using Arduino Uno. Development and Analysis of Pothole Detection and Alert based on Node MCU [3]. This project deals with the detection of potholes using Ultrasonic Sensor and then after detecting it will send its location via mail to a road Development Authorities. The location is shared using GPS and IFTTT server. Role of Ultrasonic Sensor in Automatic Pothole and Hump Detection System [5]. In this they detect the potholes and humps and save this information in server and will try to reduce the speed of the vehicle. GPS is used to find the location of the pothole.

METHODOLOGY AND DATASET



Figure-1 Proposed Methodology of system

In this project design, structured modular design concept is adopted and the system is mainly composed of Nodemcu microcontroller, ultrasonic sensor Relay and ubidots cloud-based database. The ultrasonic sensor is used to detector the potholes on road. The distance of the road from ultrasonic sensor is same when no pothole when there is pothole the distance get varied so the ULN 2003 is given the singal to relay driver to drive the buzzer and red lamp to indicate the driver as well as the location of the pothole is stored in the ubidots database using ESP8266.

These information's is collected by ubidots cloud via esp8266 and stored in database for further use. Or these information's send through SMS alert. Embedded C is a set of language extensions for the C programming language by the C standards committee to address commonality issues that exist between C extensions for different embedded systems.

V. RESULTS AND DISCUSSION

In this project we have proposed a system which will detect the potholes on the road and save the information in the server and reduce the vehicle speed if needed. Due to the rains and oil spills potholes are generated which will cause the accidents. The potholes are detected and its height, depth and size are measured using ultrasonic sensor. The IOT cloud is used to find the location of pothole. All the information is saved in the database. This timely information can help to recover the road as fast as possible. By controlling the rate of fuel injection we can control the rotation of the drive shaft by means of an IR Non-contact tachometer. This helps to reduce the vehicle speed when pothole or hump is detected. Hence the system will help to avoid road accidents

VI. CONCLUSION AND FUTURE WORK

The proposed system will provide safety and security to wildlife and help to increase their numbers which are on extinction. Pothole detection system using IOT is useful for to minimize the accident on road. So, they can be protected from accident. Embedded system based this project provides accurate location of the pothole and indicate the vehicle driver to slow down there vehicle. System provide automated solution for data prediction. Because of this the human work can be minimized and the death of human life also can be minimized. This system can also have its usage in speed breaker identification system,

This project-based on IoT which is a useful platform to connect devices to the internet and check data from any point at any location in the world. Ubidots with the advanced feature are used for this project which automates devices that are connecting to the system. By using this, different events have created to control by users. This is not only a monitoring system but also a controlling system which is connected to the internet to make smart and intelligent pothole detection.

After researching different devices like Arduino, Raspberry Pi, NodeMcU, etc had concluded to use NodeMcU which is a wireless wifi module to be operated with the help of the internet. This low cost, high speed and high technique device are finally chosen for this project.

Thus to overcome all this drawback, this project is designed. In this project, NodeMcU is used to connect all sensors, which wireless wifi module so no need of an external wireless network. Ubidots used as IoT platform which is not only able to monitor sensor from the field but also control operation of the device without manual efforts.

The analytics services should also include more complex tools. A schedule function should be implemented in order for the users to plan the frequency of the sensing for every sensor. A migration to the cloud for the server is important for the scalability of the system, as well. More complex tools like extending alerts to enable the use of functions, rather than simply local equations involving current sensor values could be a useful addition. These functions could even consider historic sensor values in order to identify patterns. The most important and useful job that has to be done is the real field testing for extended time and with several sensor platforms and sensors deployed in fields. This will provide feedback that could be meaningful for the further development of the system and would include the users' insights and real needs.

REFERENCES

1. "Real time pothole detection using Android smartphones with accelerometers," A. Mednis, G. Strazdins, R. Zviedris, G. Kanonirs, L. Selavo, dcoss, pp.16, 2011 International Conference on Distributed Computing in Sensor Systems and Workshops (2011)

2. Detecting User Activities using the Accelerometer on Android Smartphones, Sauvik Das -Georgia Institute of Technology, LaToya Green —University of Houston, Beatrice Perez — University of Puerto Rico, Mayaguez, Michael Murphy — Franklin W. Olin College of Engineering (2010)
3. Pothole Detection and Warning System using Wireless Sensor Networks” Sudarshan, Vijay, Goyal, Kulkarni, Arya, Embedded Real-Time Systems Laboratory, Indian Institute of Technology Bombay (2009)
4. The Pothole Patrol: Using a Mobile Sensor Network for Road Surface Monitoring, Eriksson, J., Girod, L., Hull, B., Newton, R., Madden, S., Balakrishnan, In: MobiSys'08. pp. 29-39 (2008)
5. Gps coordinate pothole mapping, N. Angelini, J. Brache, M. Gdula, and G. Shevlin, Technical report, Worcester Polytechnic (2006).
6. Virtual Ground Truth in Vehicular Sensing Experiments: How to Mark it Accurately, Girts Strazdins, Artis Mednis, Reinholds Zviedris, Georgijs Kanonirs, Leo Selavo, ISSN: 2308-4405, ISBN: 978-1-61208-144-1 (2011).

WSN and IoT Based Train Track Fault Monitoring System

Narendra Bawane, Parinay Lawatre and Mrunal Thakre

Department of ETC, Jhulelal Institute of Technology, Nagpur, Maharashtra, India

ABSTRACT

The train track system is the one of the most important way to travelling from one place to another place. The cost for travel system is also easy to pay for people and easy to travel all over in India specially with comfort zone. In the train track system security system will be easily implemented with the help of IOT and WSN, by solving the two struggles with wireless sensor networks. Because train travelling has been needed more security as compared to other travelling vehicle like bus and vehicles. That's why, finding the new technologies for the various uses, e.g. wireless sensor networks (WSN), is needed as a solution of decrease of these saddening and reprehensible statistics in the India. This project concern to detect fault in the system and wireless sensor network system to utilize WSN and IOT for vehicular networks in train track system. This project concern with fault detect in the various mode of system using wireless sensor network in short for using track. The project is basically for the train track fault detection system is a fault detector system and sensor network comprised of a large number of sensor node like locational . For the track damage is create more causes in the train. To avoid this one by using the wireless sensor network. When train is running if the track get damage the corresponding sensor transmit the signals to next sensor and so on the nearer small location to detect the exact location of system. The transmitter is send the signal to train which the message send from one to another. In the driver cabin it indicated the red and green lamp. If there is no break in the track the green lamp indicated. If there is any fault is indicate by red lamp and buzzer the LCD screen shows the faulty location. After some delay if driver does not put break the system put breaks the system put down the train break system there two kinds of sensor nodes, some are embedded on the track to track nodes and other are deployed in different distances besides the highway road, known as Track Side Sensor which is used by wireless sensor network is project usually concern to a process for detecting the condition of rtrai n track or the fault in the tracks and more specifically has the object of the identification of fault on the track detected by monitoring equipment on the tracks to be examine to allow maintenance crews to subsequently find these defects. When the message is given to the device of faulty system, the DC motor gets start through relay driver circuit which is help to detect fault of the system using wireless sensor network. Two sensors are fixed in with the of the train which is used to find out the fault on the track. Each of sensor will produce the signal related to the position with the rail track. If the track position is normal that is means there both the sensor gives the constant sensed output like no fault occurs there. If any of the sensor misses their output condition to fail then there is defect on that side. The wireless sensor network will be inform the fault by giving alarm to the main office station and sends information to the main head quarter with the help internet of thing and detect fault using wireless sensor network. UV sensor which is generally used to found the fault in the track if any fault occurs in the system it means the automatically transmits the message to nearby station via IOT using . The location which is detect by the GPS system of this train will automatically sends to each station via IOT.

Keywords: WSN, transport, IOT, Fault control

INTRODUCTION

In the Indian railway scenario, most commercialized and very important transport is being carried out by the train track network and that's why any problem in the same has the capacity to induce major damage to the economy-notwithstanding the social effect of loss of life. This paper put forward a cost effective yet solution to the problem of railway crack detection or any fault occurs in the train track system utilizing a method that is unique in the sense. This project discusses the technical and design aspects in detail and also provides the proposed fault detection in the system using IOT and WSN.

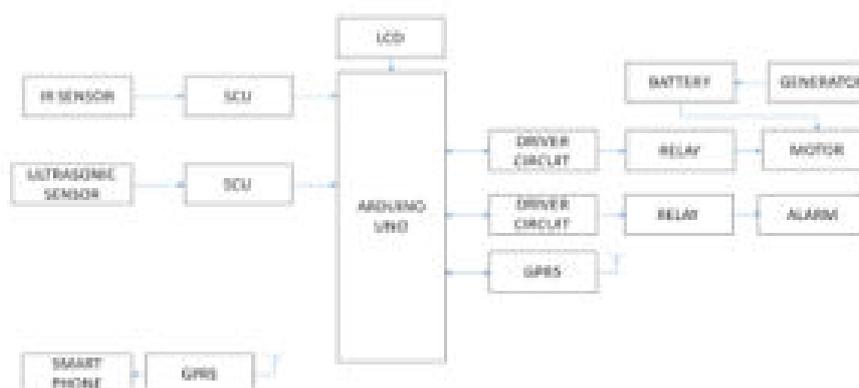
Presently industry is increasingly shifting towards automation now. The two basis components of current industrial automations are programmable controller. In order to detect the fault in the system work and to serve the mankind, there is a general tendency to develop an intelligent operation. PIC Microcontroller is the heart of the device which handles all the sub devices connected over it. The microcontroller has been used here. It has flash type reprogrammable memory and some peripheral devices to play this project perform. IR sensor is used to detect the crack in rail road, when the crack is detected its notifications are send as a message to nearby station by using GPS and GSM service in the system. Then Ultrasonic is used for the surveying process. Then other important component is PIR sensor it is used to detect the presence of humans in track. A practical

methodology to non-destructively localize cracks and estimate the sizes of the cracks in beam-type structures using changes in frequencies. Utilizing simple components like GPS module, GSM Modem, IR Transmitter and Receiver based crack detector assembly is very useful in railway crack detection. Crack detection method has been explored which uses sensors and IOT to observe the rail surface which is generally used to find the location. When a fault occurs in the track in rail is encountered along the route with the help of various sensors, the circuit will be interrupted or open, resulting in a changed flux pattern. This project will surely change is detected by a GPS sensor which help to detect the location of the system and the geographic location of the track fault in the rail is determined and sent message to the main office of the train track system. Train track fault will detect fault or damage in railway system utilizes the change in infrared emission of the rail surface and it changes the system. Initial data from this infrared method are dispense from studies of both laboratory-based three-point bend specimen and a short section of rail. This paper proposes a work of detecting the fault occurs in the railway track using IOT and also presents the details of the implementation results of the robust crack detection system utilizing simple components inclusive of a GSM modem and IR, Ultrasonic based crack detector assembly. The proposed methodology has been designed for robust implementation in the Indian scenario.

PROPOSED WORK

This system involves the design of crack finding robot for finding cracks in railway tracks. This system uses controller for interfacing the robotic vehicle and crack detection sensor. The sensing device senses the voltage variations from the crack sensor and then it gives the signal to the microcontroller. The microcontroller checks the voltage variations between measured value and threshold value and controls the robot according to it. This project uses regulated 3.3V Power supply the project is suitable for Indian scenario The system can be operated at tunnels also, without interruption. IR sensors are used for obstacles detection. First of all we give power supply to stepper motor which is 12V and 5A from power adapter and 5V Supply to Raspberry Pi. Since ultrasonic sensor is connected through stepper motor with the help of pulley system, the ultrasonic sensor continuously moves back and forth across the railway track and checks for the fault. If any fault is found on railway track anywhere on the track, it immediately stops and send ultrasonic waves to find the fault (i.e. where the fault is) and measure the distance and again reflect back the signal and gives the detailed information of the fault to the cloud server from where the railway control room officer knows about fault in advance and accidents can be prevented.

In this circuit we have used stepper motor, ultrasonic sensor, motor driver IC (A4988), Raspberry pi and LCD display. The stepper motor will rotate back and forth across the whole railway track. If there is any fault detected on the track, the ultrasonic sensor attached to the system will send out ultrasonic waves and indicates the distance which is less than the preset distance and indicates a fault in track and the fault information to monitor screen of the railway department. The motor driving belt is tied to a pulley to which ultrasonic sensor is connected and moving back and forth with help of stepper motor and if fault is detected then it shows on LCD display and information is showed on cloud server. In this system the main use is of Ultrasonic Sensor which is a kind of active sensor i.e., it has component for both reception and transmission in it. So this sensor is mounted on a wooden plate which has given support by two smooth steel rods. The steel rods are there for the support of the wooden plate on which the infrared sensor is mounted. The wooden plate and the smooth rod are kept in contact to each other with the use of linear bearings, these bearings will let the rod to pass through them and simultaneously provide the support required for wooden plate. There are two smooth rods in this project which are fixed from both the ends and they are separated to each other by the breadth of the wooden plate.



Now in wooden plate is fully supported and fully mobile. So this wooden plate is attached to a timing belt from beneath. And this timing belt is tied from a pulley from one end and from the another end it is wrapped around on a gear which is in the rod coming out of the Stepper Motor, this timing belt is tied in such a way so that when the gear on the stepper motor revolve then the timing belt also rotates and correspondingly the pulley will also rotate and accordingly the wooden plate on the smooth rod will also move in forward and backward direction. A wooden plank is used as a base for this whole project. On which these pulley, stepper motor and the other things will be screwed down to it to give it Support and make it Rigid. Now the stepper motor is controlled by the stepper motor module and the program fed in the raspberry pi so the speed and the steps of the stepper motor are controlled accordingly. The ultrasonic sensor which is mounted on the wooden plate is also connected to the raspberry pi. Now this sensor is used to sense the faults in the railway track. The ultrasonic sensor which sends emf waves to the railway track and the waves which are transmitted and reflected then the time in between this interval is calculated and accordingly the distance is calculated which is the main principle of this project. So to automate this project a IOT is used. So, a blynk app is used which is connected to the raspberry pi through internet so by which the whole project will be turned on and turned off.

FUTURE SCOPE

By using various sensor networks techniques we also develop more and more reliable security systems applications, in which continuously monitors the railway track through the sensors and detect any abnormality in the track. By using GPS in this system we can monitor position of railway and display on digital map. Enhance features of GPS includes video feature, trace mode, history track. In future CCTV systems with IP based camera can be used for monitoring the visual videos captured from the track. It will also increase security for both passengers and railways.

GPS can also be used to detect exact location of track fault area, IP cameras can also be used to show fault with the help of video. Locations on Google maps with the help of sensors can be used to detect in which area track is broken.

RESULT AND DISCUSSION

The growth in science & technology is a non-stop process in present days. New things and new technology are being invented day by day. As soon as the technical field is grow day by day, we can gives the idea about the how future in which thing we may occupy every place and how fast the technical field is expanded. The proposed system based on Arduino microcontroller is found to be more compact, user friendly and less composite which can readily be used in order to perform several monotonous and repetitive tasks. However it is designed keeping in mind about the need for industry, it can extended for other purposes such as commercial & research applications. The principle of the development of science is that “nothing is impossible”. This system can easily relate to a process for controlling and detecting of train tracks fault and more specifically has the object identification of defects detected by monitoring equipment the track which is occurs in the system and to allow maintenance and detection crews to subsequently find these defects of the system. This project presents the implementation results of the railway track crack control system using simple components inclusive of a GPRS modem and IR based crack detector assembly. This is cost effective railway track crack detection system with greater accuracy and High speed information transferring after crack detection.

CONCLUSION

This project concern to a process for monitoring the condition of train tracks and more specifically has the object of the identification of defects detected by monitoring equipment on the tracks to be examine to allow maintenance crews to subsequently find these defects. In this project the system gives the information about how to control the system the results of the railway track crack control system spent simple components inclusive of a search sensor modem and IR based train crack detector assembly. The prototype will be useful in railway system. The advantage of theses system system is to gives the low cost project materials railway track crack detection system with greater accuracy and High speed information transferring after crack detection. The detected crack will be get updated through GPS and GSM.

REFERENCES

1. Navaraja. P “Fault Detection System For Railway Track By Using Ultrasonic and PIR Sensor” International Journal of Advanced Informantion and Communication Technology Volume-1, Issue-1, PP. 126-130 May-2014.
2. Kim, N.Stubbs “Crack Detection in beam type structures using frequency data” Elseveir volume 2592, PP. 1-37, January 2003.

3. Akhil N, Dinu Mohan, Fayis P, Sija Gopinath, "Railway Crack Detection System" ISSN 2395 0056 International Research Journal of Engineering and Technology Volume-3, Issue-5, May 2016.
4. Reenu George, Divya Jose, Gokul T G, Varun A G "Automatic broken track detection using IR transmitter and receiver" ISSN 2320-3765 International Journal of Advanced Research in Electrical Electronics and Instrumentation Engineering volume 4, Issue 4, April- 2015
5. Prashanthi antari, Mirza sajid ali baig, Narsappa reddy "Automatic Railway Track Crack Detection using GSM & GPS" ijitech.org ISSN 2321- 8665 Vol.03, Issue.03, Pages:0365-0367, July-2015.
6. Milev. I and Gruendig. L, "Rail track data base of German rail-The future automated maintenance", in Proc. INGENIO Regional Central Eastern Eur. Conf. Eng. Surv., Bratislava, Slovakia, pp. 1–8, Nov11–13, 2004.
7. Trehag. J, Handel. P, and Ogren. M, "Onboard estimation and classification of a railroad curvature", IEEE Trans. Instrum. Meas., vol. 59, no. 3, pp. 653–660, Mar. 2010.
8. Beales. L, "Track system requirements, Railway Group Standards", GC/RT5021, Railway Safety, London, Oct. 2003.
9. Lemmon. R. T, "The influence of the number of satellites on the accuracy of RTK GPS positions", Australian Surv., vol. 44, no. 1, pp. 64–70, 1999.
10. Qiao Jian-hua, Li Lin-sheng and Zhang Jinggang, "Design of Rail Surface Crack-detecting System Based on Linear CCD Sensor", IEEE Int. Conf. on Networking, Sensing and Control, 2008.
11. Vijayakumar. K , S.R. Wylie, J. D. Cullen, C.C.Wright, and A.I. AISHamma'a, "Noninvasive rail track detection system using Microwave sensor", Journal of App. Phy., 2009.
12. Cacciola. M, G. Megali, D. Pellicano, S. Calcagno, M. Versaci, and F. C. Morabito, "Rotating Electromagnetic Field for Crack Detection in Railway Tracks", piers online, Vol. 6, NO. 3, 2010.
13. Wojnarowski, Robert John Welles, Kenneth Brakeley Kornrumpf, and William Paul, "Electromagnetic system for railroad track crack detection and traction enhancement" US 6,262,573 B1, Jul17, 2001.
14. Richard J. Greene, John R. Yates and Eann A. Patterson, "Crack detection in rail using infrared methods", Opt. Eng. 46, 051013, May 2007.
15. Hartman, G.A., "Infrared Damage Detection System (IDDS) for real time, small-scale damage monitoring, Charlotte, North Carolina 2003.

Highway Traffic Management System Using Wireless Sensor Network

Narendra G. Bawane and Priyanka Sudhakar Raurale

Department of ETC, Jhulelal Institute of Technology, Nagpur, Maharashtra, India

ABSTRACT

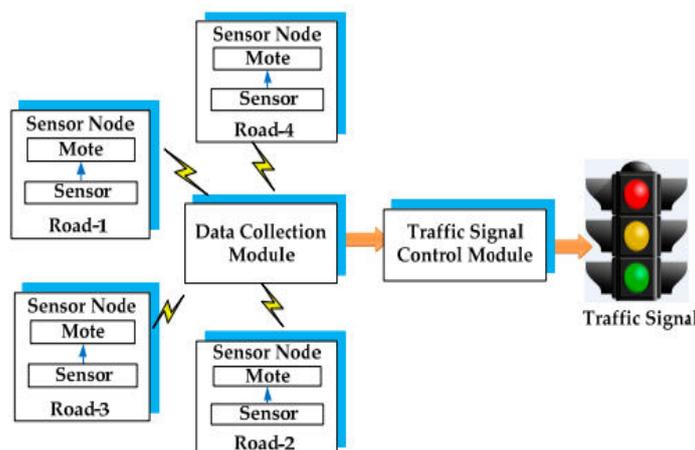
Nowadays, the number of vehicles has increased exponentially, but the bedrock capacities of roads and transportation systems have not developed in an equivalent way to efficiently cope with the number of vehicles traveling on them. Due to this, road jamming and traffic correlated pollution have increased with the associated adverse societal and financial effect on different markets worldwide. A static control system may block emergency vehicles due to traffic jams. Wireless Sensor networks (WSNs) have gained increasing attention in traffic detection and avoiding road congestion. WSNs are very trendy due to their faster transfer of information, easy installation, less maintenance, compactness and for being less expensive compared to other network options. There has been significant research on Traffic Management Systems using WSNs to avoid congestion, ensure priority for emergency vehicles and cut the Average Waiting Time (AWT) of vehicles at intersections. In recent decades, researchers have started to monitor real-time traffic using WSNs, RFIDs, ZigBee, VANETs, Bluetooth devices, cameras and infrared signals. This paper presents a survey of current urban traffic management schemes for priority-based signalling and reducing congestion and the AWT of vehicles. The main objective of this survey is to provide a taxonomy of different traffic management schemes used for avoiding congestion. Existing urban traffic management schemes for the avoidance of congestion and providing priority to emergency vehicles are considered and set the foundation for further research.

Keywords: Wireless Sensor Networks; Vehicular Ad Hoc; VASNET; Roadside Sensors; traffic sensing systems; intelligent traffic light controllers; emergency vehicle priority; traffic congestion; Average Waiting Time (AWT); traffic parameters

INTRODUCTION

The rapid increase of vehicular traffic and congestion on the highways began hampering the safe and efficient movement of traffic. Consequently, year by year, we see the ascending rate of car accidents and casualties in most of the countries. Therefore, exploiting the new technologies, e.g., wireless sensor networks, is required as a solution of reduction of these saddening and reprehensible statistics. This has motivated us to propose a novel and comprehensive system to utilize Wireless Sensor Networks for vehicular networks. We coin the vehicular network employing wireless Sensor networks as Vehicular Ad Hoc and Sensor Network in short. The proposed project is particularly for highway traffic is a self-organizing Ad Hoc and sensor network comprised of a large number of sensor nodes.

In VASNET there are two kinds of sensor nodes, some are embedded on the vehicles-vehicular nodes- and others are deployed in predetermined distances besides the highway road, known as Road Side Sensor nodes (RSS). VASNET provides capability of wireless communication between vehicular nodes and stationary nodes, to increase safety and comfort for vehicles on the highway roads.



Schematic of a traffic management centre.

Lately, Vehicular Sensor Networks (VSNs) have been proved as a great solution for monitoring traffic. In VSNs, vehicles are equipped with sensing devices and these vehicles move about the city to sense the traffic. Vehicles transfer the sensing data to a city traffic monitoring centre by using vehicle-to-vehicle or vehicle-to-infrastructure wireless communications. The vehicular sensing system has a high coverage capability and low deployment cost. Dynamic traffic monitoring using vehicular networks (DTMon) is an alternative technique to collect reliable information about traffic in free-flow and in transient-flow conditions.

LITERATURE SURVEY

Considerable research has been done on Traffic Management Systems using WSNs for congestion avoidance, prioritizing emergency vehicles and reducing Average Waiting Time (AWT) of vehicles at intersections. During the last years, quite a lot of projects on urban traffic management have been developed focusing on different traffic parameters.

A \$423 m Intelligent Transport System (ITS) [5] was developed to improve the traffic management and control system on Hong Kong's Road network, which is one of the busiest road networks in the world. This project was started in 2001 and effectively completed in 2010. The key platforms included in this project to address traffic congestion are traffic organization, monitoring, data analysis and control activities. This project has ensured optimal traffic control by tracking of all the main highways, trunk roads and road tunnels.

Sridhar et al. [6] designed and tested a low-cost sensor network instrument for monitoring traffic in a work zone. They started this project in 2009 with funding of £30,144.00 and completed it in 2010. A complete sensor network system collects data in work zones and presents it for post facto analysis and to the internet.

Al-Holou et al. [7] formulated the vehicle impact on the environment, jamming and traffic safety as a multi-dimensional model. They started this project with a budget of \$80,064 in 2010 and completed it in 2012. The adaptive sign control application recommended in this project is directed to attain two main goals: (1) improving traffic flow and diminishing traffic density; (2) refining traffic safety at intersections. An adaptive traffic light controlling approach, which uses V2V/V2I communications epitomize a revolution in the traffic management area.

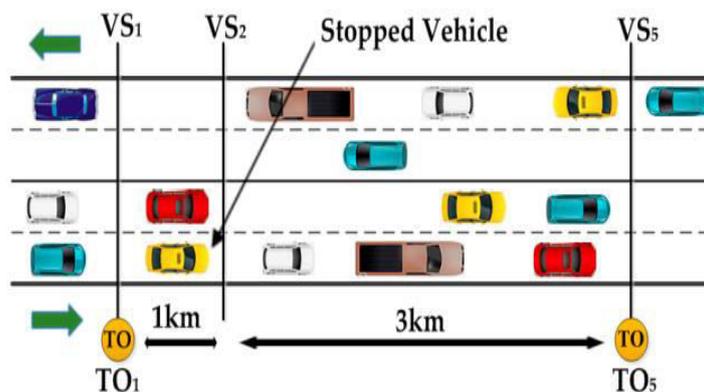
The main attention on modeling and simulation of traffic flow via Fast Lane [8] is to do the computations both fast and with a perfect outcome. Fast Lane is a software tool that can be used for short term estimation of traffic flow on freeways. A superior case study was conducted to show that the framework can be used to predict real-time traffic in the future.

A project titled "Advanced weather responsive traffic management strategies" was started in 2012 with funding of £206,856.00 [9]. The main goal of this project was road weather management. The project was successfully completed in 2013.

The development of an adaptive traffic signal control system (ACS Lite) for Wolf Road, Albany, NY, USA [10] started in 2012 with funding of £569,800.00. The objectives of this project are to demonstrate the Siemens ACS-Lite technology and signaling efficient system at the junctions along Wolf Road in Albany, NY. This project team includes UTRC member Rensselaer Polytechnic Institute (RPI) and the City College of New York (CCNY) and non-UTRC members Siemens ITS, SenSys Networks, and Annese and Associates, Inc. The project was successfully completed in 2013.

MAIN OBJECTIVES

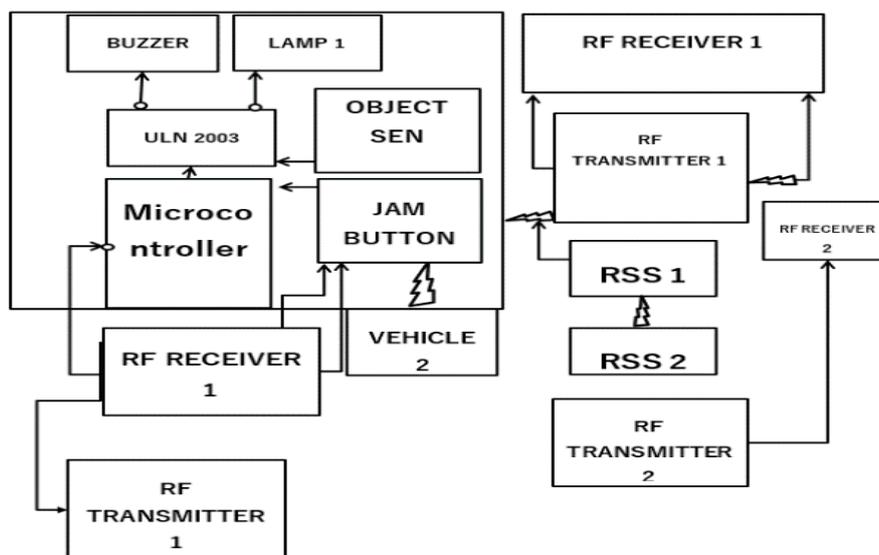
In our project we are going to make use of WSN (wireless sensor network). In this atmega 328 as the base station and the different remote station as wireless sensor network. Wireless sensor networks have been attracting many research efforts during the past few years. Sensor networks, usually composed of a few sinks and a large quantity of inexpensive and small sensor nodes, have been deployed in a variety of applications such as habitat monitoring, forest fire detection, etc.



Location of TOs and virtual strips from the entry of a four lane highway

Our goal is minimized the jam on highway due to accident or by any means. In our proposed paradigm, a large number of sensor nodes are densely deployed in a side of highway. Sensor nodes collect data from vehicle as jam indication and send to their respective cluster nodes that collaboratively process the data by constructing a wireless sensor network.

METHODOLOGY



Block Diagram of Highway Traffic Management System

- In this block diagram we are using sensors which are present at the nodes in the highway. The sensor nodes collect measurement data such as jam data, obstacle sensor, and windy speed all these factors are required. The two sensors are connected to the transmitters as shown in figure.
- When sensor senses the jam data and obstacle sensor, it transmits RF signal to the RSS1.
- At the RSS1 it transmits to next vehicle as well as next RSS2 RF signal from the transmitter.
- The RF receiver of second vehicle gives the signal to the microcontroller. The microcontroller. The uc generates the particular logic and give it to the ULN 2003.
- The ULN 2003 drives the relay circuit so that it glows the lamp & also the buzzer.

APPLICATIONS

- Forest
- Industries
- Malls
- Big societies

RESULT & DISCUSSION

In this paper, we have presented a comprehensive review of existing urban traffic management schemes. The main challenges associated with congestion control, average waiting time reduction, prioritizing emergency vehicles and the design requirements of intelligent traffic system are discussed to provide and insight into the goals of urban traffic management.

Despite the large number of research activities and the excellent progress that has been made in traffic management systems in recent years, challenges for further research remains. A few issues are outlined for future work.

A real-time traffic management system cannot be guaranteed. Processing of large amounts of real time traffic data, the run time of the control system and reliability are the problems to be solved to ensure real-time demand of the urban traffic management system. There is a need to design an intelligent traffic cloud by making use of cloud computing to solve the problems related to real-time.

REFERENCES

1. Litman, T. Congestion Costing Critique Critical Evaluation of the Urban Mobility 2014 Report; Victoria Transport Policy Institute: Victoria, BC, Canada, 2014.
2. 2013 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance; US Federal Highway Administration Report. US Department of Transportation: Washington, DC, USA, 2013.
3. Padmavathi, G.; Shanmugapriya, D.; Kalaivani, M. A study on vehicle detection and tracking using wireless sensor networks. *Wirel. Sens. Netw.* 2010, 2, 173–185. [CrossRef] *Sensors* 2016, 16, 157–22 of 25
4. Albaladejo, C.; Sánchez, P.; Iborra, A.; Soto, F.; López, J.A.; Torres, R. Wireless Sensor Networks for Oceanographic Monitoring: A Systematic Review. *Sens.* 2010, 10, 6948–6968. [CrossRef] [PubMed]
5. Hong Kong Government. Intelligent Transport System (ITS). Available online: <http://www.roadtraffic-technology.com/projects/hong-kong/> (accessed on 14 April 2015).
6. Sridhar, N. A Distributed Instrument for Measuring Traffic in Short-Term Work Zones. Available online: http://ntlsearch.bts.gov/researchhub/search.do?managed=&stgrpid=&range=&so=asc&q=traffic+management+projects&p=15&sb=ti_sort&manageableMode=&psize=50&pid=&mode=&size=1 (accessed on 14 April 2015).
7. Arbabi, H.; Weigle, C.M. Monitoring free flow traffic using vehicular networks. In Proceedings of the IEEE Consumer Communications and Networking Conference (CCNC), Las Vegas, NV, USA, 9–12 January 2011; pp. 272–276.
8. Mazloumi, E.; Asce, M.S.; Currie, G.; Rose, G. Using GPS data to gain insight into public transport travel time variability. *J. Transp. Eng.* 2010, 136, 623–631. [CrossRef]
9. Bazzi, A.; Masini, M.B.; Zanella, A.; Pasoloni, G. Vehicle-to-vehicle and vehicle-to-roadside multi-hop communications for vehicular sensor networks: Simulations and field trial. In Proceedings of the IEEE International Conference on Communication workshops (ICC), Budapest, Hungary, 9–13 June 2013; pp. 515–520.
10. Alexander, P.; Haley, D.; Grant, A. Co-operative intelligent transport system: 5.9-GHz field trials. *IEEE Proc.* 2001, 99, 1213–1235. 19. Bruno, R.; Nurchis, M. Robust and efficient data collection schemes for vehicular multimedia sensor networks. In Proceedings of the IEEE 14th International Symposium and Workshops on World of Wireless, Mobile and Multimedia Networks (WoWMoM), Madrid, Spain, 4–7 June 2013; pp. 1–10. 20. Chao, K.H.; Chen, P. An intelligent traffic flow control system based on radio frequency identification and wireless sensor networks. *Int. J. Distrib. Sens. Netw.* 2014, 2014, 1–10.

Analysis of 5 Different Gases in Air Using IoT (Internet of Things) and Cloud Computing With Air Condensed Purification System

Anil Bavaskar and Prajwal Shende

Department of Electronics & Telecommunication Engineering, Jhulelal Institute of Technology, Nagpur, India

ABSTRACT

Over the previous few decades, the standard of air has been deteriorating at an baleful rate resulting in death of nearly seven million folks annually worldwide. Within the thick of the higher than worrisome facts voters across the world be transparency concerning the standard of the atmosphere they sleep in, so acceptable selections might be taken before it's too late. Keeping this in mind an example for an air quality observation system has been developed during this work. The planned air quality display contains of an ADC Module, an MQ-135 gas sensing element and a DHT-11 temperature and wetness sensing element module. As compared to different counterparts accessible, our planned system offers an favorable position in terms of tiny size, economical power usage and value. The sensors record the info and send it to the ADC Module acting because the base station of the setup. Having an built-in microcontroller and an on chip Wi-Fi transceiver, the ADC Module not solely serves the aim of observation the info however conjointly causing it to a distant server empowering tremendous scope for physical world to be communicated at a really fine and careful level. The gas sensing element records the concentration of cyanogenetic gases like carbonic acid gas, CO, dirt and gas offers an overall air quality parameter. If the concentration of the cyanogenetic gases exceeds a typical price an alert message is additionally displayed on the server. The integrated system might presumably be a giant affirmative for the good cities to justify steps to manage pollution level within the years to follow.

INTRODUCTION

Air quality is one in all the key measures to be closely ascertained in period of time for today's urban environments, as a result of it's an overriding impact on human health, safety and luxury.

Conventionally, pollution watching stations area unit massive in sizes and overpriced for installation and maintenance. However, the air quality information generated by these stations is extremely correct. Efforts are created for various & value economical solutions. Internet-of Things (IoT) could be a novel technology that attracts attention from each domain and business. To beat the failings of current watching systems and their recognition strategies and cut back the general value, this paper offers a unique approach that mixes the IoT technology with atmosphere watching. This approach provides an occasional value, accurate, straightforward to deploy, ascendable and user friendly system.

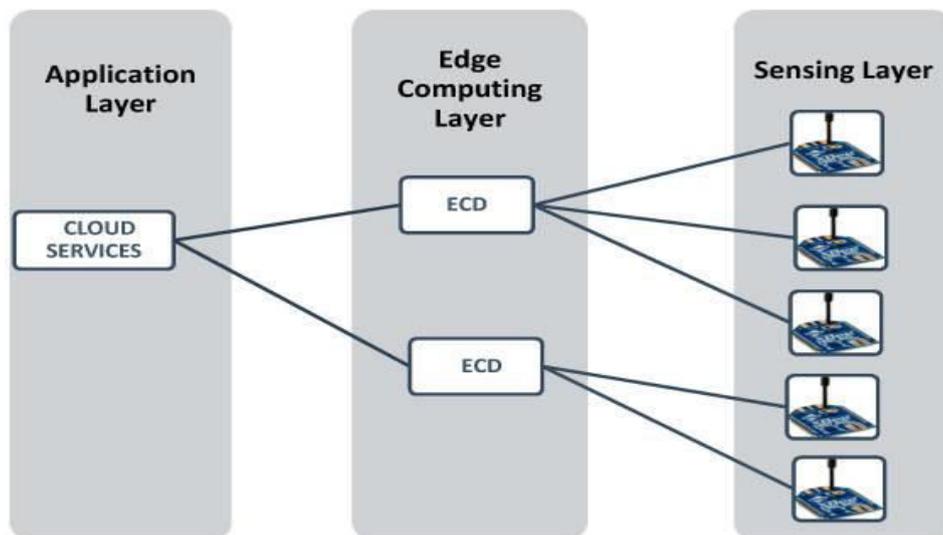
This project presents a comprehensive review of pollution watching desires, existing watching systems, their limitations, and current challenges two-faced by these watching systems. We tend to examine exhaustive the problems, infrastructure, processing, associated encounters of coming up with and deploying an integrated sensing node for perceptible indoor/outdoor pollution. This project designed associate air watching system model utilizing the cloud computing & IoT design, reassuring measuring accuracy and power potency with minimum value.

MATERIAL AND METHOD

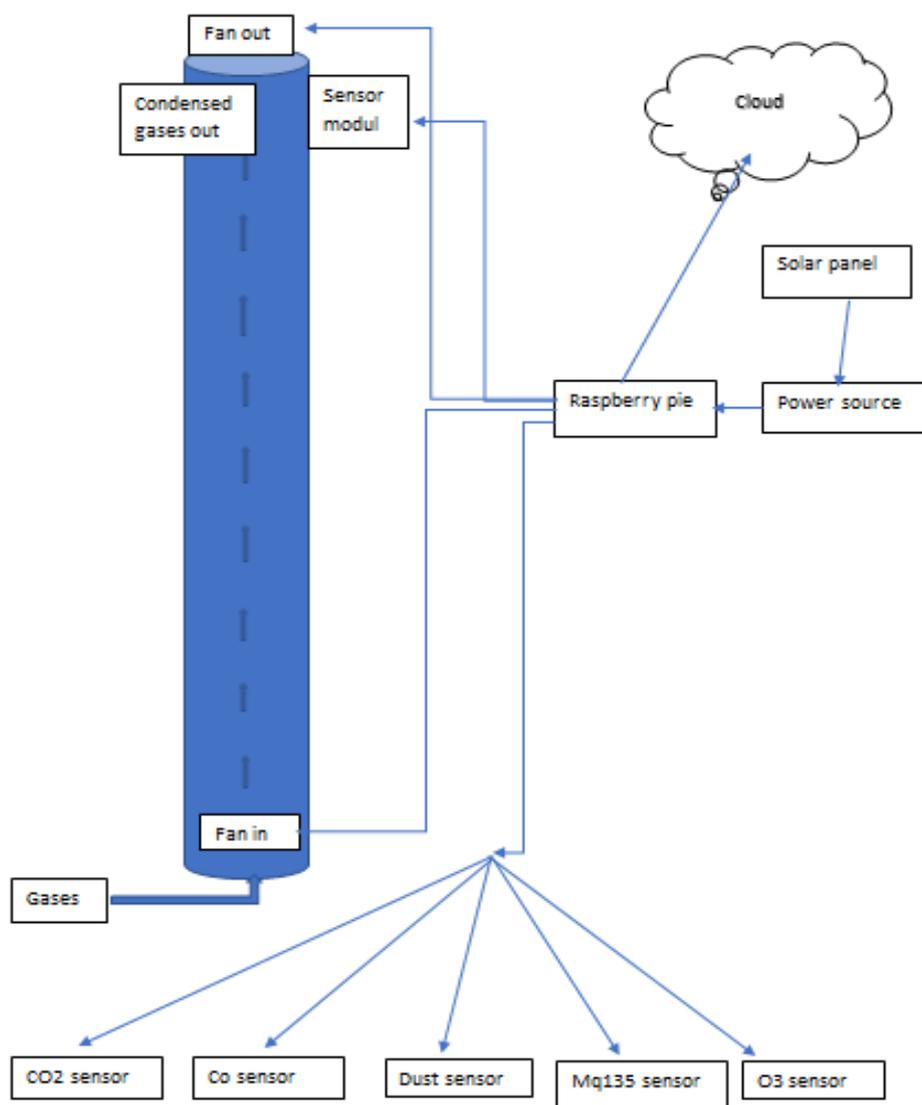
We style associate cloud-computing primarily based IoT design for the pollution observation system. As incontestable in, a stratified IoT design is used within the observation system. 3 layers were outlined because the sensing layer, network layer and also the application layer, severally. All the layers area unit human action via Zigbee and Wi-Fi, though the other similar technology are often used for this purpose. The overall work load is balanced and distributed over these 3 layers in line with the edge-computing mechanism.

- **Sensing Layer:** This is that the basis of the complete observation system. The most responsibility of this layer is to sense the air quality. The sensing nodes area unit the most entities of this layer and may be deployed over the wide space. Hardware and software system details regarding these nodes area unit provided within the next section.
- **Edge Computing Layer:** This layer consists of edge-computing devices (IoT gateways). Its duty is to speak with the opposite 2 layers. ECD gathers the information from the complete sensing layer and when necessary process, passes the information to the applying layer.

- Application Layer:** The application layer is chargeable for providing cooperative services to the customers and also the knowledge storage. It are often distributed into 2 chunks: The IoT cloud (IBM cloud), and user applications. Once it receives the information according from the sting computer, it stores {the knowledge|the info|the information} within the information of the cloud and provides data visualisation in varied ways.



Block Diagram: -



RESULT AND DISCUSSION

Mean values of gases concentrations (CO₂, CO, SO₂ And NO_x And ratio of CO₂ /CO₂+CO) in 26 air samples is presented in Table 1 and the distribution of CO₂, CO, SO₂ And NO_x And ratio of CO₂/CO₂+CO is presented in Figs. 3 and 4. The Descriptive statistics summary of the selected variables are presented in Table 2. For each Variable, the values are given as arithmetic mean, geometric mean, median, minimum and maximum concentration, variance and standard deviation. Frequency Distributions and box-whiskers plot of 3 measured variables are presented in Fig. 3. Using experimental data (Table 1) and box plot approach of City, anomalous values (extremes and outliers) of 5 variables were determined (Table 3).

Table 1: Average value of CO₂, CO, ratio of CO₂/CO₂+CO, SO₂ And NO_x.

Sample	Fuel Type	CO ₂ /ppmv (in 45 min.)	CO /ppmv (in 1 hour)	Ratio CO ₂ /CO ₂ +CO	SO ₂ /ppmv (in 10 min.)	NO _x /ppmv (in 1 hour)
WHO standard		1000	30.03		0.176	0.105
S1	Natural gas	2400	17	0.993	<0.1	<0.1
S2	Natural	1400	5	0.997	<0.1	<0.1
S3	Natural gas	800	4	0.995	<0.1	<0.1
S4	Natural gas	1000	5	0.995	<0.1	<0.1
S5	Natural gas	1700	3	0.998	<0.1	<0.1
S6	Natural gas	4000	12	0.997	0.7	0.8
S7	Natural gas	1200	5	0.996	<0.1	<0.1
S8	Natural gas, wood and coal (business locations, grill)	1800	17	0.99	<0.1	<0.1
S9	Natural gas	2200	7	0.997	<0.1	<0.1
S10	Natural gas	1200	4	0.997	<0.1	<0.1
S11	Wood and coal	1100	3	0.997	<0.1	<0.1
S12	Wood and coal	1200	2	0.997	<0.1	<0.1
S13	Wood	1110	0.6	0.998	<0.1	<0.1
S14	Wood	1100	3	0.999	<0.1	<0.1
S15	Wood	800	3	0.995	<0.1	<0.1
S16	Wood	2300	2	0.996	<0.1	<0.1
S17	Wood and coal	500	2	0.999	<0.1	<0.1
S18	Electrical power heating	1500	0	0.996	<0.1	<0.1
S19	Electrical power heating (business locations, grill)	300	2	0.993	<0.1	<0.1
S20	Electrical power heating (business locations)	1200	3	0.997	<0.1	<0.1
S21	Electrical power heating	700	2	0.997	<0.1	<0.1
S22	Electrical power heating	700	3	0.996	<0.1	<0.1
S23	Electrical power heating	800	2	0.997	<0.1	<0.1
S24	Electrical power heating	1400	7	0.995	<0.1	<0.1
S25	Electrical power heating	600	2	0.997	<0.1	<0.1
S26	Natural gas, wood and coal, oil.	700	2	0.997	<0.1	<0.1

Table 2: Basic statistical parameters of 5 variables at 26 air STATIONS

Variable	Units	Descriptive statistics						
		Mean	Geo Mean	Median	Minimum	Maximum	Variance	Std. Dev
CO ₂	ppmv	1296.538	1120.443	1155.000	300.0000	40000.000	599431.5	774.2296
CO	ppmv	4.704000	3.493148	3.000000	0.600000	17.00000	19.17373	4.378782
Ratio, CO ₂ /CO ₂ +CO		0.996222	0.996220	0.996700	0.990600	0.999400	0.000004	0.001948
SO ₂	ppmv	0.700000	0.700000	0.700000	0.700000	0.7000	-	-
NO _x	ppmv	0.800000	0.800000	0.800000	0.800000	0.8000	-	-

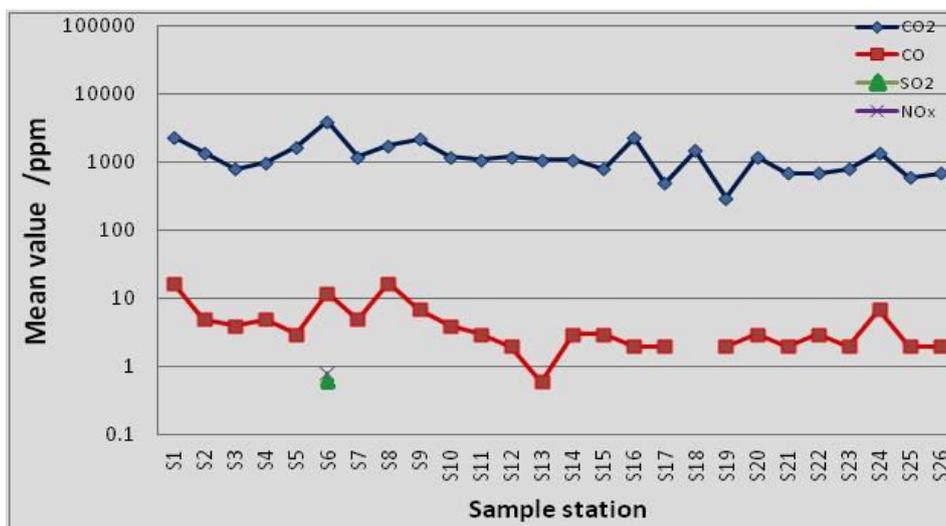


Fig. 3: Mean values of gases (CO₂, CO, SO₂ and NO_x) at 26 indoor air stations

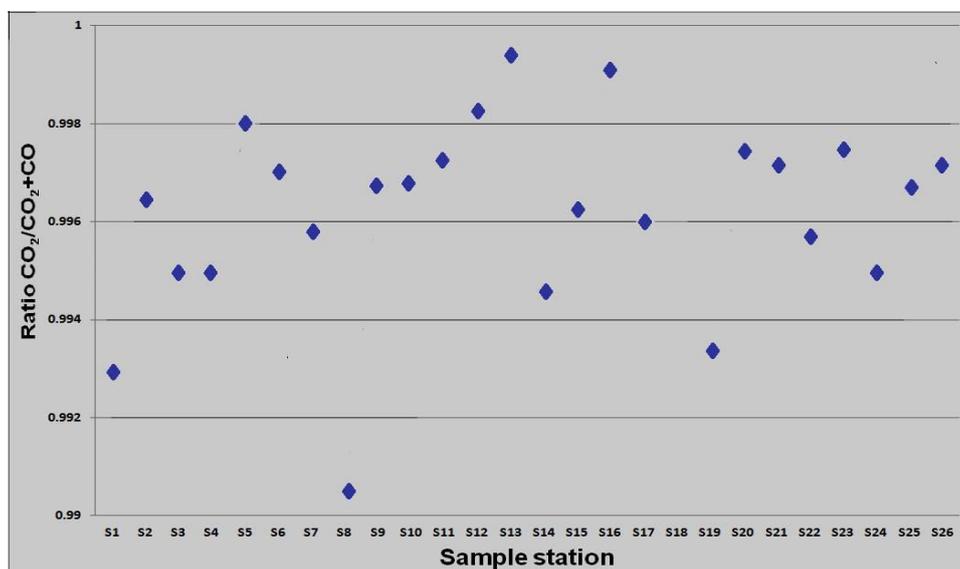


Fig. 4: Ratio of CO₂/CO₂+CO in 26 indoor air samples

The results revealed the 45 minutes concentration of CO₂ at 20° C were found to be in the range of 300-4000 ppmv with an average of 1296.54 ppmv. Our results show that significantly high values of CO₂ in most indoor air samples exceed allowable WHO limit value, as higher influence of the indoor pollution sources from burned of soil gas, coal and biomass fuels. 1 hour concentration of CO at 20° C does not exceed WHO permissible limits of 30.03 ppmv. CO concentrations found to be in the range of 0.6-17 ppmv and with an average concentration of 4.704 ppmv. 10 minutes concentrations of SO₂ at 20° C were registered and only air sample station S6 found to be 0.7 ppmv and exceed 0.176 ppmv of WHO permissible limit, as higher influence of the indoor pollution sources from (haushold) heating with burning of natural gas. Also, 1 hour concentrations of NO_x at 20° C were registered and only air sample station S6 found to be 0.8 ppmv (produced during combustion from the reaction among nitrogen, oxygen and even hydrocarbons, especially at high temperatures) and exceed 0.105 ppmv WHO air permissible limit. The results for ratio of CO₂/CO₂+CO in 26 indoor air samples were found to be in the range of 0.9906-0.9994. The highest value of ratio was registered in the air sample station S13. The lowest value of ratio was registered in the air sample station S8, as higher influence of the indoor pollution sources from incomplete combustion of biomass fuels.

Based on the frequency histograms and the two dimensional scatter box plot diagrams (Fig. 5) anomalous values (extremes and outliers) were registered in Table 3. In samples S1 and S8 extreme value of carbon monoxide was registered. In the sample S6 extreme value of carbon dioxide was registered. In the S8 outlier value of the ratio of CO₂/CO₂+CO was registered. The present study suggests that it is necessary to monitor the air quality as well as the health effects at regular intervals and at strategic locations and that there is a need for better space ventilation.

Air samples	Extremes of parameters (α)	Outliers of parameters (σ)
S1	CO (17 ppmv)	No reg.
S6	CO ₂ (4000 ppmv)	CO (12 ppmv)
S8	CO (17ppmv)	The ratio of CO ₂ /CO ₂ +CO

Table 3: Anomalous values (extremes and outliers) determined in air samples

CONCLUSION

Unprocessed coal that has not been treated by chemical, physical, or thermal means to reduce contaminants should not be used as a household fuel. Three reasons guide this recommendation, over and above the documented health risks from products of incomplete combustion of solid fuels: the International Agency for Research on Cancer has concluded that indoor emissions from household combustion of coal are carcinogenic; in those parts of the world where it is most extensively used as a household fuel and the evidence base is strongest, coal contains toxic elements, such as arsenic, lead and mercury, which are not destroyed by combustion and technical constraints make it difficult to burn coal cleanly in households. Regarding to concentrations of CO₂, especially in station S6, values are characteristic for highly and extremely contaminated indoor spaces as in most stations the WHO permissible limits are exceeded. Station S6 has also higher concentration of SO₂ and NO_x that are exceeding the WHO permissible limit. We recommend better indoor air ventilation and using of the central heating system for heating purpose in cases where this is possible. Also, to obtain a better information regarding indoor air quality in Prishtina, it is necessary to conduct a more extensive research that include more compounds, and to assess the risks for human health, primarily those carcinogens.

REFERENCES

1. OutputTotal Words 303 Alshamsi A., Anwar Y., Almulla M., Aldhoori M., Hamad N., Awad M. watching pollution: Applying IoT to make a sensible environment; Proceedings of the 2017 International Conference on Electrical and Computing Technologies and Applications (ICECTA); Ras Al Khaimah, UAE. 21–23 Gregorian calendar month 2017; Piscataway, NJ, USA: IEEE; 2017. pp. 1–4. [Google Scholar]
2. Bellavista P., Giannelli C., Zamagna R. The PeRvasive atmosphere Sensing and Sharing resolution. Sustainability. 2017;9:585. doi: 10.3390/su9040585. [CrossRef] [Google Scholar]
3. Lee S., Jo J., Kim Y., Stephen H. A framework for environmental watching with Arduino-based sensors exploitation reposeful net service; Proceedings of the 2014 IEEE International Conference on Services; Anchorage, AK, USA. twenty seven June–2 July 2014; pp. 275–282. [Google Scholar]
4. Min K.T., Forys A., Schmid T. Demonstration abstract: Airfeed: Indoor real time interactive air quality watching system; Proceedings of the thirteenth International conference on science in device Networks; Berlin, Germany. 15–17 Gregorian calendar month 2014; Piscataway, NJ, USA: IEEE; 2014. pp. 325–326. [Google Scholar]
5. Kim J.-Y., Chu C.-H., Shin S.-M. ISSAQ: associate degree integrated sensing systems for period indoor air quality watching. IEEE Sens. J. 2014;14:4230–4244. doi: 10.1109/JSEN.2014.2359832. [CrossRef] [Google Scholar]
6. Caya M.V.C., Babila A.P., Bais A.M.M., Im S.J.V., Maramba R. pollution and material detector exploitation raspberry Pi with IoT based mostly notification; Proceedings of the 2017 IEEE ninth International Conference on automaton, engineering, info Technology, Communication and management, atmosphere and Management (HNICEM); Manila, Philippines. 1–3 December 2017; Piscataway, NJ, USA: IEEE; 2017. pp. 1–4. [Google Scholar]
7. Gao Y., Dong W., Guo K., Liu X., Chen Y., Liu X., Bu J., Chen C. Mosaic: A cheap mobile sensing system for urban air quality monitoring; Proceedings of the IEEE INFOCOM 2016—The thirty fifth Annual IEEE International Conference on laptop Communications; city, CA, USA. 10–14 Gregorian calendar month 2016; April fourteen, pp. 1–9. [Google Scholar]

Recognition and Identification of Human Activity

Sachin Chaudhary and Snehal Wankhede

Department of Computer Science, Jhulelal Institute of Technology, Nagpur, Maharashtra, India

ABSTRACT

Human activity apperception plays a paramount role in human-to-human interaction and interpersonal cognitions. Because it provides information about the identity of a person, their personality, and psychological state, it is arduous to extract. The human competency to analyze another person's activities is one of the main subjects of study in the scientific areas of computer vision and machine learning. As a result of this research, many applications, including video surveillance systems, human-computer interaction, and robotics for human compartment characterization, require multiple activity apperception systems.

Keyword: HAR, Machine Learning, OpenCV, Haar Cascade, CNN.

I. INTRODUCTION

To apperceive, detect and relegate the activity of humans many applications have been developed with human-centered monitoring and researchers have proposed different solutions. Human activity apperception is one of the paramount technology to monitor the dynamism of a person and this can be procured with the fortification of Machine learning techniques. The threshold-predicated algorithm is simpler and more expeditious and is often applied to agnize human activity. But Machine algorithm provides the reliable result. Numerous sensors have been deployed to optically canvass the human dynamic characteristics. This paper intends to quantify the efficacy of sundry machine learning relegation algorithms. Low cost and commercial web cams are utilized as sensors to record the activities of humans. Different studies have been conducted in the perspicacious environment to optically canvass the activities of humans. We developed AI Models for "Human Activity Apperception". The motivation abaft our work is to implement machine learning algorithms in genuine-world datasets so that their precision can be studied and efficacious conclusions can be drawn.

II. LITERATURE REVIEW

Zameer Gulzar, et al. [1] smartphones have been playing a consequential role in identifying human activities and have become a popular field of research. This paper gives a detailed overview of sundry research papers on identifying human activity. Artificial Perspicacity models have been developed to identify the activities of Humans in the provided UCI online storehouse. The information they culled is multivariate and we have implemented sundry machine taxonomic mechanisms desultory forest, KNN, neural network, Logistic regression, stochastic gradient descent, and naïve Beige for analyzing human activity. In addition to engendering AI models, the size of the dataset is abbreviated by the feature cull process. Precision and recall values were calculated and a Discombobulation matrix was engendered for each model. The results of the experiment Proved to provide neural network and logistic regression More precise to identify human activity than other Classifiers such as k-Neighbor (KNN), SGD, and Arbitrary Forrest.

Davide Anguita, et al. [2] the purport of activity-predicated computing is to capture the utilizer's position and the environment by exploiting heterogeneous sensors to optimize exogenous computing resources. When these sensors are affixed to the body of the subject, they sanction perpetual monitoring of numerous physical signals. It has alluring uses in healthcare applications, e.g. Exploitation of the circumventing astuteness (AmI) in daily activity monitoring for the elderly. In this paper, we present a system for human physical activity identification (AR) utilizing smartphone inertial sensors. Since these mobile phones are circumscribed in terms of energy and computing puissance, we propose an incipient hardware-amicable approach to multiclass relegation. This method converts standard support vector machines (SVMs) and uses fine-tuned-point arithmetic to minimize computational costs. Comparisons with traditional SVMs show paramount amendments in computer costs while maintaining the same precision, which can contribute to the development of more sustainable systems for AMI.

Juha Vesanto, et al. [3] Self-Organizing Map (SOM) is an efficient implementation for visualizing multi-dimensional numerical data. In this paper, an overview and relegation of both old and incipient methods for visualization of SOM are presented. The purport is to provide a conception of what kind of information can be gleaned from different presentations and how SOM can best be utilized in exploratory data visualization. Most of the methods presented can withal be applied in the more general case of first making vector quantization (e.g. K-denotes) and then vector projection (e.g. mapping of salmon).

Jiang, L, et al. [4] Since learning the optimal Bayesian network classifier is an NP-conundrum, the cognition-enhanced ingenious Bayes has magnetized an abundance of researchers' attention. In this paper, we summarize the current modified algorithm and propose a novel Bayes model: obnubilated verdant Bayes (HNB). Experimental results show that HNB has performed significantly better than NB, SBC, NBTree, TAN, and AODE. In most data mining applications, precise class probability estimates and rankings are additionally desirable. We study the class probability estimation and sorting performance, the area under conditional log probability (CLL) and ROC curve (AUC), respectively, the ingenious base and its modified models, such as SBC, NBTree, TAN, and AODE, and then CLL and AUC with them. Compare HNB with deference to our experiments show that HNB withal performs the most consequential of all.

Ong Chin Ann et al. [5] Human activity apperception is one of the most active research areas in computer vision for sundry contexts such as safety monitoring, health care, and human-computer interface. This paper reviews a total of thirty-two recent research papers on sensing technologies utilized in HAR. The review work with three areas of sensing techniques such as RGB cameras, depth sensors, and wearable contrivances. It additionally discusses the advantages and disadvantages of the mentioned sensing technologies. The outcomes show that RGB cameras are less popular than depth sensors and wearable contrivances in HAR research.

Ms. Shikha et al. [6] subject of Human Activity Apperception (HAR) is a major research area in the field of computer vision and image processing. It has enabled state-of-the-art applications in many areas, including surveillance, digital regalement, and medical healthcare. Visually examining is fascinating and it is fascinating to prognosticate such forms of kineticism. Accelerometer, gyroscope, etc. A number of sensor-predicated methods have withal been introduced to study and prognosticate kindred human activities, with their own advantages and disadvantages.

III. METHODOLOGY

Data Collection Model

Machine learning is the incipient sizably voluminous thing in the world of computer science. The motivation abaft this project is to implement machine learning algorithms in genuine-world data sets so that their precision can be studied and efficacious conclusions can be drawn. In this project a self made dataset is being used for the prediction of activities. A real time video was implemented to classify and identify the activity being performed.

Random Forest Algorithm

Desultory Forest works for both relegation and regression tasks. Arbitrary forests form a plethora of cull trees. Each tree is engendered from a bootstrap test from the preparation information. Determine what number of cull trees will be incorporated into the woodland (Number of trees in the timberland), and what number of characteristics will be self-assertively drawn for noetic conception at every hub. In the event that the last isn't designated (cull Number of properties... left unchecked), this number is identically tantamount to the square base of the number of traits in the information. Unique Breiman's proposition is to develop the trees with no pre-pruning, however since pre-pruning customarily works great and is more expeditious, the client can set the profundity to which the trees will be developed.

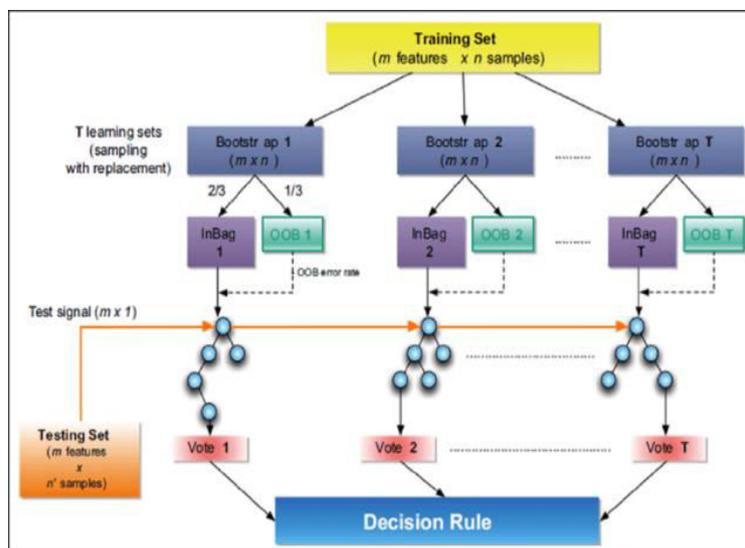


Fig. 1 Random Forest Algorithm Work Flow

CNN Algorithm

Convolutional Neural Networks withal kenneed as CNNs or ConvNets, are a type of victual-forward artificial neural network whose connectivity structure is inspired by the organization of the animal visual cortex. Diminutive clusters of cells in the visual cortex are sensitive to certain areas of the visual field. Individual neuronal cells in the encephalon respond or fire only when certain orientations of edges are present.

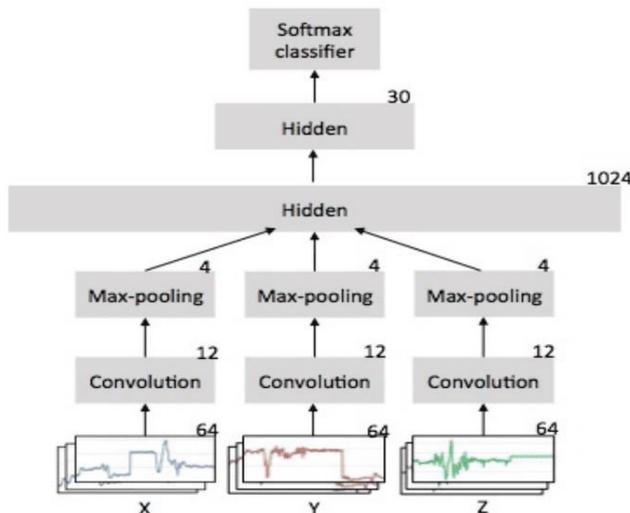


Fig. 2 CNN algorithm Classification Working

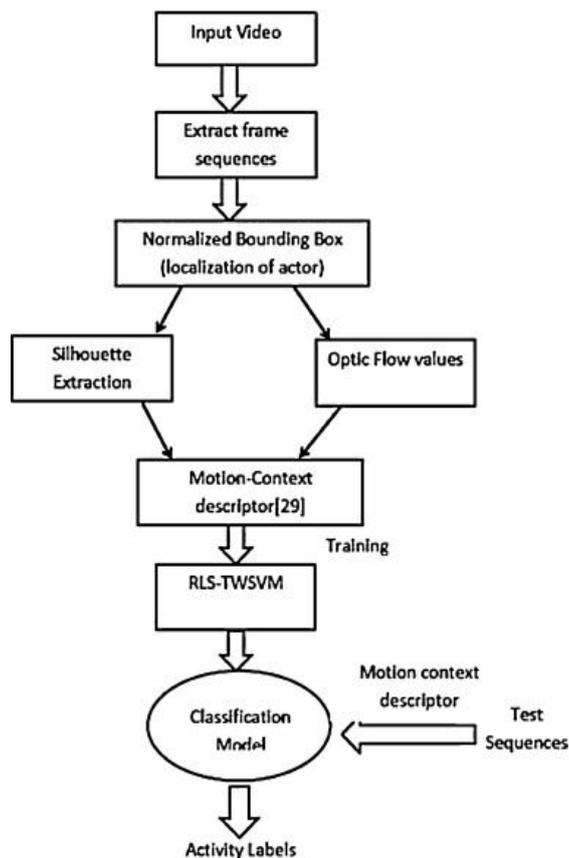


Fig. 3 CNN Working Flow

Human activity analysis is a popular activity in the growing industry and we have applied different machine learning algorithms. A comparative study was performed among the applied sundry techniques kNN, SVM, Desultory Forest, Neural Networks, Logistic regression, and Naïve Bayes. In them, Logistic Regression and the neural network gave good results whereas Ingenuous Bayes's result was not good. The implementation of Neural Network on Python gave bettel results than the one provided in the Orange implement. The inhibition of this work is though the efficiency of the neural network is good, the model is not dynamic. The inability of getting trained with genuine-time data will coerce us to train the model every time incipient data comes. In the

future, these results can be utilized for making smartwatches and kindred contrivances that can track a user's activity and notify him/her of the quotidian activity log. They can additionally be utilized for monitoring elderly people, prison inmates, or anyone who requires constant supervision.

IV. RESULTS

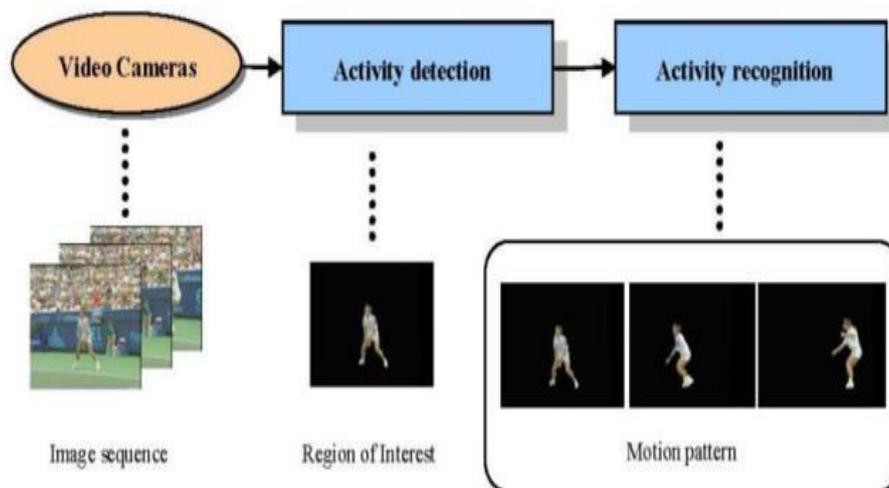


Fig. 4 Human Activity Recognition

V. REFERENCE

1. Davide Anguita, Alessandro Ghio, Luca Oneto, Xavier Parra, Jorge L. Reyes-Ortiz(2012). Human Activity Recognition on Smartphones Using a Multiclass Hardware-Friendly Support Vector Machine. Springer International Workshop on Ambient Assisted Living.Lecture notes in Computer Science. Vol(7657), pp 216-223.
2. Jun Liu, Amir Shahroudy, Dong Xu, Gang Wang(2016). Spatio-Temporal LSTM with Trust Gates for 3D Human Action Recognition. European Conference on Computer Vision., pp 816-833. Vol(9907)
3. Oyelade, Oladipupo, Obagbuwa(2010). Application of k-Means Clustering algorithm for prediction of Students' Academic Performance. International Journal of Computer Science and Information Security,7(1).292-295
4. Juha Vesanto(1999). SOM-Based Data Visualization Methods. Intelligent Data Analysis, Laboratory of Computer and Information Science, Helsinki University of Technology, P. O. Box 5400, FIN-02015 HUT, Finland vol. 3(2), pp. 111-126.
5. Ivan Viola(2010). Information Theory in Computer Graphics and Visualization. Proceeding in SA'11S IGGR APH Asia 2011 Courses
6. Jiang, L., Zhang, H., & Cai, Z. (2009). A novel Bayes model: Hidden Naïve Bayes. IEEE Vincenzo S., Zucchetta M., Franzoi P., Pellizzato M., Pranovi F., De Leo G.A., Torricelli P.(2011). Application of a Random Forest algorithm to predict spatial distribution of the potential yield of Ruditapes philippinarum in the Venice lagoon, Italy. Ecological Modelling. 222, 1471-1477
7. Jie Hu, Yu Kong, Yun fu. (2013). Activity Recognition by Learning Structural and Pairwise Mid-level Features Using Random Forest. 2013 10th IEEE International Conference and Workshops on Automatic Face and Gesture Recognition (FG) Automatic Face and Gesture Recognition
8. J.K. Aggarwal. M.S. Ryoo.(2011). Human activity analysis: A review. ACM Computing Surveys. 43(3)
9. Enea Cippitelli, Ennio Gambi, Susanna Spinsante, Francisco Florez-Revueleta (2016). Human Action Recognition Based on Temporal Pyramid of Key Poses Using RGB-D Sensors. Springer International Conference, Advanced Concepts for Intelligent Vision Systems. PP 510-521. vol(10016)

Secure Data Transfer through Internet Using Image Steganography

Kishor Peshwani and Nikita S. Jamgade

Department of Computer Science, Jhulelal Institute of Technology, Nagpur, Maharashtra, India

ABSTRACT

Data is one of the most relevant and important term from the ancient Greek age to modern science and business. The amount of data and use of data transformation for organizational work is increasing. So, for the sake of security and to avoid data loss and unauthorized access of data we have designed an image Steganographic algorithm implementing both Cryptography and Steganography. This algorithm imposed a cipher text within a cover image to conceal the existence of the cipher text and the stego-image is transferred from sender to intended receiver by invoking a distributed connection among them to achieve the data authenticity.

Keyword: Cryptography, Steganography, RSA, RMI Architecture, Distributed connection, JPEG image

INTRODUCTION

As a part of information security "Steganography" is a wellknown concept, literally which signifies the meaning "covered writing". Steganography imposes the secret information within a cover object termed as stego-medium to escape detection and to retain the original information with minimum distortion. This stego-medium appears like a non-secret file in the network and manages to avoid drawing the attention towards itself as a content of security. Secret-information + cover-medium = stegomedium (1) Steganography had been widely used for secure communication [3]. The schemes used at this age are the physical process of Steganography. In modern digital steganography information is first encrypted. Then using an embedding algorithm in the transport layer encrypted information is embedded with the cover medium and transmitted over the network [10]. Both cryptography and steganography provide data confidentiality and authenticity. In contrast to cryptography which focuses on keeping the message secret while the existence of secret message may tempt the attacker whereas Steganography hides a message as well as the very existence of secret information [5]. Cryptography ensures privacy of message and structure of the message alter whereas steganography ensures the secrecy of message and the structure of message does not alter [7].

Steganography may use in conjunction with cryptography by concealing the existence of the ciphered text so that the information is more secure [4]. Media formats .JPEG, .BMP, .GIF, .MP3, .text etc. are suitable as cover medium because of their high degree of redundancy and availability and popularity over internet [6]. Depending on what type of cover-medium used, steganography is classified as audio steganography uses .WAV, .MP3 media formats, video steganography uses .MPEG, .AVI, image steganography uses .JPEG, .BMP, .GIF media formats.

Audio steganography utilize the Psycho acoustical property of human auditory system (i.e. the presence of low-pitched sound is undetected in presence of a louder sound) and inserting data into digitalized audio-signals. LSB coding, phase coding, spread spectrum are some popular method of audio steganography. Video Steganography embedded the message within the video files. Due to its large size video Steganography is eligible to hide large amount of data. Image steganography technique utilize the weakness of human visual system [8] and embedded the information with a minor modification in image pixels. LSB coding, masking and filtering etc. are the image steganography method.

METHODS

Among various methods of Cryptography and Steganography we have used RSA algorithm and Image Steganography method.

Rivest et al. invented RSA [1] algorithm and it is widely used public key cryptography algorithm having two algebraic structures: a public key $R = \mathbb{Z}_n$

+ X and a private group $G = \mathbb{Z}(\phi(n))^*X$. In RSA algorithm two prime numbers (p and q) are taken initially and their products are used to generate the public key and private key. Public key consists of a value n and e , called modulus and public exponent respectively. Private key termed as d is called private exponent. The public key and private key generation of RSA algorithm is as follows:

Step 1: Choose two large, random prime number p and q , such that $p \neq q$.

Step 2: Compute modulus n as $n = p \times q$.

Step 3: Compute the Euler's totient for n as $\phi(n) = (p-1) \times (q-1)$.

Step 4: Select the public exponent e , where $1 < e < \phi(n)$ and e is a co-prime of $\phi(n)$.

Step 5: Calculate the private exponent d as $d = e^{-1} \pmod{\phi(n)}$.

The encryption operation in RSA for message P is done by the exponentiation to the eth power modulo

$$N: C = Pe \text{ mod } n \quad (2)$$

Decryption of ciphered text C is the exponentiation to the dth power modulo n:

$$P = Cd \text{ mod } n \quad (3) \text{ Explanation with example:}$$

1. Choose two prime numbers, $p = 61$ and $q = 53$
2. Compute Modulus $n = pq$, where $n = 61 * 53 = 3233$
3. Compute Euler's totient $\phi(n) = (p-1) \times (q-1)$, $\phi(n) = 3120$
4. Choose e co-prime to $\phi(n)$ where $1 < e < \phi(n)$, $e = 17$
5. Compute $d = e^{-1} \text{ mod } \phi(n)$, $d = 17^{-1} \text{ mod } (3120) = 2753$

Let the message to encrypt $P = 123$, we calculate C

$$= 123^{17} \text{ mod } (3233) = 855 \text{ and to decrypt } C = 855, \text{ we calculate } P = 855^{2753} \text{ mod } (3233) = 123$$

PROPOSED ALGORITHM

This section presents a step-by-step solution to the problem described above. The encryption algorithm at the Sender's end and decryption algorithm at the Receiver's end are detailed below.

Encryption Algorithm (Sender's end): Step 1: Select the text file where the original message has been written.

Step 2: Encrypt the content of the text file using the RSA algorithm with the public key of the receiver.

Step 3: Select an appropriate cover image (.jpeg format).

Step 4: Read the header and footer of the selected image in an array buffer.

Step 5: Add the encrypted data at the end of image footer.

Step 6: Sender and receiver are connected to the network.

Step 7: Sender provides the receiver's IP address and then send the Stego-image if the IP address is valid.

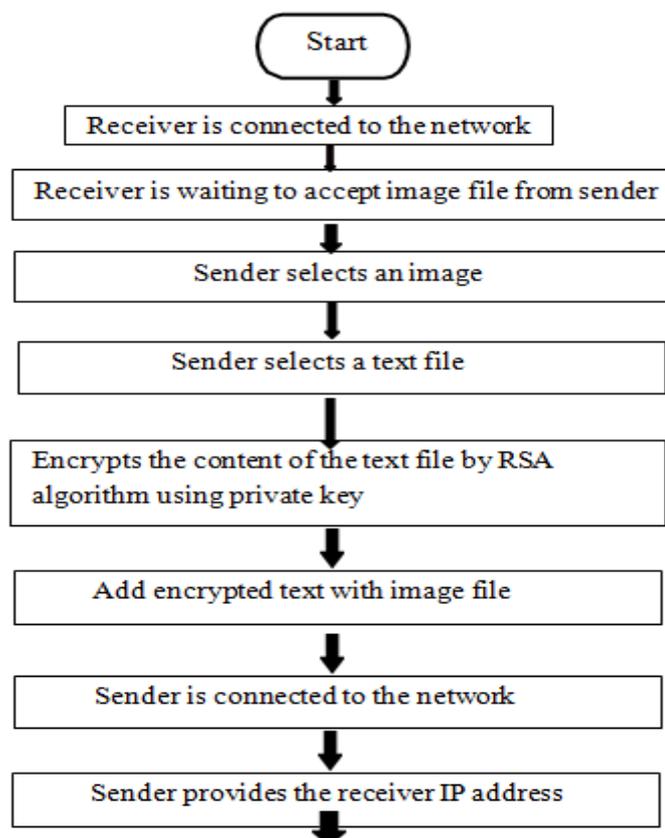
Decryption Algorithm (Receiver's end):

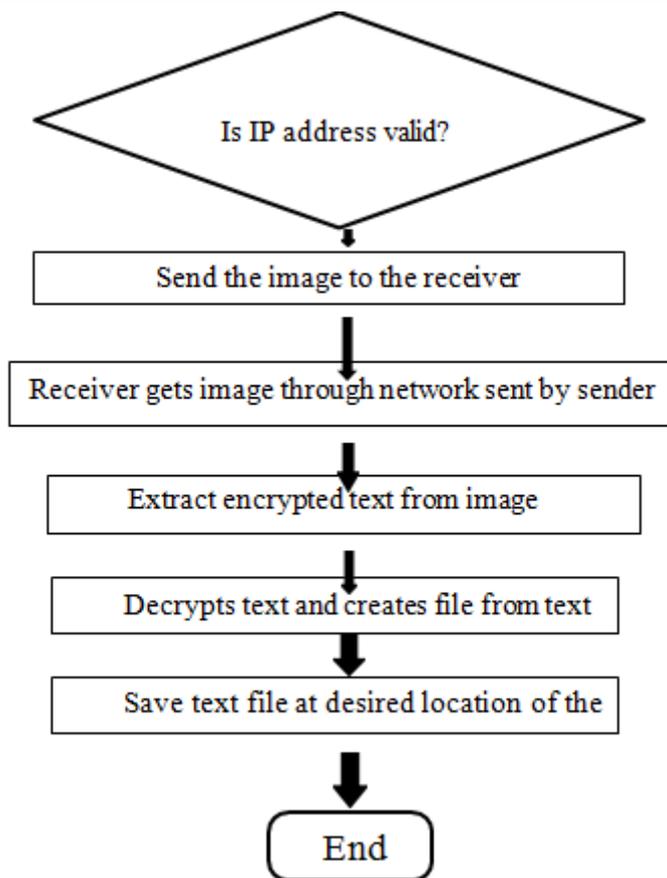
Step 1: Receive the Stego-image.

Step 2: Extract the encrypted message from the end of the stegoimage by reading the image footer.

Step 3: Generate the private key and decrypt the extracted message and then create a text file.

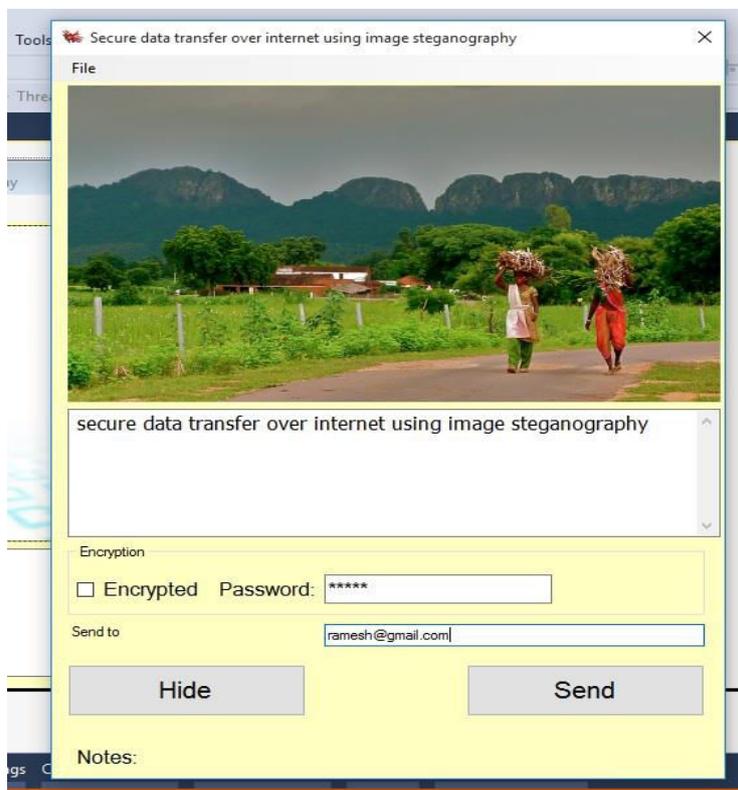
Step 4: Save the text file at the desired location



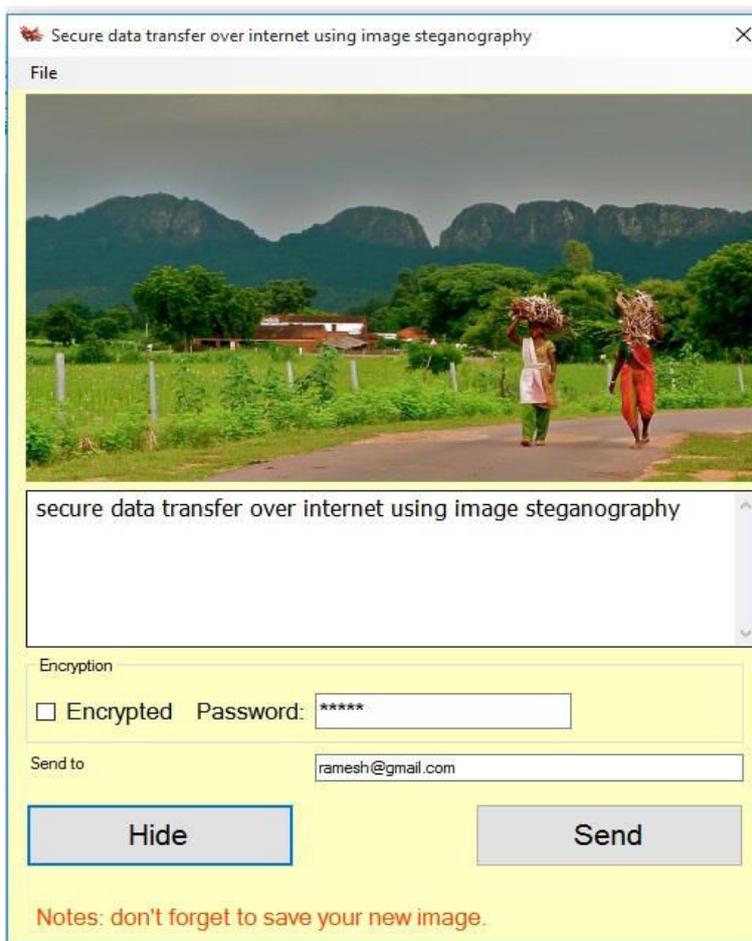


SCREENSHOT

Following are some of the screenshot of our project that we have developed that is based on the image steganography.



In this image we have take one source image and behind that image we have written the message that sender wants to send to the receiver. Password is also provided to secure data transmission over internet.





CONCLUSION

At this age of civilization exchanging data for communication through the network is an integral part of every organization and every sector of society. Our proposed algorithm is to secure this communication with a secure communication system by creating a distributed connection. This algorithm imposed an encrypted text which has been encrypted by using the RSA algorithm within a JPEG image and then the image file is send over the network i.e. we combining the concept of Cryptography and Steganography to make an illusion to the hacker that the sender sends an unsuspecting media file to the receiver. As an image file appear in the network as an innocent media file so it does not attract the hacker as a content of security. In this algorithm Cryptography makes the data secure as a cipher text and Steganography makes this cipher text disguise so that no one other than the intended receiver can know the existence of the cipher text within the image file. Here we have embedded the encrypted text at the footer of the chosen JPEG image file. In future our work will be focused on to embed the text within the image pixel and we will work to eradicate the problem of lossy compression related to the JPEG image and extend our work on other image formats like .BMP, GIF etc.

REFERENCES

1. Behrouz A. Forouzan, "Cryptography and Network Security", McGraw Hill, 2007.
2. Herbert Schildt, "Java the Complete Reference", 8th Edition, McGraw Hill, 2011.
3. N.F. Johnson and S. Jajodia, "Exploring Steganography: Seeing the Unseen", Computer, Vol. 31, No. 2, pp.26-34, 1998.
4. S. Song, J. Zhang, X. Liao, J. Du and Q.Wen, "A Novel Secure Communication Protocol Combining Steganography and Cryptography", Procedia Engineering, Vol. 15, pp. 2767-2772, 2011.
5. A.J. Raphael and V. Sundaram, "Cryptography and Steganography-A Survey", International Journal of Computer Technology and Applications, Vol. 2, No. 3, pp. 626-630, 2016.
6. S.A. Laskar and K. Hemachandran, "An Analysis of Steganography and Steganalysis Techniques", Assam University Journal of Science and Technology, Vol. 9, No. 2, pp. 83-103, 2012.
7. F.A.P. Petitcolas, R.J. Anderson and M.G. Kuhn, "Information Hiding-A Survey", Proceedings Of International Conference on Protection of Multimedia, pp. 1062-1078, 1999.

8. Y.S. Huang, Y.P. Huang, K.N. Huang and M.S. Young, "The Assessment System of Human Visual Spectral Sensitivity Curve by Frequency Modulated Light", Proceedings of IEEE International Conference On Engineering in Medicine and Biology, pp. 263-265, 2005.
9. T. Morkel, J.H.P. Eloff and M.S. Oliver, "An Overview of Image Steganography", Proceedings of 5th Annual Conference on Information Security, pp. 111-116, 2005.
10. T. Handel and M. Sandford, "Hiding Data in the OSI Network Model", Proceedings of 1st International Workshop on Information Hiding, pp. 1-7, 1996

An Implementation on Prediction of Covid-19 Using Machine Learning Techniques

Gaurav Sambhe and Shubham Gajbhiye

Department of Electronics & Telecommunication Engineering, Jhulelal Institute of Technology, Nagpur, India

ABSTRACT

A corona virus has contaminated more than 36,087,836 human beings and 1,055,387 deaths due to the fact December 2019. As it unexpectedly spreads throughout the planet, scientists and public -health experts are racing to slow down the spreading and trying to find methodologies to observe it. To do that, they need to apprehend the new virus. It's known as severe acute respiratory syndrome corona virus 2, or SARS-CoV-2. There are different approaches to diagnose COVID-19, but they are not pricey and time consuming, by the usage of chest x-ray;we can limit price and result in time . But to diagnose x-ray's we need professional radiotherapists. Thus, we developed a mannequin that mechanically become aware of COVID and non-COVID X-rays. These days Deep Learning algorithms shows the important consequences in Disease classification. Also, aspects discovered with the aid of pre - trained Convolution Neural Networks (CNN) fashions on large - scale datasets are useful in photo classification tasks. We train and test our model to analyze the pictures as COVID or normal, also we analytically decide the ultimate CNN mannequin for the purpose. The accuracy metrics are used to validate the classification of the model. The important aim of this thesis is to enhance a computer studying model that should predict whether or not a patient's suffering from COVID-19. To increase such a model, a literature find out about alongside a scan is set to become aware of an appropriate algorithm. To assess the elements that influences the prediction model.

Keywords: COVID-19, Chest-X ray Images, Machine Learning, Deep Learning, and CNN.

2. INTRODUCTION

The x-rays contain very small details, to examine that we need an expert radiotherapist. Even though some cases are a failure because of eyesight, we can't find which photo is COVID and normal.



Fig. A



Fig. B

Figure 1: Fig A was a Normal chest image and Fig B was COVID affected chest image.

From the above Figure 1. However the computer imaginative and prescient can classify them by means of coaching with some labeled data. Thus, we use deep studying [1]. Laptop imaginative and prescient is one of the areas that have been advancing. Deep Learning laptop vision is now supporting in photograph recognizing and additionally in many picture classifications tasks. Deep Learning requires a labeled dataset. For example, in our project, we want to locate whether or not the x-ray photograph is COVID or normal, for that we want to train the mannequin through giving two image units COVID and everyday as labeled. Also, deep mastering requires excessive GPU or CPU due to the fact of its high computations. Nowadays all structures are with the first-rate CPU and GPU or also we can use cloud IDEs to perform exams and teach of the model. Convolution neural community is one of the deep studying techniques with wide and deep shape, Figure two where pixels extracted from images and transfer these pixels to neural networks. We process the pixels of the photograph for much less complexity of the model.

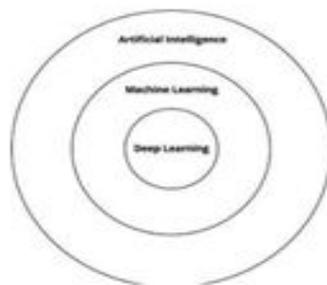


Figure 2: Relation between Artificial intelligence, Machine Learning and Deep Learning

Why CNN

Convolution Neural Systems (CNN) extricates the highlights of an picture and decreases the measure without misfortune of its characteristics. For illustration, in the event that we have an picture with a estimate of $35 \times 35 \times 1$ (where 1 speaks to as it were 1 channel in RGB). The full number of Neurons for the completely associated layer will be $35 \times 35 = 1125$. on the off chance that the picture estimate is 100×100 we require 10000 neurons as input for the completely associated layer, where it was exceptionally troublesome to compute that numerous layers [2]. But by utilizing Convolution neural systems (CNN) we will diminish the number of neurons with the assistance of pooling layers, where we are able diminish the number of computations in a completely associated arrange.

Image Representation

The images are represented as pixels in image processing, the pixels are packed in matrices as height x width x number of channels (for colored image 3 channels RGB as in Figure 3). Based on the red, green, and Blue channels intensity the pixel values may vary, for the grayscale images, there will be only one channel.

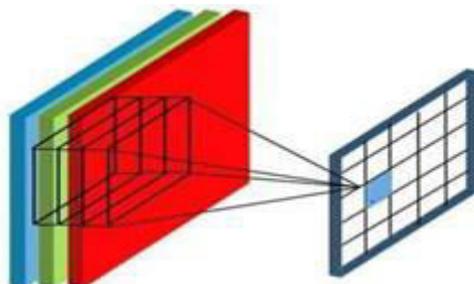


Figure 3: RGB channels representation

Methodology and Dataset Description A. Cxr Image Collection

Chest X-ray images were collected from different sources and used for the classification algorithm [8] [9]. These images have been compiled by various persons some of who are doctors, researchers, clinical persons, etc. Some of the sample images have been depicted in Fig. 1.

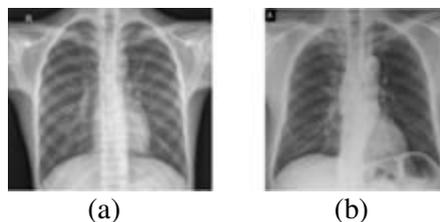


Fig. 1: Sample CXR images: (a) COVID-ve (b) COVID+ve

B. Dataset Description

We have used the datasets that contains CXR images from patients with confirmed COVID-19 disease, common bacterial pneumonia and normal incidents (no infections) [15]. It is a combination of two different publicly available datasets at [8] and [9]. COVID-19 positive cases are taken from Dr. Joseph Cohen's Github repository [9] and consist of 1002 Posterior-Anterior (PA) X-ray images of lungs. In addition, 1341 normal and 3875 Pneumonia (bacterial) and 390 Pneumonia (viral) chest X-Ray images were downloaded from Kaggle's repository [8] [15]. The images from these sources were combined and in total 1032 images were finally selected for the project. The bacterial and normal datasets were chosen for training the model and viral dataset was chosen for testing. Suitable amount of data are available now for us to predict with less error. One should

note that, a “normal” case doesn’t mean that the person will not get emerging diseases in the near future. It depicts only the normal CXR images without any respiratory disease.

C. Image Pre-Processing

The CXR pictures have been resized so that it fits the calculation and speeds up the planning plan. Picture resizing and labeling is required so that the planning calculation can legitimize its importance. Pictures were as well changed over to 'gray' channel

1) Image Augmentation

CCN requires enough image data for it to work properly and give excellent performance. Techniques like rotation, horizontal flip, vertical flip, translation, etc. provide adequate image data which is good enough to train the CNN model properly and fully [4]. This is necessary as when certain image is fed into the model as test image, then the model must be robust enough to detect and extract features which correspond to the particular class.

In this study we have changed the input image size to 512-by-512. Images were rotated by 20°, translated by 50 pixels both left and right, top and bottom, and flipped by 180° horizontally.

III. Architecture of the Deep Learning Model

The demonstrate was prepared from scratch utilizing the datasets as in [8] and [9]. Fundamental Profound Learning Organize is something like as appeared in Fig. 2. It comprises of an input layer, covered up layers, and yield layer. Covered up layers comprise of diverse layers, each layer having usefulness of its own€.

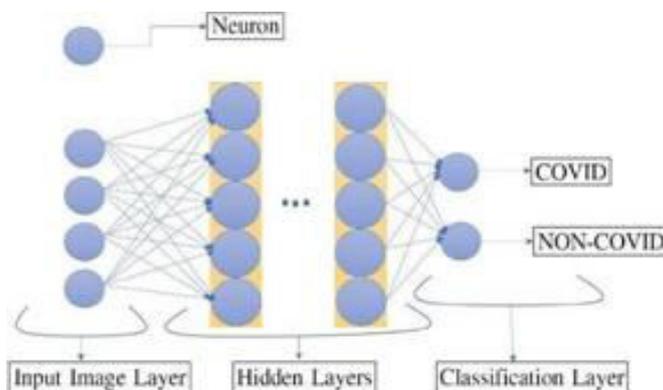


Fig. 2: Basic Deep Learning Network

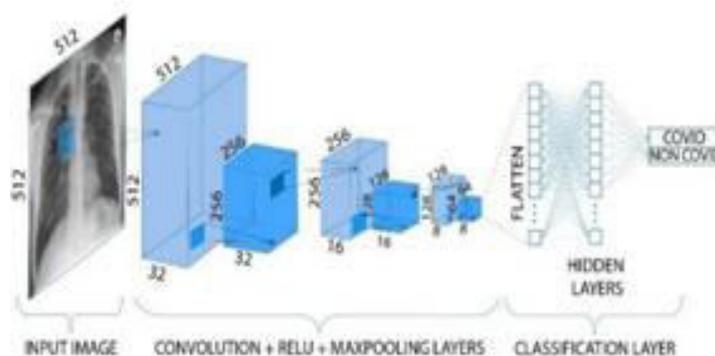


Fig. 3: Deep Learning Network used in the model

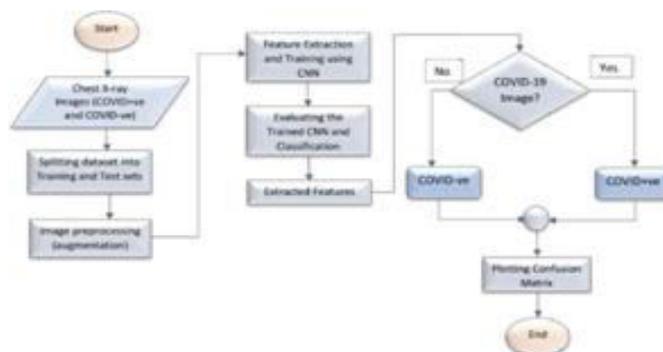
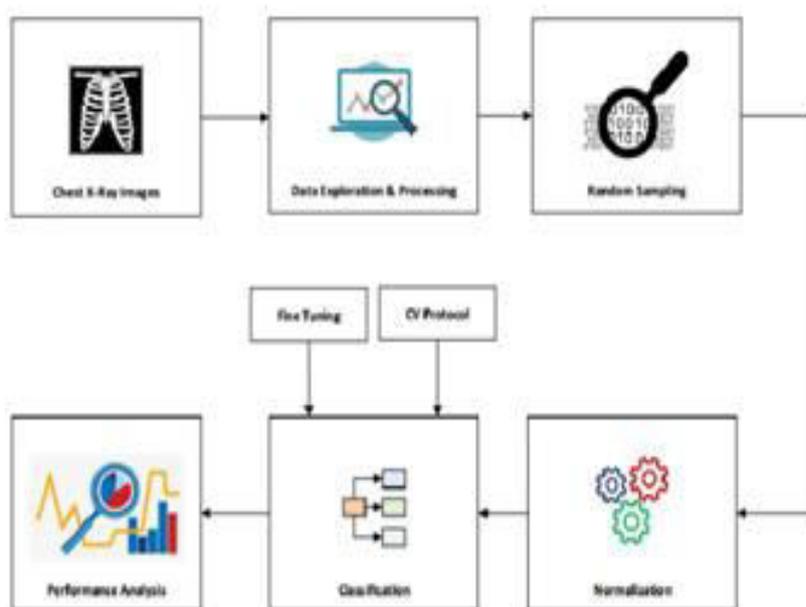


Fig 4: Flowchart of the prospered model

Convolution layers apply filters to extract features from the image dataset. Pooling layers are used to further reduce processing power by using 'max pooling', which takes the maximum value in a certain filter region, or 'average pooling', which takes the average value of all the features extracted in a filter region. These methods are used to reduce the dimensionality of the network. Fully connected layers collect all the final features and generate final classification values accordingly [13].

The Deep Learning model that we have trained from scratch is as shown in the Fig. 3. It consists of an Image input layer, 3 Convolution layers, 3 Normalization layers, 3 ReLu activation function layers, 3 Max Pooling layers, and finally the Classification layer which consists of a fully connected flattening layer- an array of neurons, a softmax layer which labels the output with some probabilities. All these layers combined together perform tasks like feature extraction, normalizing the extracted features, max pooling the normalized features, train a fully connected neural network and finally classify them accordingly. A simple flowchart of the process is as shown in Fig. 4.

IV. BLOCK DIAGRAM



We build a novel architecture to classify the input COVID-19 CXR images into normal and abnormal categories. The proposed network is called Chest X-Ray COVID-19 Network (CXRVN), it is considered as the first specialized deep neural network for analyzing chest X-ray images against the pandemic COVID-19. Our network architecture is summarized in Fig. 2. Generally, CXRVN consists of four convolution layers, three pooling layers, and one fully connected layer. Next, we describe the main features of our architecture and their importance for diagnosis COVID19 patients.

The collected datasets consist of normal cases and COVID-19 ones. These datasets splits into two sets, and they are the training and testing sets. To overcome the over fitting problem, we split the datasets into 80% for the trained images, and the remaining 20% is for the testing ones. Subsequently, the training sets are augmented via the use of GAN. Therefore, the hyper-parameters values of the training sets have learned and proceeded with the evaluation to produce the validation set. Every- iteration of the shuffled fold is split by generating an independent number of the trained/tested image.

V. RESULTS AND DISCUSSION

In this study, we had trained a network from scratch on CXR images and classified them into COVID+VE and COVIDVE classes. We had tested on CXR images that were not used in the training phase, and got good results that were 95.63% accurate (overall). We had trained the model up to 1640 iterations which we found sufficient to validate the trustworthy of our results. Training accuracy indicates how correct the image being currently trained is classified under the correct label. The loss function calculated is actually cross-entropy loss function which is plotted for the same iterations. It tells us how close is the validation image to the trained image. Usually training is stopped if the training parameters are not changing enough, but we had continued it till the final epoch so that we can see the end results.

Following Table I show in the training..

Label	Count	the number of COVID +ve images and -ve images used
COVID +ve	516	
COVID -ve	516	

TABLE I. LABEL
DISTRIBUTION

Also the training accuracy and loss were measured and tracked during the training process. It has been shown in the Fig. 5(a) and Fig. 5(b).

As we can see from the accuracy plots, training and validation plots go hand in hand, depicting good trained model which can classify accurately (> 90%). Cross entropy loss depicts how good is the training progressing further, lower values are best. To measure the 'effectiveness' of the model, a Confusion Matrix is used [14]. Performance of the model depends on how effectively and accurately it classifies the dataset. Confusion Matrix is a performance measurement for machine learning classification. Same has been plotted in Fig. 6. As we can see from the confusion matrix plot, majority of the images have been classified correctly (true positive) and few of them (< 4%) have been wrongly classified (false positive).

Further, we randomly selected CXR images from the test dataset, and tried to classify them based on the trained network. The results came out be 100% accurate. This shows that the network is responding well on the test images. Example classified images has been shown in the Fig. 7.

VI. CONCLUSION AND FUTURE WORK

The study is about to identify Covid-19 by investing chest X-ray images of patients and lessen the spread rate of this disease at an early stage. We proposed both Machine learning and deep learning –based approach by investigating open source of normal, viral pneumonia and Covid-19 patient's images to predict Covid-19. Eventually in a short period of time the corona virus has challenged researchers to venture for a new, precise, and faster method besides the traditional methods to investigate the presence or absence of COVID-19 affected pulmonary hotspots and to discriminate it from other types of Pneumonias. The proposed method starts from chest segmentation, then enhancement of the excluded region to make the classification task more accurate. Based on this study and various other sources, it can be concluded that deep learning with CNN has a significant role in the detection and classification of COVID-19 from CXR images. We had achieve the accuracy of about 95.63% which we find good in terms of proper classification. This model can accurately classify about 96.2% of the images into correct labels of data. Rest 3.8% of the images have been wrongly classified.

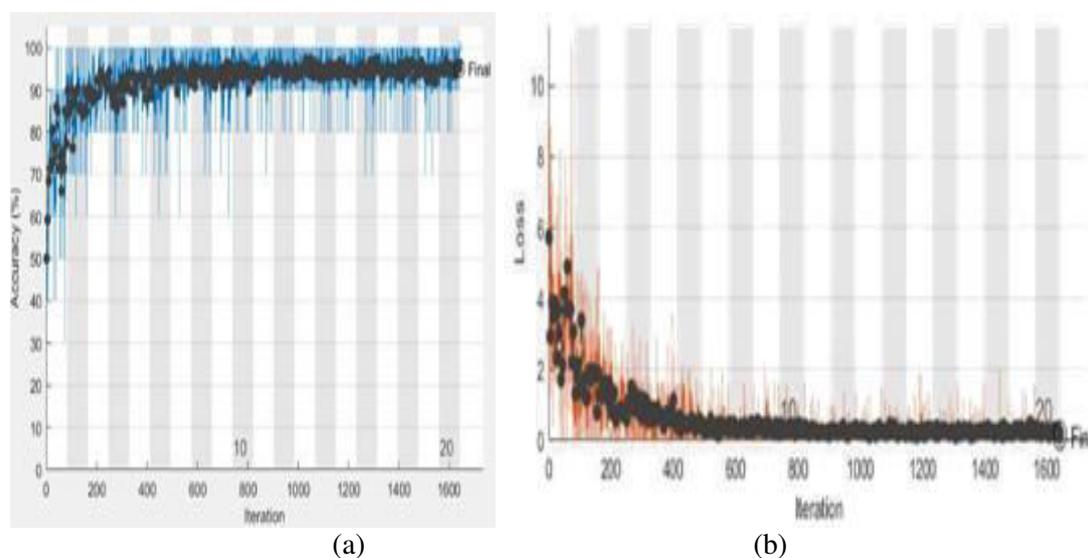


Fig. 5: (a) Training and validation accuracy of the model and (b) cross entropy loss. The black dots(validation accuracy) closely match with the blue line(training accuracy) and the orange line(loss function)

	COVID+VE	COVID-VE	
Output Class COVID+VE	106 51.5%	3 1.5%	97.2% 2.8%
COVID-VE	5 2.4%	92 44.7%	94.8% 5.2%
	95.5% 4.5%	96.8% 3.2%	96.1% 3.9%
	COVID+VE	COVID-VE	Target Class

Fig. 6: Confusion Matrix. Green colored region depicts correctly classified data and orange colored region depicts wrongly classified data

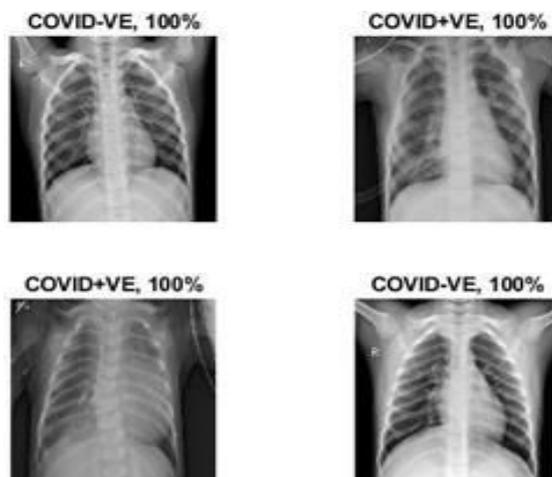


Fig. 7: Tested CXR images which turned out to be 100% accurately classified.

However, this can be improved using pre trained, more advanced CNNs like VGG16, ResNet50, InceptionV3, Inception ResNetV2, Google Net, etc. [15] [16]. These studies can help medical staffs in dealing such pandemics more safely. Since, medical treatments have a certain limits; we should utilize other measures as well which is somewhat nonmedical. Radiographs can easily be done at various hospitals and medical centers. Processing the radiographs using the model we have defined in this study, can significantly improve the speed of detection of COVID-19.

In this era of Artificial Intelligence, Machine Learning, we must welcome such steps of automation which do not involve humans, as they can be erroneous. Future work may include building AI based apps that can detect the disease automatically on scanning the CXR images. Also, when plenty of data is available, we may further improve the detection accuracy. The model may be trained such that it could be used to classify different lung diseases as well like, SARS, Asthma, etc.

REFERENCES

- 1 <https://www.covid19india.org/>
- 2 Chimmula, V. K. R. and L. Zhang (June 2020). "Time sequence forecasting of COVID-19 transmission in Canada using LSTM networks". In: Chaos, Solitons and Fractals 135.109864. URL: <https://www.sciencedirect.com/science/article/pii/S0960077920302642>.
- 3 Gao, Junyi et al. (Jan. 2021). "STAN: spatio-temporal interest network for pandemic prediction using real-world evidence". In: Journal of the American Medical Informatics Association 28. URL: <https://academic.oup.com/jamia/article/28/4/733/6118380>.
- 4 Kapoor, Amol et al. (July 2020). "Examining COVID-19 Forecasting the use of Spatio-Temporal Graph Neural Networks". In: arXiv. URL: <https://arxiv.org/abs/2007.03113>.

- 5 Kufel, T. (June 2020). "ARIMA-based forecasting of the dynamics of validated Covid-19 cases for selected European countries". In: *Equilibrium. Quarterly Journal of Economics and Economic Policy* 15, pp. 181–204. URL: <https://ideas.repec.org/a/pes/ierequ/v15y2020i2p181-204.html>.
- 6 Tian, Y., I. Luthra, and X. Zhang (July 2020). "Forecasting COVID-19 instances using Machine Learning models". In: *MedRxiv*. URL: <https://www.medrxiv.org/content/10.1101/2020.07.02.20145474v1.article-info>
- 7 Zeroual, A. et al. (Nov. 2020). "Deep studying techniques for forecasting COVID19 time-Series data: A Comparative study". In: *Chaos, Solitons and Fractals* 140.110121. URL: <https://www.sciencedirect.com/science/article/pii/S096007792030518X>.
- 8 Hu, S., et al. Weakly supervised deep getting to know for covid-19 contamination detection and classification from ct images. *IEEE Access* 8 (2020), 118869– 118883
- 9 Gozes, O., et al. Rapid ai improvement cycle for the coronavirus (covid-19) pandemic: Initial effects for automated detection & patient monitoring the use of deep learning ct photo analysis, 2020.
- 10 Narin, A., Kaya, C., and Pamuk, Z. Automatic detection of coronavirus ailment (covid-19) the usage of x-ray pictures and deep convolutional neural networks. *Pattern Analysis and Applications* (2021).
- 11 Song, Y., et al. Deep getting to know enables accurate prognosis of novel coronavirus (covid-19) with ct images. *IEEE/ACM Transactions on Computational Biology and Bioinformatics* (2021), 1–1.
- 12 Wang, S., et al. A deep gaining knowledge of algorithm using ct pics to display screen for corona virus ailment (covid-19). *European Radiology* (2021), 1–9

An Implementation on Fire Fighting Robot Using IoT (Internet of Things) and Cloud Computing

Anil Bawaskar and Tejswini Kakde

Department of Electronics & Telecommunication Engineering, Jhulelal Institute of Technology, Nagpur, Maharashtra, India

ABSTRACT

This paper aims to design a robot that acts as an extinguisher of fire. This proposed firefighting robot is expected to produce a small but very powerful and versatile robot. It detects fire in disaster-prone areas. We design this project with the help of the CAM board. It controls and detects fire automatically. With the help of the IoT, we can also control our robot manually. We can switch between these two modes i.e., automatically or manually in either way we want. We are using a camera to know what is happening and Raspberry pi to know the status of the robot. Here, the fire detection robot overcomes the problem of hitting the obstacle by sensing the obstacle and moving in the direction where it is obstacle-free.

Keywords: Flame Sensor, Temperature Sensor, Cam Board ESP 32, Atmega 328p UC, IoT, Power Supply.

INTRODUCTION

This advanced project Fire Fighter Robotic Vehicle with Night Vision Camera allows a user to control a firefighter robot equipped with a water tank and gun remotely wirelessly for extinguishing fires. For this purpose, the system uses an IoT remote for remote operation along with WiFi receive-based microcontroller circuit for operating the robotic vehicle and water pump. The receiver circuit receives WiFi signals through WiFi-based remote transfer users' commands. The receiver circuit now decodes the data commands sent. It then forwards it to the microcontroller. Now the microcontroller processes these instructions and then instructions the vehicle motors to run the vehicle in desired directions. It also operates the water pump motor and pumps direction motor to spray water based on the user's commands. This allows the user to operate the robot and put off the fire by standing at a safe distance. This robot body also has a wireless night vision enabled camera mounted over it. This night vision camera helps to direct the robot body in whichever direction is needed. This is because whatever area that will be captured by this wireless camera can be viewed on a PC for reference. The robot operates within a 20-meter range of the remote. Thus this system helps to extinguish a fire from a safe distance with the help of the water tank attached to the robot body. The devastation of a fire incident is like a nightmare. Every year many people around the world lose their lives because of it. A statistics report provided by the International Association of Fire and Rescue Services made on official reports of fire incidents in 34 countries shows that 16.9 thousand people lost their lives in 2016, and that is very unfortunate. This report is an only official report, but the number of casualties may be much higher in reality. It also shows that the average occurrence of fire incidents is 2.9 per 1000 inhabitants, which is relatively high. In Bangladesh, the average number of fires per year is 17,743. So, tackling fire incidents timely and adequately is an important task. While tackling a fire incident, two essential aspects are speed and safety. When a fire incident occurs, it becomes difficult for the firefighters to evaluate the situation without being subjected to harm. It is sometimes impossible for firefighter personnel to get access to the fire-affected area. So, the speed and safety of the firefighters become questionable.

I. LITERATURE REVIEW

The literature reviews of various papers are as follows:

[1] Reference proposes an Internet of Things (IoT) system that monitors air pollution in real-time. The authors use multiple gas sensors, but do not follow the specific standard measurement procedure. Also, there is no proper architecture for the system and it lacks experimental evaluations. Reference designed a monitoring system based on the IoT concept where they monitor the environmental parameters using low-cost sensors from the MQ series, there is no data validation or the sensors calibration procedure that is compulsory in the case of low-cost sensors.

[2] The system presented in Reference operates on an existing Wi-Fi network via the MQTT protocol. They intended to monitor the indoor air quality, and the focus was on a single pollutant, being PM control. Reference aims to detect PM only and notify the user via email using a low-cost dust sensor and Raspberry Pi for data transmission. Reference put their efforts into developing a system to measure the 3D AQI map. The researcher's prototype is a quadcopter for 3D data collection, compare the results with official data, and claims to achieve reasonable accuracy. This design is not cost-efficient and the system implementation is quite complex.

III. METHODOLOGY

The methodology is divided into three parts. The first part is on the mechanical schematics, followed by hardware description, and finally on the programming design. All parts were assembled and experiments were then performed to determine the optimal distance of QRob to extinguish the fire were carried out. A. Mechanical Design Structure Google SketchUp software and AutoCad were used to produce 3D and 2D schematic diagrams. For the main structure of the robot, to get the preferred movement and speed, QRob has two wheels on the rear side and two wheels on the front side. The wheels can stabilize the robot and make rotations to 360 degrees. The body of the robot is made from an acrylic plate to protect the electronic circuit. The acrylic sheet is resistant to heat up to 200 ° C. This gives the ability to use and work with (cut and drill). The body of the acrylic chassis contains holes that make it easier to mounting of various types of sensors and other mechanical components. The ultrasonic and flame sensors were installed in front of the robot to avoid hitting any obstacles and detect the fire. In addition, a mini camera was installed on the front side of the robot to monitor the way and condition of the location and is linked to the smartphone. The structure of the fire extinguisher robot is shown in Fig. 1 and Fig. 2. Fig. 1. 3D Structure of QRob with Dimension. Fig. 2. Firefighting Robot (QRob). B. Hardware Implementation The electronic part is one of the vital parts in the development of QRob. It includes several sensors, a microcontroller, a DC motor with a wheel, Transmitter, remote control, and a Water pump. Fig. 3 shows the block diagram of the QRob operation which consists of the flame sensor and ultrasonic sensor as input of the system. Arduino Uno is used as a microcontroller that is connected with other components. Motor Driver (L298N) is used to activate the moving of the gear motor while Transmitter Remote Control will give the output of the system. The flow of water and fire extinguisher were pumped after being controlled by the operator. On the other hand, the operator can monitor the robot's movements by using a camera (Go Pro) that connects to a smartphone. 1) Flame sensor: In most firefighting robots, fire sensors perform an essential part in investigations, which are always used as robot eyes to discover sources of fire [1]. It can be utilized to identify fire based on the wavelength of the light from 760 nm to 1100 nm. The detection angle and distance are roughly 60 degrees and the distance is 20 cm (4.8V) to 100 cm (1V) respectively. The flame sensor has two signal pins that are Digital Output (DO) and Analog Output (AO). DO pins will give two kinds of information that it's has flame or non-flame while AO pins will detect the exact wavelength of the different light. Fig. 3. Block Diagram of QRob

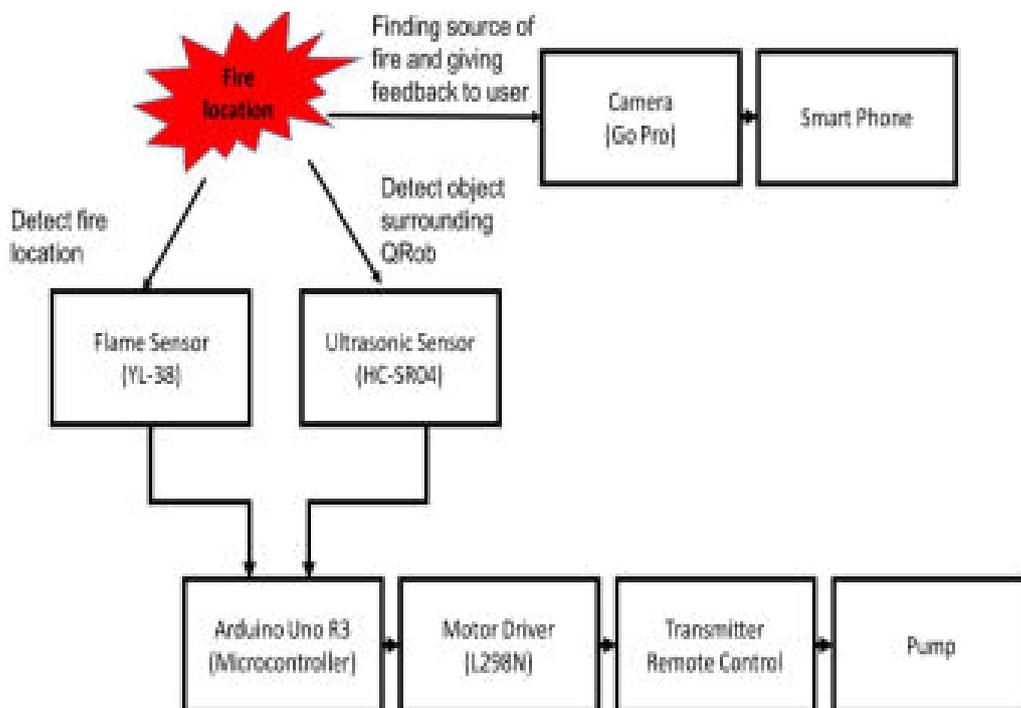


Fig. 3. Block Diagram of QRob.

MATERIAL & METHOD OF IMPLEMENTATION

Block diagram: The block diagram for the proposed system consists of a flame sensor, temperature sensor, two motors, Atmega 328p UC, motor driver, water pump, two motors, Relay, power supply, IoT, Bluetooth module, Cam Board ESP 32.

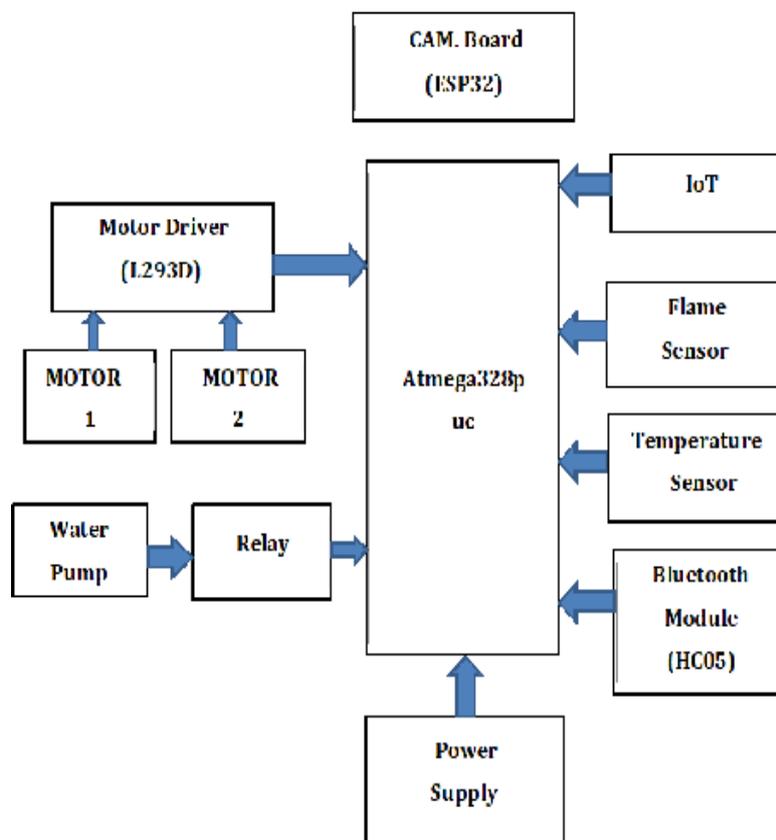


Fig. Block Diag. of Fire Fighting Robot

What is ESP 32 and why do we use it?

The ESP32- CAM has a very competitive small-sized camera module that can operate independently as a minimum system with a footprint of only 27*40.5*4.5mm and a deep sleep current of up to 6mA.

ESP-32 CAM can be widely used in various IoT applications. It is suitable for home smart devices, industrial wireless control, wireless monitoring, QR wireless identification, wireless positioning system signals, and other IoT applications. It is an ideal solution for IoT applications.

ESP-32 CAM adopts a DIP package and can be directly inserted into the backplane to realize rapid production of products, providing customers with a high-reliability connection mode, which is convenient for application in various IoT hardware terminals.

Working

We use a 12V 1 Amp battery to give power supply to the ESP 32 CAM board. Since the board's supply voltage is 3.3V, we use a voltage regulator LM7805 to limit the voltage and is passed to ESP 32 CAM board. We also use a voltage regulator LM1117 to limit the voltage to 5V which is passed to two DC motors. The Filter used in this is used to produce the complete DC pulsating voltage. Since the Microprocessor used in this has very little voltage it can supply voltage to the motors which are 5V. So we use the L293D driver to supply voltage of 5V to motors. So L293D acts as an interface between the microprocessor and the motors in the robot. A threshold value is given to the temperature sensor which detects the temperature. In this, the obstacle avoidance feature is maintained by flame sensors. Initially, the microcontroller is programmed using embedded c code. In this robot, if any flame is placed in front of the device the flame sensors get activated. If the obstacle is placed on the left side of the motor, the flame sensor on the left gets activated and drives the motor to another side. Similarly, if the obstacle is placed on the right side, the flame sensor on the right side gets activated and drives the motor to another side. Thus obstacle avoidance is maintained by IR sensors. And once the temperature value reaches the threshold value, the temperature sensor 554 Kalathiripi Rambabu, Sanjay Siriki, D. Chupernechitha, Ch. Pooja International Journal of Engineering Technology Science and Research IJETSr www.ijetsr.com ISSN 2394 – 3386 Volume 5, Issue 3 March 2018 detects it. Once it is detected, automatically the relay connected to the board gets on and the pump connected to it gets activated and sprinkles the water. The user can switch in either mode i.e., automatic or manual. If it has been switched in automatic mode, the robot itself detects the fire

automatically, then its relay gets ON, and hence it goes to the fire detected area and then extinguishes the fire by sprinkling water onto it. If it has been switched to manual control, the user gets the status of the surroundings of the robot through camera by creating a server page which is connected using IoT to control the robot with the help of CAM board. The Advantage of this manual control over automatic control is that in automatic mode it takes time for the robot to monitor itself. But whereas in manual mode when the users get the status regarding the fire, they can control it manually to save time and to stop causing more harm. In the working model of our project, we have been used IoT. The Internet of Things (IoT) is an ecosystem of connected physical objects that are accessible through the internet. The 'thing' in IoT could be a person with a heart monitor or an automobile with built-in sensors, i.e. objects that have been assigned an IP address and can collect and transfer data over a network without manual assistance or intervention. The embedded technology in the objects helps them to interact with internal states or the external environment, which in turn affects the decisions taken. In our project, we are controlling our robot and giving the instructions as we needed.

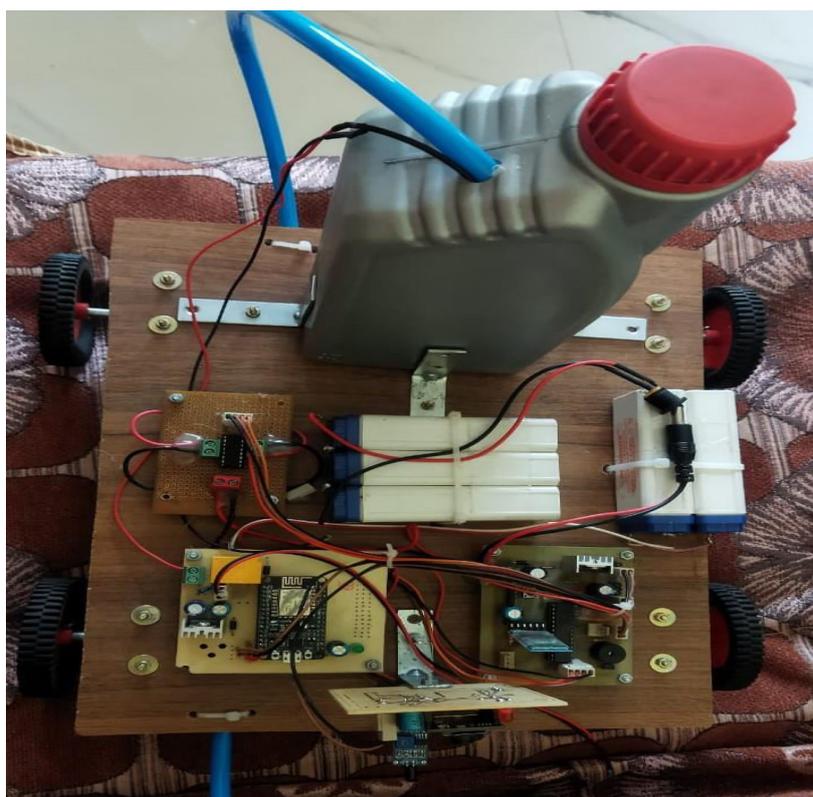


Fig: Actual Image of Project

CONCLUSION

It is designed by using a temperature sensor. Fire-fighting is the act of extinguishing fires i.e., it sprinkles water onto the fire. Monitors the areas where natural calamities and bomb explosion occurs. The robot detects temperature, at the site where the robot exists. This robot is helpful in those areas where natural calamities and bomb explosions will occur. If the fire is detected with the help of sensors or manually operates the water pump mechanism through a relay circuit. The proposed method is verified to be great benefits for security purposes and industrial purposes. Through this, we can conclude that a robot can be used in place of humans reducing the risk of the life of Firefighters. We can use them in our Homes, Labs, Offices, industries, etc. They provide us with greater efficiency to detect the flame and it can be extinguished before it can become uncomfortable and a threat to life. Hence, this robot can play a crucial role.

REFERENCES

1. https://www.researchgate.net/publication/269406029_Fire_Fighting_Robot
2. <https://www.ijser.org/researchpaper/AUTONOMOUS-FIRE-FIGHTING>
3. Velásquez P., Vásquez L., Correa C., Rivera D. A low-cost IoT based environmental monitoring system. A citizen approach to pollution awareness; Proceedings of the 2017 CHILEAN Conference on Electrical, Electronics Engineering, Information and Communication Technologies (CHILE CON); Pucon, Chile. 18–20 October 2017; Piscataway, NJ, USA: IEEE; 2017. pp. 1–6. [Google Scholar]

4. Chen X.J., Liu X.P., Xu P. IOT-based air pollution monitoring, and forecasting system; Proceedings of the 2015 International Conference on Computer and Computational Sciences (ICCCS); Noida, India. 27–29 January 2015; Piscataway, NJ, USA: IEEE; 2015. pp. 257–260. [Google Scholar]
5. Alvear O., Zamora W., Calafate C.T., Cano J.C., Manzoni P. EcoSensor: Monitoring environmental pollution using mobile sensors; Proceedings of the 2016 IEEE 17th International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM); Coimbra, Portugal. 21–24 June 2016; Piscataway, NJ, USA: IEEE; 2016. pp. 1–6. [Google Scholar]
6. Caya M.V.C., Babila A.P., Bais A.M.M., I'm S.J.V., Maramba R. Air pollution and particulate matter detector using raspberry Pi with IoT based notification; Proceedings of the 2017 IEEE 9th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment and Management (HNICEM); Manila, Philippines. 1–3 December 2017; Piscataway, NJ, USA: IEEE; 2017. pp. 1–4. [Google Scholar]
7. Gao Y., Dong W., Guo K., Liu X., Chen Y., Liu X., Bu J., Chen C. Mosaic: A low-cost mobile sensing system for urban air quality monitoring; Proceedings of the IEEE INFOCOM 2016—The 35th Annual IEEE International Conference on Computer Communications; San Francisco, CA, USA. 10–14 April 2016; Apr 14, pp. 1–9. [Google Scholar]

Technology Adoption Models: A Study on Brick Kiln Firms in Punjab

Ajay Kumar and Shamily Jaggi
Lovely Professional University, Phagwara, India

ABSTRACT

In growing nations like India improvement of current technology has been a key determinant to boost up industrialization and urbanization. But in a quest of fast economic growth, tendencies are taken into consideration key priorities, even as safety of surroundings has now no longer been given the equal importance. Thus, some of factories, sited haphazardly, had been mounted main to deterioration of natural assets like soil, water, and air. As a result, surroundings pollutants is rather growing because of industrialization and mechanization this is serving to satisfy needs of population. With increasing population, demand for bricks for construction is also increasing establishing brick industry as a booming industry.

Brick production requires two main resources; water, as a source of life, and soil, as a dwelling environment. Water and soil conservation is a critical issue in areas facing soil and water resource constraints. The purpose of this paper is to provide an overview on the theoretical frameworks used in the analysis of the adoption of soil and water conservation practices in brick industry.

Different models and frameworks have been used in the analysis of the adoption/analysis of new practices and technologies; these include Technology acceptance model, Theory of reasoned action, Motivational model, Theory of planned behavior, Innovation diffusion theory and the Unified theory of acceptance and use of technology. Theory of Planned Behavior has been used as a conceptual framework in many studies on the factors affecting the adoption of soil and water conservation practices. This theory allows examining the impact of social norms (cf. subjective norms), individual factors (i.e. attitude) and situational factors (i.e. perceived behavioral control) on the adoption of practices.

Keywords: Theory of Planned Behavior, Technology Adoption, Unified Theory of Acceptance and Use of Technology, Water conservation, Soil conservation.

INTRODUCTION

The destruction of agricultural land leads to the loss of quality of soil and, consequently, its productivity. Erosion of soil is a major driver of degradation of agricultural and can be very important because it is often irreversible and, in cases of severe degradation, causes complete soil loss (Hugo, 2006). Erosion is a big challenging issue not only because it diminish productivity, but also because it is strongly linked to rural poverty and desertification (Bishop & Barbier, 1995). The causes of agricultural land degradation are complex and varied and can be classified into three main categories (Muchena et al., 2005): (1) Bio-geophysics (such as slope, soil type); (2) climate (such as rainfall, drought) and (3) Management (such as farmers' education, experience, access to development services). These three groups of variables are very crucial in determining the probability and rate of soil erosion (Muchena et al., 2005).

Third type of category in these days is main reason of soil erosion in state of Punjab, reason behind this is rapid growth in development and urbanization of rural areas.

Bricks are most important building materials. Bricks are made of mainly soil with the addition of additives in order to increase its strength and durability. The bricks are burned or fired in the brick kilns for some time span. These bricks are then used for construction work (Khan and Vyas, 2008). India is the second largest producer of clay fired bricks, accounting for more than 10 percent of global production. India, the world's 2nd biggest brick manufacturer, has an estimated 200,000 brick kilns (Reuters, 2019). India produce 200 billion bricks a year, accounting for 13 percent of the world's total. The sector consumes about 35-40 million tones of coal every year (Eco-business reports, 2016). While as per Punjab Pollution Control Board circular (2017), there are about 3,000 brick kilns in Punjab. According to the Punjab State Council of Technology in Punjab, brick kilns produce about 15-20 billion bricks, which is about 8% of the total production of the country. This is the reason why soil erosion happening a lot.



Picture 1: Erosion of soil in agriculture land. **Picture 2:** Brick kiln on bank of a canal in Punjab.

On the other hand due to degradation of top soil layer from the agricultural land ultimately the eroded soil goes to the nearby aquatic system through different catchment channels. Water reflect its sustenance quality and ecological potential by its biological, chemical and physical characteristics. Now a days due to increase in anthropogenic influences in and around the catchment area of the aquatic systems causes large extent of nutrient enrichment in the aquatic systems and leads to deterioration in quality of water. The brick industries highly affect the biological and physicochemical properties of aquatic systems.

In view of the above-mentioned factors, it is very important to consider water and soil conservation practices. In this regard, understanding the challenges surrounding the adoption of these practices by brick kiln industry and determining the contribution of social, economic, financial, human and user characteristics to the acceptance process is crucial. Also, understanding the factors affecting the acceptance of conservation practices by brick kiln owners can provide insights for appropriate policy and long-term planning. In other words, focusing the factors affecting the adoption of conservation practices is a path for planners and policymakers to reach the micro and macro goals in all social, economic, and so forth fields. Many conceptual models or theories have been used in the study of the adoption or acceptance of new practices or technologies and this study introduces and compares them.

ADOPTION THEORETICAL FRAMEWORKS

Technology Acceptance Model (TAM)

The TAM (Technology Acceptance Model) first proposed by Davis (1985), contains the core variables of user motivation (i.e., perceived ease of use, perceived usefulness and attitudes toward technology) and outcome variables (i.e. technology use, behavioral intentions). Of these variables perceived usefulness (PU) and perceived ease of use (PEU) are considered main variables that directly or indirectly explain the outcomes (Marangunić & Granić, 2015). These variables are often accompanied by external variables clarifying variation in perceived usefulness and ease of use; among others, self-efficacy (CSE), subjective norms (SN) and facilitating conditions (FC) were significantly related to the TAM core variables—however, to different degrees (Schepers & Wetzels, 2007; Abdullah & Ward, 2016). These external variables explain personal capabilities next to contextual factors and their conceptualizations vary across studies. Overall, perceived usefulness and perceived ease of use, the most important factors in the TAM, refer to the degrees to which a person believes that technology use would be free from effort (cf. PEU) and that using a technology would enhance their job or task performance (cf. PU). Since many technology adoption studies have used this model, it can also be used to study the adoption of soil and water conservation measures.

Motivational Model (MM)

Since 1940's, number theories have been developed from motivation research. Self-Determination Theory (SDT) developed by Deci & Ryan (1985) is one of them. SDT proposed that self-determination is a human quality that involves having choices, the experience of choice and making choices (Deci & Ryan, 1985). Deci et al. (1991) stated that the regulatory process is choice when behavior is self-determined, but when it is controlled, the regulatory process is compliance or defiance in some cases. The motivation theory has advocated the researches in psychology as an explanation for behavior. These researches explained that the motivational theory contains two major factors of motivations: intrinsic motivation and extrinsic motivation. Self-Determination Theory represents the extrinsic motivation and consists of four types of self-determinations (external, interjected, identified and integrated form of regulation), while the intrinsic motivation refers to intrinsic regulation. It also shows how the social environment influences on motivated behaviors. In addition to that, the motivation behavior must be considered to understand human behavior fully (Deci & Ryan, 1985). A motivation behavior is non-regulation and intrinsically motivated or not extrinsically.

Theory of Reasoned Action (TRA)

The Theory of Reasoned Action (TRA) was developed in the field of social psychology by Ajzen and Fishbein in 1975. Its history returns to the period from 1910's to 1960s. This period was the beginning of studying the behavior of individuals with the effect of approach. Attitude has either a direct or an indirect effect on behavior, and it is either multidimensional or one-dimensional factor. They mentioned that TRA was designed to explain virtually any human behavior. It is a general model, it is not designed for a specific technology or behavior but one of the most fundamental theories of human behavior. TRA model was a result of a research program that started in the late of 1950s on the Persuasion Models of Psychology (PMP). Their aim was to develop a theory that could explain, predict and influence human behavior (Ajzen and Fishbein, 1980). They considered that this theory is moderated by two main constructs; subjective norm and attitude toward behavior.

Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (Ajzen, 1991, 2005, 2012) is an alternative approach to understanding consumer decision making. Instead of depending on the overall evaluation or utility of a product or service, this theory focuses specially on the consumer behavior of interest. The motive of this theory is to provide a comprehensive framework for understanding the determinants of such behaviors. The TPB is today one of the most popular social psychological models for understanding and predicting human behavior (Ajzen, 1985).

Briefly, in the Theory of Planned Behavior, the immediate antecedent of a particular behavior is the "intention" to perform the behavior in question. This intention is assumed to be determined by three kinds of beliefs or consideration. The first is termed "behavioral beliefs" and it refers to the perceived positive or negative consequences of performing the behavior and the subjective values or evaluations of these consequences. In their aggregate, behavioral beliefs that are readily accessible in memory lead to the formation of a positive or negative "attitude toward the behavior". A second kind of consideration has to do with the perceived behaviors and expectations of important referent groups or individuals, combined with the person's motivation to comply with the referents in question. The third type of consideration, 'control beliefs', is concerned with the perceived presence of factors that can influence a person's ability to perform the behavior. The third type of consideration, control beliefs, is concerned with the perceived presence of factors that can influence a person's ability to perform the behavior.

Theory of Diffusion of Innovation (TDI)

Diffusion of innovations is a theory by Everett Rogers that seeks to explain how, why, and at what rate new technologies and ideas spread. Rogers argues that diffusion is the process by which an innovation is communicated or spread over time among the participants in a social system. Rogers (2003) explain diffusion as "the process in which an innovation is communicated through certain channels over time among the members of a social system". As expressed in this definition, innovation, communication channels, social system, and time are the four key components of the diffusion of innovations. Innovation diffusion research has attempted to explain the variables that influence how and why users adopt new technologies or ideas. Mango et al. (2017) used the TDI in a study about awareness and adoption of soil and water conservation practices in the Chinyanja Triangle (Southern Africa).

Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh et al. (2003) developed a unified model that brings together alternative views on user and innovation acceptance viz. the Unified Theory of Acceptance and Use of Technology. The UTAUT model suggests that four main constructs (viz. performance expectancy, effort expectancy, social influence and facilitating conditions) are direct determinants of behavioral intention and ultimately behavior, and that these constructs are, in turn, moderated by age, gender, experience and voluntariness of use. It is argued that by examining the presence of each of these constructs in a 'real world' environment, practitioners and researchers will be able to assess an individual's intention to use a specific system/ technology, thus allowing for the identification of the key influences on acceptance in any given context. In the years since its introduction, UTAUT has been widely employed in adoption of technology and diffusion research as a theoretical lens by researchers/practitioners conducting empirical studies of user intention and behavior. Since the original article by Venkatesh et al. (2003), UTAUT has been discussed with reference to a range of technologies (e.g. information and communication technologies) with different control factors (e.g. age, gender, experience, voluntariness to use, education, and income), and focusing upon a variety of user groups.

DISCUSSION

Each of the presented models has its strengths but also shortcomings and limitations. One of the limitations of the Technology Acceptance Model concerns the variable that pertains to the behavior of users, which is

inevitably evaluated through subjective means such as behavioral intention (BI) and interpersonal influence. Nevertheless, interpersonal influence, as a subjective norm, means when a person is influenced by words of mouth (WOM) from a colleague, or a friend. While a superior or high authority or law can influence subordinate or employer or employee by directing him/her to perform a specific task with the use of a specific technology, based on the company or government policy. Another limitation is that behavior cannot be reliably quantified in an empirical investigation, owing to a number of different subjective factors such as the values and norms of societies, personality traits and personal attributes. Hence, the argument that a relative or friends could influence the use of a technology through exerting social pressure (Shan & King, 2015; Ang et al., 2015) is highly falsifiable.

The Motivational Model (MM) has many applications on the motivational studies and health care. But its application on technology usage and its acceptance is not effective (Ryan & Deci, 2000; Deci & Ryan, 2008). It still needs to include many factors to become more suitable or reliable to study technology usage (Gagné & Deci, 2005; Parijat & Bagga, 2014).

The Theory of Planned Behavior (TPB) is an extension to the limited Theory of Reasoned Action model. It shows that the behaviors are already planned by adding a new construct that is the perceived behavioral control (Sheppard et al., 1988). However, it does not show the planning mechanism of people and the way it pertains to TPB, with no mention to other variables that affect behavioral intention and motivation, such as fear, threat, mood or past experience. Furthermore, it does not take into account the economic or environmental factors that may influence the individuals' intention to perform a behavior (Truong, 2008).

The TRA aims to explain the relationship between behaviors and attitude within human action. It is mainly used to predict how individuals will behave based on their preexisting behavioral and attitudes intentions. It is a very general model and not designed for a specific behavior or technology (Davis et al., 1989). Ajzen stated that Correspondence is the main limitation for it; it predicts a specific behavior, attitude, and intention to be in agreement with action, target, context, and time frame (Sheppard et al., 1988; Silva & Dias, 2007). TRA is still limited with no mention to other variables that affect behavioral intention like fear, threat, mood or previous experiences.

The Theory of Diffusion of Innovation (TDI) explains the decision of innovation and predicts the rates of its adoption (Hameed et al., 2012; Askarany et al., 2012). But it does not mention how the attitude affects accepting or rejecting a technology (Oliveira & Martins, 2011; Karahanna et al., 1999). In addition, this theory doesn't care about individual's resources or social support to adopt the new behavior.

On the other hand the Theory of Acceptance and Use of Technology (UTAUT) is useful for its capability to inform the understanding of factors that determine the acceptance of an impending new technology. its popularity and growth are high as compared to the preceding versions (Al-Hakim, 2006). Moreover, its validity, stability, and viability in technology adoption surveys within several contexts have already been ascertained and practically confirmed. For instance, the study of Alshehri et al (2012) on TRA, TAM and TPB ascertained that UTAUT model enlightens the understanding of factors that influence the acceptance of new technologies (Mayer-Schönberger & Lazer, 2007; Jaeger & Matteson, 2009;). UTAUT model explains over 70% of all the technology acceptance behavior, unlike other models that explain as little as 40% of the entire technology acceptance behavior. Therefore, UTAUT exposes more factors influencing the intention of the observed behavior (Grant, 2011).

CONCLUSION

This paper provides an overview on the main conceptual models and theories used in the studies on the adoption of new technologies and practices, namely the Technology Acceptance Model (TAM), the Motivational Model (MM), the Theory of Planned Behavior (TPB), the Theory of Reasoned Action (TRA), the Theory of Diffusion of Innovation (TDI) and the Unified Theory of Acceptance and Use of Technology (UTAUT). It also discusses the main shortcomings and limitations of each model.

Models	Limitations and Shortcomings
Technology Acceptance Model (TAM)	Model focuses primarily on the impact of friends or colleagues on technology adoption, it cannot be used as a reliable model to study the adoption of water and soil conservation practices.
Motivational Model (MM)	This model loses its qualification for use due to its incompleteness and lack of required components.
Theory of Reasoned	The TRA is a general model and can be used to analyze the acceptance of

Action (TRA)	soil and water conservation practices and the attitudinal factors that affect it, but it ignores external factors that may be effective. Therefore, despite the relative competence of this model, it cannot be effectively applied.
Theory of Planned behavior (TPB)	Although TPB is an expanded model of TRA and has been applied in a wide range of studies related to acceptance of soil and water conservation practices, it has some limitations (e.g. lack of relationship between behavioral intention and motivation, not considering environmental and economic factors) that make it less effective in predicting use behavior (Amirali FARIDI et. al., 2020).
Theory of Diffusion of Innovation (TDI)	While the primary focus is on attitudinal factors, the TDI does not cover how attitudes affect individual decisions regarding the acceptance of protection practices. Therefore, this theory also cannot play a significant role in the research on the adoption of soil and water conservation practices.
Unified Theory of Acceptance and Use of Technology (UTAUT)	It is more complete and more applicable than the other models, its advantages are far more than its weakness and disadvantages, and its competence for application is far greater than the other models that were introduced in this study. Therefore, despite the widespread use of the TPB model, researchers studying the adoption of new practices and technologies should use the UTAUT model.

REFERENCES

1. Abdullah, F. & Ward, R. (2016). Developing a General Extended Technology Acceptance Model for E-Learning (GETAMEL) by analysing commonly used external factors. *Computers in Human Behavior*, 56, 238-256. doi:10.1016/j.chb.2015.11.036
2. Adilović S., Andrijanić M., Adilović E., Ravić I. (2014). Bosanskohercegovačke autohtone pasmine domaćih životinja /Indigenous breeds of domestic animals in Bosnia and Herzegovina/ drugo dopunjeno izdanje, Univerzitet u Sarajevu, Veterinarski fakultet, Sarajevo, 247
3. Ajzen I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2): 179-211. DOI: 10.1016/0749- 5978(91)90020-T
4. Ajzen I. (2005). Attitudes, personality, and behavior. Maidenhead, UK: Open University Press.
5. Ajzen I. (2012). The theory of planned behavior. In, Lange P.A.M., Kruglanski A.W. & Higgins E.T. (Eds.), *Handbook of theories of social psychology*. London, UK: Sage. pp. 438-459.
6. Ajzen, I. & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour*. Englewood Cliffs, N.J.: Prentice-Hall.
7. Ajzen, I. (1985), *From Intentions to Actions: A Theory of Planned Behavior*. Edited by Khul, J. and Beckmann, J. Springer-Verlag, and Berlin Heidelberg. New York Tokyo.
8. Anderson, J., Schwager, P., Kerns, R. (2006), The drivers for acceptance of tablet PCs by faculty in a college of business. *Journal of Information Systems Education*, 17(4), 429-440.
9. B. M. Skinder, A. K. Pandit, A. Q. Sheikh, and B. A. Ganai (2014). "Brick kilns: cause of atmospheric pollution," *Pollution Effects and Control*, vol. 2, no. 2, article 112.
10. Barbier, E. B. and Bishop, J. T. (1995). Economic values and incentives affecting soil and water conservation in developing countries. *Journal of soil and water conservation* 50(2): 133-137.
11. Cetron, J. F. (2007). *Wireless acceptance in a University setting using the Unified Theory of Acceptance and Use of Technology*. University of Delaware: New York.
12. Davis, F. D., Bagozzi, R. P. & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, 35(8), 982-1003.
13. Davis, F. (1989), *Technology acceptance model for empirically testing new end-user information systems: Theory and results*. Massachusetts Institute of Technology.

14. Ekhlal, M., Salah, I.M., Kreama, N.M. (2009), Potential for solar water heating in Libya. Planning & studies department in Renewable Energy Authority of Libya (REAOL).
15. Fishbein, M., Ajzen, I. (1975), *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Addison-Wesley, Reading, MA.
16. Hameed, M. A., Counsell, S. & Swift, S. (2012). A conceptual model for the process of IT innovation adoption in organizations. *Journal of Engineering and Technology Management*, 29(3), 358-390
17. Karahanna, E., Straub, D. W. & Chervany, N. L. (1999). Information technology adoption across time: a cross-sectional comparison of pre-adoption and post- adoption beliefs. *MIS quarterly*, 23(2), 183-213.
18. Oliveira, T., & Martins, M. F. (2011). Literature review of information technology adoption models at firm level. *Electronic Journal of Information Systems Evaluation*, 14(1), 110-121.
19. Venkatesh, V., Morris, M. G., Davis, G. B. & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 27, 425-478.

Natural Language Processing For Medical Information Extraction

B. Backiyalakshmi and M. Rajakumar

Jamal Mohamed College, Trichy, (Affiliated To Bharathidasan University, Tiruchir Appalli), India

ABSTRACT

Extracting medical data from narrative clinical papers using NLP is called NLP-based retrieval of medical information. In many cases, retrieving data in this manner may be really beneficial. This study examines and discusses the use of Natural Language Processing (NLP) to extract medical issues from clinical records. In addition to the architecture of the system that has been proposed, this article discusses the methods employed in this sector. Medical data extraction, on the other hand, is challenging due to the difficulty in recognising symptoms and illnesses. The suggested expert systems would analyse the input, which may be a question about disease or a list of symptoms, and then make an attempt to offer the proper response. Data processing, query processing, data extraction, response matching, and a user interface are all included in the proposed system. Traditional rule-based systems do not have access to this information, therefore instead we may utilise natural language processing (NLP) to obtain this information, which may give us with the answers we are looking for in the medical field.

Keywords: Medical data extraction, narrative text, and natural language processing

1. INTRODUCTION

Free text in electronic health records must be interpreted, and this is a difficult step to take given the increasing usage of electronic health records and the subsequent interest in quality improvement and research created by these records. Another major source of data is the biomedical literature, which would substantially benefit from the implementation of an organisation based on narrative language. There are a slew of approaches for gleaning knowledge from medical books. Noun entity recognizers, resolvers for cross-references and part of speech tags are only some of the tools used in the natural language processing method. As a result of the difficulty of medical terminology, standard textbooks require simpler tools, whereas medical textbooks demand more complex ones.

1.1. Motivation

The statements that follow express the necessity of a computerised programme.

- **Processing of Text is Necessary:** As long as we continue to work with data, we need to always be able to access it by means of a format known as a database. We are squandering a lot of information merely due to the fact that it is not presented in the appropriate style. It is required that this data be processed by a system, as indicated in the statement. That way, we won't ever have to worry about not having enough data, and we'll be able to make better use of the information that's currently available to us in the form of free text.
- **Medical Text Processing is Required:** Within the realm of medicine, one may easily have access to a wealth of information. However, the application of Natural Language Processing in the field of medicine has not advanced nearly as far as it has in other fields. Electronic Medical Records, often known as EMRs, as well as several other types of medical data are easily accessible. Data can be extracted from these medical records, but only by a select few computer systems. As a consequence of this, the aforementioned data has to be processed, and natural language processing can be of assistance in this endeavour.
- **Diagnosis of Diseases Requires an Automated System:** The typical patient has no means of knowing what kind of diagnosis or treatment he will receive until after he has seen the attending physician. It is concerning that some individuals are incapable of recognising the early warning signs of any disease. Patients who have access to an automated system for the diagnosis of their ailment will, at the very least, be able to judge how severe their condition is.
- **Doctors require a Computerised System:** The ability to remember a significant amount of information is essential for a career in medicine. If they could utilise some kind of automated system to help them diagnose a patient's disease, that would be a terrific idea. It also notes that medical professionals, such as physicians, require an automated system.

It is necessary to develop a system that is able to analyse medical documents in order to produce a diagnosis of the disease and the degree to which it has progressed. Currently, we are putting to the test a method to risk categorization for general disorders that is based on Natural Language Processing (NLP). This technique uses

medical data. In the long run, researchers expect that by providing patients with information about their diseases and the severity of those illnesses, they will be able to enhance patient safety.

1.2. Retrieval of Data is Made Easier by Utilising NLP:

Rule-based systems are utilised by the overwhelming majority of computer programmes in order to retrieve information. In rule-based systems, there is a limit on the total number of rules that may be implemented. The quantity of information that may be obtained is constrained due to the fact that there are only a few rules to follow. Because it does not have any rules, the rule-based system is unable to give the required new data when it is called for. Natural language processing has the ability to make use of free-form text. The volume of freely accessible text data has ballooned to tremendous proportions in recent years. On the other hand, nobody ever makes use of it. The information that is contained in documents such as Electronic Health Records may be utilised in a variety of different ways. The unrestricted text provides details on several diseases, including their manifestations and the factors that contribute to their development. The use of natural language processing might be utilised in order to extract all of this information (NLP). One such finding is that medical professionals do not always use their entire skills while treating patients with various ailments. Clinicians may be able to improve the accuracy of their disease diagnosis by utilising a data extraction approach that is automated.

2. SIMILAR WORK

MedLEE, MetaMap, and the Linguistic String Project [9] are examples of medical extraction systems. MedLEE can be used to extract, organise, and encode clinical data, resulting in textual patient reports. The MedLEE system was developed by Columbia University's Biomedical Informatics Department, Columbia University's Radiology Department, and Queens College's Computer Science Department, under the direction of Carol Friedman. The National Library of Medicine's Dr. Alan Aronson developed MetaMap, a highly customizable piece of software (NLM). Metathesaurus ideas that are quoted in text can be converted to the UMLS Metathesaurus using this tool [9]. Between 1960 and 2005, the Linguistic String Project (LSP) was being developed in the field of computer language processing [9]. As a result, Zellig Harris's string theory, transformation analysis and sublanguage grammar were employed in the book's writings.

A wide range of techniques are employed in natural language processing, including relationship extractors, post-taggers, co-ref resolutions, and NER, to name a few. Named Entity Recognition and Classification was invented by Branimir Todorovic and Svetozar R. Rancic by applying a context-based Hidden Markov Model. [14] Mauricio Hashem suggested the construction of a supervised approach for extracting named items from medical literature. Hidden Markov Model-Based System by Louise Deleger effectively adjusted Andreea Bodnari's Biomedical Named Entity Recognizer [14].

It is referred to in [15] that Jiaping Zheng devised a strategy for resolving clinical narrative coreferences. Clinical Relationships techniques were established by using patient narratives by Wafaa Tawfik and Abdelmoneim [7]. Annotated co-reference pairings total 7214 in the Ontology Development and Information Extraction corpuses, which have been used to create the relationships. Semantic, syntactic, and surface aspects can be trimmed from classifier training by using feature selection. In terms of working with noun phrases, relative pronouns and personal pronouns. It's feasible to construct machine learning using support vector machines, decision trees, and perceptrons with linear and radial basis function kernels [10].

It is referred to in [15] that Jiaping Zheng devised a strategy for resolving clinical narrative coreferences. Clinical Relationships techniques were established by using patient narratives by Wafaa Tawfik and Abdelmoneim [7]. Annotated co-reference pairings total 7214 in the Ontology Development and Information Extraction corpuses, which have been used to create the relationships. Semantic, syntactic, and surface aspects can be trimmed from classifier training by using feature selection. In terms of working with noun phrases, relative pronouns and personal pronouns. It's feasible to construct machine learning using support vector machines, decision trees, and perceptrons with linear and radial basis function kernels [10].

As a result of this method, semantic links may be drawn between words and phrases.

- (i) Medical entities are recognised as such.
- (ii) Each pair of entities must be linked in the proper semantic way.

The first step towards attaining this aim is to increase the use of metamaps. The following stage is based on semi-automatically created patterns of language from the previously selected corpus. Using semantic criteria, an evaluation of the treatment-disease link may be made.

3. INFORMATION RETRIEVAL

In the 1960s, a subfield of Artificial Intelligence and Linguistics known as "Natural Language Processing" (NLP) was formed in order to investigate issues in the automatic synthesis and interpretation of natural language. This was done with the goal of improving machine translation. The following is a list of the three primary components that make up a text retrieval system:

1. Documents in the form of records
2. Indexer
3. Information retrieval methods.

Records can be recovered using extraction methods with the aid of an indexer. Any or all of these processes can be supplemented by Natural Language Processing. Both the query and the document are interpreted and stored in NLP. The processes listed below should be followed if NLP information retrieval is included.

Step 1: Preparation of Records.

Step 2: processing of Queries

Step 3: Query retrieval.

Step 4: Sorting and Ranking

4. PROPOSED WORK

In addition to document and query processing using natural language processing, these are the two core components of the proposed system. The successful completion of phases one and two of the project is essential. The architecture illustrates the five components that come together to form the suggested system. In addition to that, it features a knowledge database. The knowledge base contains copies of all of the patients' medical histories:

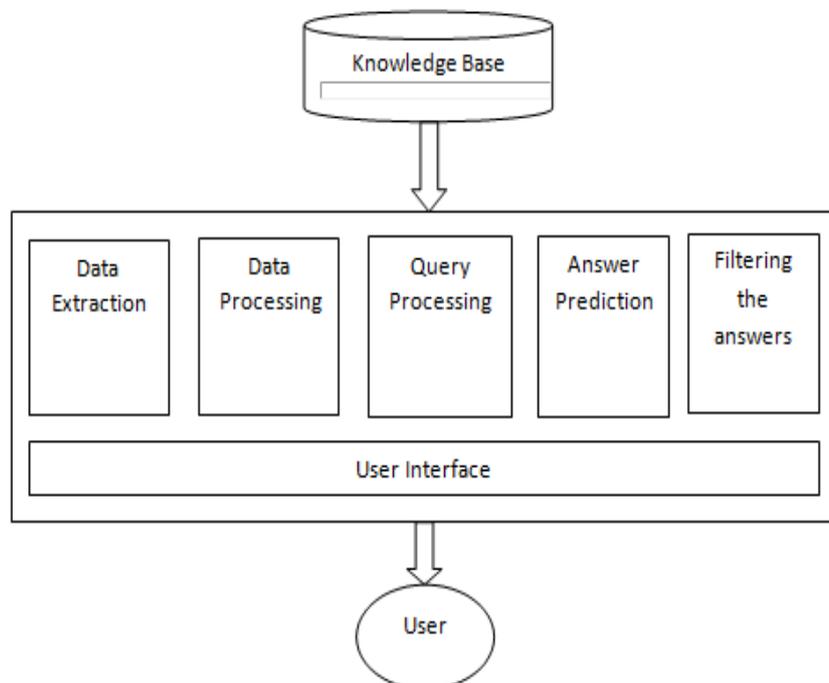


Fig. 1: The Proposed System's Architecture

4.1. Flow of the Proposed System:

Request will be sent to the module responsible for query processing, which will then process it. The query will be mined for valuable information. They say papers will be analysed in order to get the right replies from them.

Question and answer matching aims to discover the most appropriate response from a pool of potentials The following modules are included in the proposed system:

- 1) Extraction of Data
- 2) Processing of Data

- 3) Retrieval of Queries
- 4) Congruency in Reply
- 5) Answers are Sorted

4.2. Extraction of Data

The Knowledge Base will be managed by this module. A search for information on the Internet will be carried out. Biomedical books on a variety of systems will be included in the knowledge base. It can be filled with any sort of free text that includes information on a certain ailment.

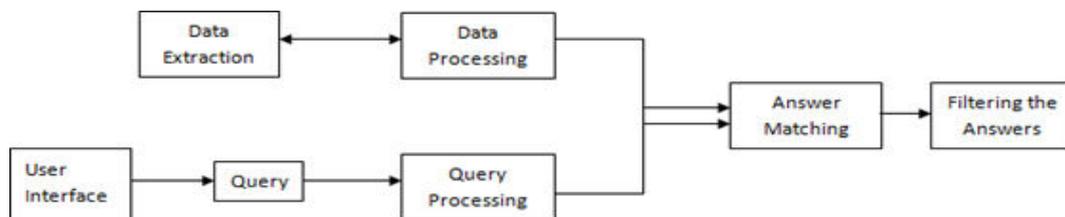


Fig. 2: The natural progression of the project.

4.3. Processing of Data

During the processing of documents, a Natural Language Processing (NLP) system is utilised. The method will consist of a number of steps, some of which include tokenization, relationship extraction, section splitting, and others.

4.4. Retrieval of Queries

Natural language processing (NLP) will be used to aid with query processing. Extraction of significant linkages and keywords will be done using this tool

4.5. Congruency in Reply

Predicting an answer will be based on the relationships and keywords that are provided.

5. RESULTS

The project's goal is to provide the most accurate and reliable responses to disease-related questions. The system should be able to provide a plausible illness name based on a user-supplied list of symptoms.

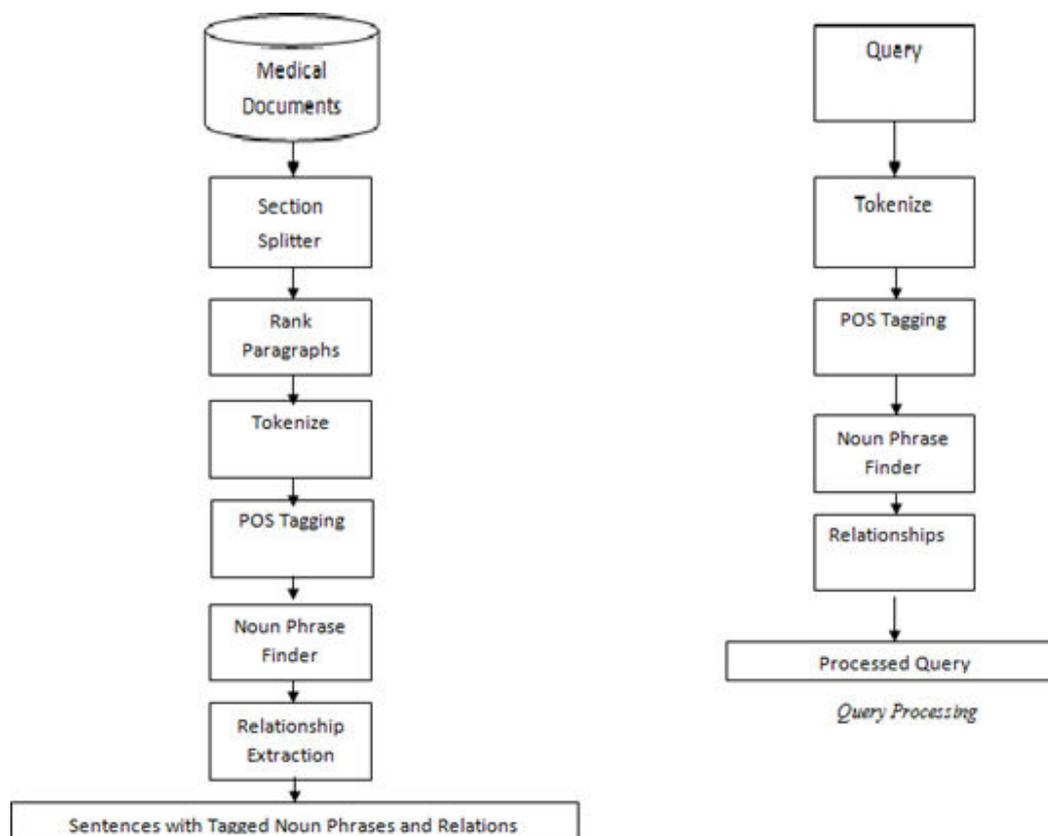


Fig.3: Document Processing

6. CONCLUSION

The use of natural language processing (NLP) to the extraction of medical text is a topic that is now receiving a lot of attention. Because of the significant differences between medical language and other forms of writing, more advanced NLP methods are required. The extraction of text is another another use for many of these systems. Methods for extracting information from medical texts need to be refined. The current inquiry indicates that the proposed system is able to retrieve information regarding illnesses.

REFERENCES

1. Andreea Bodnari, Louise Deleger, Thomas Lavergne, "A Supervised Named-Entity Extraction System for Medical Text"
2. James Freeman-Hargis "Introduction to Rule-Based Systems" at <<http://ai-depot.com/Tutorial/RuleBased.html>>
3. Ngô Thanh Nhân "linguistic string project - medical language processor" at <http://www.cs.nyu.edu/cs/projects/lsp/>
4. The Brandeis University, "MedLEE" at <<http://www.medlingmap.org/taxonomy/term/80>>
5. Asma Ben Abacha, Pierre Zweigenbaum, "Automatic extraction of semantic relations between medical entities: a rule based approach" From Fourth International Symposium on Semantic Mining in Biomedicine (SMBM)
6. Dan Shen Jie Zhang Guodong Zhou, "Effective Adaptation of a Hidden Markov Model-based Named Entity
7. D. Nagarani, Avadhanula Karthik, G. Ravi, "A Machine Learning Approach for Classifying Medical Sentences into Different Classes", IOSR Journal of Computer Engineering (IOSRJCE) Volume 7, Issue 5 (Nov-Dec. 2012), PP 19-24
8. Faguo ZHOU Enshen WU, "The Design of Computer Aided Medical Diagnosis System Based on Maximum Entropy" 978-1-61284-729-0111 2011 IEEE
9. Hinxton, UK. 25-26 October 2010
10. Jiaping Zheng,¹ Wendy W Chapman,² Timothy A Miller,¹ Chen Lin, "A system for coreference resolution for the clinical narrative", J Am Med Inform Assoc (2012). doi:10.1136/amiajnl-2011-000599
11. Kyle D. Richardson¹, Daniel G. Bobrow¹, Cleo Condoravdi¹, Richard Waldinger², Amar Das³, "English Access to Structured Data", 2011 Fifth IEEE International Conference on Semantic Computing
12. Khan Razik, Dhande Mayur , "To Identify Disease Treatment Relationship in Short Text Using Machine Learning & Natural Language Processing", Journal of Engineering, Computers & Applied Sciences (JEC&AS), Volume 2, No.4, April 2013
13. L. Smith¹, T. Rindfleisch² and W. J. Wilbur, "MedPost: a part-of-speech tagger for bioMedical text", Vol. 20 no. 14 2004, pages 2320–2321, bioinformatics/bth227
14. Lucila Ohno-Machado, Editor-in-chief, Prakash Nadkarni, Kevin Johnson "Natural language processing: algorithms and tools to extract computable information from EHRs and from the biomedical literature", amiajnl-2013-002214
15. Romer Rosales, Faisal Farooq, Balaji Krishnapuram, Shipeng Yu, Glenn Fung, "Automated Identification of Medical Concepts and Assertions in Medical Text Knowledge Solutions" , AMIA i2b2/VA text mining challenge

Formulation and Evaluation of Thermosensitive Dental Sol-Gel of Azadirachtin & Serratiopeptidase

Piyush Raj Singh Chauhan* and Upasana Sharma

Agra Public Institute of Technology & Computer Education, Artoni, Agra- 282007, India

ABSTRACT

Background: Periodontal disease (PD) is a inflammatory disease that results in major damage to gums and bone that support the tooth.

Aim: In this research study, a thermosensitive dental solution of azadirachtin drug and serratiopeptidase enzyme was formulated for the treatment of periodontal diseases, aiming at the local drug administration as directly into the periodontal pockets around the teeth, hence, avoiding the unrequired systemic loading of the drugs into the body.

Methodology: The total of nine formulations (F1-F9) were prepared by Pluronic 127F and Carbopol 934P polymers combination, here, the Pluronic was used to provide gelling like properties and thermal sensitive transition of dental solution into a gel on the applying it on patient's dentine and periodontal cavity. Whereas, Carbopol was used to contribute its mucoadhesive property, so that gel can adhere to the gum-dental mucosa effectively after application. The prepared formulations were also evaluated for their various physicochemical parameters in which solution to gel transition temperature, pH of solution, syringe-ability and mucoadhesive strength of transit gel were the most significant parameters for formulation administration. All nine dental sol formulations were analyzed for the percent drug release (%CDR) of azadirachtin and serratiopeptidase in 12 hours of duration.

Result: After statistical interpretation of data, it was established that, sol-gel system provided zero order-controlled release of drugs in 12 hours. After analyzing all the above parameters with Design Expert 8.0.7, formulation with code F9 was selected as optimized one and subjected for the accelerated stability studies where it was found satisfactory on all results.

Discussion & Conclusion: Developed and optimized formulation F9 has a future potential of therapeutically effective system of dental sol-gel to treat periodontal inflammatory anaerobic infections.

Keywords: Dental sol, Thermosensitive, Azadirachtin, Serratiopeptidase, Periodontal diseases, Pluronic 934P and Carbopol 127F

INTRODUCTION

In the world of dental science, there are many problems related to the dentine structure and gums around them. One of such major condition is periodontal disease for which conventional antibiotics have been used that produces side effects to the patients (Jain et al., 2008).

Periodontal disease (PD) is simply the inflammation of the soft tissue around the tooth that results in major damage to gums and bone that support the tooth. Microorganism causing PD, produce harmful byproducts like inorganic acids and also secrete enzymes, by which host cell membranes get proteolyzed to produce nutrients for their own growth. Pathogens recruit harm directly by causing host facilitated response that leads to cell injury. In the initial stage of the disease (called as gingivitis), inflammation is limited to the gingival cavity but spreads to deeper tissues then called as periodontitis, resulting into gingival bulging, then bleeding and then bad breath. In the advance phase of the PD, the subsidiary collagen of the periodontium is deteriorated and the alveolar bone begins to get degenerated. Gingival tissue epithelium drifts off the tooth surface creating a cavity called as periodontal pocket (PP). This periodontal pocket offers ideal circumstances for the propagation of microorganisms. Pathogens colonizing in this PP area represent the major factor in the growth of the inflammation and tissue annihilation. PD is associated with a complex bacterial population that mainly consists of non-mobile Gram-negative anaerobic bacteria. They are facultative anaerobic species of *Bacteroidessp gingivalis*, *Bacteroidessp intermedius* and *Actinomycetem comitans* (Bickel et al., 1985; Bogren et al., 2008).

Serratiopeptidase is a proteolytic enzyme that has anti-inflammatory activity and is widely used in dental dealing. It recovers microcirculation and diminishes pain by delaying the release of pain persuading amines from swollen tissues. The topical practice of enzyme is also related with a important upsurge in the concentration of antibiotic at the PD site and reduction in the rate of contagion. But proteolytic enzymes may diminish bio adhesivity as of their mucolytic act (Lakshmi et al., 2015; Mathew, 2015).

MATERIAL AND METHODS

Materials: Azadirachtin (National Analytical Corp., Mumbai, India), Serratiopeptidase (National Analytical Corp., Mumbai, India), Pluronic F127 (Biocon International drug Ltd., Mumbai, India), Carbopol 934 P (Qualigens Fine Chemicals, Mumbai, India), Potassium dihydrogen ortho phosphate (H. D. Chemicals, New Delhi, India), Glacial acetic acid (Qualigens Fine Chemicals, Mumbai, India), Sodium hydroxide (Titan Biotech Limited, Mumbai, India), Agar powder (Hi-Tech Media, Mumbai, India), Peptone (Qualigens Fine Chemicals, Mumbai, India), Beef extract (Hi-Tech Media, Mumbai, India), Concentrated sulphuric acid (Hi-Tech Media, Mumbai, India), Fourier Transform Infrared Spectrophotometer (Shimadzu, Tokyo, Japan), UV-Visible spectrophotometer 1700 (Pharmaspec Shimadzu, Kyoto, Japan), Brookfield viscometer (Brookfield Engineering laboratories. INC. USA)

METHODS

Drug Identification Studies

Melting Point Analysis

Melting point of the drug was resolved using capillary fusion method. Glass capillary tube was fused at its one end and a tiny quantity of azadirachtin was placed through the other free end of capillary. Then the capillary was placed in digital melting point apparatus. The gradual rise in temperature at which the drug got melt, was noted and equated with the literature value of it (Becker et al., 1979).

UV Spectrophotometric Analysis

A stock solution was prepared by dissolving 10 mg of azadirachtin in phosphate buffer (pH 7.6) in 100 ml volumetric flask to simulate the gingival crevicular fluid. From this stock solution, 2 ml was pipette out and volume made up to 10 ml with buffer to make the concentration of 20 μ g/ml. This sample was scanned in the UV range of 200-400 nm and λ_{\max} was noted. Similarly, the procedure was repeated separately for serratiopeptidase and λ_{\max} was recorded (Pavia et al., 2008).

Proteolytic Activity of Serratiopeptidase

Serratiopeptidase was dissolved in distilled water to make a concentration of 0.1mg/mL. 0.5mL of enzyme solution was taken into a test tube and the volume was made up to 1.0mL with Tris-HCl buffer. To this 5mL of substrate solution was added and then incubated for 25min at 25°C. The enzyme reaction was terminated by adding 1mL of 30% acetic acid. Using the spectrophotometer, the absorbance of p-nitroaniline (that was released into the solution by enzymatic activity) at 410nm was measured against a control solution (without the enzyme) (Carranza et al., 2004).

Expansion of Simultaneous Equations

Scanning of Azadirachtin and Serratiopeptidase UV-Spectra

A stock solution was prepared by dissolving 10 mg of azadirachtin in phosphate buffer (pH 7.6) in 100 ml volumetric flask to simulate the gingival crevicular fluid. From this stock solution, 2 ml was pipette out and volume made up to 10 ml with buffer to make the concentration of 20 μ g/ml. This sample was scanned in the UV range of 200-400 nm and λ_{\max} was noted. Similarly, the procedure was repeated separately for serratiopeptidase and λ_{\max} was recorded (Needleman et al., 1995).

Serratiopeptidase was dissolved in distilled water to make a concentration of 0.1mg/mL. 0.5mL of enzyme solution was taken into a test tube and the volume was made up to 1.0mL with Tris-HCl buffer. To this 5mL of substrate solution was added and then incubated for 25min at 25°C. The enzyme reaction was terminated by adding 1mL of 30% acetic acid. Using the spectrophotometer, the absorbance of p-nitroaniline (that was released into the solution by enzymatic activity) at 410nm was measured against a control solution (without the enzyme) (Nguyen et al., 2015).

Preparation of Calibration Curve

A stock solution was prepared by dissolving 10 mg of azadirachtin in phosphate buffer (pH 7.6) in 100 ml volumetric flask to simulate the gingival crevicular fluid. From this stock solution, one ml was pipette out and volume made up to 10 ml with buffer so to make the different concentrations of 5, 10, 15, 20, 25 μ g/ml of azadirachtin and 10, 20, 30, 40, 50 μ g/ml of serratiopeptidase. Absorbance was recorded for azadirachtin at 221nm and for serratiopeptidase at 205nm by UV spectrophotometer wavelength (Tariq et al., 2012).

Statistical Validation

The described calibration methods had validated for both the drugs using USP parameters and ICH, Q2A guidelines.

Preparation Method of Thermosensitive Dental Sol

Thermosensitive dental sols were prepared using the cold method as per the weighed amount described in the formulation Table No 1. Pluronic F127 was slowly added into 10ml of cold water between 4 - 5°C with a constant stirring. Such prepared dispersion was chilled below 5°C until a clear solution was obtained for 4 to 5 hours. With a constant stirring AZ, SP and Carbopol 934P were added into the dispersed solution and lastly stored in refrigerator at 5 - 10°C in a closed container (Nguyen et al., 2015; Tariq et al., 2012; Jones et al., 1997).

Table No. 1: Thermosensitive dental sol-gel formulations (3)2 factorial design of azadirachtin (AZ) and Serratiopeptidase (SP).

Formulation code	AZ (mg)	SP (mg)	Pluronic (mg)	Carbopol (mg)
F1	40	5	800	20
F2	40	5	800	40
F3	40	5	800	60
F4	40	5	900	20
F5	40	5	900	40
F6	40	5	900	60
F7	40	5	1000	20
F8	40	5	1000	40
F9	40	5	1000	60

Evaluation of Thermosensitive Dental Sol

Drug Content

100 mg from each formulation was located in 10ml volumetric flask and using phosphate buffer pH 7.6 volume of flask was made up to the mark. This was shaken well for one minute using orbital shaker. The solution was filtered out of flask and was properly diluted with phosphate buffer to determine the concentration of AZ and SP with the help of derived equations (Maragathavalli et al., 2012).

PH Determination

The pH of thermosensitive dental sols was determined using digital pH meter. One gram of sol gel was liquified in the 100 ml of distilled water and then stored at 4°C for 2 hours. The pH measurement of each formulation was done (Sabry et al., 2018).

Viscosity Analysis

Viscosity of thermosensitive dental sol was determined using Brookfield viscometer that was attached with T-bar spindle (S-94). 5 gm of thermosensitive dental sol was placed in a 10 ml beaker and the spindle was rotated at 100 rpm of speed that generated torque greater than of 50%. After 60 sec, readings were recorded in centipoises (Rawat et al., 2010).

Spread Ability Test

Spread ability of thermosensitive dental sol was determined by glass fabricated apparatus that had 2 glass slides comprising of lower slide that fixed to the wooden plate and the upper slide bind to a weight 'w' by a hook (Saraf et al., 2006). The spread ability was intended by means of formula,

$$S = w \times l/t \text{ (g cm/sec)} \quad \text{Eq. 2.4}$$

S is spread ability, w is the upper slide weight, l is glass slide length and t is time taken.

Syringe Ability of Formulation

Syringe ability was conducted by using 1mL plastic syringe of 22 gauge. The formulations that were stored at 4°C filled into the syringe. Easily pressing the injector of syringe without force, so that gelling solution can easily come out from it (Scherlund et al., 2000).

Temperature for Sol to Gel Transition

Transition temperature was determined by 'test tube inverting method' where 5mL of solution was transferred to test tube. Test tube sealed with aluminum foil was immersed in water bath that was maintained at 4°C. The temperature of water was augmented in increments of 0.5°C and port to equilibrate for one minute. The solution was then examined for up move upon tilting the tube at 90° angle. The time at which up move was stopped was the gelling time and the temperature was recorded (Maheswari et al., 2006).

Ex-Vivo Testing of Mucoadhesion

A glass fabricated assembly was used for significant testing the mucoadhesive strength. Fresh cut mucosal dentine of goat was purchased from slaughtering and was used by time of 2 hour. The assembly was arranged as per depicted in the figure 6.2 to conduct the experiment. Mucoadhesive sol-gel was kept in contact position with dental mucosa for 2 min of time. The water from 50mL glass burette was gradually dropped into the right hand of the pan at the rate of 100 drops/minute until the buccal mucosa got detached from the surface of gel (Gowrishankar et al., 1985). The force of detachment was used to determine bio-adhesive strength by the following equation.

$$\text{Force of adhesion (N)} = \text{Bio-adhesive strength (g)} \times 9.81/1000 \quad \text{Eq. 2.5}$$

In-Vitro Drug Release of AZ & SP

In-vitro drug release of the developed thermosensitive dental sol was achieved using dialysis bag technique. In archetypal manner, 1000mg of thermosensitive dental sol was placed in dialysis bag membrane of grade MWCO-12000. The membrane bag was then positioned in a container holding 100ml of phosphate buffer pH 7.6 and maintaining the temperature at 37°C with the 100rpm as depicted in figure 6.3. Sample from the container were collected at fixed time intervals and replaced with fresh buffer solution. Using simultaneous equation, concentrations of AZ and SP were calculated spectrophotometrically (Buckley et al., 1984).

In-Vitro Analysis of Antibacterial Activity

For conducting antibacterial activity, nutrient agar medium was organized and it was sterilized using autoclave and their plates were prepared maintaining aseptic condition. After solidification, plates were seeded by anaerobic bacteria *Streptococcus mutans* which is a periodontitis causing bacterium using well diffusion method. Agar plates were placed in vacuum desiccator with anaerobic conditions. A sterile cavity was prepared by cork borer at the center of the plate. Small quantity of selected formulation was filled in the cavity. Gel without drug was used as negative control and 100µg/ml solution of AZ was used as positive control. For bacterial growth anaerobic environment was maintained by moist calcium chloride that maintained anaerobic situation by CO₂ released by it, where the plates were incubated at 37° C for 12 hours. After incubation of 12 hours the plates were detected for zone of inhibition around the cavity by microbial zone reader and equated against the negative / positive controls. The interpretations were taken in fixed different three directions (Buckley et al., 1984).

Stability Analysis

The stability study at 25°C with 60% RH and at 40°C with 75% RH was performed for optimized formulation as per ICH guidelines. At the interval of 0, 30, 60 and 90 days, samples were taken and analyzed for content uniformity of drug, odor and color. According to Food Chemical Codex 2003, the sample was also imperiled to enzymatic content of SP in formulation.

RESULTS

Drug Related Studies

Melting Point

Melting point analysis of AZ was found to be in the range of 156.9 °C that was fully obeyed with the literature value of 154 to 158 °C that established the identity of drug sample.

UV Spectrophotometric Analysis

AZ and enzyme SP were scanned in the UV range of 200nm to 400nm in the phosphate buffer pH 7.6 where, the λ_{max} of AZ was analyzed to be 221 nm obeyed with the literature values (Indian Herbal Pharmacopoeia, 2002) and that of SP was analyzed to be 205 nm that was in good correlation with reported values (Table No. 2).

Table No. 2: Compiled Drug related studies for AZ and SP

S. No.	Parameters	Observed value	Literature value
1	Melting point of AZ	156.9 °C	154 to 158 °C
2	UV absorption maxima of AZ (Phosphate buffer pH 7.6)	221 nm	220 nm
3	UV absorption maxima of SP (Phosphate buffer pH 7.6)	205 nm	203 nm

Infrared Spectrophotometry

Probable functional groups of AZ were found in the IR spectral analysis that was in the close established to the literature values (Silverstein et al.2003). Chemical purity of drug was further confirmed by it (Table No.3).

Table No. 3: FTIR Interpretation of drug AZ

S. No.	Interpretation of bond vibrations	IR absorption bands (cm-1)	
		Observed peak	Literature value
1	Aliphatic C-H bend	1233	1080-1250
2	Aliphatic C-H stretch	2912	2850-3000
3	Methoxy -OCH ₃	2856	2800-2860
4	Cyclic ring C-C strong	1320	1250-1550
5	Cyclic ring C-H strong	1205	1020-1250
6	Carbonyl C=O strong	1712	1680-1740
7	Ether -O- strong	1120	1085-1150
8	2 ^o O-H strong	1102	1087-1124
9	3 ^o O-H strong	1187	1124-1205
10	H-Bonding strong & broad	3473	3200-3550

Proteolytic Activity of Serratiopeptidase

In this test, BAPNA was an artificial substrate which was hydrolyzed by serratiopeptidase enzyme and p-nitroaniline was released during this reaction. Which was measured at 410nm. With the help of molar extinction coefficient of p-nitroaniline, the enzyme activity was calculated. Alternatively, the color intensity of the released p-nitroaniline in the sample may be compared with the standard p-nitroaniline (Table No. 4).

As calculated in the table, the enzymatic activity of serratiopeptidase was found to be active for protein hydrolysis and released 3.25µg of p-nitroaniline per minute at 25°C.

Table No. 4: Calculation of p-nitroaniline amount that was hydrolyzed by serratiopeptidase

S. No.	Absorbance	Amount of p-nitroaniline released per minute (µg)	Mean amount (µg)
1	1.510	3.26	3.25
2	1.480	3.20	
3	1.530	3.30	

Progress of Simultaneous Equation of AZ and SP

After UV scanning of drug AZ & SP, their absorption maxima were obtained as 221nm and 205nm respectively, in the previous section of study. Thereafter, molar absorptivity of drug AZ was analyzed at both these absorption maxima under UV spectrometer and similarly that was done for SP enzyme. Then, these values were used for developing simultaneous equations (Table No. 5).

Table No. 5: Molar absorptivity of drug AZ and enzyme SP

Parameter	Azadirachtin		Serratiopeptidase	
	At 221 nm	At 205 nm	At 221 nm	At 205 nm
Molar Absorptivity (L/mol cm)	158.7	18.12	10025.45	4124.5

Established Simultaneous Equations

$$C_{SP} = A_{221} 4124.5 - A_{205} 18.12 / 96.93 \quad \text{Eq. 3.1}$$

$$C_{AZ} = A_{205} 10025.45 - A_{221} 158.7 / 96.93 \quad \text{Eq. 3.2}$$

Establishment of AZ & SP Calibration Curves

Calibration curves of AZ & SP were established in phosphate buffer pH 7.6 at wavelengths of 221 nm and 205 nm as depicted in figures 7.4 and 7.5. Whereas, statistical data were generated in the form of tables 7.4 and 7.5 (Table No.6).

Table No. 6: Statistics of AZ calibration curve

S. No.	Concentration (µg/ml)	Absorbance	
		At 205 nm	At 221 nm
1	5	0.175 ± 0.012	0.315 ± 0.012
2	10	0.246 ± 0.014	0.620 ± 0.013
3	15	0.382 ± 0.014	0.913 ± 0.012
4	20	0.478 ± 0.015	1.209 ± 0.011
5	25	0.556 ± 0.013	1.512 ± 0.014

Statistical Validation

The described calibration methods had validated for both the drugs using USP parameters and ICH, Q2A guidelines (United State Pharmacopoeia, 2004). Statistical validation data of linearity, range, LOD and LOQ for calibration curve of AZ & SP that was prepared in phosphate buffer pH 7.6 is illustrated in the Table No.7 below.

Table No. 7: Statistics of SP calibration curve

S. No.	Concentration (µg/ml)	Absorbance	
		At 205 nm	At 221 nm
1	10	0.209 ± 0.012	0.123 ± 0.011
2	20	0.413 ± 0.012	0.324 ± 0.011
3	30	0.621 ± 0.013	0.521 ± 0.013
4	40	0.811 ± 0.014	0.732 ± 0.014
5	50	1.012 ± 0.014	0.925 ± 0.011

Evaluation of Thermosensitive Dental Sol

Thermosensitive dental sols were successfully prepared using the cold method as per the 3² factorial blends that were described in the formulation table 2.3 in previous sections. All the nine established formulations (F1 to F2) were found clear and transparent.

Drug Content

Drug content of AZ and SP in all the thermosensitive dental sol formulations was exhibited to be uniform. From F1 to F9, the drug content was analyzed in the range of 93.1 ± 0.7 to 99.1 ± 0.6 for AZ and 92.1 ± 1.1 to 98.0 ± 0.4 for SP as depicted in Table No.8 which was satisfactory result.

PH Determination

The pH of thermosensitive injectable dental sol was stretched over precise range of 6.2 ± 0.5 to 7.2 ± 0.3, that was required as pH of periodontal cavity during inflammation is reported in a range of 6.8 to 8.2 that indicated irritation less administration of dental sol into the cavity or pocket is possible without any potential problems.

Viscosity Analysis

Viscosity analyzed is an important parameter for thermosensitive dental sol as it affects the syringe pouring ability and also influence its spreading ability. Viscosity of all nine formulations (F1 - F9) was established from 14.4 ± 0.3 x 10³ cps to 19.2 ± 0.3 x 10³ cps elaborated in table 7.7. From analyzing results in the table, viscosity was predominantly depending on the concentration of Pluronic and Carbopol polymers. Formulations comprising of higher Pluronic amounts (F7, F8 and F9) were more viscous than others. And within these three (F7, F8 and F9), F9 unveiled the highest viscosity of 19.2 ± 0.3 x 10³ cps as because of the highest Carbopol amount among these three formulations. Vice versa for the F1 displayed least viscosity of 14.4 ± 0.3 x 10³ cps. This was because of the lowest concentration of both the polymers Pluronic and Carbopol.

Table No. 8: Statistical validation data for calibration curve of AZ & SP

S, No.	Parameter	AZ		SP	
		205 nm	221 nm	205 nm	221 nm
1	r ²	0.9992	0.9996	0.9991	0.9993
2	Range	5-25	5-25	10-50	10-50
3	LOD(µg/ml)	0.556	0.348	1.52	0.35
4	LOQ(µg/ml)	1.625	1.360	3.45	0.65

Spread Ability Test

Spread ability signifies the squeezability of formulation that influence the amputation of the product from the container and its administration into the periodontal cavity. Spread ability of the formulations reached from 30.3 ± 0.9 g.cm./sec to 35.3 ± 0.3 g.cm./sec as described in table 7.7 was showing decrease in spread ability with increased in the concentration of Pluronic F127 and Carbopol. These results showed that formulation F1 to F9 was in range of acceptable spread ability that is suitable for PD treatment and similar understanding was attained by (Pandey et al. 2011).

Syringe Ability of Formulation

Syringe ability was conducted by using one ml plastic syringe of 22 gauge. After pressing the injector of syringe without force, the gelling solution was easily coming out from it. All the nine formulations were passed the test of syringe ability.

Temperature for Sol to Gel Transition

Establishment of sol to gel transition temperature and its time by test tube inversion technique which exhibited that changeover temperature ranged amid $27.1 \pm 2.7^\circ\text{C}$ to $33.1 \pm 1.8^\circ\text{C}$ and sol to gel conversion time was analyzed to differ from 28.1 ± 0.3 to 34.2 ± 0.8 sec as illustrated in table 7.7. Therefore, formulation comprising of highest concentration of polymers (F9) unveiled lowest sol to gel transition temperature with least time when compared to rest of formulations (Table No. 9).

Table No. 9: Summarized evaluation parameter data of thermosensitive dental sol

Code	AZ drug content (%)	SP drug content (%)	pH	Viscosity (10^3 cps)	Spread ability (g.cm/sec)	Transition temperature ($^\circ\text{C}$)	Gelling time (Sec)	Mucoadhesive strength (N)
F1	94.2 \pm 0.5	96.2 \pm 1.4	6.2 \pm 0.5	14.4 \pm 0.3	35.3 \pm 0.3	33.1 \pm 1.8	34.2 \pm 0.8	19.1 \pm 0.5
F2	99.1 \pm 0.6	95.7 \pm 0.3	6.3 \pm 0.3	14.1 \pm 0.5	33.6 \pm 0.5	32.6 \pm 0.5	31.4 \pm 0.6	21.8 \pm 0.4
F3	94.2 \pm 1.1	97.8 \pm 0.9	6.5 \pm 0.5	14.8 \pm 0.3	32.2 \pm 0.6	31.2 \pm 0.7	29.8 \pm 1.0	23.6 \pm 0.7
F4	97.8 \pm 0.2	93.2 \pm 0.5	7.1 \pm 0.2	15.2 \pm 0.9	32.1 \pm 0.7	32.1 \pm 0.7	31.8 \pm 0.2	20.9 \pm 0.3
F5	96.2 \pm 0.5	97.1 \pm 0.2	6.4 \pm 0.4	15.6 \pm 1.2	31.8 \pm 0.5	31.8 \pm 0.5	28.9 \pm 0.2	22.3 \pm 0.3
F6	93.1 \pm 0.7	92.1 \pm 1.1	6.1 \pm 1.2	16.7 \pm 0.8	31.2 \pm 0.9	30.2 \pm 0.9	27.0 \pm 0.5	24.1 \pm 0.2
F7	96.1 \pm 0.6	95.1 \pm 1.4	7.2 \pm 0.3	17.4 \pm 0.9	30.5 \pm 0.3	29.5 \pm 0.3	30.2 \pm 0.5	22.8 \pm 0.4
F8	95.8 \pm 0.9	98.0 \pm 0.4	6.9 \pm 0.4	18.2 \pm 0.4	30.3 \pm 0.5	28.1 \pm 0.4	29.2 \pm 0.6	23.1 \pm 0.2
F9	98.7 \pm 1.2	96.1 \pm 0.3	6.9 \pm 0.2	19.2 \pm 0.3	30.3 \pm 0.9	27.1 \pm 2.7	28.1 \pm 0.3	26.3 \pm 0.6

Ex-Vivo Testing of Mucoadhesive Strength

A glass fabricated assembly was used for significant testing the mucoadhesive strength of formulations. The force of detachment was used to determine bio-adhesive strength of dental sol which was assessed for mucoadhesive strength presented that the adhesive possessions was amplified with increasing concentrations of Carbopol polymer as in table 7.7 and the mucoadhesive strength of nine formulations fluctuated from $19.1 \pm 0.5\text{N}$ to $26.3 \pm 0.6\text{N}$. Subsequently, F3, F6 and F9 with higher amount of Carbopol 934P revealed higher mucoadhesive strength when equated to F1, F2, F4, F5, F7 and F8 consuming low levels of polymer. Out of these three F3, F6 and F9, the formulation F9 was having also the highest amount of Pluronic polymer that justified its uppermost mucoadhesive strength.

These results were in harmony with the discovery of Jones et al. (1997) and ascribed to superior concentration of polymer. Consequences of ex-vivo muco-adhesive strength in terms of impartiality stress recommended that the formulations with higher Carbopol concentrations would be appropriate for PD treatment. Ease of administration and residence time is important for deciding the efficacy of periodontal sol in treatment of periodontitis. Henceforth according to these findings, F9 was seems to be hopeful.

In-Vitro Drug Release

In-vitro drug release study was achieved in phosphate buffer pH 7.6 using dialysis bag technique up to 12 hours due to its unpretentious experimental process, reproducibility and robustness. The relative in-vitro drug release statistical data of AZ and SP of formulations F1 to F9 was organized in table 7.9 and 7.10 correspondingly. The comparative invitro drug release profiles are depicted in figure 7.5 and 7.6 respectively. The percent cumulative drug release (% CDR) of AZ was reached from $93.2 \pm 0.5\%$ to $99.96 \pm 0.7\%$ at the end of 12th hour and that of SP was fluctuated from $94.3 \pm 0.8\%$ to $98.5 \pm 0.5\%$ at the end of 12th hour. It can be detected from the investigational design that formulations that were comprising of high level of Pluronic F127 (F7, F8 & F9) showed slighter percent cumulative drug release of both AZ and SP than those formulations that was containing low and middle level of Pluronic 127F (as in F1 to F6). Formulations from F1 to F3 were covering low levels of Pluronic 127F displayed highest of all % CDR of $99.96 \pm 0.7\%$ at the end of 12th hour for AZ and $98.5 \pm 0.5\%$ at the end of 12th hour for SP even before the completion of 12 hours that showed these formulations released the drug and enzyme too early into the medium which was not desired. Additionally, Carbopol 934P also had parallel effect on % CDR as that was revealed by Pluronic F127. Formulations F1, F4 and F7 with their low levels of Carbopol 934P displayed higher drug released as equated to that of F2, F4 and F6 those were with intermediate levels of Carbopol 934P among their corresponding groups. Carbopol 934P complemented hydrogen bonding, which improved the desiccation of the PPO blocks of the micelles and their entanglement. As a result of these entanglements, micellar bodies could not discrete easily from each other, which accounts for the firmness and slow suspension of these sol-gels (Maheshwari et al. 2006) (Table No10, 11)

Table No. 10: Data statistics of in-vitro drug AZ released in phosphate buffer pH 7.6 in terms of % CDR.

Time (hrs)	F1 (%)	F2 (%)	F3 (%)	F4 (%)	F5 (%)	F6 (%)	F7 (%)	F8 (%)	F9 (%)
0	0	0	0	0	0	0	0	0	0
1	25.8±0.5	24.2±0.4	23.4±0.8	24.5±1.0	23.8±1.1	22.7±0.6	21.4±0.5	20.3±1.2	20.1±0.8
2	39.4±0.2	39.9±0.8	38.8±0.7	37.6±0.3	36.7±0.8	35.6±0.5	34.4±0.3	33.7±0.8	31.4±0.7
4	58.5±1.1	57.3±0.5	57.2±1.1	56.7±0.4	55.3±0.6	54.5±0.2	51.4±1.1	50.5±0.7	48.9±1.0
6	78.8±0.3	76.5±0.2	75.9±0.7	74.3±0.2	72.2±0.3	70.5±0.9	68.2±0.6	64.1±0.3	61.8±0.2
8	86.9±0.6	85.4±1.0	84.7±1.3	82.5±0.9	80.3±0.7	76.8±0.5	78.9±0.7	75.5±1.0	72.9±1.1
10	94.5±0.6	93.4±0.7	92.3±0.3	91.4±0.2	90.5±0.7	89.8±0.4	88.4±0.6	86.7±0.2	84.5±0.6
12	99.6±0.7	98.4±0.4	97.6±0.3	96.9±0.4	95.8±0.8	95.4±0.4	93.2±0.5	94.4±0.2	93.6±0.7

Table No. 11: Data statistics of in-vitro drug SP released in phosphate buffer pH 7.6 in terms of % CDR.

Time (hrs)	F1 (%)	F2 (%)	F3 (%)	F4 (%)	F5 (%)	F6 (%)	F7 (%)	F8 (%)	F9 (%)
0	0	0	0	0	0	0	0	0	0
1	20.1±1.1	19.4±0.5	17.2±1.1	16.6±0.4	17.3±0.6	16.7±0.2	16.8±1.1	16.4±0.7	17.2±1.0
2	35.6±0.7	34.2±0.4	34.7±0.3	33.6±0.4	32.7±0.8	31.8±0.4	30.5±0.5	28.4±0.2	29.0±0.7
4	55.3±0.6	52.6±1.0	51.8±1.3	48.3±0.9	50.2±0.7	49.9±0.5	47.8±0.7	48.1±1.0	47.5±1.1
6	75.3±0.3	73.6±0.2	71.8±0.7	72.6±0.2	71.9±0.3	70.5±0.9	69.3±0.6	68.2±0.3	68.9±0.2
8	87.4±0.2	86.2±0.8	85.5±0.7	83.5±0.3	84.8±0.8	84.1±0.5	83.8±0.3	80.2±0.8	79.1±0.7
10	95.8±0.6	94.7±0.7	93.5±0.3	92.6±0.2	93.5±0.7	92.9±0.4	91.4±0.6	90.6±0.2	88.7±0.6
12	98.5±0.5	98.0±0.4	97.4±0.8	96.7±1.0	96.2±1.1	95.9±0.6	95.3±0.5	94.7±1.2	94.3±0.8

The after, to examine the drug release kinetics of AZ and SP from thermosensitive dental sols-gel, the drug release statistical data was imperiled to fit well known kinetics models such as zero order, first order, Higuchi, and Peppas. After the deep statistical interpretation of data, the best fit model was established to be zero order that containing correlation coefficient, r^2 of more than 0.999 value with a consistency. The release performance designated to the release of drug was well controlled and also drug released from the thermosensitive dental sols-gel system up to desired time that was till the 12th hour and specified the effectiveness of the system for periodontal disease infections as depicted in Table No. 12.

Table No.12: Data statistics model fitting of % drug released of AZ and SP

Code	Zero order		First order		Higuchi		Peppas	
	AZ	SP	AZ	SP	AZ	SP	AZ	SP
F1	0.9995	0.9990	0.8734	0.8876	0.9726	0.9815	0.9715	0.9834
F2	0.9800	0.9997	0.8802	0.9652	0.9238	0.9996	0.9166	0.9982
F3	0.9839	0.9802	0.9829	0.9786	0.9115	0.9989	0.8899	0.9992
F4	0.9978	0.9989	0.8791	0.8162	0.9123	0.9998	0.9870	0.9991
F5	0.9997	0.9998	0.9795	0.9871	0.8997	0.9860	0.8880	0.9795
F6	0.9998	0.9902	0.8980	0.8898	0.8987	0.9871	0.8971	0.9680
F7	0.9996	0.9991	0.8872	0.9942	0.9665	0.9865	0.8865	0.9872
F8	0.9855	0.9982	0.9822	0.8763	0.8833	0.9705	0.9605	0.9822
F9	0.9998	0.9992	0.9850	0.9875	0.9765	0.9930	0.9830	0.9850

Statistical Analysis of Responses by Design Expert 8.0.7

Statistical investigation of the experimental design was done by Design Expert software that of version 8.0.7 that was from Stat-Ease, Inc., Minneapolis, USA and the second order polynomial equations were established. The transformed equations attained after elimination of non-significant coefficients were designed as;

A) Sol-Gel Transition Temperature (Y1)

$$Y1 = 27.19 + 1.78 X1 - 0.089 X12 + 1.52 X1X2 - 0.81 X12X2 - 1.95X1X22 + 0.87 X12X22 \quad \text{Eq. 3.4}$$

B) Mucoadhesive Strength (Y2)

$$Y2 = 26.02 + 4.10 X2 - 4.19 X12 - 1.37X1X2 - 3.32X12X2 + 2.08 X1X22 - 1.98X12X22 \quad \text{Eq.3.5}$$

C) % CDR at 12th hr (Y3)

$Y_3 = 77.11 + 6.11 X_1 + 0.21 X_{12} + 0.041 X_2 + 0.39 X_1 X_2 - 0.14 X_2 X_1 - 0.028 X_1 X_2 X_2 - 1.16 X_{12} X_2 X_2$
Eq. 3.6

Where X_1 = Concentration of pluronic F127

X_2 = Concentration of Carbopol 934 P

Using the overhead polynomial equations 3D response surface were plotted and graphs were generated which were used to envisage the consequence of independent variables on response variables. Here, plots of response surface had explained that three aspects, sol-gel transition temperature, mucoadhesive strength and % CDR at 12th hour were had important effect on dependent variables.

In-Vitro Antibacterial Activity

After drug release study, in-vitro antibacterial activity was conducted out using periodontitis producing facultative anaerobic bacterium *S. mutans*. Among all, optimized formulation F9, solution of pure AZ that set as positive control and formulation F9 without AZ and SP set as negative control. The zone of inhibition of drug loaded optimized formulation F9 was found to be 26 ± 0.86 mm. That for positive control was found to be 16.12 ± 0.43 mm, nevertheless no zone of inhibition was observed for negative control. The in-vitro antibacterial activity exposed that the gel was able to hinder the growth of microbes more efficiently rather than pure drug solution.

Assimilation of AZ in the polymer matrix providing a system that confirmed continuous and slow delivery of drug from the matrix to exercise the antibacterial effect that was not possible for pure solution of the drug AZ. No zone of inhibition was found in the negative control indicated that Carbopol 934P and Pluronic F127 possess no antibacterial activity, they were inert.

Stability Studies

Stability study results exposed that improved formulation F9 was stable when stored at 25°C with 60% RH and at 40°C with 75% RH for period of 90 days. The drug content was analyzed to be greater than 95% till the end of 90 days specified the stability of developed system. Similarly, drug content of STP was also analyzed for 90 days. It was found that drug content of STP was not decreased significantly during the 90 days period and was remained in the acceptable range as per Food chemical codex 2003. The study indicated that periodontal sol may remain stable in long terms of storage. The organoleptic traits of the gel remained unchanged. Therefore, this formulation was stable at diverse conditions of temperature and humidity as depicted in Table No. 13.

Table No. 13: Data statistics of stability study for optimized formulation F9

Time (Days)	Colour change	Odour change	At 25° ± 2°C & 60% RH (% Drug content)		At 40° ± 2°C & 75% RH (% Drug content)	
			ZA	SP	AZ	SP
0	-	-	98.33±1.1	98.52±1.6	98.50±1.5	98.82±1.06
30	-	-	97.68±1.8	98.78±1.9	97.10±1.2	97.42±1.43
60	-	-	97.80±1.4	97.81±1.5	96.78±1.6	96.40±1.06
90	-	-	96.13±2.1	96.12±2.6	95.61±1.7	95.19±1.66

DISCUSSION

The total of nine formulations (F1-F9) were prepared in this research project by Pluronic 127F and Carbopol 934P polymers combination, here, the Pluronic was used to provide gelling like properties and thermal sensitive transition of dental solution into a gel on the applying it on patient's dentine and periodontal cavity. Whereas, Carbopol was used to contribute its mucoadhesive property, so that gel can adhere to the gum-dental mucosa effectively after application.

The prepared formulations were also evaluated for their various physicochemical parameters in which solution to gel transition temperature, pH of solution, syringe-ability and mucoadhesive strength of transit gel were the most significant parameters for formulation administration. All nine dental sol formulations were analyzed for the percent drug release (%CDR) of azadirachtin and serratiopeptidase in 12 hours of duration. After statistical interpretation of data, it was established that, sol-gel system provided zero order-controlled release of drugs in 12 hours.

After analyzing all the above parameters with Design Expert 8.0.7, formulation with code F9 was selected as optimized one and subjected for the accelerated stability studies where it was found satisfactory on all results. Developed and optimized formulation F9 has a future potential of therapeutically effective system of dental sol-gel to treat periodontal inflammatory anaerobic infections.

CONCLUSION

The effect of thermosensitive dental sol-gel of azadirachtin and serratiopeptidase was evaluated for the antibacterial activity for dental restoration and periodontal regeneration. The formulations were evaluated for the physicochemical parameters, mucoadhesive strength and %CDR for 12 hours duration. From the result it can be concluded that formulation (F9) has a potential to become an effective candidate for the treatment of periodontal inflammatory condition caused by anaerobic infections.

REFERENCES

1. Becker W, Berg L and Becker BE. (1979) Untreated PD: A longitudinal study. *J Periodontol.* **50**:234-244.
2. Bickel M, Munoz JL and Giovannini P (1985). Acid base properties of human gingival crevicular fluid. *J dental Res.* **64**: 218-1220.
3. Bogren A, Teles RP, Torresyap G, Haffajee AD, Socransky SS and Wennstrom JL (2008). Locally delivered Doxycycline has no long term benefits for periodontal health. *J Periodontol.* **79**: 827-835.
4. Buckley LA and Crowley MJ (1984). A longitudinal study of untreated PD. *J Clin Periodontol.* **11**:523-530.
5. Carranza L, Newman GM and Fermen AC. (2004). *Clin periodontol.* Saunders pub.
6. Gowrishankar R, Phadke RP, Oza SD and Tulwalker S (1985). Satranidazole: experimental evaluation of activity against anaerobic bacteria in vitro and in animal models of anaerobic infection. *J Antimicrob Chemother.* **4**:463- 470.
7. Jain N, Jain GK, Javed S, Iqbal Z, Talegaonkar S, Ahmad FJ, et al (2008). Recent approaches for the treatment of periodontitis. *Drug Discov Today* **13**:932-43.
8. Jones SD, Woolfson, AD and Brown AF (1997). Texture, Viscoelastic and mucoadhesive properties of pharmaceutical gels composed of cellulose polymers. *J Controlled Release.* **151**:223-233.
9. Lakshmi T, Krishnan V, Rajendran R, Madhusudhanan N. Azadirachta indica: a herbal panacea in dentistry-an update. (2015). *Pharmacogn Rev.* **9**:41-4.
10. Mathew AK. (2015). Oral local drug delivery: an overview. *Pharm Pharmacol Res.* **3**:1-6.
11. Maragathavalli S, Brindha S, Kaviyarasi NS, Annadurai B, Gangwar SK. (2012) Antimicrobial activity in leaf extract of neem (*Azadirachta indica* Linn.). *Int J Sci Nat* **3**:110-3.
12. Maheswari M, Kadam S, Miglani G, Mali A, Pradhakar P and Yamamura S (2006). Development of tetracycline-serratiopeptidase containing periodontal gel: formulation and preliminary clinical study. *AAPS Pharma Sci Technol.* **7**:1- 10.
13. Needleman IG and Smales FC (1995). In-vitro assessment of bioadhesion for periodontal and buccal drug delivery. *Biomaterials.* **16**:617-624.
14. Nguyen S, Hiorth M. (2015) Advanced drug delivery systems for local treatment of the oral cavity. *Ther Delivery* **6**:595-608
15. Pavia DL, Lampman GM and Kriz GS (2008). *Introduction to spectroscopy.* Australia, Thompson learning.
16. Rawat S, Warade S and Lahoti S (2010). In -situ gel formulation of ornidazole for the treatment of PD. *Curr Pharma Res.* **1**:60-69.
17. Sabry SA. (2018) Sodium cromoglycate mucoadhesive buccal patches: Design, fabrication, in vitro and in vivo characterization. *Int J Appl Pharm* **10**:76-82
18. Saraf S, Grag G, Dharawal SJ and Saraf S (2006). Various UV spectrometric simultaneous estimation methods. *Pharmainfonet.* **4(2)**:1-34.
19. Scherlund M, Malmsten M, Holmqvist P and Brodin A (2000). Thermosetting microemulsions and mixed micellar solutions as drug delivery systems for periodontal anaesthesia. *Int J Pharma.* **194**:103-109
20. Tariq M, Iqbal Z, Ali J, Baboota S, Talegaonkar S, Ahmad Z, et al. (2012) Treatment modalities and evaluation models for periodontitis. *Int J Pharma Investig* **2**:106-22.

Effect of Partially Purified Phenolic Rich Fractions of *Acacia Nilotica* on Enzymes of *Spodoptera Litura*

Swati Gautam*, Satwinder Kaur Sohal and Samiksha
Guru Nanak Dev University, Amritsar, India- 143005

ABSTRACT

Phenolics, secondary metabolites, of plant play a major role in the defence mechanism against the diverse variety of pests. These phenolics are mainly found in high concentrations in the bark, roots and leaves of plants. In the present study, two partitioned fractions viz. ethyl acetate and water fraction, of acetone bark extract of *Acacia nilotica* with their respective LC₅₀ concentration were incorporated in the diet of second instar larvae (6 days old) of *Spodoptera litura* to assay the activity of antioxidant and detoxification enzymes. The study revealed that both the fractions significantly altered the activity of antioxidant and detoxification enzymes of *S. litura*.

Keywords: phenolics, secondary metabolites, *Spodoptera litura*, *Acacia nilotica*

INTRODUCTION

The extensive use of synthetic pesticides all over the world to raise the crop productivity for feeding the ever increasing population has led to a huge amount of side effects on the human health. Due to this the focus is on the use of biopesticides, mainly plant secondary metabolites. Secondary metabolites in plants act as antibiosis agents against insects (Panda and Khush, 1995). Among the plant secondary metabolites, phenolics are the largest class which have a variety of functions in plants along with their interaction with other organisms and environmental factors (Elliger et al., 1980). Phenolics play an important role in the plant's defense mechanism as they repel or kill microorganisms and resist herbivory (Dreyer et al., 1981; Ikonen et al., 2001; Upasani et al., 2003; Lattanzio et al., 2006). *Acacia nilotica* is a medicinal plant whose bark is a rich source of phenolic compounds with insecticidal activity against *S. litura* (Gautam et al., 2018; 2021). The antioxidant and detoxification enzymes in insects serve as a powerful assemblage which detoxify these defense chemicals by oxidation, reduction, hydrolysis or conjugation of molecules (Scott and Wen, 2001). The present study is an attempt to further explore the effect of two partitioned fractions (ethyl acetate and water fraction) from acetone bark extract of *Acacia nilotica* on various antioxidant and detoxification enzymes of *Spodoptera litura*. *Spodoptera litura* is a polyphagous pest and it has been reported to attack 112 cultivated plant species and about 60 Indian species (Garad et al., 1984).

MATERIALS AND METHODS

Partitioned Fractions of Acetone Extract of *A. nilotica*

In a previous study, we reported the toxicity of six crude extracts viz. hexane extract, chloroform extract, ethyl acetate extract, acetone extract, methanol extract and distilled water extract from the bark of *A. nilotica* against *S. litura* larvae (Gautam et al., 2018). Maximum adversity was observed with acetone crude extract which was further partially purified into two fractions viz. ethyl acetate and water fraction (Gautam and Sohal, 2015) (Flow Chart 1).

INSECT ASSAYS

Rearing of *Spodoptera litura*

The culture of *S. litura* was reared and maintained on castor leaves (*Ricinus communis* Linn.) in the insect culture laboratory, maintained at 27±2°C, relative humidity 60% and photophase (L16:D8).

Biochemical Assays

The second instar larvae i.e. 6 days old larvae of *S. litura* were used to assay the activity of antioxidant and detoxification enzymes. The larvae were fed on diet incorporated with LC₅₀ concentration (217.115 ppm) of E-AE fraction and LC₅₀ concentration (462.924 ppm) of W-AE fraction along with control. The larvae were then procured and the activity of various enzymes was estimated for three time intervals i.e. 24h, 48h and 72h. Each experiment had six replicates along with control for each time interval and the experiments were repeated twice. In total seven enzymes were studied.

Superoxide Dismutase (SOD)

This enzyme activity was estimated according to the method given by Kono (1978). The homogenized larvae (50mM Sodium carbonate buffer, pH 10.0) were centrifuged at 10,000rpm for 20 mins at 4°C in which the

supernatant was used for the estimation of superoxide dismutase activity. The increase in absorbance was recorded at 540nm at one minute interval for 5 minutes at 25°C.

Catalase (CAT)

The extraction and estimation of enzyme was done by the methodology given by Bergmeyer (1974). The homogenized *S. litura* larvae (0.05M Potassium phosphate buffer, pH 7) were centrifuged at 2,500g for 20mins at 4°. The absorbance was recorded at 240nm at one minute interval for 5 minutes at 25°C room temperature.

Ascorbate Peroxidase (APOX)

The enzymatic activity was estimated using the methodology given by Asada (1984). Centrifugation of the larvae homogenized in 0.05M Potassium phosphate buffer, pH 7.0 at 10,000g for 40mins at 4°C. The decrease in absorbance due to extinction of H₂O₂ was recorded spectrophotometrically at 290nm at an interval of 30 seconds for 5 mins at 25°C.

Glutathione S-transferases (GSTs)

The Chien and Dauterman (1991) methodology was used to estimate the activity of glutathione-S-transferases. The *S. litura* larvae were homogenized in 0.01M Sodium phosphate buffer, pH 7.6 and were centrifuged at 10,000rpm for 30mins at 4°C. The increase in absorbance was recorded spectrophotometrically at 340nm at intervals of one minute for 5 minutes at 25°C.

Esterases

The Katzenellenbogen and Kaftos (1971) methodology was used to extract and estimate esterases. The homogenization of *S. litura* larvae was carried out in 0.01M Sodium phosphate buffer, pH 6.5 for 20mins at 10,000rpm at 4°C. The activity of enzyme was determined by recording the absorbance of end product at 540 nm at room temperature.

Acid Phosphatase (ACP)

The Mac Intyre (1971), methodology was used for determining acid phosphatase activity. The homogenate of *S. litura* larvae was made in 0.05M Acetate buffer, pH 5. The homogenate was centrifuged at 10,000rpm for 20mins at 4°C. The formation of the end product was measured with spectrophotometer at 540nm.

Alkaline Phosphatase (Akp)

The methodology given by Mac Intyre (1971) was used for extraction and estimation of alkaline phosphatase. The *S. litura* larvae homogenized in 0.05M Tris buffer, pH 8.6 were centrifuged at 10,000rpm for 20mins at 4°C. The formation of the end product was measured with spectrophotometer at 540nm.

RESULTS AND DISCUSSIONS

A significant effect of the two partitioned fractions of acetone bark extract of *A. nilotica* was observed on antioxidant and detoxifying enzymes of *S. litura* with a variation in the degree of influence. Initially the superoxide dismutase (SOD) activity was suppressed but a significant increase in enzyme activity was observed at 72hour treatment interval. A similar induction in SOD activity in *S. litura* larvae was also perceived by Usha Rani and Pratyusha (2013) when they were fed on cotton plant having high concentration of phenolic compounds. Ahmad and Pardini (1990) had also reported an increase in SOD activity in the gut of *T. ni*, *S. eridania* and *P. polyxenes* exposed to plant prooxidants, quercetin and xanthotoxin.

Catalase activity was significantly increased in the larvae of *S. litura* treated with the partitioned fractions after 24hour of treatment but later when the treatment was prolonged for another 48hour, the enzyme activity decreased which could be due to the high metabolic cost involved in sustaining higher levels of enzymes. A significant increase in catalase activity in *S. littoralis* had also been observed by Krishnan and Kodrik (2006) after the larvae were fed on leaves of potato, *Solanum tuberosum* L. containing an abundance of polyphenolic compounds. Krishnan et al. (2007) too had reported an increase in catalase activity in colorado beetle, *Leptinotarsa decemlineata* (Say) fed on potato leaves.

The significantly increased levels of ascorbate peroxidase were observed at 24hour treatment interval, but thereafter declined when the treatment was extended for another 48hour. Krishnan and Kodrik (2006) associated increased ascorbate peroxidase activity to a strong oxidative response evoked by feeding *S. littoralis* on diet containing phenolic compounds such as tannic acid. Both the partitioned fractions had induced the activity of GST in the larvae of *S. litura*, however the enzyme induction after 72hour of treatment was higher with E-AE than with W-AE fraction. Usha Rani and Pratyusha (2013) too had observed an induction in the activity of GST in *S. litura* after feeding on leaves treated with phenolic acids such as gallic acid, caffeic acid and catechin. The larvae of *P. g. galucus* fed on tulip tree (*Liriodendron tulipifera* L.) had high GST activity than those fed on brass wood (*Tilia Americana* L.) (Lindroth, 1989) due to higher phenolic concentration in tulip tree.

During the initial treatment of 24 hours the esterases activity was suppressed in the larvae of *S. litura* but later increased significantly on prologation of treatment time to 72hour. A significant induction of esterases due to plant phenolics and other allelochemicals has been earlier reported in *S. litura* (Mukherjee, 2003; Usha Rani and Pratyusha, 2013). Both the partitioned fractions showed an increase in the activity of both the phosphatases enzymes (acid and alkaline) in the larvae of *S. litura* at all treatment intervals but the acid phosphatase activity was more pronounced. In comparison to all the enzymatic activities the E-AE fraction showed more pronounced effect than W-AE fraction which could possibly be due to the high concentration of phenoilcs in it (Gautam and Sohal, 2015).

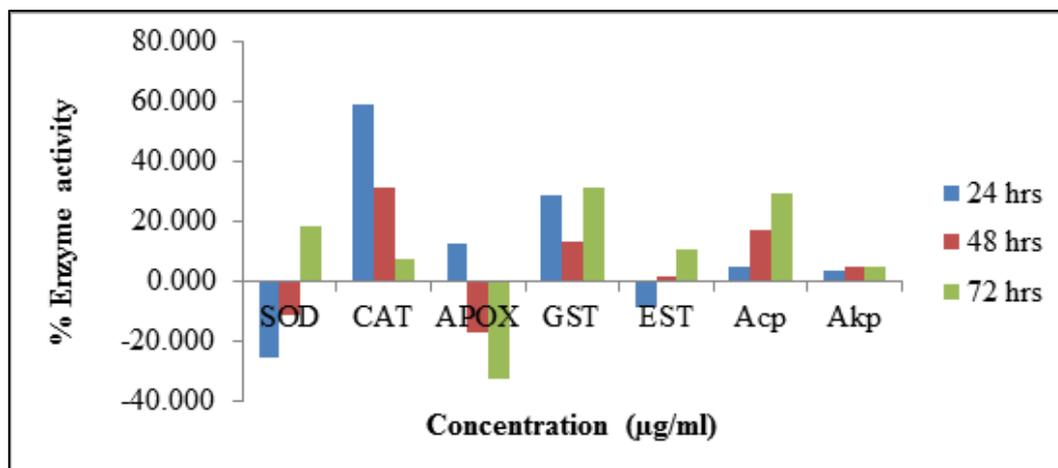


Figure 1: Effect of E-AE partitioned fraction of *A. nilotica* on the activity of antioxidant and detoxification enzymes in the second instar larvae of *S. litura*.

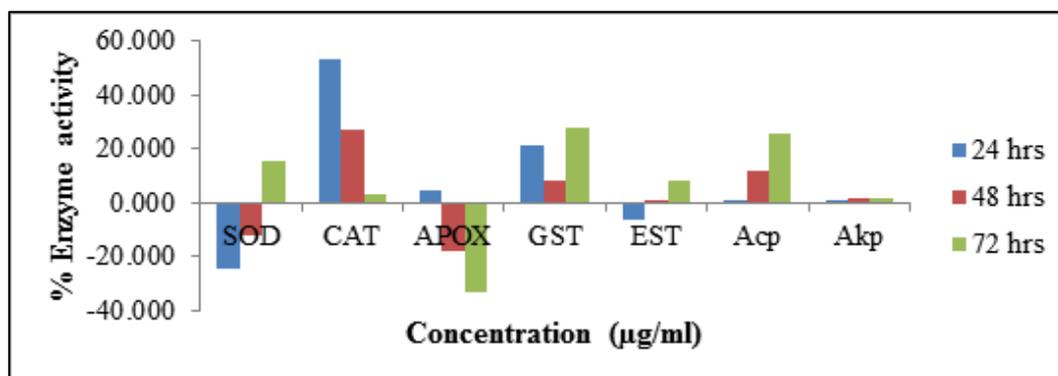


Figure 2: Effect of W-AE partitioned fraction of *A. nilotica* on the activity of antioxidant and detoxification enzymes in the second instar larvae of *S. litura*

REFERENCES

1. Ahmad, S. and Pardini, R.S. (1990). Antioxidant defense of the cabbage looper, *Trichoplusia ni*: Enzymatic responses to the superoxide generating flavonoid, quercetin and photodynamic furanocoumarin, xanthotoxin. *Journal of Photochemistry and Photobiology* 15: 305-311.
2. Asada, K. (1984). Chloroplast: formation of active oxygen and its scavenging. *Methods in Enzymology* 105: 422-429.
3. Bergmeyer, H.U. (1974). *Methods of Enzyme Analysis*. Vol 1, pp 438. Academic press, New York.
4. Chien, C. and Dauterman, W.C. (1991). Studies on Glutathione S-transferases in *Helicoverpa (=Heliothis) zea*. *Insect Biochemistry* 21: 857-864.
5. Dreyer, D.L., Reese, J.C. and Jones, K.C. (1981). Aphid feeding deterrents in sorghum: bioassay, isolation and characterization. *Journal of Chemical Ecology* 7: 273-284.
6. Elliger, C.A., Chan, B.C. and Waiss Jr, A.C. (1980). Flavanoids as larval growth inhibitors structural factors governing toxicity. *Naturwissenschaften*, 67 (7): 358-360.
7. Garad, G.P., Shivpuje, P.R. and Bilapate, G.G. (1984). Life fecundity tables of *Spodoptera litura* (Fabricius) on different hosts. *Proc. Indian Acad. Sci. (Anim. Sci.)* 93(1): 29-33.

8. Gautam, S., Sohal, S. K. (2015). Influence of partially purified fractions of acetone extract of *Acacia nilotica* (L.) on development of *Spodoptera litura* (Fab.). *Int. J. Adv. Res.* 3(2): 1008-1012.
9. Gautam, S., Samiksha, Robin, Arora, S., Sohal, S.K. (2018). Chemical profiling of polyphenols in extracts from bark of *Acacia nilotica* (Linn.) and their efficacy against *Spodoptera litura* (Fab.). *Archives of Phytopathology and Plant Protection.* 51(1-2): 41-53, 20.
10. Gautam, S., Samiksha, Chimni, S.S., Arora, S., Sohal, S.K. (2021). Toxic effects of purified phenolics compounds from *Acacia nilotica* against common cutworm. *Toxicon.* 203: 22-29.
11. Ikonen, A., Tahvanainen, J. and Roininen, H. (2001). Chlorogenic acid as an antiherbivore defence of willows against leaf beetles. *Entomological Experimentalis et Applicata* 99: 47-54.
12. Katzenellenbogen, B. and Kafatos, F.C. (1971). General esterases of silkmouth moulting fluid: Preliminary characterization. *Journal of Insect Physiology* 17: 1139-1151.
13. Kono, Y. (1978). Generation of superoxide radical during auto-oxidation of hydroxylamine and an assay for Superoxide dismutase. *Archives of Biochemistry and Biophysics* 186: 189-195.
14. Krishnan, N. and Kodrik, D. (2006). Antioxidant enzymes in *Spodoptera littoralis* (Biosduvial): Are they enhanced to protect gut tissues during oxidative stresses? *Journal of Insect Physiology* 52: 11-20.
15. Lattanzio, V., Lattanzio, V.M.T. and Cardinali, A. (2006). Role of polyphenols in the resistance mechanisms of plants against fungal pathogens and insect. In: Imperato F., ed. *Phytochemistry: Advances in Reaserch Trivandrum, Kerala, India: Research Signpost.* pp. 23-67.
16. Lindroth, R.L. (1989). Host plant alteration of detoxication activity in *Papilio glaucus glaucus*. *Entomologia Experimentalis et Applicata* 50: 29-35.
17. Mac Intyre, R.J. (1971). A method for measuring activities of acid phosphatases separated by acrylamide gel electrophoresis. *Biochemical Genetics* 5: 45-50.
18. Mukherjee, S. (2003). Influence of plant allelochemicals on growth rate, nutritional physiology and mid-gut esterase activity in fifth instar larvae of *Spodoptera litura* (F.) (Lepidoptera: Noctuidae). *Invertebrate Reproduction and Development* 43: 125-132.
19. Panda, N. and Khush, G.S. (1995). *Host plant resistance to insects.* CAB International, Wallingford.
20. Scott, J.G. and Wen, Z.M. (2001). Cytochromes P450 of insects: the tip of the iceberg. *Pest Management Science* 57: 958-967.
21. Upasani, S.M., Kotkar, H.M., Mendki, P.S. and Maheshwari, V.L. (2003). Partial characterization and insecticidal properties of *R. communis* flavonoids. *Pest Management Science* 59: 1349-1354.
22. Usha Rani, P. and Pratyusha, S. (2013). Defensive role of *Gossypium hirsutum* L. anti-oxidative enzymes and phenolic acids in response to *Spodoptera litura* F. feeding. *Journal of Asia- Pacific Entomology.* 16: 131-136.

Excess Molar Volumes, Excess Isentropic Compressibilities and Excess Refractive Indices of Binary Mixture Containing Ethyl Laurate (E.L) and 3-Methylbutan-1-ol (3M1b) At Different Temperatures (298.15k, 303.15k, 308.15k, 313.15 K, 318.15k)

Sunita Rani¹, Nisha Sangwan², Rajesh K. Siwach*³ and Vimal Sinha⁴

³Government College for Women, Gohana (Sonipat), India

^{1,2,4}Department of Chemistry, B.M. University, Rohtak, India

ABSTRACT

The densities and speeds of sound and refractive indices of binary mixtures and pure components Ethyl laurate (E.L) and 3-Methylbutan-1-ol (3M1B) were determined over the entire mole fraction range (0.1 to 0.9) at various temperatures (298.15K, 303.15K, 308.15K, 313.15K, 318.15K). The excess thermodynamic properties covering the excess molar volume (V^E) and excess isentropic compressibilities (K_S^E) were calculated from the measured results of densities and speeds of sound. The densities and speeds of sound were measured using DSA5000M Anton Paar. The refractive indices of liquid mixtures were deliberate using Abbemat200. The refractive indices (n_D) have been measured using mixing rules viz Lorentz-Lorentz (L.L), Gladstone –Dale (G.D), Weiner-relation (W.R), Heller-relation (H.R). The experimental data compare very well with refractive indices predicted using mixing rules for binary mixtures containing Ethyl laurate (E.L) and 3-Methylbutan-1-ol (3M1B). The experimental data for binary mixtures involving Ethyl laurate (E.L) and 3-Methylbutan-1-ol (3M1B) validate the mixing rules.

Keywords: Ethyl laurate, thermodynamic properties, mixing rules

1. INTRODUCTION

The greatest concern of present time is environmental pollution and the major cause observed for pollution is particulate matter released in exhaust of conventional fuels. To limit this concern biodiesel can play a vital role, as these can be the best substituent of conventional fuels. The advantage of biodiesels over conventional fuel is its ability to reduce the exhaust emissions involving particulate matter. However, it hardly reduces the concentration of nitrogen oxides in exhaust emissions [1]. The alcohol fuels can be used to blend to produce biodiesel- alcohol blend in various percentages because of their miscibility with biodiesel [2,3]. The data obtained from thermodynamic studies are of great utility for designing of processes involved in chemicals, petrochemicals and pharmaceuticals. Biofuel is an alternate diesel fuel; it can be used in accessible diesel engines with some modification [4]. Biodiesel is multi-factor mixture, change in fatty compounds contour will affect its density, engine performance controls the composition of exhaust gases [4]. Excess molar volume is very useful in quantitative prediction of molecular interactions in liquid mixtures [5-8]. These molecular interactions in turn are very useful for designing new technological processes and solving various problems related to engineering of instruments [9,10]. Even the molecular interactions also help in elucidation of molecular structures. The excess thermodynamic properties of biodiesel alcohols are important for theoretical and experimental studies which will provide information about the differences of size and structure of molecules [2]. In present work we have studied the effect of temperature on the refractive indices, excess molar volume (V^E) and excess isentropic compressibilities (K_S^E) of binary mixtures involving ethyl laurate (E.L), 3-methylbutan-1-ol (3M1B) over whole mole fraction range at various temperatures 298.15K, 303.15K, 308.15K, 313.15K and 318.15K. Various mixing rules like Lorentz-Lorentz (L.L), Gladstone-Dale (G.D), Weiner-relation (W.R) and Heller-relation (H.R) relations are used to predict the refractive indices of the binary mixtures. These properties can be used further for the prediction of structures and interactions involving solute and /or solvent in binary liquid mixtures.

2. MATERIAL AND METHODS

Ethyl laurate (E.L) was supplied by TCI with purity higher than 99.5% and analyzed by GC. 3Methylbutan-1-ol (3M1B) was purchased from Sigma-Aldrich with purity higher than 99%. All samples were readied immediately after measurement of weight of solute and solvent in order to neglect the variation in chemical composition of the mixtures. The densities and speeds of sound were determined using DSA5000M Anton paar [10,11]. The refractive indices of liquid mixtures were determined using Abbemat200 refractometer which is equipped with an automatic peltier temperature control providing a fast and precise automatic temperature control of the sample [12,13]. The refractometer was calibrated by using doubly distilled water and toluene [14]. The liquid mixtures were injected using micro syringe and covered the whole prism by magnetic sample cover

to avoid evaporation. The refractive indices of all binary mixtures were measured after attainment of constant temperature.

3. RESULTS AND DISCUSSION

3.1 Excess Molar Volume

The excess molar volumes (V^E) for the binary mixtures involving (Ethyl laurate + 3-methylbutan-1-ol) were calculated by using the densities measured experimentally, by using,

$$V^E = \sum_{i=1}^j x_i M_i (\rho_{ij})^{-1} - \sum_{i=1}^j x_i M_i (\rho_i)^{-1} \quad (1)$$

Where, x_i is mole fraction of component (i) and ρ_{ij} and ρ_i are densities of binary mixtures(i+j) and density of pure component (i) respectively and M_i is the molecular mass of component (i). the molecular masses of component (i) and (j) are represented in **Table 1**

Table 1: Molecular masses of pure liquids.

Liquid	Molecular mass
Ethyl laurate	228.15
3- Methylbutan-1-ol	88.15

(V^E) values for the binary mixture involving ethyl laurate (E.L) and 3-methylbutan-1-ol (3M1B) over whole mole fraction range at various temperatures are calculated using equation (1) and represented in **Table 2** and **Fig 1**.

Table 2 The excess molar volumes (V^E) for ethyl laurate(x_i) + 3-methylbutan-1-ol ($1 - x_i$) as a function of mole fraction (x_i) at various temperature 298.15K, 303.15K, 308.15K, 313.15K, 318.15K.

x_i	$V^E(298.15K)$	$V^E(303.15K)$	$V^E(308.15K)$	$V^E(313.15K)$	$V^E(318.15K)$
0.12915	0.09203	0.09953	0.10953	0.11672	0.12922
0.21964	0.14641	0.15641	0.17141	0.18360	0.20110
0.31355	0.18983	0.20636	0.22323	0.24177	0.26012
0.40755	0.21079	0.23330	0.25221	0.27267	0.29518
0.52710	0.20504	0.22383	0.24304	0.26371	0.28544
0.60935	0.18605	0.20150	0.22002	0.24270	0.26023
0.72342	0.15881	0.17238	0.18664	0.20338	0.22321
0.80782	0.13844	0.15063	0.16313	0.17681	0.19321
0.92989	0.08622	0.09483	0.10112	0.10915	0.11547

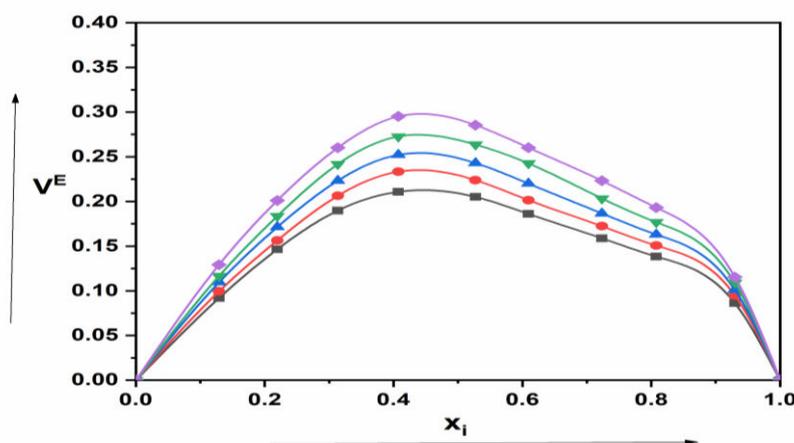


Fig1: Excess molar volume (V^E) versus mole fraction (x_i) in binary mixtures involving ethyl laurate (x_i) + 3-methylbutan-1-ol ($1 - x_i$) at various temperatures (■)298.15K, (●)303.15K, (▲)308.15K, (▼)313.15K, (◆)318.15K.

From the **Fig 1**, it is clear that (V^E) values are positive over the complete range of composition. Variation in excess molar volumes with change in composition can be explained in terms of molecular structural, physical and chemical factors [2]. The difference in shape, size of components and free volume arises due to structural characteristics. However, decrease in dipolar association or dissociation of the components or hydrogen bond formation between unlike molecules can affect the physical and chemical factors. As ethyl laurate (E.L) is a

polar and non-associating liquid while 3-methylbutan-1-ol (3M1B) involves hydrogen bonding due to presence of hydroxyl groups. So ethyl laurate (E.L) is non associating while 3-methylbutan-1-ol (3M1B) is associated liquid in pure state. So, addition of ethyl laurate (E.L) to 3-methylbutan 1-ol (3M1B) leads to disruption of H-bonding in 3-methylbutan-1-ol. It causes increase in excess molar volume and the same is reflected in experimental work. Even this disruption continues with increasing temperature and consequently V^E values for the binary mixture increases with increasing temperature as shown in **Fig 1**. Maxima in V^E versus mole fraction (x_i) curve for the binary mixture at various temperatures is observed at mole fraction ($x_i = 0.44$). it reflects that addition of ethyl laurate (an-ester) to 3-methylbutan-1-ol (3M1B) leads to breaking of hydrogen bonding in 3-methylbutan-1-ol (3M1B) up to (0.44) mole fraction further addition of Ethyl laurate (E.L) to 3-Methylbutan -1-ol (3M1B) leads to formation of weak dipole -dipole interaction between ethyl laurate (E.L) and (3-methylbutan1-ol) (3M1B).

3.2 Excess Isentropic Compressibilities

The excess isentropic compressibilities (κ_S^E) were measured by equation (2).

$$\kappa_S^E = \kappa_S - \kappa_S^{id} \quad (2)$$

$$\kappa_S = (\rho_{ij} u^2)^{-1} \quad (3)$$

$$\kappa_S^{id} = \sum_{i=1}^k \phi_i \left[\kappa_{S,i} + \frac{T v_i a_i^2}{C_{P,i}} \right] - T \left(\sum_{i=1}^k x_i v_i \right) \frac{\left(\sum_{i=1}^k \phi_i a_i \right)^2}{\left(\sum_{i=1}^k x_i C_{P,i} \right)} \quad (4)$$

(κ_S) values are determined using equation (3) by using densities and speeds of sound of binary mixture ethyl laurate (E.L) and 3- methyl butan-1-ol (3M1B) over whole mole fraction range at various temperatures. (κ_S^{id}) is measured using equation (4) by using the literature values of various parameters involved in this equation. Excess isentropic compressibilities(κ_S^E) are further measured by equation (2). Speeds of sound of pure liquids measured experimentally at different temperatures are reported in **Table 3**.

Table 3: Experimental speeds of sound (u) of pure components at T = 298.15K, 303.15K, 308.15K, 313.15K, 318.15K.

Liquids	Temperature	Speed of sound (ms ⁻¹)
Ethyl laurate	298.15K	1320.58
	303.15K	1302.46
	308.15K	1284.33
	313.15K	1266.36
	318.15K	1248.53
3-Methylbutan-1-ol	298.15K	1230.78
	303.15K	1214.10
	308.15K	1197.40
	313.15K	1180.77
	318.15K	1164.23

While (κ_S^E) values for the binary mixtures at different temperature over the whole mole fraction range are reported in **Table 4**. The (κ_S^E) values over whole molefraction range at different temperatures are represented using graphs in **Fig 2**.

Table 4: The excess isentropic compressibility (κ_S^E) of Ethyl laurate (x_i) + 3-Methylbutan-1-ol ($1-x_i$) as the function of mole fraction (x_i) at various temperatures 298.15K, 303.15K, 308.15K, 313.15K, 318.15K.

x_i	κ_S^E (298.15K)	κ_S^E (303.15)	κ_S^E (308.15)	κ_S^E (313.15K)	κ_S^E (318.15K)
0.12915	-1.87059E-8	-1.91602E-8	-1.97874E-8	-2.01335E-8	-2.09338E-8
0.21964	-2.90956E-8	-2.98959E-8	-3.08692E-8	-3.15542E-8	-3.24122E-8
0.31355	-3.57339E-8	-3.66957E-8	-3.76387E-8	-3.86405E-8	-3.97061E-8
0.40755	-3.66475E-8	-3.76301E-8	-3.87176E-8	-3.97069E-8	-4.08992E-8
0.52710	-3.27440E-8	-3.36958E-8	-3.46857E-8	-3.57050E-8	-3.67605E-8
0.60935	-2.89534E-8	-2.98825E-8	-3.08718E-8	-3.18020E-8	-3.27913E-8
0.72342	-2.26332E-8	-2.33147E-8	-2.40236E-8	-2.47820E-8	-2.55576E-8
0.80782	-1.65328E-8	-1.71189E-8	-1.76655E-8	-1.80940E-8	-1.86406E-8
0.92989	-6.27633E-9	-6.43286E-9	-6.62706E-9	-6.79179E-9	-6.96899E-9

(κ_S^E) values provide information related to close packing of molecules and compressibility of liquid mixtures. These informations are based on the aggregate effects of different contributions made by (1) intermolecular interactions between components of mixtures; (2) close packing of molecules; and (3) depolymerization of associated molecular species. The first two factor lead increase in density and hence make the mixture less compressible while the (3) factor lead to decrease in density and make the mixture more compressible. From Fig 2 it is clear that (κ_S^E) values are negative over the whole mole fraction range. It is because of dominance of first two factors over the (3) factor.

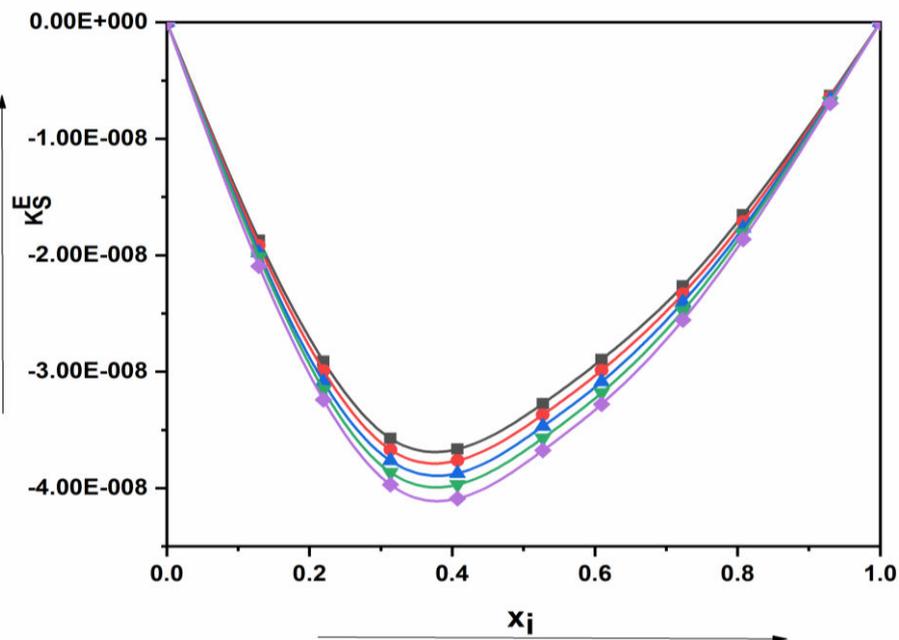


Fig 2: Excess isentropic compressibility (κ_S^E) versus mole fraction (x_i) in binary mixtures involving ethyl laurate (x_i) + 3-Methylbutan-1-ol ($1-x_i$) at various temperatures (■)298.15K, (●)303.15K, (▲)308.15K, (▼)313.15K, (◆)318.15K.

3.3 Excess Refractive Indices

The excess refractive indices (n_D^E) were calculated using the equations (5 to 6) [12].

$$n_D^E = n_D - n_D^{id} \quad (5)$$

$$n_D^{id} = [\phi_1 \cdot n_{D,1}^2 + \phi_2 \cdot n_{D,2}^2]^{1/2} \quad (6)$$

Where (n_D) is the refractive index of mixture and ϕ_1 and ϕ_2 are the volume fraction of component 1 and 2 and (n_D^{id}) is ideal refractive index of mixture. And $n_{D,1}^2$ and $n_{D,2}^2$ are refractive index of pure component 1 and 2 respectively. The excess refractive indices values over the whole mole fraction range at different temperatures are reported in Table 5 and the variation of excess refractive indices as a function of volume fraction of ethyl laurate (E.L) + 3- methylbutan-1-ol (3M1B) presented in Fig 3.

Table 5: Excess refractive index (n_D^E) versus mole fraction of Ethyl laurate (x_i) and 3-Methylbutan-1-ol ($1-x_i$) at different temperatures (298.15K, 303.15K, 308.15K, 313.15K, 323.15K).

x_i	n_D^E (298.15K)	n_D^E (303.15)	n_D^E (308.15)	n_D^E (313.15K)	n_D^E (318.15K)
0.12915	0.00302	0.0029	0.00286	0.00281	0.0028
0.21964	0.00458	0.00442	0.00437	0.00432	0.00422
0.31355	0.00444	0.00421	0.00404	0.00405	0.00399
0.40755	0.00216	0.00202	0.0019	0.00175	0.00164
0.52710	-8.90E-04	-9.70E-04	-0.00109	-0.00149	-0.00149
0.60194	-0.00193	-0.00199	-0.00209	-0.00229	-0.00228
0.72342	-0.00212	-0.00221	-0.00222	-0.00232	-0.00232
0.80782	-0.00172	-0.00177	-0.00181	-0.00185	-0.00184
0.92989	-7.40E-04	-8.40E-04	-7.40E-04	-7.40E-04	-7.40E-04

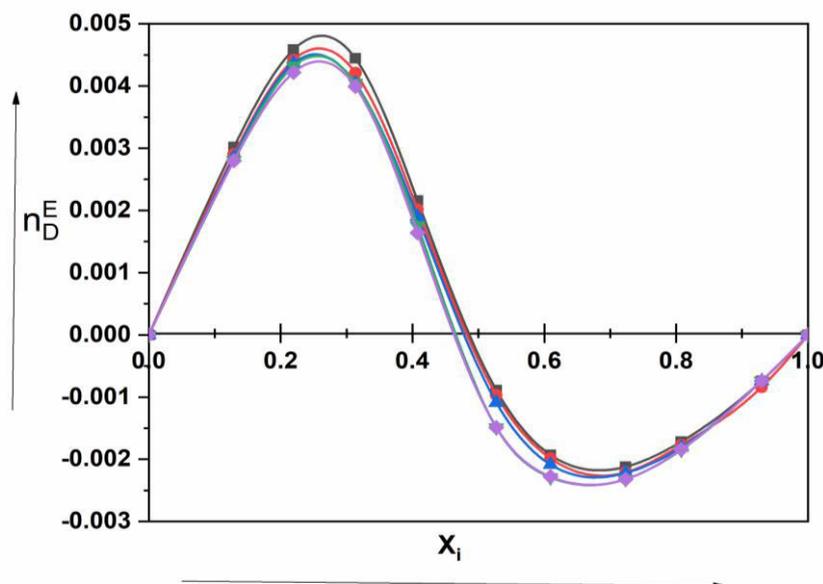


Fig 3: Excess refractive indices (n_D^E) versus mole fraction (x_i) in binary mixtures involving ethyl laurate (x_i) + 3-methylbutan-1-ol ($1-x_i$) at various temperature (■)298.15K, (●)303.15K, (▲)308.15K, (▼)313.15K, (◆)328.15K.

The excess refractive indices of binary mixtures of ethyl laurate (E.L) and 3-methyl butan-1-ol (3M1B) at various temperatures (298.15K, 303.15K, 308.15K, 313.15K, 318.15K) were measured over entire mole fraction range. The excess refractive indices (n_D^E) shows positive and negative values over the whole mole fraction range, with maxima at ($x_i=0.26$) and minima at ($x_i=0.67$). The same tendency has been observed at all temperatures. The positive values of excess refractive index (on the basis of volume fraction) are considered to be due to the presence of significant interactions in the mixtures, whereas negative values indicate weak interactions between the contributing components of the mixtures [9].

In earlier days the refractive index of binary or ternary mixtures were estimated from the pure components by using certain mixing rules [15-17]. Generally, Lorentz-Lorentz (L.L), Gladstone-Dale (G.D), Weiner-relation (W.R), Heller-relation (H.R) are commonly used as mixing rules [14]. The goal of our research work is to validate the mixing rules Lorentz-Lorentz (L.L), Gladstone-Dale (G.D), Weiner (W), Heller (H) relations for predicting the refractive indices of liquid mixtures involving Ethyl laurate (E.L) and 3Methylbutan-1-ol(3M1B) as a function of temperature and mole fraction and effect of temperature and mole fraction in intermolecular interactions [16,17]. The equations for mixing rules are as follows:

Lorentz-Lorentz (L-L)

$$\frac{n_{L,L}^2 - 1}{n_{L,L}^2 + 2} = \left(\frac{n_1^2 - 1}{n_1^2 + 2} \right) \phi_1 + \left(\frac{n_2^2 - 1}{n_2^2 + 2} \right) \phi_2 \quad (7)$$

Gladstone-Dale (G.D)

$$n_{G,D} - 1 = (n_1 - 1)\phi_1 + (n_2 - 1)\phi_2 \quad (8)$$

Weiner-relation (W.R)

$$\frac{n_{W,R}^2 - n_1^2}{n_{W,R}^2 + 2n_2^2} = \left(\frac{n_2^2 - n_1^2}{n_2^2 + 2n_1^2} \right) \phi_2 \quad (9)$$

Heller-relation (H.R)

$$\frac{n_{H,R} - n_1}{n_1} = \frac{3}{2} \left[\frac{\left(\frac{n_2}{n_1} \right)^2 - 1}{\left(\frac{n_2}{n_1} \right)^2 + 2} \right] \phi_2 \quad (10)$$

Where, x_i is mole fraction and ϕ_1 and ϕ_2 are volume fractions and n is the refractive index of mixture x_1 and x_2 , and pure components have refractive index n_1 and n_2 , the volume fractions are obtained from $\phi_1 = \frac{x_1 v_1}{x_1 v_1 + x_2 v_2}$, v_1 and v_2 are the molar volume of constituent 1 and 2. The theoretical and experimental values over the whole

mole fraction range at different temperature are reported in **Table 6** and Root mean square deviation (RMSD) is used as a technique to determine how much a system's theoretical approach deviates from its experimental approach. It follows from the following relation.

$$RMSD = \left(\frac{1}{N} \sum_i (n_{exp} - n_{cal})^2 \right)^{1/2}$$

Where, N is experimental data points. **Table 7** shows the R.M.S.D values for Gladstone-Dale (G.D), Lorentz-Lorentz (L.L), Heller-Relation (H.R), and Wiener-Relation (W.R). All of the systems' G.D, L.L, H.R, and W.R work well, and each correlation's RMSD value is very small.

Table 6: Theoretical and experimental values of refractive indices in Ethyl laurate (x_i) and 3Methylbutan-1-ol ($1-x_i$) at various temperatures 298.15K, 303.15K, 308.15K, 313.15K, 323.15K listed in **table -6**

At 298.15K					
x_i	$n_{(EXP)}$	$n_{G.D}$	$n_{L.L}$	$n_{H.R}$	$n_{W.R}$
0.12915	1.4091	1.406053	1.406043	1.405987	1.406590
0.21964	1.4134	1.408787	1.408758	1.408729	1.409255
0.31355	1.4176	1.413109	1.413061	1.413063	1.413471
0.40755	1.4202	1.418018	1.417964	1.417986	1.418264
0.52710	1.4225	1.423354	1.423313	1.423337	1.423482
0.60935	1.4240	1.425927	1.425900	1.425917	1.426000
0.72342	1.4260	1.428102	1.428091	1.428098	1.428131
0.80782	1.4272	1.428937	1.428933	1.428936	1.428949
0.92989	1.4287	1.429442	1.429442	1.429442	1.429444
At 303.15K					
x_i	$n_{(EXP)}$	$n_{G.D}$	$n_{L.L}$	$n_{H.R}$	$n_{W.R}$
0.12915	1.4069	1.403958	1.403948	1.403891	1.404500
0.21964	1.4112	1.406703	1.406674	1.406644	1.407175
0.31355	1.4153	1.411042	1.410994	1.410996	1.411407
0.40755	1.4180	1.415971	1.415916	1.415938	1.416220
0.52710	1.4204	1.421328	1.421288	1.421311	1.421458
0.60935	1.4219	1.423912	1.423885	1.423902	1.423986
0.72342	1.4239	1.426096	1.426085	1.426092	1.426125
0.80782	1.4252	1.426935	1.42693	1.426934	1.426947
0.92989	1.4266	1.427442	1.427442	1.427442	1.427443
At 308.15K					
x_i	$n_{(EXP)}$	$n_{G.D}$	$n_{L.L}$	$n_{H.R}$	$n_{W.R}$
0.12915	1.4047	1.401853	1.401842	1.401787	1.402391
0.21964	1.4090	1.404586	1.404557	1.404528	1.405055
0.31355	1.4130	1.408908	1.40886	1.408862	1.409271
0.40769	1.4158	1.413816	1.413762	1.413784	1.414064
0.52710	1.4181	1.419153	1.419112	1.419135	1.419281
0.60936	1.4197	1.421726	1.421699	1.421716	1.421800
0.72342	1.4217	1.423902	1.42389	1.423898	1.42393
0.80778	1.4229	1.424737	1.424732	1.424736	1.424749
0.92989	1.4245	1.425242	1.425242	1.425242	1.425244
At 313.15K					
x_i	$n_{(EXP)}$	$n_{G.D}$	$n_{L.L}$	$n_{H.R}$	$n_{W.R}$
0.12915	1.4026	1.399752	1.399742	1.399686	1.400292
0.21964	1.4068	1.402486	1.402457	1.402427	1.402955
0.31355	1.4109	1.406807	1.406759	1.406760	1.40717
0.40769	1.4135	1.411715	1.411661	1.411682	1.411963
0.52710	1.4156	1.417052	1.417011	1.417034	1.41718
0.60936	1.4174	1.419625	1.419599	1.419615	1.419699
0.72342	1.4195	1.421802	1.421790	1.421798	1.421830

0.80778	1.4208	1.422637	1.422632	1.422636	1.422649
0.92989	1.4224	1.423142	1.423142	1.423142	1.423143
At 318.15K					
x_i	$n_{(EXP)}$	$n_{G.D}$	$n_{L.L}$	$n_{H.R}$	$n_{W.R}$
0.12915	1.4005	1.396552	1.396550	1.396483	1.397116
0.21964	1.4046	1.396873	1.396869	1.396805	1.397428
0.31355	1.4087	1.397289	1.397281	1.397222	1.397833
0.40769	1.4113	1.398029	1.398016	1.397964	1.398555
0.52710	1.4134	1.399132	1.399111	1.399070	1.399630
0.60936	1.4152	1.400465	1.400436	1.400407	1.400929
0.72342	1.4173	1.419601	1.419589	1.419597	1.419629
0.80778	1.4186	1.405547	1.405497	1.405503	1.405887
0.92989	1.4202	1.412652	1.412604	1.412628	1.412828

Table 7: Root mean square deviation (RMSD) for binary mixture at various temperatures (298.15 to 318.15)K.

T/K	G.D	L.L	H.R	W.R
298.15K	0.0027	0.0028	0.0028	0.0025
303.15K	0.0027	0.0027	0.0027	0.0025
308.15K	0.0026	0.0026	0.0027	0.0024
313.15K	0.0026	0.0027	0.0027	0.0024
318.15K	0.0107	0.0107	0.0108	0.0103

CONCLUSION

The experimental densities and speeds of sound of binary mixture involving Ethyl laurate with 3-Methylbutan-1-ol at various temperatures (298.15K, 303.15K, 308.15K, 313.15K, 318.15K) were measured using DSA. Excess molar volumes (V^E) for established system showed positive values and excess isentropic showed negative values over the whole mole fraction range. Furthermore, excess molar volumes (V^E) are increasing and excess isentropic compressibilities (κ_ξ^E) become more and more negative with increasing temperature. The refractive indices were calculated using mixing rules viz. Lorentz-Lorentz (L.L), Gladstone-Dale (G.D), Weiner-relation (W.R), Heller-relation (H.R) and compare very well with the experimental refractive indices. So, the experimental data for binary mixtures involving ethyl laurate (E.L) and 3-methylbutan-1-ol (3M1B) validate the mixing rules.

REFERENCES

- Gerhard Knothe,* Christopher A., Sharp, and Thoms W., Ryan, III.: Exhaust Emissions of Biodiesel, Petrodiesel, Neat Methyl Esters, and Alkanes in a New Technology Engine. Energy and fuel. 20, 403-408(2006).
- Li, D., Guo, M., Wu, Q., Li, M., Ruan, N., & Gao, L.: Investigation on the Thermophysical Properties of the binary mixtures of Ethyl laurate with Four n-Alkanols. Journal of chemistry. 49, 1237-1249 (2020).
- Jin, C., Pang, X., Zhang, X., Wu, S., Ma, M., Xiang, Y., Ma, J., Ji, J., Wang, G., Liu, H.: Effects of C3-C5 alcohols on solubility of alcohols/ diesel blends. Fuel 236, 65-74 (2019).
- Wang, X., Kang, K., Lang, H.: High- pressure densities and derived thermodynamic properties for methyl laurate and ethyl laurate. J.chem Thermodynamic103, 310-315 (2016).
- Siwach, R.K., Dimple and Sharma, V.K.: Excess molar volumes and isentropic compressibilities change of mixing of Tetrahydropyran + benzene +cyclo or n-alkanes ternary mixtures at 303.15K. Thermochem.Acta.,85,503-504(2010).
- Siwach, R.K., Dimple, Jangra, S.K., Sharma, V.K.: Excess molar volume of ternary mixtures of cyclic ethers with aromatic hydrocarbons at 303.15K. J. Solution chem., 2010 (in press)
- Siwach, R.K., Dimple, Sharma, V.K.: Thermodynamic properties of binary mixtures containing Tetrahydropyran: Excess molar volume, Excess molar enthalpies and isentropic compressibility change of mixing: Thermochem. Acta, 1,506,(2010).
- Sharma, V.K., Siwach, R.K., Dimple.: Excess molar volume, Excess molar enthalpies and isentropic compressibility change of mixing of tetrahydropyran with aromatic hydrocarbons. J.Chem. Thermodyn.,43,39-46(2011).

9. Pandey, V. K., Verma, V., Srivastava, R., Awasthi, A., & Awasthi, A.: Refractive indices and their related properties for binary mixtures containing 2-Diethylethanolamine with 1-Propanol and 1-Butanol. *Journal of solution Chemistry*, 5, 1459-1472 (2020).
10. Liao, W., Tang, M., Chen, Y.: Densities and viscosities of butyl acrylate 1-butanol and ethyl laurate 1-butanol at 293.15, 303.15, and 313.15 K. *J. Chem. Eng. Data* 43, 826–829 (1998).
11. Mrad, S., Lafuente, C., Hichri, M., Khattech, I.: Density, speed of sound, Refractive index, and Viscosity of the Binary Mixtures of N,N-dimethylacetamide with Methanol and Ethanol. *J. Chem. Eng. Data*, 61, 9, 2946-2953 (2016).
12. Mardones, Cea, P., Lopez, M.C., Lafuente, C.: Refractive index of binary mixtures containing pridinium-based ionic liquids and alkanols. *Thermochimica Acta* 572, 39-44, (2013)
13. Calvar, N., Gonzalez, B., Gomez E., Canosa, J.: Density, speed of sound, and refractive index for binary mixtures containing cycloalkanes and aromatic compounds at T= 313.15K. *J. Chem. Eng. Data*, 54, 1334-1339 (2009).
14. Bhatia, S.C., Tripathi, N., Dubey, G.P.: Refractive indices of binary mixtures of (decane+benzene) and (hexadecane +benzene), or +hexane) at 303.15, 308.15 and 318.15K. *Indian J. Chem.*, 41, 266-269 (2002).
15. Narendra, K., Naraynamurthy, P., Srinivasu, Ch.: Refractive indices of binary liquid mixtures at different temperatures. *Asian Journal of applied Science*, 4(5), 535-541, (2011).
16. Mandava, S., Kolla, N., Chagarlamudi, K., Anne, S.B., Abbineni, R.: Refractive properties for binary mixtures containing DEC+ o-xylene or m-xylene or p-xylene., 4, 2319-8753 (2015).
17. Sirbu, F., Dragoescu, D., Shchamialiou, A., Khasanshin, T.: Densities, speeds of sound, refractive indices, viscosities and their related thermodynamic properties for n-hexadecane + two aromatic hydrocarbons binary mixtures at temperature from 298.15K to 318.15K. *J. Chem. Thermodynamics*, 128, 383-393 (2019).

A Comparative Study of Ecocriticism in the Select Novels of Easterine Kire and Chinua Achebe

Sonali Dudihalli and Pramod Kumar
SHSS, Sharda University, Greater Noida, India

ABSTRACT

Ecocriticism has basically originated from the uncontrolled exploitation of the environment by humans, creating natural and climatic hazards. Though ecocriticism, cannot stop the environmental hazards from happening, it can definitely create a consciousness in people with the help of literature. The works of both Easterine Kire from North East India and Chinua Achebe from Nigeria, Africa, are embodied with the awareness of nature and its influence on human beings. The character of Vilie, from 'When the River Sleeps', by Easterine Kire, a member of the Angami tribe of Nagaland, is the protector of forest and his life completely revolves around it. Likewise, Okonkwo, from the Igbo tribe of Nigeria, in 'Things Fall Apart' by Chinua Achebe, is shown to be successful and in peace only when he follows and respects Goddess Ani, the Earth Goddess. Thus, emphasizing the never-ending importance of nature in their lives. This research paper is an attempt to recognize the interconnection between nature and literature, a comparative study of ecocriticism in the novels of Easterine Kire 'When the River Sleeps' and Chinua Achebe's 'Things Fall Apart'. The methodology used to achieve the above objective is the conceptual examination of the theory of ecocriticism.

Keywords: Ecocriticism, North East India, Nigeria, Easterine Kire, Chinua Achebe

Ecocriticism, the term was first used in the essay 'Literature and Ecology; An experiment in Ecocriticism', 1978, by William Rueckert. His main purpose was to apply the ecological terms in understanding literature. Ecocriticism is a critical theory which has developed gradually from the 1990's. The Association for the Study of Literature and Environment (ASLE), in the United States, hosts a conference twice a year, for researchers who deal with environmental concerns in literature and humanities, in general. Ecocriticism has been influenced by many different subjects and studies. Primarily, it is influenced by ecology, sociology, philosophy, feminism, Marxism, to name a few.

Ecocriticism basically works on two levels. In the first it tries to draw together a culture's ecological approaches from the texts related to that particular culture. This deals in the present or the contemporary understanding of environmental problems faced by a particular culture at a specific time. At the second level it uses canonical texts to interpret and understand ecocriticism by re-reading it. At this level, it highlights the attitude to nature present in those times, through these texts. For Example, Henry David Thoreau 'Walden; or, Life in the Woods' (1854). In the novel, the protagonist is seeking solitude, self-sufficiency, and harmony in the woods and trying to understand the philosophical implications of the quest to find a meaningful existence in this world. The serenity of nature, the changing of seasons, the availability of food with the change in seasons all are highlighted by the author. It also reflects on the prevailing attitude in nature in the early 19th Century.

Ecocriticism pursues to study, explore and analyse texts which emphasize nature, relationship and attitude towards non-human life in every period, conflict between rationality and emotions, developmental changes causing harm to nature are many of the approaches which are included in the study of ecocriticism.

Another approach which focuses on environmental issues concerning the third world countries has been propagated by Juan Martinez-Alier and Indian thinker Ramchandra Guha. According to them, there is a strong link "between poverty and ecological degradation, especially in Asian and African countries." (Nayar, 2009). Environmental issues in these countries are multifaceted than the developed countries. Social inequalities, illiteracy, poverty, population and sustenance on farming has made land-use very haphazard. This makes it difficult to protect the wilderness and environment. To follow the approaches adopted by the first world countries in this respect will not work in the third world countries. A noted historian and thinker, Ramchandra Guha, mentions that third world countries like India and Africa, cannot have developmental models based on Western approaches. Conservational idea of ecology which the West follow may overlook the cultural and social practices which are followed by local people since ancient times.

The term 'environmentalism for the poor' (Nayar, 2009) was an idea developed by Ramchandra Guha and Martinez-Alier. They suggest a simple framework that environmental issues in the third world or poor nations cannot be disconnected from the concerns of daily income, dispersal of resources and social justice. Many tribes cut wood for fuel which is a basic necessity for survival and to argue that it leads to de-forestation and therefore,

should be stopped, would lead to injustice and inequality. Many environmental movements have therefore, been initiated which stand for the preservation of the ecosystems that are necessary to help the poorer sections of the society to survive.

Thus, it becomes imperative that an approach of ecocriticism to the literature of the third world countries should be more focused, on their strong links with the local communities and environment. This would lead to creating a balance between nature, life and literature.

Nagaland, one of the north eastern states in India and Nigeria, one of the countries on the western coast of Africa, placed almost at the opposite ends of the world, are quite similar. In the sense that they both are situated in the midst of environmental beauty. The people residing in both these places are an amalgamation of different tribes who believe in Goddess Nature, and abound in myths, folklores and oral traditions. Both these parts were under colonial rule and had to fight for their freedom. And most importantly, the people in these regions had to face the annihilation of their local religion and customs by the White Missionaries and Christianity was forced on them.

Nagaland is a land shrouded in mystery, occupied by vibrant people, who passionately guard their culture. It is a land occupied by hunters, warriors and dancers, bursting with forests, rivers, valleys and mountains. It has a tropical climate. The plant and animal life exists as in a tropical region. The green forests provide not just the precious timber but also provide bamboo, palms and rattan. Nagaland has a varied wildlife. Wild animals such as tigers, leopards, bears, elephants, numerous species of monkey, deer, etc. can be seen in the dense and green forests.

There are more than twenty Naga tribes and numerous subtribes and everyone has a precise geographic location. These tribes share many cultural traits, but they are also kept themselves isolated from each other and avoid creating larger communities.

It only in the last few decades that North East Indian literature has been noticed by main stream Indian writing in English. The literature and works of the authors of the North East India then without fail reflect the closeness with nature. Many of the writers have spun their novels/stories around nature, folklore, myths and spirits. Ecology or ecocriticism has been seen in the works of like Mamang Dai, Janice Pariat, Easterine Kire, Nzanmongi Jasmine Patton, Temsula Ao, Mitra Phukan, Monalisa Changkija, Rashmi Narzary etc.

Mamang Dai's novel, 'The Legends of Pensam' (2006), showcases the unique ecological wisdom of the Adi tribe of Arunachal Pradesh and promotes an eco-mystical way of living. It highlights the vast restructuring of nature which has been done and justified on the grounds of development. How materialism and commercialism has uprooted the deep ecological connections of the Khasi tribe, is demonstrated in Janice Pariat's 'Boats on Land' (2012),

'A Girl Swallowed by a Tree: Lotha Naga Tales Retold' (2014) by Nzanmongi Jasmine Patton's focuses on the mutual relationship of humans with forests, trees, and animals on earth. Temsula Ao's 'Laburnum for My Head' (2009), has distinctly shown how worshipping, preserving, and living in complete harmony with nature are the only ways to ascertain continuity against the winds of ecological changes. Another North East writer, who has spoken about the insurgency of the 1970-80's in Assam is Mitra Phukan's 'The Collector's Wife'. This novel shows the interdependence of the protagonist with nature for its survival.

Located towards the western coast of Africa, is the country of Nigeria, which has a mixed geography, and the climate too ranges from arid to humid. Nevertheless, Nigeria is quite famous for its varied people. It boasts of innumerable dialects and languages. Most known languages of Nigeria are Tev, Igbo, Yoruba, Fula, Edo, Hausa, Ibibio and of course English. There is no dearth of natural resources in Nigeria, such as natural gas and petroleum. Due to its tropical nature, Nigeria has a wet and dry climate most part of a year. Freshwater swamps and mangroves occur along the coast leading to thick tropical rainforests. The oil palm trees that grow uninhabited in Nigeria are preserved after forest cultivation, which leads to economic prosperity.

Many African writers are therefore nature writers too. Their works and nature are interconnected. African societies are conservative and practice conservation of all natural resources, mainly environment. African writers like Wole Soyinka, Ben Okri, Chinua Achebe, Ngugi wa Thiong'o, Chimamanda Adichie, J.M.Coetzee, have all demonstrated the use of nature in their works.

The literature of Nigeria is greatly influenced by its local environment. For example, the oil palm has a great significance in Nigerian literature. Chinua Achebe in 'Things fall Apart', Soyinka in 'The Road' and 'A Dance of Forests' use oil palms to a great extent. Tribal and rural background is another distinctive feature of Nigerian

writing. The most popular African novel by the well-known Nigerian author Chinua Achebe, *Things Fall Apart* by Achebe, is set in the village of Umuofia. In the Igbo language it means 'children of the forest'. Again, Achebe's second novel *Arrow of God* has its setting in the Igbo village of Umuaro.

Wole Soyinka, one of the well-known writers of Nigeria, in his novel 'The Swamp Dwellers' talks about the Nigerian swamps. Other Nigerian writers such as Amos Tutuola, Cyprian Ekwensi and Elechi Amadi have also published works that revolve around the ecology of Nigeria. In Ekwensi's 'Burning Grass', too ecology plays an important role. Another famous South African writer, J.M.Coetzee, has written novels which are influenced by African environment. The protagonist of his novel 'Disgrace', revolves around the alienation face by the protagonist on his own land.

Thus, nature writing or ecological writing has emerged as a 'literature of hope' in the North East Indian and African literature. The intimacy with nature is reflected in their works and have become excellent examples of ecocriticism texts.

Born in Kohima, in Nagaland, a North East state in India, Easterine Kire, is a well-known novelist, short-story writer as well as a poet. Most of her novels are based on the indigenous tribes of Nagaland. She presently lives in Norway. Easterine Kire is also the first poet from Nagaland to have published in English. In 2003, Easterine Kire published her first novel, 'A Naga Village Remembered'. It was later republished as 'Sky is my father: A Naga Village Remembered' in 2018. In 2011, Easterine Kire received the Governor's Medal of excellence for the novel 'Bitter Wormwood', which tells the story about Naga freedom struggle. It was nominated for the Hindu Lit for Life prize in 2013. Easterine Kire is also a reputed children's author from Nagaland who has recently published her fifth children's book 'The Dancing Village'. Her other published works are, 'A Respectable Woman' (2019), 'Don't Run, My love' (2017), 'Son of the Thundercloud' (2016), 'When the River Sleeps' (2014) and 'A Terrible Matriarchy' (2007).

'When the River Sleeps', is the story of a hunter who is in his forties. He is the protector of the forest and has made forest his home. Vilie is frequently troubled by a dream of a specific river which was talked about by the seers of his ancestral village where he lived. A specific stone in the bottom of the river was such that it had the power to grant any wish to its owner. Eventually, Vilie decides to fulfil his dream and starts on this risky and adventurous journey. To pick the stone from the river bottom, Vilie had to catch the river 'sleeping', metamorphically.

Easterine Kire's description of this journey is the most enchanting part of the whole novel. The harmony with nature that Vilie tries to create and develop in himself is itself full of self-learning and wisdom. The hills of Nagaland, encounter with weretigers, widow-spirits, and demons makes the journey almost surreal. He travels on foot with minimum luggage. He seeks shelter in the villages where he comes across different tribes. In a certain village Vilie is blamed by the villagers of a murder that he by chance happens to witness. After a lot of courage and risk he finally reaches the 'sleeping river' and at the right moment he collects the stone from its bottom. Then on his return journey he meets two magical sisters who have been outcasted by their community as they were thought to have magical powers. They could just carry out a curse on anyone by merely raising a finger towards them. Ate, the younger sister is warm hearted and Vilie is convinced that she is harmless. Certain events lead to the death of the elder sister. As Ate is alone now, Vilie insists that she come with him.

When Vilie visits his forest house with Ate, on the way they visit a neighbouring Nepali couples house. There they find the couple murdered but their infant son is miraculously saved. Then Vilie takes Ate and the child to his ancestral home in the village where his two aunts lived. The little infant and Ate, bring joy in the lives of his aunts. Before leaving for forest, Vilie hands over the river stone to Ate. The novel has a tragic ending, where Vilie, after returning to his forest home, is unexpectedly killed by a man who was after the precious stone. Ate gets married and every quarter of a year, visits the forest home of Vile with the child and husband. She continues to feel the presence of Vilie in his forest home.

The novel 'When the River Sleeps' is set in Nagaland, a state full of hills and scenic beauty. During his journey, the author gives us a panoramic view of the Naga people as Vilie, meets and stays with different people. A stranger and a tired traveller, Vilie, is not just given food and shelter but, also a place in their homes without expectations. In the afternoon, when Vilie assumes it must be around two 'o'clock, he sees the women pluck nettle from the nettle forest and begin bark weaving - an art which is carried on from generations. From it bark cloth is made which is a rare art in today's times.

Throughout the novel Vilie is shown to be a protector of the forest and vice versa. The forest protected Vilie from wild animals, it provided food when he was hungry and shelter when he needed it. The mysteries of nature are always unknown even to those who live consider it God. Vile too, had to face various threats to his life even

though he had spent most of his life in the forest. The relationship of Vilie with the forest is thus, interlinked and mutual. He was thus called the ‘guardian of the forest’. (Kire, 2014)

Nature is a provider of remedy and provides cure for all diseases. The tribal people heavily depend on it for treatment. In one of the instances, Vilie was stung by the nettle plants. One of the women present there Idele, tried to find an antidote. She looked for the plant of ‘bitter wormwood’ and pulled off some leaves and squeezed them into a paste in her hand. After the paste was applied, Vilie kept rubbing it into his skin, it relieved the pain caused by the sting.

In the novel, ‘When the River Sleeps’, nature is almost shown like another character. It helps Vilie to conquer his fear. He decides to take shelter in the forest so that he could escape the people who were after him, even his aunts. They wanted him to get settled. But the calmness and peacefulness provided by the nature helps Vile to clear his mind and take the right decisions. The forest helps him to get rid of his fear of people and spirits too.

The African (Nigerian) writer, Chinua Achebe, was born in 1930, Ogidi, Nigeria and died on 21st March, 2013, in Boston. He belonged to the Igbo tribe. Through his novels Achebe, brought forth the imposition of customs by the Western (White) people on the natives, which led to disintegration on traditional values and customs of the African society. His novels portray the disruption caused in the lives of African natives, the Igbo tribe, when they first came in contact with the white man to the aftermath of education and colonization.

The traditional Igbo life and how it fights colonialism are portrayed in the novels *Things Fall Apart* (1958) and *Arrow of God* (1964). His other novels *No Longer at Ease* (1960), *A Man of the People* (1966), and *Anthills of the Savannah* (1987) also deal with various aspects of post colonialism in Africa. His part autobiographical novel, *Home and Exile* (2000) talks about the distortions created in African life by forceful implementation of western approaches. Chinua Achebe won the Man Booker Prize in 2007, however, in spite of being a pioneer in African literature and one of the most popular writers, Achebe never won the Nobel prize.

‘Things fall Apart’, Chinua Achebe’s first novel was published in the year 1958. The plot begins with Okonkwo who is troubled by the actions of his father Unoka, who was a spendthrift and had accumulated many village debts unsettled before he died. As a result, Okonkwo becomes a warrior leader, accumulates wealth and becomes a provider to his large family with various wives and children. His son Nwoye is twelve years old who is extremely lazy and Okonkwo worries about him. In one of the villages where Okonkwo wins a virgin and a fifteen-year-old boy named Ikemefuna, who starts living with him. Ikemefuna is an ideal son to Okonkwo, but he cannot consider Ikemefuna as his actual son. As the story progresses, we find Okonkwo banished from his village for seven years, as he accidentally kills a clansman. When he returns back to his village, he is now confronted with a new problem. He realises the entry of the white missionaries and colonial rule begins in the traditional and tribal Igbo society. This leads to the down fall of his village and also Okonkwo.

A typical African tribe learns to identify the changing seasons since a young age. Even in Achebe’s ‘Things Fall Apart’, we are shown how the Igbo tribe community recognizes the changing seasons, from summer to rainy. This knowledge of seasons helps the community in farming activities. They can plan the cultivation of Yam, the wealthiest crop of Igbo tribe. Okonkwo, the main protagonist, for example, learns to identify the different seasons with the help of knowledge gained from observing natural phenomena. This knowledge of the seasons helps him to become a successful yam farmer.

Even in ‘Things Fall Apart’, nature is projected as an abundant provider. It not only of provides food but also offers its healing ability. The ancient wisdom passed on by the elders of the Igbo tribe, about plants, leaves, grasses and trees, regarding their medicinal use is precious and helps the community in their everyday lives. It provides medicinal treatment. Okonkwo tries to heal Enzima, the daughter of his second wife, who was lying on the bed shivering by the fireside. Okonkwo’s daughter suffers from iba or fever. “It is iba,” said Okonkwo (Achebe, 1958) as he takes his machete and goes into the forest to collect ingredients that went into the making of iba, such as the leaves, grasses and barks of trees. Many a times, Okonkwo had used different parts of plants to prepare medicines for both the young and the old. A paste was prepared from the specific part of the plant and given to the patient by mixing it with water.

Animals too play an important part in the lives of the traditional African community. Goats are precious in many ways. Not just for meat and milk, their skin is also used to make bags to carry water and food items. Okonkwo had to pay a fine to Goddess Ani, of a she-goat when he beat and abused his wife during the ‘Week of Peace’, meant to honour the Earth goddess Ani.

The balance between nature and human life has to be well maintained. Nature had to be respected and conserved in every way. Unnecessary or misuse of forest resources can result in the ruin of mankind which depends on it as a provider and protector. In Achebe's, 'Things Fall Apart', Okonkwo get immensely upset when he finds his second wife Enzima had carelessly used banana leaves for packing things. This had withered the plant which angered Okonkwo. The dependency on plants and animals had to be finely balanced and was a way of life for the Igbo tribe.

Thus, living life in happiness and enjoying the benefits and loss that come with various seasons, the Igbo tribe in Chinua Achebe's 'Things Fall Apart' find harmony with nature.

Another important and recent branch in Ecocriticism is called Ecofeminism. This theory can be called as an extension of feminist theories too. It can be explained as the suppression of women and the oppression of nature and their interconnection. It has a intricate relation between woman and ecology (nature). Feminist writers such as Vandana Shiva, Ariel Shallah, Mary Mellor, have "generated nuanced readings of the relationship between gender and nature". (Nayar, 2009)

Nature is imagined as feminine as it reproduces and nurtures its offspring just as a woman. Ecofeminism arrives from the thought that both nature and women are abused or oppressed by males with their thoughts and actions, in a society. An important stand in Ecofeminism is that it brings back and focusses on older myths and religious beliefs that were adulated by people. This is because they believed that the pre-modern societies always treated nature with respect. All knowledge and wisdom were acquired from nature and so female form in any form such as female sexuality, female power, female bodies and female wisdom was all revered. This leads to the debate on introducing spiritual ecofeminism in ecofeminist texts. Goddess worship in Hinduism, presence of Celtic and Egyptian Goddess, Nature goddesses in native tribes of Africa and America also become part of Ecofeminism. Ecofeminist writers such as Vandana Shiva, Ynestra King and Noël Sturgeon have talked about the spiritual facet of ecofeminism in ancient cultures leading to a re-reading of canonical texts.

Chinua Achebe's 'Things fall Apart' is an excellent illustration of ecofeminism. In this novel woman are shown as a symbol of productivity, fertility, continuity and sustenance, just like nature. The prosperity, peace and the survival of the community depends upon women. The Earth Goddess Ani, who is responsible for fertility and growth of crops is highlighted throughout the novel. In her honour, a week was devoted which was called the Week of Peace. Any clan member who violated or abused women this week were severely punished. Okonkwo, for example, beats his wife in this week, and he is told by the seers to compensate his sin with paying fine of a She-goat, money and other things. One of the wives of Okonkwo, Ezinma, was not gifted with children for many years as she had run away from her first husband and had come to stay with Okonkwo. She always wanted to marry Okonkwo, but at the time of giving the bride prize, Okonkwo did not have enough money, so she had married the highest bidder. After two years with him she ran away from him and came to Okonkwo. For this act of adultery, she was punished by Goddess Ani. It was only after burying nine children that Goddess Ani gifted Ezinma with a child.

A woman is as protective as is nature. They provide the comfort and warmth that men seek. After Okonkwo was banished from his village for accidentally killing a person of his clan, he finds comfort and protection in the village of his mother Mbanta. It is here Okonkwo realizes the importance of women in his life.

Easterine Kire's 'When the River Sleeps' is also a study of ecofeminism. Ate, the younger sister with magical powers but cursed, plays the role of a protector to Vilie. Though Vilie is physically stronger, it is Ate's careful ways which help Vilie in facing the arduous return journey. It is the 'river' which plays a major role of a female in the novel. The 'river spirit' is the main female character. It provides Vilie with the much-needed protection by realizing his dream of finding the precious stone. Vilie is nurtured by the river through his dreams motivated to fulfil it. Many ardent men had tried to find the precious stone from the river's base but none of them had succeeded because they thought of the river as a possession which they abused in order to achieve their goal. However, Vilie was aware of this fact. His respect to the river as an entity, a goddess, a woman, a guiding spirit, allowed him to get the stone without much fear.

In the novel, we hear Vilie saying "forest is my wife" (Kire, 2014), though he may have used the word as a personification, but the feeling was quite real for him. When he had to leave the forest even for a few days, he used to feel lonely. He felt he was an "unfaithful spouse". (Kire, 2014) The forest provided him with a place to hide when he had to run away from people, it provided him with food when he was hungry and shelter during his journey.

CONCLUSION

Literature plays an important role in our lives by redirecting and guiding us. In our moments of crisis specially, when we are threatened, we take refuge in literature. Ecocritical writing guides human beings in being aware of the threats to nature. For decades ecological literature was ignored. Contemporary ecological issues, throughout, the world have made common men aware of the dangers of abusing and exploiting natural resources. And what a better way to highlight these issues, than the use of literature for it. Natural world is beautiful and literature provides a medium to be its protector. The literature of Easterine Kire and Chinua Achebe transport the message that nature and women are not to be abused and exploited. They are the sole source of our survival and existence. When we realize this, we will have created a place of ourselves in our environment, where each one of us can be in peace.

Nature is 'SHE', the protector, the provider and the personification in literature.

Ecocriticism is a contemporary theory and many new approaches are yet to be explored. Canonical works that are popular can be used to highlight the environmental concerns. Spiritual Ecofeminism, a strand of ecofeminism has to be studied in greater detail. Not just Indian literature, but African and European literature too has texts which can be re-read with spiritual ecofeminism. Nature should be interwoven in every work of literature and till then there will always be some way to improvise it.

REFERENCES

1. Achebe, C. (1958). 'Things Fall Apart'. (ed. 1st). William Heinemann Ltd. Nigeria
2. Nayar, P.K. (2009). 'Contemporary Literary and Cultural Theory'. (ed. 1st). Pearson. Delhi.
3. Kire, E. (2014). 'When the River Sleeps'. (ed. 1st). Zubaan Books. Delhi.
4. Editors of Encyclopaedia Britannica, viewed 2nd May 2022, < [https:// www.britannica.com/ biography/ Chinua-Achebe](https://www.britannica.com/biography/Chinua-Achebe)>
5. Barbican Press, viewed 2nd May 2022, < <https://barbicanpress.com/contributor/easterine-kire/>>
6. Encyclopaedia Britannica, Kirk-Greene, Anthony Hamilton Millard, Falola, Toyin O, Ajayi, J.F. Ade and Udo, Reuben Kenrick, viewed 3rd May 2022, <<https://www.britannica.com/place/Nigeria>>

Pathophysiological Changes in Cord Blood and Placenta in Anaemic and Hypertensive Pregnant Women

Shahina Khan¹, Yogesh Tripathi², Rinku Garg³, Dolly Rastogi⁴ and Yogesh Kumar Yadav⁵

^{1,3}Department of Physiology, Santosh Medical College, Ghaziabad, India

²Department of Physiology, Sharda Medical College, Greater Noida, India

⁴Department of Physiology, GSVM Medical College, Kanpur, India

⁵Department of Pathology, Rajarshi Dashrath Autonomous State Medical College, Ayodhya, India

ABSTRACT

Background- Pregnancy is one of life's most exciting and fulfilling adventures. A healthy mother and a healthy baby is the goal for every pregnancy¹⁵. Ongoing researches in this field aim to develop many successful maternal and infant health care programmes.

Objective: A comparative study of pathophysiological changes in cord blood and placenta among anaemic, hypertensive and normal pregnant women.

Method: The present study was conducted in the department of Physiology in collaboration with the department of Obstetrics and Gynaecology and department of Pathology, Govt. Medical College, Kannauj. Permission from the institutional Ethics Committee has taken. Sample size included 150 third trimester pregnant women of 20-40 yrs. Group I (normal group) included subjects (n=50) with haemoglobin concentration more than 11gm/dl and normal Blood Pressure- Systolic range 100-139mmHg, Diastolic 60-89mmHg). Group II (anaemic group) included subjects (n=50) with haemoglobin concentration less than 11gm/dl and normal Blood Pressure- Systolic range 100-139mmHg, Diastolic 60-89mmHg). Group III (hypertensive group) included subjects (n=50) with haemoglobin concentration more than 11gm/dl and Blood Pressure- $\geq 140/90$ mmHg). Haematological parameters (haemoglobin concentration, total RBC count, Blood Indices, total platelets count, total WBC count, differential leucocyte count in cord blood) and gross changes in placental morphology like weight, shape, thickness, surface area, no of cotyledons) and histopathological changes like syncytial knot formation, syncytial trophoblastic proliferation, hyalinised villi, fibrinoid necrosis, calcification in placenta were studied.

Results: Total RBC count was observed lower in anaemic group (Group II) mothers' cord blood. Absolute neutrophil count (ANC), absolute lymphocyte count (ALC), platelets count were found significantly lower in hypertensive group (Group III) mother's cord blood. The weight of newborned baby was found lower in hypertensive group (Group III). The heavier placenta were found in anaemic group (Group II) as compared to other groups. The thickness and surface area were measured more in anaemic group (Group II). Mean number of cotyledons, calcified areas, perivillous fibrin deposition, intervillous space, hypovascular villi, syncytial knot formation, fibrinoid necrosis, hyalinised villi were observed more in anaemic group (Group II).

Conclusion: Increased blood pressure and decreased amount of haemoglobin in pregnancy influence haematological changes in cord blood and morphology of placenta, which in turn can affect the perinatal outcome and mother's health.

Keywords: Anaemia, Hypertension, Placenta, Cord blood, Third Trimester

INTRODUCTION

Pregnancy is one of the major physical, psychological as well as a social moment in every woman's life¹⁸. Women's health is more central to the survival of the society as they give beginning to the new life and cares for the family¹⁹. In developing countries, underprivileged people have often limited medical facilities and preventive measures which may increase their risk of becoming anaemic, hypertensive and contributing to high maternal mortality². Anaemia in pregnancy is common, but severe anaemia in pregnancy may have more effects on pregnancy, delivery and neonates. Anaemia is a nutritional deficiency disorder and 56% of women living in developing countries are anaemic (World Health Organisation)¹. In India, anemia affects about fifty percent of the population. A key component of Safe Motherhood is the treatment of anemia during pregnancy¹¹. Prevalence of anaemia in South Asian countries is highest and India has the highest prevalence of anaemia (87%)². In our country there is mainly iron deficiency anemia although in children and pregnant women folate deficiency also plays a role¹². There are multiple causes of anemia during pregnancy, including inadequate diet, impaired micronutrient absorption, blood loss resulting from hemorrhage, and worm infestation²⁰. Umbilical cord is the main link and vital attachment between mother and fetal¹³. Patients with anemia are being treated in the short term with haematinics and transfusions with relief of symptoms¹⁴.

Due to anaemia fetus are at high risk of preterm deliveries, low birth weight due to less oxygen delivery to placenta and fetus⁶.

Hypertension is an universal problem and it affects at least 10% of all the pregnancies¹⁷. Gestational hypertension is defined as increased blood pressure which presents after 20 weeks of pregnancy without any significant proteinuria, this diagnosis is made in women whose blood pressures reach 140/90 mmHg or greater for the first time after 20 weeks of gestation, but proteinuria is not identified⁵.

Many complications, related to pregnancy induced hypertension occur either due to maternal negligence or unawareness on the disease and its management¹⁶. The classification for hypertension describes as first gestational hypertension, second Pre-eclampsia and eclampsia syndrome, third chronic hypertension of any etiology and fourth Preeclampsia or chronic hypertension⁵.

Depending on severity, maternal anaemia and hypertension can significantly influence morphometric and histological characteristics of placental tissue, pregnancy course and outcome of fetus³. So, in this study we tried to study the haematological parameters in maternal and cord blood along with morphological and histological changes in placenta of anaemic and hypertensive mothers, which may affect the status of the mothers and their foetus. So that an early diagnosis of anemia and hypertension during pregnancy may allow prompt treatment and facilitate proper planning to improve quality of life in mothers and their newborns.

MATERIALS AND METHODS-

This research was conducted in the department of Physiology in collaboration with the department of Obstetrics and Gynaecology and department of Pathology, Govt. Medical College, Kannauj after Institutional Ethics Committee approval.

INCLUSION AND EXCLUSION CRITERIA

Inclusion

- Pregnant women aged 20-40 years.
- Pregnant women in third trimester from the outpatient department (OPD), labour room or operation theatre.
- Non-smokers, non-alcoholic, non-diabetic mothers having perfect sense of physical, mental and psychological well being.
- Pregnant women with normal haemoglobin concentration (>11gm/dl) and normal Blood Pressure- Systolic range 100-139mmHg, Diastolic 60-89mmHg) were included in group I and haemoglobin concentration (<11gm/dl) and normal Blood Pressure- Systolic range 100-139mmHg, Diastolic 60-89mmHg)were included in group II and with haemoglobin concentration more than 11gm/dl and Blood Pressure->=140/90mmHg were included in Group III.

Exclusion Criteria

- Elderly women aged more than forty years.
- Pregnant women in 1st and 2nd trimester.
- Pregnant women with any disease like coronary artery disease/ischemic heart disease or congenital heart disease.
- Subjects having any history of neurological disorder, diabetes, with features of hypo- or hyperthyroidism.
- Patients on any drug therapy were excluded.

Sample size included in the study was 150 pregnant women aged 20-40 years.

The subjects that satisfied the inclusion and exclusion criteria were divided into:

1. **Group I**-Normal healthy group I (n=50)
2. **Group II**-Anaemic group II (n=50)
3. **Group III**- Hypertensive group (n=50)

Eligible participants were recruited and the desirable data of the mothers (age, chronic disease, drug usage, parity, blood group, gestational week, history of past illness, history of previous childbirth, problems during pregnancy, mode of delivery, birth weight of the newborn, gender, maturity of the newborn were recorded).

Apgar scores at the first and fifth minutes were noted. The blood samples of mother and her cord blood were collected and sent to pathology lab for investigations. Placentas with cord and membrane were collected from labour room, operation theatre after delivery for gross and histopathological studies and sent to pathology lab.

Statistical Analysis

The data was collected (Basal parameters, SBP, DBP, haematological parameters and Placental morphology and histopathology in all three groups) & entered in MS Excel 2016 and analyzed with PASW statistics software (version 20.0; SPSS Inc., Chicago, IL). One-way ANOVA (analysis of variance) was applied to make a comparison among the groups and hypothesis was tested at the level of signification $\alpha = 0.05$, i.e. differences between samples was considered as significant if $p < 0.05$.

Observations and Results

In this study, the weight of newborned baby was observed significantly higher in anaemic group (3364 ± 347). Absolute neutrophil count (1998.2 ± 280.4), Absolute lymphocyte count (1232.6 ± 160.0) and platelets count (1.1 ± 0.1) were significantly found lower in hypertensive mother's cord blood investigations as compared to other two groups. In anaemic group, the significant higher thickness (3.82 ± 0.35) and surface area (566.89 ± 81.36) of placenta were noted. The more mean number of cotyledons (28.04 ± 2.39) were observed in anaemic group. Calcified areas (27.18 ± 2.14), perivillous fibrin deposition (9.92 ± 1.36), intervillous space (10.24 ± 1.39), hypovascular villi (11.48 ± 0.97) were seen significantly more in anaemic group as compared to other two groups.

Table 1- Birth weight values in Group I, Group II, and Group III

Parameter	Group I Normal mothers	Group II Anaemic mothers	Group III Hypertensive mothers
Birth weight (gm)	3175 \pm 210	3364 \pm 347**	2408 \pm 413

Values are expressed as mean \pm SD

= $p < 0.01$ (= Group II versus Group I, Group II Versus Group III, Group III Versus Group I)

Table 2- Hb, Total RBC count, MCV, MCH, MCHC values in Group I, Group II and Group III (Cord blood)

Parameter	Group I Normal mothers	Group II Anaemic mothers	Group III Hypertensive mothers	P value
Hb (gm%)	12.6 \pm 0.4	8 \pm 1.4**	13 \pm 0.4	0.004 ^S
Total RBC count (million/mm ³)	4.0 \pm 0.3	3.4 \pm 0.6**	4.0 \pm 0.2	0.003 ^S
Haematocrit (%)	37.1 \pm 1.6	36.4 \pm 1.2	35.9 \pm 0.9	0.21 ^{NS}
MCV (fl)	97.1 \pm 6.6	96.2 \pm 5.5	97.3 \pm 5.3	0.24 ^{NS}
MCH (pg)	29.2 \pm 2.3	30.0 \pm 1.0	30.1 \pm 2.4	0.25 ^{NS}
MCHC (%)	33.1 \pm 1.9	32.9 \pm 3.4	33.1 \pm 1.3	0.20 ^{NS}

Values are expressed as mean \pm SD

S= significant versus Group I $p < 0.05$

NS= Not significant versus Group I $p > 0.05$

= $p < 0.01$ (= Group II versus Group I, Group II Versus Group III, Group III Versus Group I)

Table 3: Total WBC Count, Absolute Neutrophil Count, Absolute Lymphocyte Count and Platelet Count values in Group I, Group II and Group III (Cord Blood)

Parameter	Group I Normal mothers	Group II Anaemic mothers	Group III Hypertensive mothers	P value
Total WBC count (thousands/ mm ³)	7156.3 \pm 1127.5	6930.9 \pm 1232.0	6653.3 \pm 863.9	0.34 ^{NS}
ANC (thousands/ mm ³)	4421.0 \pm 710.0	4429.0 \pm 486.0	1998.2 \pm 280.4**	0.003 ^S
ALC (thousands/ mm ³)	2830.6 \pm 500.0	2955.6 \pm 502.0	1232.6 \pm 160.0**	0.001 ^S
Platelets count (lacs/cc)	3.0 \pm 0.3	3.1 \pm 0.5	1.1 \pm 0.1**	0.002 ^S

Values are expressed as mean \pm SD

S= significant versus Group I $p < 0.05$

NS= Not significant versus Group I $p > 0.05$

= $p < 0.01$ (= Group II Vs Group I, Group II Vs Group III, Group III Vs Group I)

Table 4- Morphometric finding of the placenta in Group I, Group II and Group III

Parameter	Group I Normal mothers	Group II Anaemic mothers	Group III Hypertensive mothers
Thickness(cm)	2.60±0.37	3.82±0.35**	2.25±0.60
Surface area(cm ²)	225.40±32.04	566.89±81.36**	91.35±19.12
Mean no of cotyledons per placenta	16.6±1.66	28.04±2.39**	10.94±1.87

Variables are expressed as mean ± SD

= $p < 0.01$ (= Group II versus Group I, Group II versus Group III, Group III versus Group I)

Table 5: Microscopic findings of the placenta in Group I, Group II and Group III

Parameter	Group I Normal mothers	Group II Anaemic mothers	Group III Hypertensive mothers
Mean no of areas of Perivillous fibrin deposition per lpf	1.31±1.18	9.92±1.36**	4.68±2.0
Mean no of areas of intervillous space per lpf	5.25±1.15	10.24±1.39**	6.9±3.03
Mean no of areas of Hypovascular villi per lpf	3.62±1.09	11.48±0.97**	6.94±1.20

Values are Expressed as Mean ± Sd

= $p < 0.01$ (= Group II versus Group I, Group II versus Group III, Group III Versus Group I)

Figure 1 shows that in normal mothers mean number of calcified areas in placenta per lpf were seen as 8.4 ± 1.07 , mean number of calcified areas in placenta per lpf were seen as 27.18 ± 2.14 in anaemic mothers, as 16.36 ± 2.52 in hypertensive mothers. So, the mean number of calcified areas in placenta per lpf were seen significantly higher in anaemic group (**= $p < 0.01$).

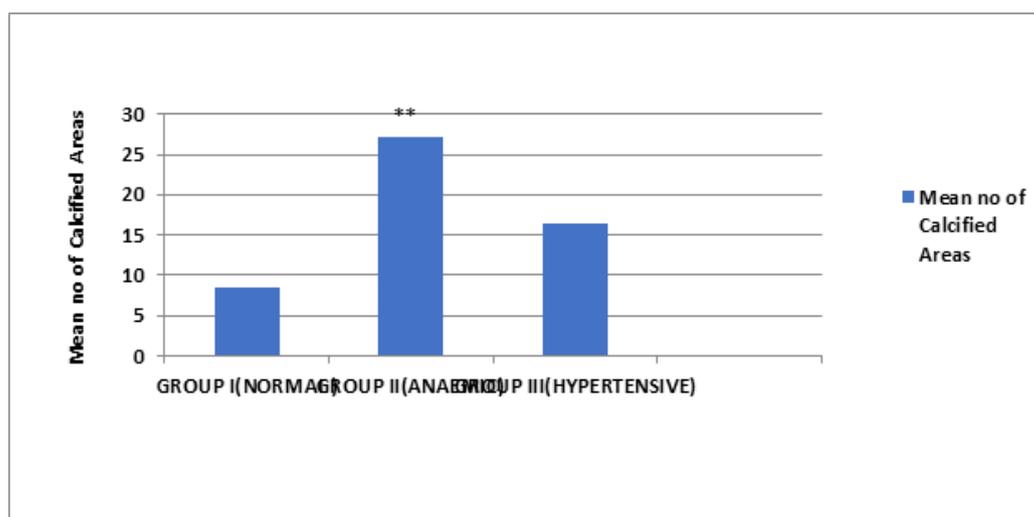


Fig.1: Comparison of mean number of Calcified areas per placenta in Group I, Group II, and Group III

Values are expressed as mean ± SD

= $p < 0.01$ (= Group II Versus Group I, Group III Versus Group I, Group II Versus Group III)

Group I= Normal mothers

Group II= Anaemic mothers

Group III= Hypertensive mothers

DISCUSSION

As placental growth and functions are precisely regulated and coordinated to ensure the exchange of nutrients and waste products between maternal and fetal circulatory system and it shares same stress and strain to which the fetus is exposed. Thus, any disease affecting mother and fetus also has great impact on placenta.

Some previous studies suggested that neonatal haematological parameters are influenced by genetic, socio-economic status as well as various environmental factors experienced by the pregnant mother during her pregnancy. In this study, the changes which were observed, supposed to be due to anaemia in female during pregnancy which leads to maternal hypoxia and might produces changes on the maternal circulatory system and affects both mother and fetus. Some studies explained that maternal anaemia represents an independent risk factor for abnormal placental growth and its morphology. It has been reported that hypoxia can cause changes in placental weight, diameter, thickness and surface area Placental anomalies therefore can be an early warning signs about fetal problem. It can be said that the haematological parameters are easy to perform and when properly interpreted along with their normal range and cut off values, as done in this study, it can aid in early recognition of type of anaemia during pregnancy and a combination of different other parameters can improve their usefulness⁵. Neutropenia and lymphocytopenia suggest that there may be some uteroplacental failure due to hypoxia. This study is in support with Koenig and Christensen, who also found neutropenia in his study. He suggested that decrease in neutrophil count may be caused by a decrease in growth factors which increases neutrophil production, decrease in response of progenitor cells to growth factors and presence of inhibitor substance which inhibit neutrophil production⁸. Their investigations showed that the activity of colony stimulating factor may be decreased in the placenta of hypertensive mothers and they found an inhibitor substance for inhibiting neutrophil production in the placenta⁸.

Thrombocytopenia in pregnancy induced hypertension is mostly caused due to increase consumption of platelet which may be caused due to adherence of platelet at the site of damaged vascular endothelium⁸. So, hypertensive disorders of pregnancy (HDP) represent greatest danger for the fetus due to compromised uteroplacental circulation and unfavourable uterine environment for the fetus as a result of marked imbalance in maternal homeostasis and pathophysiological changes in placenta⁷.

CONCLUSION

The possible explanation for increased weight, diameter, surface area of placenta is that the maternal anemia results in fetal hypoxemia and stimulates placental growth.

Increased fibrosis and formation of Syncytial knots indicates ischemic response under hypoxic condition like maternal anemia or functional inactivity.

As this study is conducted only in one tertiary care hospital and that too with a limited number of patients and also, the study only included the patients attending hospital for delivery so the results cannot be generalized as it might not be a true reflection of the general population. However the data and results presented could actually represent the population of a particular area. So, further studies are to be conducted in the field to achieve complete results.

Moreover, for better findings further morphometric placental studies with larger samples are needed to support the present study. Studies with larger sample and best techniques are needed to find out the molecular basis of such causation in cord blood and placenta.

REFERENCES

1. Biswas Sharmistha, Meyur Rudra dev, Adhikari Anjan, Bose Koushik, Kundu Panchanan. Placental changes associated with maternal anaemia. *Eur. J. Anat.* 2014; 18(3):165-169.
2. Dhabhai Pooja, Gupta Ghanshyam, Bapna Neelam. Histological study of human placenta in normal and pregnancy induced hypertension cases. *International Journal of Pharmaceutical Science Invention* 2013; 2(1):30-35.
3. Qaisar Danish hasan, Sandila Mohammad Perwaiz, Omair Aamir, Ghulam Moinuddin Ghori. Correlation of Routine Haematological Parameters between Normal maternal Blood and the Cord Blood of Healthy Newborns in Selected Hospitals of Karachi. *Journal of the college of Physicians and Surgeons Pakistan* 2013; 23(2):128-131.
4. Shah R Amar, Patel Neha, Shah Menka. Hematological parameters in anaemic pregnant women attending the antenatal clinic of rural teaching hospital. *Innovative journal of medical and health science* 2012;2(5):70-73.

5. Mohammed Al-Bahadily AJ, Mohammed Al-Omrani AA, Mohammed M. The effect of pregnancy induced hypertension on complete blood count of newborn. *International Journal of Pediatrics* 2017; 5(9):5667-76.
6. Panchal Bhavika, Parmar Jigna, Mehta CD. Morphological study of placental changes in anemia with its clinical significant. *International Journal of Medical Science and Public Health* 2016;5(2):2588-2591.
7. RL Naeye, EA Friedman. Causes of perinatal death associated with gestational hypertension and proteinuria. *Am J Obstet Gynecol* 1979; 133: 8-10.
8. Dhakre Ruchika, Nandmer Kaur Gurpreet, Sapkal Rekha. Correlation of platelet indices with severity of pre-eclampsia. *International journal of reproduction, contraception, obstetrics and gynecology* 2018;7(4):1416-1420.
9. Ranga Siva Sree, Thangam Adaline, Mallika Vasantha, Indira M.V.. Morphological and Histological variations of human placenta in hypertensive disorders of pregnancy. *International journal of anatomy and Research* 2017;5(1):3591-98.
10. Singnarpi Evalyn, Bhattacharjee Debanjan, Baidya Jahar Lal. Study of changes in Haemoglobin and Leukocytes count in cord blood of newborns of Hypertensive mothers in AGMC and GB Pant Hospital. *JEMDS* 2014; 3(63):13905-13912.
11. Chinchpure Supriya. A comparative study to assess relationship of placental weight in normal pregnant women and in anemic pregnant women in selected hospital of Pune city. *Asian journal of Nursing education and research* 2014; 4(3):307-313.
12. Kannammal N. Nutritional anaemia. *Asian journal of Nursing education and research* 2012; 2(1):37-39.
13. Sahoo Ritanjali, Rana Laxmi. Pregnant women's knowledge and attitude about stem cells and cord blood banking. *Asian journal of Nursing education and research* 2020; 10(4):452-456.
14. Dubey Brijesh, Prashar Deepak, Chand Subash. Anaemia- An issue of national health concern. *Asian J. Res. Pharm. Sci.* 2013; 3(2):66-67.
15. Komathi V. Effectiveness of guided imagery on level of blood pressure among PIH mothers in selected hospital at Trichy. *International journal of Advances in Nursing management* 2015; 3(3):245-252.
16. Prathima P, Anuchitra S. Compliance on antenatal care advices among antenatal mothers with pregnancy induced hypertension in selected hospital Bangalore. *International journal of Advances in Nursing management* 2014; 2(4):196-199.
17. Dandagi Shweta, Dandagi Shivarajkumar. A study to assess the knowledge of III year GNM students regarding management of pregnancy induced hypertension in selected college of Belgaum Karnataka. *International journal of Advances in nursing management* 2015; 3(3):190-196.
18. Raina Roopal Menezes, Sandhya D' Almeida. A study to assess childbirth related fear and associated factors among third trimester primigravida mothers visiting antenatal clinic in a selected hospital of Mangalore. *International journal of Advances in nursing management* 2014; 2(3):199-205.
19. Sudarsi mariya Gabriel, Vasundhara Rayapu, Miryani Jonnalagadda. A study to assess the knowledge of antenatal women with regard to anaemia in pregnancy in selected hospital at Guntur district, Andhra Pradesh. *International journal of Advances in Nursing management* 2018; 6(3):321-324.
20. Patil Ashwini, Biradar Sateesh. Iron deficiency anaemia and its prevention among primi antenatal mothers. *International journal of Advances in nursing management* 2019; 7(3):333-336.

Sonicated Assisted Synthesis of 2-Aryl Benzimidazoles and 2-Aryl Benzoxazoles by Using Ammonium Copper Sulphate as A Catalyst in Aqueous Media

Anil Solunke*, Mahesh More, Sandip Agre and Tanuja Kadre

Department of Chemistry, Dr. A.P.J. Abdul Kalam University, Indore (M.P)- 452016, India

ABSTRACT

Ammonium copper sulphate was found as a new and an efficient catalyst for synthesis of 2-aryl benzimidazoles and 2-aryl benzoxazoles in aqueous media under sonication irradiation. The present procedure offers advantages such as eco-friendly, short reaction time, good yield, clean reaction, green solvent and simple workup.

Keywords: Benzimidazole, benzoxazole, ammonium copper sulphate, aqueous media, sonication.

1. INTRODUCTION

Aromatic five membered heterocyclic ring containing a C=N bond, such as benzimidazole and benzoxazole are important in pharmaceutical, agrochemical and natural product [1, 2]. These compound have found application such as antiperkinson [3], antimicrobial [4], anticancer [5], antifungal [6], antibiotics [7], antiviral [8] properties. These benzazoles can be prepared by techniques such as condensation of ortho esters [9-11], aldehyde [12,13], carboxylic acid [14], acid chloride [15], nitriles [16], amides [17] and esters [18] with ortho substituted amino aromatics in presence of different acid catalyst such as pd catalyzed oxidative cyclization [19], different heteropolyacid catalyst [20], FeCl₃.6H₂O [21], ZrCl₄ [22], Sc(OTf)₃ [23], Pb(OAc)₄ [24], In(OTf)₃ [25] and etc. Reported these methods are multistep synthesis, use of hazardous reagent and solvent, long reaction time, lower yield and in case of metal containing reaction, polishing with metal scavengers is often required in order to remove metal from the reaction mixture. Therefore strong demand for simple, more effective and environmentally friendly process for synthesis of these heterocycles.

The volatile and toxic natures of many organic solvents have exposed various serious problems of human being and environment. Due to this serious issue, organic reaction in water media have attracted much attention in synthetic organic chemistry, because H₂O is one of the most cheap, abundant and eco-friendly solvent, however there are very limited reaction reports for synthesis of benzazoles in aqueous media.

Ultrasound irradiation has been an important technique in synthetic organic chemistry. In most of organic reaction it has been used as an efficient energy source. Simple experimental procedure, easy operation, very high yields, clean reaction and increased selectivity of many ultrasound induced organic reaction transformations offers additional benefit in the field of synthetic organic chemistry [26-29]. These all finding were promoted us to investigate the synthesis of benzimidazoles and benzoxazoles in aqueous media.

2. EXPERIMENTAL

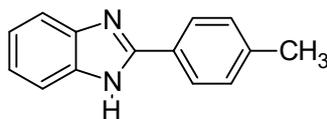
All reagents were purchased from merck and commercial vendor and used without further purification. The reaction was monitored by TLC using 0.2 mm Merck silica gel 60 F254 pre-coated plates, which were visualized with UV light. Melting points were measured on an Lab-India MR.Vis⁺ apparatus. The ¹H-NMR spectra were determined 500 MHz instrument using TMS as the internal standard. PCI analytics (30 kHz) ultrasonic bath was used for ultrasonic irradiation.

2.1 General Procedure of Preparation of 2-Aryl Benzimidazoles.

Mixture of o-phenylenediamine (1 mmol) and aromatic aldehyde (1.05 mmol) in water (10 ml) at room temperature was added ammonium copper sulphate (10 mol %) added in 25ml single neck round bottom flask. The reaction mixture was sonicated at room temperature (26-30°C) for the appropriate time given in table-1 (entries 1 to 7). The reaction progress was monitored by TLC. After completion of reaction, reaction mass was extracted with ethyl acetate (2 x 5ml). The combined organic layer dried over anhydrous sodium sulphate and evaporated on under vacuum; crude material was purified by column chromatography (Eluted with 2:8 ethyl acetate: n-hexane) to afford pure product. All of Isolated compounds were identified by comparing their melting point with literature reported melting points (table -1, entries 1 to 7) and some of compounds also characterized by ¹H NMR which is described below.

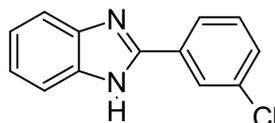
Selected Spectral Data

2-(4-methylphenyl)-1H-benzimidazole:



(Entry-6 in table-1): ¹H NMR(500MHz, DMSO-d₆, ppm, δ) 12.83 (s, 1H, NH), 8.08 (d, 2H, J=8.4Hz, ArH), 7.58 (s, 2H, ArH), 7.37 (d, 2H, J=7.8Hz, ArH), 7.20 (dd, 2H, ArH), 2.39 (s, 3H, CH₃). MP: 276-277°C

2-(3-chlorophenyl)-1H-benzimidazole:



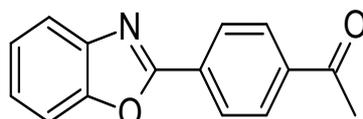
(Entry-7 in table-1): ¹H NMR(500MHz, DMSO-d₆, ppm, δ) 13.05 (s, 1H, NH) 8.24 (s, 1H, ArH), 8.16-8.15 (m, 1H, ArH), 7.61-7.56 (m, 4H, ArH), 7.24 (s, 2H, ArH). MP: 233-234°C.

2.2 General Procedure of Preparation of 2-Aryl Benzoxazoles.

Mixture of o-aminophenol (1 mmol) and aromatic aldehyde (1.05 mmol) in water (10 ml) at room temperature was added ammonium copper sulphate (10 mol %) added in 25ml single neck round bottom flask. The reaction mixture was sonicated at room temperature (26-30°C) for the appropriate time given in table-1 (entries 8 to 14). The reaction progress was monitored by TLC. After completion of reaction, reaction mass was extracted with ethyl acetate (2 x 5ml). The combined organic layer dried over anhydrous sodium sulphate and evaporated on under vacuum; crude material was purified by column chromatography (Eluted with 2:8 ethyl acetate: n-hexane) to afford pure product. All of Isolated compounds were identified by comparing their melting point with literature reported melting points (table -1, entries 8 to 14) and some of compounds also characterized by ¹H NMR which is described below.

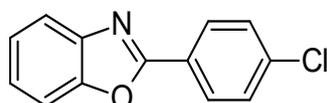
Selected Spectral Data

2-(4-acetylphenyl) benzoxazole



(Entry-10 in table-1): ¹H NMR (500MHz CDCl₃, δ, ppm) 8.36(d, J=8.5Hz, 2H, ArH), 8.10 (d, J=8.5Hz, 2H, ArH), 7.82-7.81(m, 1H, ArH), 7.63-7.61 (m, 1H, ArH), 7.42-7.37(m, 2H, ArH), 2.67(s, 3H, CH₃). MP: 213-214°C

2-(4-chlorophenyl) benzoxazole:

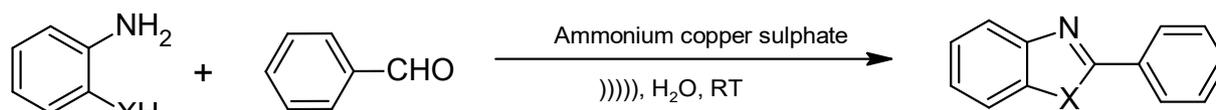


(Entry-11 in table-1): ¹H NMR (500MHz CDCl₃, δ, ppm) 8.19 (d, J=8.5Hz, 2H, ArH), 7.78-7.76(m, 1H, ArH), 7.58-7.57(m, 1H, ArH), 7.50 (d, J=8.5Hz, 2H, ArH), 7.37-7.35 (m, 2H, ArH). MP: 148-149°C

3. RESULT AND DISCUSSION

In this article, we report a new, simple and eco-friendly procedure for the one-pot synthesis of 2-aryl benzimidazoles and 2-aryl benzoxazoles by using ammonium copper sulphate as a catalyst in aqueous media (scheme-1).

First we conducted the reaction between o-phenylenediamine and p-anisaldehyde in present mentioned catalyst in water as solvent at different temperature and time to get 2-aryl benzimidazole but yield are very less (table-2, entry-8 to 10). With the aim increase of yield and reduce of reaction time cycle and temperature, we move to non-conventional energy source i.e. ultrasound energy, so we carried the reaction under ultrasound, to afford the corresponding benzimidazole with higher yield (table-2, entry-12) in much shorter time at room temperature.



X= NH, O

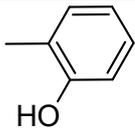
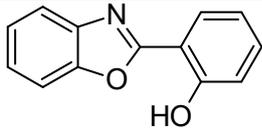
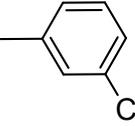
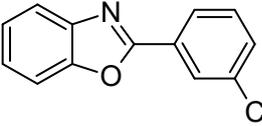
X= NH (entry 1-7)
X= O (entry 8-14)

Scheme-1: synthesis of 2-substituted benzazoles.

As a result of our experiments was found that different aldehyde containing both electron donating and electron withdrawing substituents. Aldehydes are reacted with o-phenylenediamine well to give the corresponding 2-aryl benzimidazoles in good yield (table-1, entry 1 to 7) similarly reacted with o-aminophenol to give corresponding 2-aryl benzoxazoles (table-1, entry 8 to 14). The all details results are summarized in Table-1.

Table 1: Reaction of o-phenylenediamine or o-aminophenol with various aromatic aldehydes.

Entry	Ar-CHO	X	Product	Time (min)	Yield % ^a	Melting point °C	
						Observed	Reported
1		N		120	86	289-291	292
2		N		90	91	227-228	226
3		N		75	93	276-278	279
4		N		90	92	292-294	294
5		N		90	89	313-315	316
6		N		70	91	276-277	277-278
7		N		105	89	233-234	234
8		O		120	87	100-101	101-102
9		O		105	91	97-98	98
10		O		95	87	113-114	112-114
11		O		90	91	148-149	150
12		O		75	90	171-173	170-172

13		O		120	80	121-122	122-124
14		O		105	82	122-124	124-125

^a Isolated yield.

In order to survey the effect of the solvents on the preparation of benzimidazoles and benzoxazoles, the reaction was carried out in various solvents (Table -2). It is observed that the excellent results were obtained in water as a solvent at room temperature using ammonium copper sulphate as catalyst.

Table 2: Effect of solvents on the reaction of *o*-phenylenediamine and anisaldehyde.

Entry	Solvent	Catalyst (mol %)	Temp °C	Time (min)	Yield ^a %
1	CHCl ₃	10	RT*	90	Trace
2	DMSO	10	RT*	90	50
3	DMF	10	RT*	90	53
4	Ethanol	10	RT*	90	44
5	CH ₃ CN	10	RT*	90	47
6	1,4-Dioxane	10	RT*	90	46
7	2-Me THF	10	RT*	90	44
8	H ₂ O	10	RT	6hrs	Trace
9	H ₂ O	10	50	6hrs	38
10	H ₂ O	10	80	6hrs	54
11	H ₂ O	5	RT*	90	75
12	H ₂ O	10	RT*	90	91
13	H ₂ O	15	RT*	90	91

^a Isolated yield.

*Under ultra-sonication

4. CONCLUSION

Ammonium copper Sulphate as a catalyst provides cheap, safe and environment friendly procedure to the synthesis of 2-aryl substituted benzimidazole and benzoxazole derivatives from various aromatic aldehydes with *o*-phenylenediamine and *o*-aminophenol respectively. The advantages offered by this method are cheap, non-toxic easily available and safe catalyst as well as easy operation, short reaction time, green solvent and good yield of product compare to earlier provided method. Here we used efficient energy source in reaction that is ultrasound irradiation which is also green technique.

5. ACKNOWLEDGMENT

The author thanks the department of chemistry and colleague student, Dr. A.P.J. Abdul Kalam University, Indore. for their constant encouragement and support for this work.

6. REFERENCE

1. M. L. McKee, S. M. Kerwin, *Bioorg. Med. Chem.* 16, 2, 1775, 2008.
2. C. G. Mortimer, G. Wells, J. P. Crochard, E. L. Stone, T. D. Bradshaw, M. F. G. Stevens, A. D. Westwell, *J. Med. Chem.* 49, 179, 2006.
3. A. Benazzou, T. Boraund, P. Dubedat, J.M. Boireau, C. Stutzmann, *Eur. J. Pharmacol.* 284 299–307, 1995.
4. O. I. Yildiz, I. Yalcin, E. Aki-Sener, N. Ucarturk, *Eur. J. Med. Chem.* 39, 291–298, 2004.
5. D. Kumar, M.R. Jacob, M.B. Reynolds, S.M. Kerwin, *Bioorg. Med. Chem.* 10, 3997–4004, 2002.
6. M. J. Yamato, *Pharm. Soc. Jpn.* 112, 81–99, 1992.
7. D. A. Evans, C. E. Sacks, W. A. Kleschick, T. R. Taber, *J. Am. Chem. Soc.* 101, 6789–6791, 1979.

8. X. Song, B. S. Vig, P. L. Lorenzi, et al, *J. Med. Chem.* 48, 1274–1277, 2005.
9. D. Villemin, M. Hammadi, B. Martin, *Synth. Commun.* 26, 2895–2899, 1996.
10. M. Doise, F. Dennin, D. Blondeau, H. Sliwa, *Tetrahedron Lett.* 31, 1155–1156, 1990.
11. G. L. Jenkins, A. M. Knevel, C. S. Davis, *J. Org. Chem.* 26, 274–276, 1961.
12. P. Salehi, M. Dabiri, M. A. Zolfigol, S. Otokesh, M. Baghbanzadeh, *Tetrahedron Lett.* 47 2557–2560, 2006.
13. M. Mohammadi, G. R. Bardajee, N. N. Pesyan, *RSC Adv.* 4, 62888–62894, 2014.
14. Y. H. So, J. P. Heeschen, *J. Org. Chem.* 62, 3552–3561, 1997.
15. R. N. Nadaf, S. A. Siddiqui, T. Daniel, R. J. Lahoti, K. V. Srinivasan, *J. Mol. Catal, A: Chem.* 214, 155–159, 2004.
16. D. W. Hein, R. J. Alheim, J. J. Leavitt, *J. Am. Chem. Soc.* 79, 427–429, 1957.
17. M. Terashima, M. A. Ishii, *Synthesis* 6, 484–485, 1982.
18. A. K. Chakraborti, S. Rudrawar, G. Kaur, L. Sharma, *Synlett* 9, 1533–1536, 2004.
19. Y. Pang, W. Hua, *Tetrahedron Lett.* 50, 6680–6683, 2009.
20. M. M. Heravi, S. Sadjadi, H. A. Oskoose, R. H. Shoar, *Catal. Commun.* 9, 504–507, 2008.
21. M. P. Singh, S. Sasmal, W. Lu, M. N. Chatterjee, *Synthesis* 1380, 2000.
22. Z. H. Zhang, L. Yin, Y. M. Wang, *Catal. Commun.* 8, 1126, 2007.
23. (a) T. Itoh, K. Nagata, H. Ishikawa, A. Ohsawa, *Heterocycles* 63, 2769, 2004; (b) K. Nagata, T. Itoh, A. Ohsawa, *Heterocycles* 61, 93, 2003.
24. F. F. Stephens, J. D. Bower, *J. Chem. Soc.* 2971, 1949.
25. R. Trivedi, S. K. De, R. A. Gibbs, *J. Mol. Cat. A: Chem.* 245, 8, 2006.
26. T. J. Mason, J. P. Lorimer, John Wiley and Son: New York. 34, 1988
27. K. S. Suslick, VCH: Weinheim. 35, 1988.
28. A. Gaplovsky, M. Gaplovsky, S. Toma, J. L. Luche, *J. Org. Chem.* 65, 8444. 36, 2006.
29. R. R. Deshmukh, R. Rajagopal, K. V. Srinivasan, *Chem. Commun.* 1544, 2001.

Cerium (III) Triflate Promoted Synthesis of 2-Substituted Quinazolin-4(3h)-Ones from 2-Amino Benzoic Acid and Benzoyl Chloride

Mahesh More¹, Anil Solunke², Sandip Agare³, Sandip Pardeshi⁴, Jayant Sonar⁵ and Tanuja Kadre^{6*}
^{1,2,3,6}Department of Chemistry, Dr. A.P.J. Abdul Kalam University, Indore (M.P)- 452016, India
^{4,5}Department of chemistry, Vinayakrao Patil Mahavidyalaya, Vajapur, Aurangabad, Maharashtra, India

ABSTRACT

2-Substituted Quinazolin-4(3H)-ones synthesized from 2-Amino benzoic acid, Benzoyl chloride and ammonium acetate in presence of Cerium (III) Triflate is presented. Current new method has advantages over classical reaction conditions are as of excellent yields, shorter reaction time and simplest isolation process.

Keywords: 2-Aminobenzoic acid, Benzoyl chloride, Cerium (III) Triflate, Quinazolin-4(3H)-ones

1. INTRODUCTION

Quinazolinones are a significant motif in medicinal and pharmaceutical chemistry which shows its multidisciplinary biological effects. Due to highly potent scaffold, most of the scientists are attracted towards its utilization of Quinazolinones. Quinazolinones are pharmacophoric gallows omnipresent in an assortment of biologically active natural products, synthetic compounds, pharmaceutical drugs, agrochemicals and veterinary products. A chemical structures of quinazolinones exhibit a variety of therapeutic and biological activities such as antibacterial, Antifungal [1, 2], Anti-inflammatory, Analgesic [3], Anticancer [4], Anticonvulsant [5], Antimalarial [6, 7, 8], Cytotoxicity and anti-HIV [9], Tyrosine Kinase Inhibitors [10], Antiviral [11], non-peptidyl inhibitors [12], anti-influenza [13, 14], Anti-tubercular [15].

In the last few years many metal catalysts/Lewis acids such as $(KAl(SO_4)_2 \cdot 12H_2O)$, $Yb(OTf)_3$ [16], MnO_2 [17], $[Cp^*IrCl_2]_2$ [18], ZnI_2 [19], CuI_2 [20], $InCl_3$ [21], $La(NO_3)_3 \cdot 6H_2O$, $AlCl_3/ZnCl_2-SiO_2$ [22], $NaHSO_4-SiO_2$, amberlyst-15 [23], $FeCl_3 \cdot 6H_2O$ [24], $Al(NO_3)_3 \cdot 9H_2O$, [25], I_2/KI [26], $Ga(OTf)_3$ [27], $Sc(OTf)_3$ [28], Fe_3O_4 nanoparticles [29], molecular iodine [30], $CuCl_2$ [31], CuI [32], $CeCl_3 \cdot 7H_2O-NaI$ [33], $CeCl_3 \cdot 7H_2O$ [34], $InCl_3$ [35], $NaHSO_3 \cdot SiO_2/H^+/Amberlyst-15$ [36], $FeCl_3$ [37], CuO [38], $CuBr$ [39], Triethanolamine/ $NaCl$ [40], $Cu(OTf)_2$ [41], $Cu(NO_3)_2 \cdot 3H_2O$ [42]

along with ligands or individually. However, in spite of large number of 2-Substituted quinazolin-4(3H)-ones Synthetic Strategies [43] are reported using variety of metal catalysts, lewis acid go through drawbacks such as the use of classy reagents, strong or harsh reaction conditions and elongated reaction times. Therefore, to avoid these restrictions, the introduction of a milder and more efficiently methods accompanied with higher yields are needed.

To our knowledge Cerium (III) Triflate is not explored by any one for the synthesis of 2-Substituted quinazolin-4(3H)-ones from 2-Amino benzoic acid and Benzoyl chloride.

Hence, in continuation of our interest in Lewis acid applications for the synthesis of 2-Substituted quinazolin-4(3H)-ones, herein we wish to report for the first time a novel, simple and efficient methodology for the synthesis of 2-Substituted quinazolin-4(3H)-ones analogs in good yields by the reaction of 2-Amino benzoic acid, substituted Benzoyl chloride using Cerium (III) Triflate as catalyst (Scheme 1).

2. EXPERIMENTAL SECTION

All reagents, AR and LR grade were procured from commercial resources like Sigma Aldrich, Merk, Avra, Spectrochem and finar etc and used directly without any kind of further purification. Progression of the reactions was checked on pre-coated TLC plate of silica-gel polygrams SIL G/UV 254 plates, which were visualized under UV light. Melting points were obtained by using Lab-India MR. Vis+ apparatus. The ¹H-NMR spectra were determined using Bruker 300 MHz or 400MHz instrument using TMS as the internal standard. Isolated compounds are purified using Silicycle (40 – 60 mm) silica gel. Synthesized products are reported and identified by comparing with melting points and ¹H-NMR values with reported values.

2.1 General Procedure for the Preparation of 2-Substituted Quinazolin-4(3H)-Ones 4(A-L).

To a stirred solution of 2-Amino benzoic acid (7.29 mmol) and Sodium carbonate (14.58 mmol) in Acetonitrile (3.0 rel. volume), a solution of substituted Benzoyl chloride (7.29 mmol) in Acetonitrile (3.0 rel. volume) charged at ambient temperature and reaction mass stirred till completion. After completion of reaction, solid Sodium carbonate removed by filtration. Filtrate ML transferred to a pressure kettle along with Ce (III) Triflate (5 mol %) and ammonium acetate (14.58 mmol). Pressure kettle sealed well along with air and heated to 80°C,

reaction maintained under pressure in pressure kettle till completion. Reaction progression checked by TLC. After completion of reaction, reaction mass filtered and ML concentrated to get residue. This residue diluted with water and extracted by Methyl-Tert. Butyl ether. The organic layer dried over anhydrous sodium sulphate and concentrated under vacuum to get crude material which was recrystallized by ethanol to afford a pure solid of 2-Substituted quinazolin-4(3H)-ones 4(a-n) with good yields. The synthesized product confirmed by Melting point (summarized in Table-2) and ¹H-NMR data with reference standards.

3. RESULTS AND DISCUSSION

As an effort to develop new applications, we report herein a simple and efficient cerium (III) Triflate-catalyzed synthesis of 2-Substituted quinazolin-4(3H)-ones from 2-Amino benzoic acid and Benzoyl chloride.

Initially, 2-Amino benzoic acid, Benzoyl chloride and ammonium acetate were selected as reference substrates, for optimization of reaction condition (Entry-1 in Table-2). Different catalysts, solvents, were screened as reported in Table-1. Entry-1 indicates longer reaction time with lower yield in absence of catalyst. Entry 2 to 5 represents superiority of Ce (III) Triflate among the other catalysts. In solvent screening, MeCN observed as an excellent solvent for reaction condition.

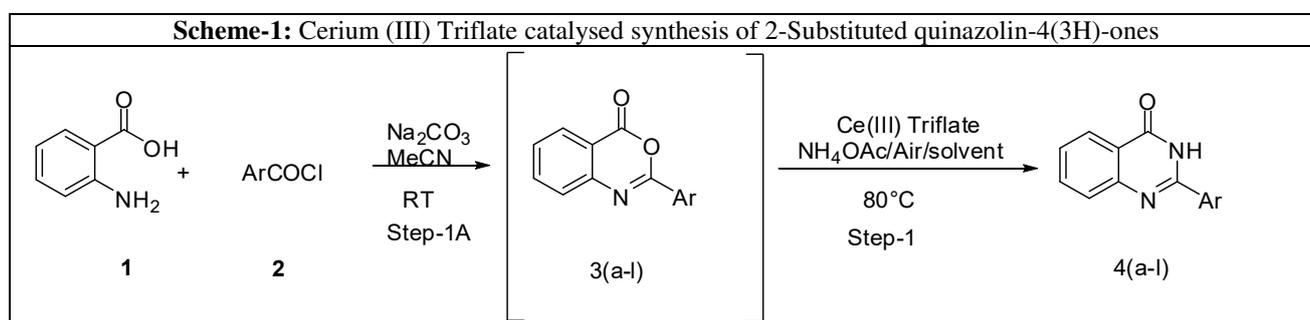


Table-1: Optimization of reaction conditions for the synthesis of 2-Substituted quinazolin-4(3H)-ones (Step-1) (Scheme-1)

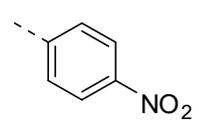
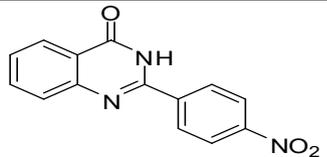
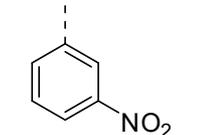
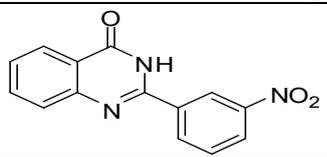
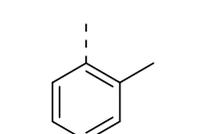
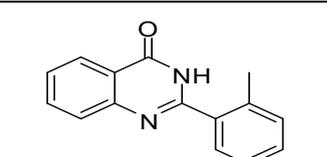
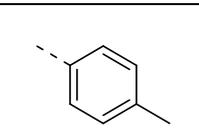
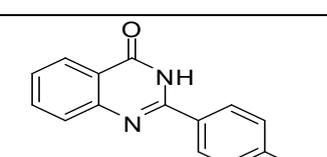
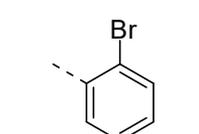
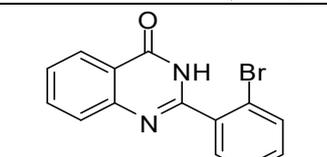
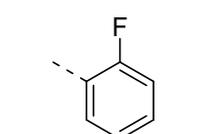
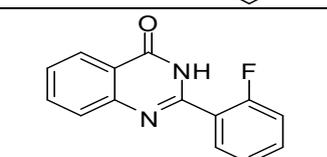
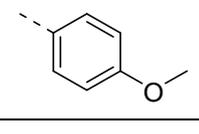
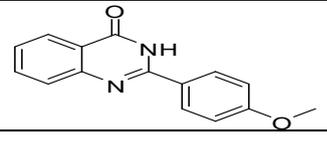
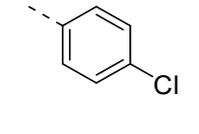
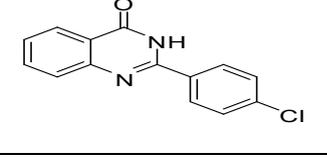
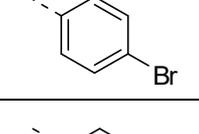
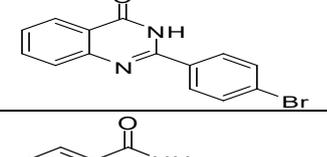
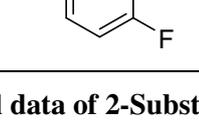
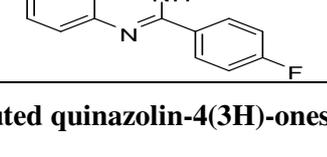
Entry	Catalyst (5 mol %)	Solvent	Ammonia source	Temperature °C	Time (h)	Yield (%)
1.	-	Toluene	NH ₄ OAc	100	24	43
2.	CeCl ₃	Toluene	NH ₄ OAc	100	16	58
3.	Ce NO ₃	Toluene	NH ₄ OAc	100	16	23
4.	CAN	Toluene	NH ₄ OAc	100	16	81
5.	Ce (III) Triflate	Toluene	NH ₄ OAc	100	8	90
6.	Ce (III) Triflate	NMP	NH ₄ OAc	80	8	82
7.	Ce (III) Triflate	MeCN	NH ₄ OAc	80	8	95
8.	Ce (III) Triflate	DMSO	NH ₄ OAc	80	8	79
9.	Ce (III) Triflate	DMF	NH ₄ OAc	80	8	77

* Reaction conditions: 1 (1.0 mmol), 2 (1.0mmol), NH₄OAc (2.0 mmol), catalyst (5.0 mol %), Solvent (6 rel. vol.) the reaction was performed at 80°C under pressure in seal tube for 8 h under pressure.

After finalizing reaction condition, selected substrates were evaluated by with optimized reaction condition summarized in Table 2,

Table.2: Exploration of reaction conditions on a selected substrates i.e. 3(a-l) to afford products i.e. 4(a-l).

Entry	Ar	Product	Yield (%)	Melting Point °C	
				Observed	Reference
a.			95	127.1	122-123
b.			95	299.5	295-296

c.			97	284.3	280-282
d.			96	291.4	292-294
e.			92	217.7	218-220
f.			82	221.8	223-225
g.			94	205.7	204-206
h.			88	237.5	239-240
i.			89	203.1	200-201
j.			90	318	318-320
k.			88	314.3	315-316
l.			89	297.6	293-295

Selected spectral data of 2-Substituted quinazolin-4(3H)-ones (Table-2, 4(a-n)) :

2-phenylquinazolin-4(3H)-one (4a)

¹H-NMR (300 MHz, CDCl₃): δ 7.53 (t, 2H, J= 7.1 Hz), 7.72-7.87 (m, 5H), 8.10-8.16 (m, 2H), 12.58 (s, 1H);

2-(2-Chlorophenyl) quinazolin-4(3H)-one (4b)

¹H-NMR (300 MHz, DMSO-D₆): 6.12-6.75 (m, 2H), 7.25 (t, 1H, J= 7.7 Hz), 7.39-7.43 (m, 2H), 7.46-7.53(m, 1H), 7.67 (d, 2H, J=6.6 Hz)

2-(4-nitrophenyl) quinazolin-4(3H)-one (4c)

¹H-NMR (300 MHz, CDCl₃): δ 7.55 (d, 1H, J=6.6 Hz), 7.74-7.86 (m, 4H), 8.10-8.15 (m, 3H), 12.62 (s, 1H)

2-(3-nitrophenyl) quinazolin-4(3H)-one (4d)

¹H-NMR (300 MHz, DMSO-D₆): δ 6.66-6.75 (m, 2H), 7.21 (t, 1H, J=7.7 Hz), 7.33-7.39 (m, 2H), 7.45-7.48 (m, 1H), 7.62 (dd, 2H, J=6.0 Hz, J=2.7 Hz)

2-(2-Methyl) quinazolin-4(3H)-one (4e)

¹H-NMR (300 MHz, CDCl₃) δ 10.78 (s, 1H), 8.26 (d, J = 8 Hz, 1H), S3

7.81 (d, J = 4 Hz, 2H), 7.56 (d, J = 7.2 Hz, 1H), 7.52 (dt, J₁ = 8, J₂ = 4 Hz, 1H), 7.45 (t, J = 7.2 Hz, 1H), 7.36 (d, J = 7.2 Hz, 2H), 2.55 (s, 3H);

2-(2-Bromophenyl) quinazolin-4(3H)-one (4g)

¹H-NMR (400 MHz, CDCl₃) δ 10.61 (s, 1H), 8.27 (d, J = 8 Hz, 1H), 7.83 (d, J = 4 Hz, 2H), 7.72 (t, J = 7.2 Hz, 2H), 7.58 – 7.50 (m, 1H), 7.48 (d, J = 7.2 Hz, 1H), 7.39 (t, J = 8 Hz, 1H).

2-(2-Fluorophenyl) quinazolin-4(3H)-one (4h)

¹H-NMR (400 MHz, CDCl₃) δ 10.36 (s, 1H), 8.31 (m, 2H), 7.82 (m, 2H), 7.53 (m, 1H), 7.53 (d, J = 8 Hz, 1H), 7.36 (t, J = 8 Hz, 1H), 7.25 (t, J = 8 Hz, 1H).

2-(4-Methoxyphenyl) quinazolin-4(3H)-one (4i)

¹H-NMR (400 MHz, DMSO-d₆) δ 12.42 (s, 1H), 8.18 (d, J = 7.6 Hz, 2H), 8.14 (d, J = 7.6 Hz, 1H), 7.80 (t, J = 7.2 Hz, 1H), 7.70 (d, J = 8.0 Hz, 1H), 7.46 (t, J = 7.2 Hz, 1H), 7.09 (d, J = 7.6 Hz, 2H), 3.83 (s, 3H).

2-(4-Chlorophenyl) quinazolin-4(3H)-one (4j)

¹H-NMR (400 MHz, DMSO-d₆) δ 12.62 (s, 1H), 8.21 (d, J = 8.4 Hz, 2H), 8.13 (d, J = 8, 1H), 7.85 (t, J = 7.6 Hz, 1H), 7.73 (d, J = 8.0 Hz, 1H), 7.65 (d, J = 8.0 Hz, 2H), 7.54 (t, J = 7.6 Hz, 1H).

2-(4-Bromophenyl) quinazolin-4(3H)-one (4k)

¹H-NMR (400 MHz, DMSO-d₆) δ 12.61 (s, 1H), 8.14 (d, J = 8.4 Hz, 3H), 7.83 (t, J = 6.4, 1H), 7.75 (d, J = 6.4 Hz, 3H), 7.53 (t, J = 6.4, 1H).

2-(4-Fluorophenyl) quinazolin-4(3H)-one (4l)

¹H-NMR (400 MHz, DMSO-d₆) δ 12.61 (s, 1H), 8.24 (t, J = 8.0, Hz, 2H), 8.14 (d, J = 7.6 Hz, 1H), 7.85 (t, J = 7.6 Hz, 1H), 7.74 (d, J = 8.0 Hz, 1H), 7.53 (t, J = 7.2 Hz, 1H), 7.41 (t, J = 8.4 Hz, 2H).

4. CONCLUSION

A new methodology for the synthesis of 2-Substituted quinazolin-4(3H)-ones from 2-Amino benzoic acid and Benzoyl chloride in the presence of 5 mol% of Ce (III) Triflate was developed. This method is more beneficial in the sense of yield, lower reaction time and temperature. Used catalyst is commercially available and inexpensive, easy to handle, and water soluble.

5. ACKNOWLEDGMENT

The author thanks the department of chemistry and colleague student, Dr. A.P.J. Abdul Kalam University, Indore, for their constant encouragement and support for this work.

6. REFERENCE

1. Nagar A.A, Patel A, Rajesh K.S, Danao K.R and Rathi L.G., Solvent Free One Pot Microwave Synthesis of Quinazolin-4(3H)-One derivative with their Antibacterial and Antifungal Activity, PHARMAGENE Vol: 1 Issue: 1
2. Vijay Anand P.R., Suresh K. K., Sivakumar R., Sam Solomon W.D, and Jayaveera K.N, Synthesis of Quinazoline Derivatives and their Biological Activities, Asian Journal of Chemistry Vol. 21, No. 9 (2009), 6656-6660
3. Mohamed M. S, Kamel M. M, Kassem E. M .M, Abotaleb N, Khedr M, and Ahmed M. F, Synthesis, Biological Evaluation and Molecular Docking of Quinazoline-4(1h)-one Derivatives as Anti-inflammatory and Analgesic Agents, Acta Poloniae Pharmaceutica ñ Drug Research, Vol. 68 No. 5 pp. 665ñ675, 2011
4. Chen J.N, Wang X.F, Li T, Wu D. W, Design, synthesis, and biological evaluation of novel quinazolinyl-diaryl urea derivatives as potential anticancer agents, European Journal of Medicinal Chemistry 2016; 107: 12-25.
5. Noureldin N.A, Kothayer H, Lashine E.S.M, Baraka M.M, Eraky W.E.I, Awdan S. A. El, Synthesis, anticonvulsant activity, and SAR study of novel 4-quinazolinone derivatives, Arch. Pharm. Chem. Life Sci. 2017, 350, e1600332

6. Sen D, Banerjee A, Ghosh A.K, Chatterjee T.K, Synthesis and antimalarial evaluation of some 4-quinazolinone derivatives based on febrifugine, *Journal Advanced Pharmaceutical Technology Research* 2010; 1 (4): 401-405.
7. Zhu S, Wang J, Chandrashekar G, Smith E, Liu X, Zhang Y., Synthesis and evaluation of 4-quinazolinone compounds as potential antimalarial agents *Drug design Febrifugine Malaria chemotherapy Plasmodium falciparum, European Journal of Medicinal Chemistry* 45 (2010) 3864e3869
8. Honaker E, Pippuri A, Kairisalo P, Nore P, Karppanen H, Paakkari I, Synthesis and Antihypertensive Activity of Some new Quinazoline Derivatives, *Journal of Applied Pharmaceutical Science* Vol. 3 (03), pp. 171-174, March, 2013
9. Mohamed, Y. A. , El-galil, A., Amrb, C., Mohamed, S.F., Abdalla, M. M., Al-omar M, Shfik,S.H, Cytotoxicity and anti-HIV evaluations of some new synthesized quinazoline and thioxopyrimidine derivatives using 4-(thiophen-2-yl) 3, 4, 5, 6-tetrahydrobenzo[h]quinazoline-2(1H)-thione as synthon, *J. Chem. Sci.* Vol. 124, No. 3, May 2012, pp. 693–702.
10. Traxler P, Green J, Mett H, Séquin U, Furet P., Use of a pharmacophore model for the design of EGFR tyrosine kinase inhibitors: Isoflavones and 3-phenyl- 4(1H)-quinolones, *Journal of Medicinal Chemistry.* 1999; 42:1018-1026.
11. Wang Z, Wang M, Yao X, Li Y, Tan J, Wang L, Design, synthesis and antiviral activity of novel quinazolinones, *European Journal of Medicinal Chemistry.* 2012; 53:275-282.
12. Singh M, Raghav N., 2,3-Dihydroquinazolin-4(1H)-one derivatives as potential non-peptidyl inhibitors of cathepsins B and H., *Bioorganic Chemistry.* 2015; 59:12-22.
13. Raghav N, Singh M., Design, synthesis and docking studies of bischalcones based quinazoline-2(1H)-ones and quinazoline-2(1H)-thiones derivatives as novel inhibitors of cathepsin B and cathepsin H, *European Journal of Pharmaceutical Sciences.* 2014; 54:28-39.
14. Liu S, Wang W, Jiang L, Wan S, Zhang L, Yu R, 2-Pyridinyl-4(3H)- quinazolinones: A scaffold for anti-influenza a virus compounds, *Chemical Biology & Drug Design.* 2015; 86:1221- 1225.
15. Devi K and Kachroo M, Synthesis and antitubercular activity of some new 2, 3-disubstituted Quinazolinones, *Der Pharma Chemica*, 2014, 6(5):353-359
16. Yoshimura T, Di Y, Kimura Y, Yamada H, Toshimitsu A , Simple, selective and practical synthesis of 2-substituted 4(3H) -quinazolinones by Yb(OTf)₃ -catalyzed condensation of 2-aminobenzamide with carboxamides., *Heterocycles* 2015; 90 (2): 857-865.
17. Zhang Z, Wang M, Zhang C, Zhang Z, Lu J, The cascade synthesis of quinazolinones and quinazolines using an MnO_2 catalyst and tert- butyl hydroperoxide (TBHP) as an oxidant. *Chemical Communications* 2015; 51(44): 9205-9207.
18. Zhou J, Fang J., One-pot synthesis of quinazolinones via iridium-catalyzed hydrogen transfers. *Journal of Organic Chemistry* 2011; 76 (19): 7730-7736.
19. Sharif M, Opalach J, Langer P, Beller M, Wu X.F., Oxidative synthesis of quinazolinones and benzothiadiazine 1,1-dioxides from 2-aminobenzamide and 2-aminobenzenesulfonamide with benzyl alcohols and aldehydes., *RSC Advances* 2014; 4 (1): 8-17.
20. Abdel-Jalil RJ, Voelter W, Saeed M., A novel method for the synthesis of 4(3H) -quinazolinones. *Tetrahedron Letters* 2004; 45 (17): 3475-3476.
21. Mulakayala N, Kandagatla B, Rapolu RK, Rao P, Mulakayala C., InCl₃ -catalysed synthesis of 2-aryl quinazolin-4(3H) -ones and 5-aryl pyrazolo[4,3-d]pyrimidin-7(6H) -ones and their evaluation as potential anticancer agents., *Bioorganic & Medicinal Chemistry Letters* 2012; 22 (15): 5063-5066.
22. Dabiri M, Salehi P, Mohammadi AA, Baghbanzadeh M. One-pot synthesis of mono and disubstituted (3H) -quinazolin-4-ones in dry media under microwave irradiation., *Synthetic Communications* 2005; 35 (2): 279-287
23. Das B, Banerjee J., Silica-supported sodium hydrogen sulfate and Amberlyst-15: two efficient heterogeneous catalysts for single-step synthesis of 4(3H) -quinazolinones from anthranilic acid, ortho esters, and amines under solvent free conditions., *Chemistry Letters* 2004; 33 (8): 960-961.
24. Wang GW, Miao CB, Kang H., Benign and efficient synthesis of 2-substituted 4(3H) -quinazolinones mediated by iron(III) chloride hexahydrate in refluxing water., *Bulletin of the Chemical Society of Japan* 2006; 79 (9): 1426-1430.

25. Wang M, Song Z, Zhang T., Aluminum nitrate-catalyzed one-pot synthesis of 4(3H) -quinazolinones by a three component coupling of anthranilic acid, amines, and ortho esters., *Synthetic Communications* 2011; 41 (3): 385-391.
26. Bakavoli M, Shiri A, Ebrahimpour Z, Rahimizadeh M., Clean heterocyclic synthesis in water: I2 /KI catalyzed one-pot synthesis of quinazolin-4(3H) -ones., *Chinese Chemical Letters* 2008; 19 (12): 1403-1406.
27. Chen J, Wu D, He F, Liu M, Wu H., Gallium (III) triflate-catalyzed one-pot selective synthesis of 2,3-dihydroquinazolin-4(1H) -ones and quinazolin-4(3H) -ones., *Tetrahedron Letters* 2008; 49 (23): 3814-3818.
28. Chen JX, Wu HY, Su WK. A facile synthesis of 2,3-dihydro-2-aryl-4(1H) -quinazolinones catalyzed by scandium(III) triflate., *Chinese Chemical Letters* 2007; 18 (5): 536-538. 1594
29. Zhang ZH, Lü HY, Yang SH, Gao J.W., Synthesis of 2,3-dihydroquinazolin-4(1H) -ones by three-component coupling of isatoic anhydride, amines, and aldehydes catalyzed by magnetic Fe₃O₄ nanoparticles in water. *Journal of Combinatorial Chemistry* 2010; 12 (5): 643-646.
30. Zhu Y, Fei Z, Liu M, Jia F, Wu A., Direct one-pot synthesis of Luotonin F and analogues via rational logical design., *Organic Letters* 2013; 15 (2): 378-381.
31. Nguyen T.T, Nguyen K.X, Pham P.H, Ly D, Nguyen D. K, Nguyen K.D and Phan N.T.S, Copper-catalyzed synthesis of pyrido-fused quinazolinones from 2-aminoarylmethanols and isoquinolines or tetrahydroisoquinolines. *Org. Biomol. Chem.*, 2021, 19, 4726-4732
32. Wang C, Li S, Liu H, Jiang Y and Fu H., Copper-Catalyzed Synthesis of Quinazoline Derivatives via Ullmann-Type Coupling and Aerobic Oxidation., *J. Org. Chem.* 2010, 75, 22, 7936–7938.
33. Bartoli, G., Bosco M, Giuliani A., Marcantoni E., Palmieri A., Petrini M., and Sambri L., Investigation into the Allylation Reactions of Aldehydes Promoted by the CeCl₃·7H₂O-NaI System as a Lewis Acid., *J. Org. Chem.* 2004, 69, 4, 1290–1297.
34. Dhara, D., Gayen K. S., Khamarui S., Pandit P., S. Ghosh P., and Maiti D. K., CeCl₃ · 7H₂O Catalyzed C-C and C-N Bond-Forming Cascade Cyclization with Subsequent Side-Chain Functionalization and Rearrangement: A Domino Approach to Pentasubstituted Pyrrole Analogues.” *J. Org. Chem.* 2012, 77, 22, 10441–10449.
35. Mulakayala N, Kandagatla B, Rapolu RK, Rao P, Mulakayala C., InCl₃ -catalysed synthesis of 2-aryl quinazolin-4(3H) -ones and 5-aryl pyrazolo [4, 3-d]pyrimidin-7(6H) -ones and their evaluation as potential anticancer agents., *Bioorganic & Medicinal Chemistry Letters* 2012; 22 (15): 5063-5066.
36. Das B, Banerjee J., Silica-supported sodium hydrogen sulfate and Amberlyst-15: two efficient heterogeneous catalysts for single-step synthesis of 4(3H) -quinazolinones from anthranilic acid, ortho esters, and amines under solvent free conditions., *Chemistry Letters* Vol.33, No.8 (2004)
37. Wang G.W, Miao C.B, Kang H., Benign and efficient synthesis of 2-substituted 4(3H) -quinazolinones mediated by iron (III) chloride hexahydrate in refluxing water. *Bulletin of the Chemical Society of Japan* 2006; 79 (9): 1426-1430.
38. Zhan D, Li T, Wei H, Weng W, Ghandi K and Zeng Q., A recyclable CuO-catalyzed synthesis of 4(3H)-quinazolinones., *RSC Adv.*, 2013, 3, 9325–9329.
39. Viji M and Nagarajan R., Copper catalysed synthesis of indolyl quinazolinone alkaloid bouchardatine., *J. Chem. Sci.* Vol. 126, No. 4, July 2014, pp. 1075–1080.
40. Khandebharada A. U , Sardaa S.R, Gill C.H, and Agrawala B.R., Synthesis of Quinazolinone Derivatives Catalyzed by Triethanolamine/NaCl in aqueous Media., *Polycyclic Aromatic Compounds*, 1563-5333
41. Zhu X, Kang S.R, Xia L, Lee J, Basavegowda N, Lee Y. R., Efficient Cu(OTf)₂-catalyzed synthesis of novel and diverse 2,3-dihydroquinazolin-4(1H)-ones., *Epub* 2014 Nov 18
42. Ravikumar R, Durgareddy G, Ravi S, Adapa S.R., A Cu (NO₃)₂·3H₂O catalysed facile synthesis of substituted 4(3H)-quinazolinones and benzimidazoles, *Journal of Chemical Sciences* volume 125, pages 175–182 (2013)
43. Rohokale R.S, Kshirsagar U.A., Advanced synthetic strategies for constructing quinazolinone scaffolds, *Synthesis* 2016; 48: 1253-1268.

User Satisfaction on Library Resources and Services: A Study of Government District Public Library

Arun Kumar Pandey and Ashok Kumar Upadhyay

Department of Library & Information Science, Mangalayatan University, Aligarh

ABSTRACT:

The present study aims to analyze user satisfaction on library resources and services of Government District Public Library, Jhansi. The investigator distributed 100 questionnaires to the users in which 82 filled questionnaires were returned back by the users. From the results, it can be analyzed that the majority of users visit the library on a weekly basis rather than daily, followed by the majority of users desire the most up-to-date collection and the majority of respondents were not satisfied with the library resources and services.

Keywords: User Satisfaction, Library Resources, Library Services, Public Libraries, A study.

INTRODUCTION

Man's need for information is limitless. People ask for information in different fields and formats to perform a variety of tasks, make decisions, discover new phenomena, develop new technologies, and use information to improve existing knowledge and theories. Information plays a vital role in shaping human thinking and character building, communication and learning process. Tremendous growth in knowledge and the rapid progress and changes in the modern world have raised awareness of the importance of information in all aspects of life.

Public libraries play an important role in the dissemination of information. Public libraries are those that are developed for the use of the general public. Public library serves peoples of any subject area regardless of age, religion and gender; etc. Public libraries play an important role in the educational, social, political and economic fields. Due to the ever-changing demands of society and the revolution brought about by information technology, public libraries have to create and implement new technologies and services to meet the information need of the users. Accountability and evaluation are required due to users' high expectations, rapid changes, and new and improved technology. Surveys of patron satisfaction should be now routinely conducted at public libraries.

SCOPE OF THE STUDY;

The scope of the present study is limited to User satisfaction on library resources and services of Government District Public Library, Jhansi.

Objectives of the Study:

- To find out the frequency of library visit by users
- To find out the purpose of library visit by users
- To determine satisfaction level of library users with library resources and services.
- To know about the problems being faced by the users while using the library

RESEARCH METHODOLOGY

A structured questionnaire was structured and distributed randomly among 100 library users in which 82 field questionnaires received back to derive the study's conclusion. The questionnaire was personally distributed to the library users of Government District public Library Jhansi. The obtained data was organized and processed using statistical methods. This questionnaire inquired about user satisfaction with library resources and services.

DATA ANALYSIS AND INTERPRETATION:

Table-1 Frequency of Library Visit

Frequency of Library Visit	Response	Percentage
Daily	12	14.63%
Weekly	38	46.34%
Once in a month	18	21.95%
Occasionally	14	17.07%

Table -1 highlight the frequency of respondents to visit the library. Maximum number of users 38 (46.34%) visit to library weekly, followed by 18(21.95%) respondents to visit library once in a month, 14 (17.07%) visit the library occasionally, while 12(14.63%) visit the library daily.

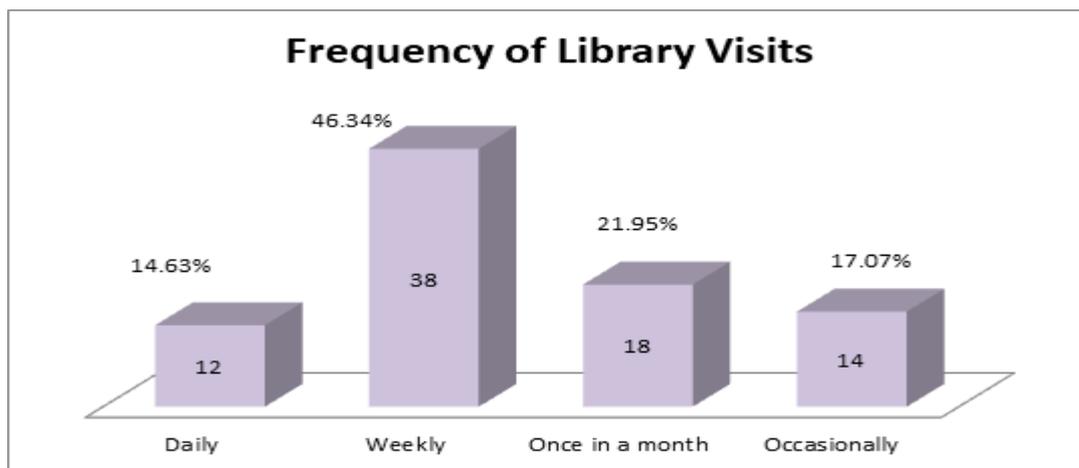


Figure-1 Frequency of Library Visits

Table-2 Purpose of using Library

Purpose of using Library	Response	Percentage
To Borrow books	21	25.61%
For reference in the library	42	51.22%
To use Internet /E-resources	2	2.44%
For Xeroxing information resources	14	17.07%
To read Newspapers/Magazines	48	58.54%

(Multiple answers were permitted)

Above table-2 and figure-2 shows the purposes of the visit the library. The above table shows that 21 (25.61%) respondents use the library to borrow books. 42 (51.22%) respondents use for the reference and 02(2.44%) respondents use the library for Internet /E-resources access in the library, 14(17.07%) of the respondents use the library for Xeroxing information resources. It can be seen that 48(58.54%) respondents prefer to use the library for reading newspaper and magazines.

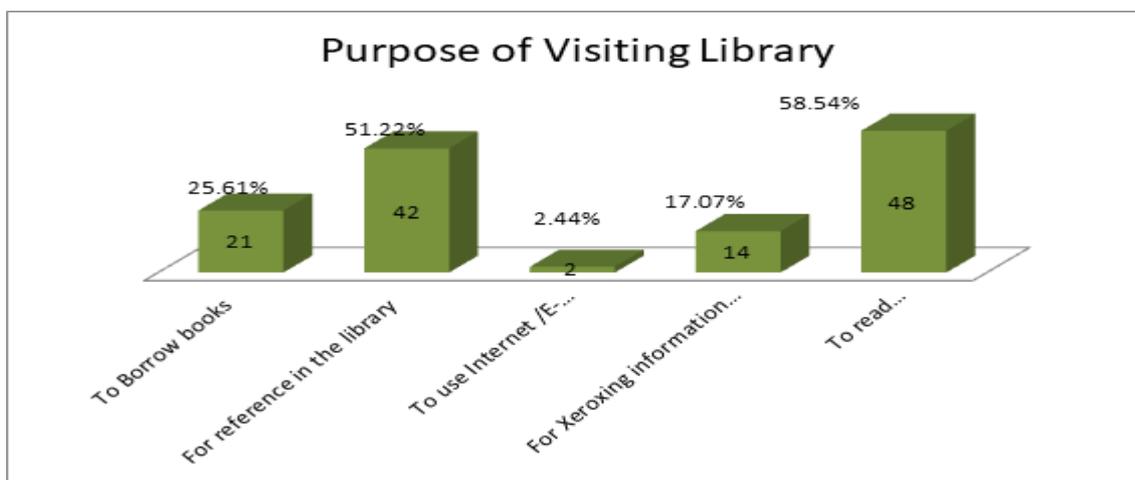


Figure-2 Purpose of using Library

Table 3 Satisfaction Level from Information Resources

Information Resources	Satisfied	Percentage	Not Satisfied	Percentage
Books	21	25.61%	61	74.39%
Journals	34	41.46%	48	58.54%
Reference sources	31	37.80%	51	62.20%
News Paper	44	53.66%	38	46.34%
Internet/E-Books /E-Journals	18	21.95%	64	78.05%
Annual Report	46	56.10%	36	43.90%
Government Order/Notices	43	52.44%	39	47.56%

(Multiple answers were permitted)

Above table-3 and figure-3& 4 shows that 21 (25.61%) respondents are satisfied with books Collection, while 61 (74.39%) respondents are not satisfied with the available book collection, however 34 (41.46%) respondents satisfied and 48 (58.54%) respondents unsatisfied with journals collections of library. 31 (37.80%) respondents are satisfied with Reference sources while 51 (62.20%) respondents are unsatisfied, and 44 (53.66%) respondent satisfied with News Paper, while 38(46.34%) are unsatisfied. Regarding Internet/E-Books /E-Journals, 18 (21.95%) users are satisfied, 64 (78.05%) are unsatisfied and 46(56.10%) respondents are satisfied with Annual Report, while 36 (43.90%) respondents are unsatisfied, however 43(52.44%) respondents satisfied and 39 (47.56%) respondents unsatisfied with Government Order/notices.

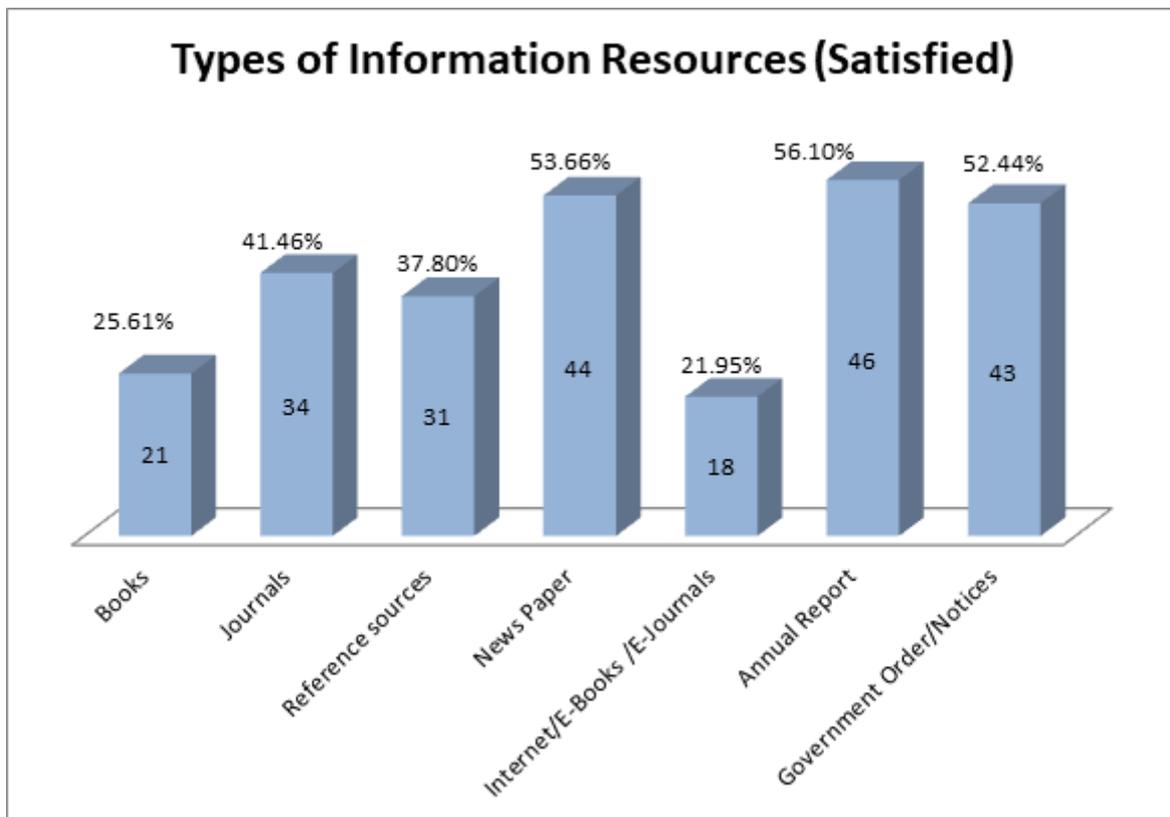


Figure-3 Types of Information Resources (Satisfied)

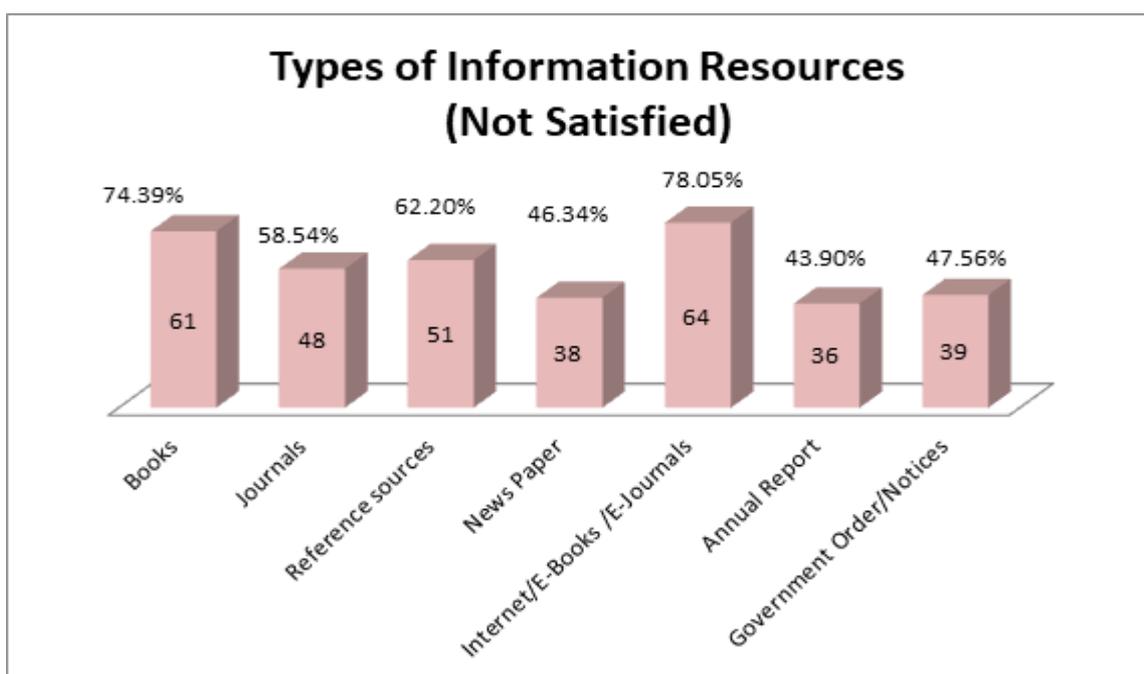


Figure-4 Types of Information Resources (Not Satisfied)

Table 4 Types of Library Services

Types of Library Services	Satisfied	Percentage	Not Satisfied	Percentage
Circulation service	27	32.93%	55	67.07%
Cataloguing service/ OPAC	23	28.05%	59	71.95%
Reference service	44	53.66%	38	46.34%
Reprographic service	21	25.61%	61	74.39%
Online search service	24	29.27%	58	70.73%

(Multiple answers were permitted)

Table 4 and Figure- 5 & 6 shows the satisfaction level of respondents towards library services ,27 (32.93%) respondents are satisfied with Circulation service of library, while 55 (67.07%) respondents are not satisfied with this service,while 23 (28.05%) respondents are satisfied with Cataloguing service of library and 59 (71.95%) respondents are unsatisfied. The 44 (53.66%) respondents show their satisfaction and 38 (46.34%) respondents are not satisfied with Reference service, 21 (25.61%) respondents show their satisfaction and 61 (74.39%) respondents are not satisfied with Reprographic service and 24 (29.27%) respondents are satisfied with online search service of library, while 58 (70.73%) respondents are unsatisfied with this service.

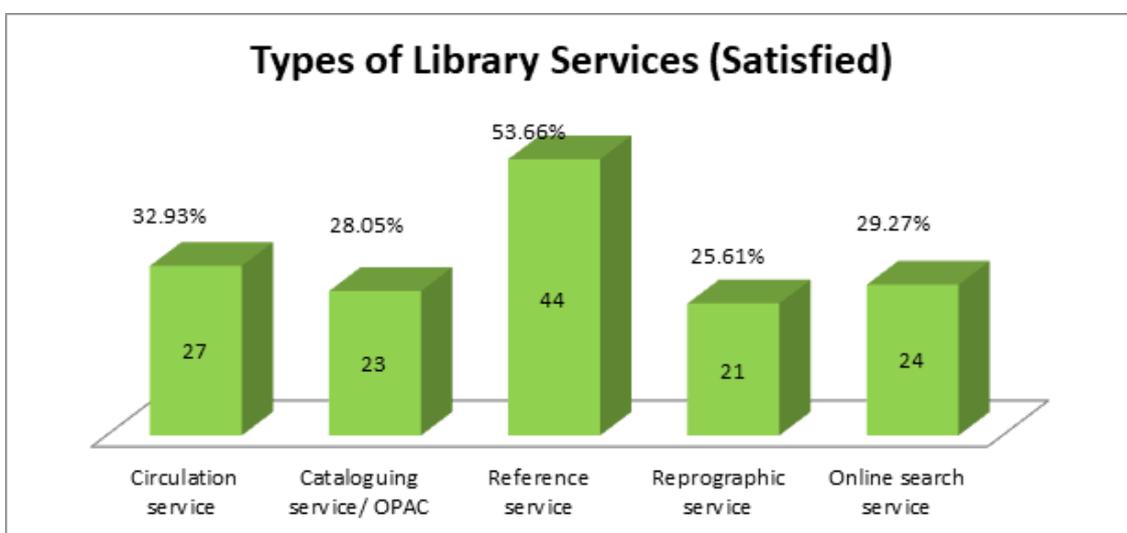


Figure-5 Types of Library Services (Satisfied)

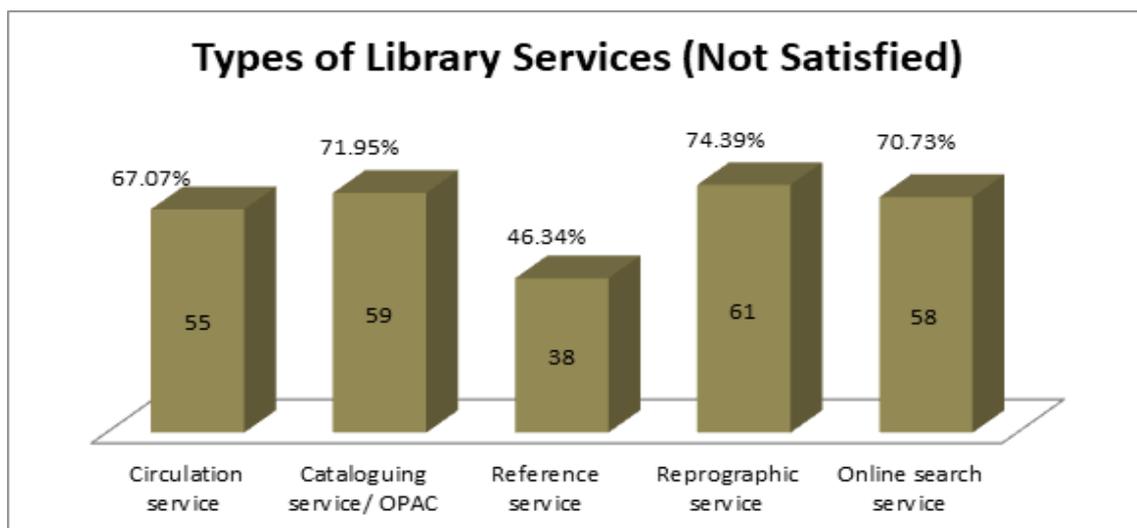


Figure-6 Types of Library Services (Not Satisfied)

FINDINGS

The major findings of the study are:

- A high percentage of respondents 38(46.34%) are visit the library once in a week.
- Most of the users 48 (58.54 %) users are visit to the library for the reading of the Newspaper.

- The high percentage, i.e., 56% users are satisfied with the available Annual Reports, while 53.66% respondents are satisfied with Newspaper collection of the library.
- 53.66% of the respondents are satisfied to the Reference services in their library.
- Maximum users want latest collection of resources in their library.

CONCLUSION

According to the findings, the majority of users visit the library on a weekly basis rather than daily, and the majority of users desire the most up-to-date collection in the library, and the majority of respondents are not happy with library services.

RECOMMENDATIONS

- The library should also make sure that users have access to up-to-date materials.
- Library management should take the required steps to improve the library's overall services.
- Library awareness initiatives and seminars should be arranged to encourage people to utilize the library.
- Librarian should encourage users to use of the print resources and other resources in order to further strengthen their academic careers.

REFERENCE

1. Udo, C., & Philip, K. (2020). User satisfaction with Public Library services in Abak Community, Akwa Ibom State, Nigeria. *Library Philosophy and Practice* (e-journal).
2. Chandrasekar, K., & Sivathaasan, N. (2016). Children's section of the Jaffna Public Library: User satisfaction survey. *Library Review*, 65(1/2), 108-119.
3. Cha, S. J. (2011). A study on the user satisfaction of public library users in Korea. *Journal of the Korean Society for information Management*, 28(1), 285-308.
4. Hussain, A. (2018). Role of Libraries in Education. Research Gate Available at <https://www.researchgate.net/publication/325192754>.
5. Pandya, R., Maniar, A. (2014). Non formal education: an Indian context. Available at http://www.isca.co.in/SOC_HU_SCI/book/ISBN%20978-93-84648-51-0.pdf
6. Bhuvaneshwari Ravi, & Gayathri Vivek, (2014). Importance of partnership for development of public libraries in India. *DESIDOC Journal of Library and Information Technology*, 33(1), 12-20.
7. Pors, Niels and Ole., 2006, The public library and students' information needs, *New library world*, Vol.107, No.7/8, pp. 275-285.
8. Umopathy, K.S. (1973). Non-Formal Education: educational goals and their implications for Library services. *ALIS*, 20(1-4), 69-74. Available at <http://nopr.niscair.res.in/bitstream/123456789/28219/1/ALIS%2020%281-4%29%2069-74.pdf>.

Synthesis and Pharmacological Activity of Phenylethylidene Derivatives

Shivansh Mishra¹ and Amit K Chaturvedi*²

¹J.S. University Shikohabad, Firozabad Uttar Pradesh

²Department of Chemistry, J.S. University Shikohabad, Firozabad Uttar Pradesh

ABSTRACT

Five new phenylethylidene derivatives, designated RM-1 to RM-5, are produced through the synthesis of physiologically active heterocyclic derivatives using 2-bromo-1-phenylethanone, para-chlorophenol, and anhydrous K₂CO₃ in dry acetonitrile.

Using several moles of propylene oxide to hydroxylate the synthesised compounds produced nonionic surface-active agents with good water solubility, ease of handling, and good biodegradability. These agents' surface properties also revealed the significance of their applications in preventing pollution issues and making them safe for both people and the environment.

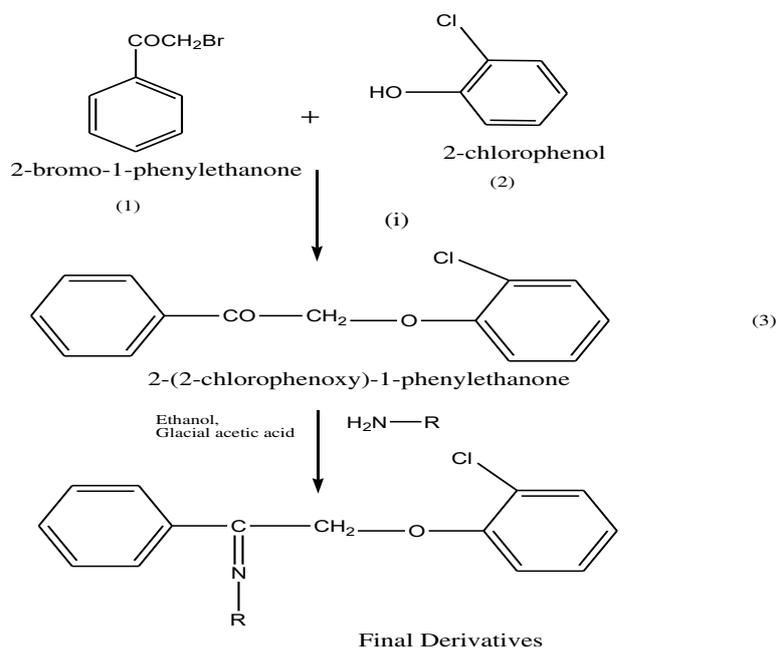
These substances may have good potential for industrial uses and can be used to make cosmetics, textiles, mild emulsifiers, dyes, insecticides, and medications.

Keywords: Heterocyclic compound, phenylethylidene, pharmacology.

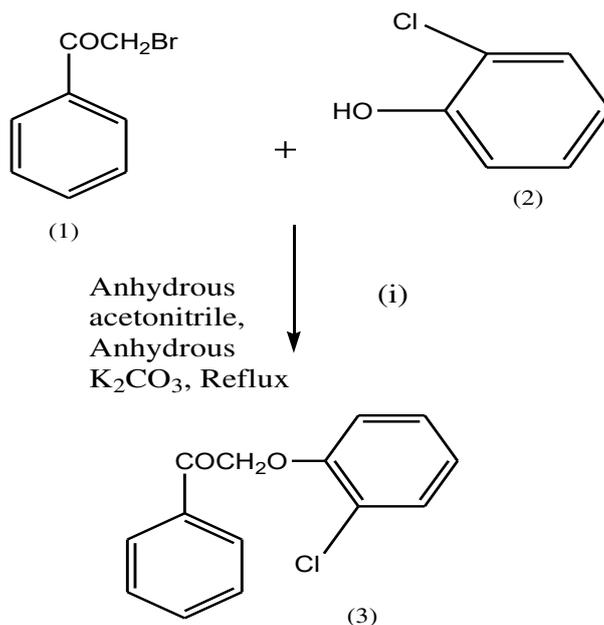
INTRODUCTION

In chemistry, heterocyclic compounds are essential.

Better antibacterial and antimalarial activity was found in natural products synthesised in an asymmetric manner. The important class of selenium-based heterocyclics known as selenophene derivatives. These substances are crucial for both the discovery of novel drugs and the creation of novel light-emitting materials. Medium-sized heterocycles (with 8 to 11 atoms) are structurally significant in a number of biologically active natural compounds and offer promise as therapeutic scaffolds, according to 2, 3, and 4.6 aryl-4-azidocinnolines (5-7). Numerous amine-spaced conjugates of 1,4,7,10-tetraazacyclododecane-1,4,7,10-tetraacetic acid and ursolic acid (UA) have been created (DOTA). Based on the formation of intramolecular carbon-heteroatom (nitrogen or sulphur) bonds by the carbon-hydrogen bond (C-H) functionalization/palladium catalysed process. Utilizing ring-opening cyclization of cyclohexane-1,3-dione-2-spirocyclopropanes, 11 indoles and benzofurans were produced. Inflammatory gene expression is triggered by pathogens' interactions with immune system cells. It has been reported that 14 arylsulphonamide derivatives are likely PDF inhibitors. 15 Several derivatives of heterocyclic carboxamides have anti-norovirus properties. Tetrabutylammonium bromide (TBAB), an effective metal-free homogeneous phase-transfer catalyst, has drawn a lot of attention over the past 20 years. 17 In the current work, a synthesis of phenylethylidene derivatives was attempted.



Step I. Synthesis of 2-(2-chlorophenoxy)-1-phenylethanone (3)



2-(2-chlorophenoxy)-1-phenylethanone

Reagents and conditions: (i) Anhydrous acetonitrile, Anhydrous K_2CO_3 , Reflux.

Procedure

Equimolar amounts of 2-bromo-1-phenylethanone **1** (0.01 mol), para chloro phenol **2** (0.01 mol) and anhydrous K_2CO_3 (0.02 mol) in dry acetonitrile was refluxed for about 10 h. The mixture was filtered and solvent was removed under reduced pressure. The resulting solid was washed with excess of water. The crude product was purified by recrystallization from ethanol to afford compound **3**.

The physical parameters were of the compounds (**3**)

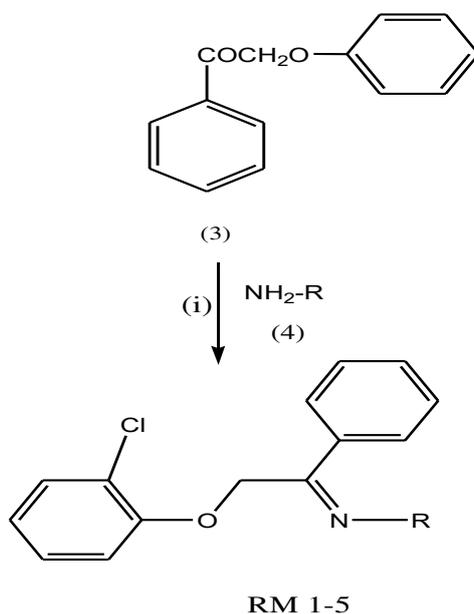
Percentage yield : 74.00%

Melting range : 62-63°C

R_f value : 0.64

Mobile phase : n-Hexane: ethyl acetate: (3:1)

Step II. Synthesis of target compounds: Phenylethylidene Derivatives (RM 1-5)



Synthesis of the target compounds. Reagents and conditions: (i) Ethanol, Glacial Acetic Acid, Reflux.

Amino Compounds Used the Preparation of Phenylethylidene Derivatives

Cpd. Code	Amino compounds
RM-1	4-Amino acetophenone
RM-2	4-Amino -1, 2, 4-triazole
RM-3	2-Chloro -5- amino pyridine
RM-4	2-Chloro-5-amino thiophenol
RM-5	2-Amino-5-methyl pyridine

CONCLUSION

Novel, cheap, and ecologically acceptable surface-active chemicals using 2-bromo-1-phenylethanone and related fused systems as heterocyclic nucleus were developed in this study.

During testing, it was determined that the solubility and biodegradability of these surfactants contributed to their low toxicity to both humans and the environment.

These findings suggest that further derivatization and heterocyclization of these hetero-analogues of fatty molecules could be employed as novel templates for the discovery of antimicrobial medicines, which could lead to the development of more potent antimicrobial medications.

This subject requires further study.

REFERENCE

1. Harada S. Catalytic Synthesis of Optically Active Polycyclic Heterocyclic Compounds. *Yakugaku Zasshi*. 2020; 140(10):1213-1224.
2. Gadd MS, Testa A, Lucas X, Chan KH, Chen W, Lamont DJ, Zengerle M, Ciulli A. Structural basis of PROTAC cooperative recognition for selective protein degradation. *Nat Chem Biol*. 2017 May;13(5):514-521.
3. Hellwig PS, Peglow TJ, Penteado F, Bagnoli L, Perin G, Lenardão EJ. Recent Advances in the Synthesis of Selenophenes and Their Derivatives. *Molecules*. 2020 Dec 13;25(24):5907
4. Sousa AC, Martins LO, Robalo MP. Laccases: Versatile Biocatalysts for the Synthesis of Heterocyclic Cores. *Molecules*. 2021 Jun 18;26(12):3719.
5. Choury M, Basilio Lopes A, Blond G, Gulea M. Synthesis of Medium-Sized Heterocycles by Transition-Metal-Catalyzed Intramolecular Cyclization. *Molecules*. 2020 Jul 9;25(14):3147.
6. Ishizawa J, Zarabi SF, Davis RE, Halgas O, Nii T, Jitkova Y, Zhao R, St-Germain J, Heese LE, Egan G, Ruvolo VR, Barghout SH, Nishida Y, Hurren R, Ma W, Gronda M, Link T, Wong K, Mabanglo M, Kojima K, Borthakur G, MacLean N, Ma M CJ, Leber AB, Minden MD, Houry W, Kantarjian H, Stogniew M, Raught B, Pai EF, Schimmer AD, Andreeff M. Mitochondrial ClpP-Mediated Proteolysis Induces Selective Cancer Cell Lethality. *Cancer Cell*. 2019 May 13;35(5):721-737.
7. Wang P, Lindsey JS . Riley Oxidation of Heterocyclic Intermediates on Paths to Hydroporphyrins-A Review. *Molecules*. 2020 Apr 17;25(8):1858.
8. Danilkina NA, Bukhtiarova NS, Govdi AI, Vasileva AA, Rumyantsev AM, Volkov AA, Sharaev NI, Povolotskiy AV, Boyarskaya IA, Korniyakov IV, Tokareva PV, Balova IA Synthesis and Properties of 6-Aryl-4-azidocinnolines and 6-Aryl-4-(1,2,3-1H-triazol-1-yl)cinnolines. . *Molecules*. 2019 Jun 27;24(13):2386.
9. Sharma SH, Pablo JL, Montesinos MS, Greka A, Hopkins CR. Bioorg. Design, synthesis and characterization of novel N-heterocyclic-1-benzyl-1H-benzo[d]imidazole-2-amines as selective TRPC5 inhibitors leading to the identification of the selective compound, AC1903. *Med Chem Lett*. 2019 Jan 15;29(2):155-159.
10. Kahnt M, Hoenke S, Fischer L, Al-Harrasi A, Csuk R. Synthesis and Cytotoxicity Evaluation of DOTA-Conjugates of Ursolic Acid. *Molecules*. 2019 Jun 17;24(12):2254.
11. Inamoto K . Synthesis of heterocyclic compounds through palladium-catalyzed C-H cyclization processes. *Chem Pharm Bull (Tokyo)*. 2013;61(10):987-96.

12. Devaiah BN, Mu J, Akman B, Uppal S, Weissman JD, Cheng D, Baranello L, Nie Z, Levens D, Singer DS. MYC protein stability is negatively regulated by BRD4. *Proc Natl Acad Sci U S A*. 2020 Jun 16;117(24):13457-13467.
13. Nambu H. Novel Methods for the Synthesis of Heterocycles Using Highly Reactive Spirocyclopropanes. *Yakugaku Zasshi*. 2018;138(1):19-25.
14. Nicodeme E, Jeffrey KL, Schaefer U, Beinke S, Dewell S, Chung CW, Chandwani R, Marazzi I, Wilson P, Coste H, White J, Kirilovsky J, Rice CM, Lora JM, Prinjha RK, Lee K, Tarakhovsky A. Suppression of inflammation by a synthetic histone mimic. *Nature*. 2010 Dec 23;468(7327):1119-23.
15. Singh A, Srivastava R, Singh RK. Design, Synthesis, and Antibacterial Activities of Novel Heterocyclic Arylsulphonamide Derivatives. *Interdiscip Sci*. 2018 Dec;10(4):748-761.
16. Ohba M, Oka T, Ando T, Arahata S, Ikegaya A, Takagi H, Ogo N, Owada K, Kawamori F, Wang Q, Saif LJ, Asai A. Discovery and Synthesis of Heterocyclic Carboxamide Derivatives as Potent Anti-norovirus Agents. *Chem Pharm Bull (Tokyo)*. 2016;64(5):465-75.
17. Banik BK, Banerjee B, Kaur G, Saroch S, Kumar R.. Tetrabutylammonium Bromide (TBAB) Catalyzed Synthesis of Bioactive Heterocycles. *Molecules*. 2020 Dec 14;25(24):5918.

Significance of Customer Feedback System as an Effective CRM Strategy in the Hospitality Industry

Pushpa Gore and Atul Ramgade

Department of Tourism and Hospitality, Arunodaya University, Itanagar, Arunachal Pradesh

ABSTRACT

In today's era retaining guest in hotel industry is one of the key aspects as there is growing competition in Hospitality Industry. Guest prospects on hotel services are believed to be up-and-coming however; there is a need to study and identify how guest expectations are transforming with time. Measuring guest satisfaction in the hotel industry is imperative in order to know guests' feedback. Every guest has diverse expectations about hotel services, thus it is important to know their impressions not only by aggregated statistics but also singularly determine the expectations, the needs and the requests of customers, overcome the gaps between customer's expectation and services offered.

This study is carried out to understand and improve the hotel customer relationship management (CRM) by concerning it with Customer feedback, it is the personal experience shared by the guest about their satisfaction or dissatisfaction with the product or service they have received. The feedback can be positive or negative depending upon the guest's experience. Some of the suggestions can be act as a resource to improve your business strategies in order to improve guest experience. This study deals with the importance of customer feedback system for implementing CRM strategies in the Hospitality Industry. For this study Primary data in the form of Qualitative data was collected through focus interviews which consisted of structured Questionnaire, from 32 senior managers of star category hotels of Pune Region through convenience sampling on which statistical test was applied and conclusions were drawn.

Keywords – Customer Feedback System, Hospitality Industry, CRM strategies, Loyalty, Customer satisfaction

INTRODUCTION

Customer relationship management (CRM) is the amalgamation of practices, SOP's and technologies that hotel employs to direct and analyze guest interactions and data throughout the guest cycle .The objective is to progress the customer service relationships and assist in customer retention and drive sales growth.

Hotel must ensure guests are satisfied with their products and services for higher customer retention. Remember one satisfied guest brings ten new clients with him where as one dissatisfied customer takes away ten customers along with him.

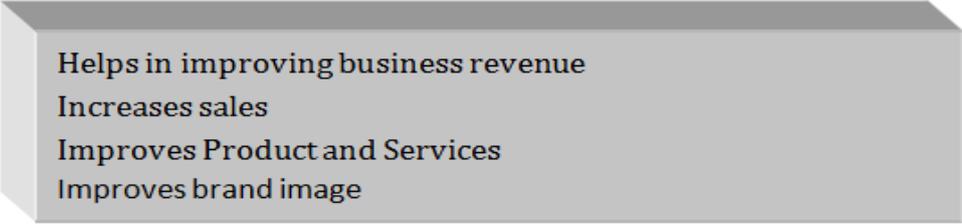
OBJECTIVE OF THE STUDY

1. To study and understand the Importance of Feedback system in Hospitality Industry.
2. To find out the Impact of good Feedback system on guest retention and customer satisfaction.

RESEARCH METHODS:

For this study Primary data was collected through focus interviews from 32 senior managers of star category hotels of Pune Region on which conclusions were drawn and secondary data was collected through sources such as research articles, books, journals and magazines.

Customer Feedback

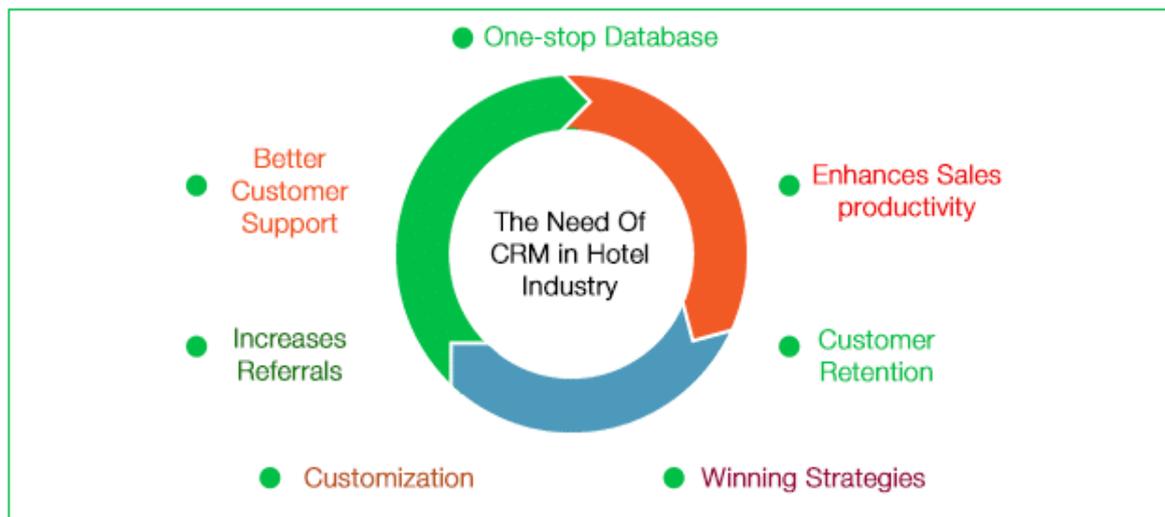


- Helps in improving business revenue
- Increases sales
- Improves Product and Services
- Improves brand image

Customer feedback is the personal experience shared by the customers about their satisfaction or dissatisfaction with the product or service they have received. The feedback can be positive or negative depending upon the customer's experience. Some of the feedback or suggestions can be a resource to improve your department procedures in order to improve customer experience, without customer feedback, organisation will never know if the customers are getting the value for money of their product.

Why is Customer Feedback Important

Hospitality industry is primarily determined by service given to customers during a stay, and every stages of the guest cycle; with an increase in consumer purchasing power, more and more people can afford to travel and visit places. On the other hand, the rise in tourism also helps in the growth of the hospitality industry and this has made the industry stand out from the other industry by making sure that their customers are satisfied by all the product and services which are provided by the organisation.



Source: - blog-post/the-need-of-crm-in-hotel-industry/

Why Is Customer Feedback an Important Part of CRM

• Customer Feedback Helps to Improve Products and Services

Customer feedback is vital for refereeing a customer's needs and requirements, particularly when a hotel launches new products or services. A guest Feedback System allows the organization to improve the understanding of their Clients' needs and which automatically helps in repeat business Customer feedback helps hotel to understand what's important to their customers – without customer feedback, organization could not possibly meet the product/ Services requirement of the consumer.

• Customer Feedback Helps You to Improve Customer Retention Strategies

Customer retention is the act of keeping existing customers on whom Hotel have already spent money this is extremely imperative for any business. Attracting a new customer costs five times as much as keeping an existing one, and depending on the industry you are in, it can cost up to 30 times as much! Increasing customer retention automatically increase profit rate, Custer feedback system helps to improve the quality of your product service, and in consecutively progress customer satisfaction and retention.

• Customer Feedback Improves Up-Sell and Cross-Sell

A customer's revenue potential doesn't instantly end at the point of sale of the hotel. There's a possessions of opportunity for more business beyond each initial purchase and practices known as cross-selling and up selling; customer feedback plays an important role in suggesting the other services to the customer by using the guest history which will help the organization for revenue generation.

Ways of Receiving a Quality Customer Feedback

• Online Guest Reviews for Hotels:

Guests can be motivated to take up online hotel guest surveys that help outline both the collective and individual suggestions of the guests regarding the hotel and the quality of stay and services. Utilizing the power of Artificial Intelligence and advanced technology, and expertise most of the hotels are trying to understand their guests as much as possible and to know what's trending, what's popular, and what improvements and developments are to be made.

• Guest Feedback/Surveys:

customer satisfaction Feedback / surveys are used to estimate how your customers feel about your organization ,These surveys can come in several different forms, and organization can utilize these surveys to section

customers based on satisfaction scores, measure relative customer satisfaction scores over time, or find understanding for customer experience /requirements and service improvements.

Practical Implications:

Focusing on your customer requirements, trying to satisfy them will ultimately try to retain your loyal customers. The hotel might be offering the best of product or service in the whole industry however until and unless the organisation don't put in efforts to Understand what your customers actually think, it cannot offer them the best customer service and support (This study will help the hoteliers to understand the importance of customer feedback system as a part of CRM strategies in order to attract new customers and retain loyal customers.

FINDINGS:

Based on the data collection and analysis from senior managers of star category hotels of Pune Region around 32 Managers were interviewed on the structured questionnaire and their comments were noted which were the findings

The Following Were the Findings According To the Senior Managers

- Customer feedback system Improves business revenue
- Customer feedback system Increases sales
- Customer feedback system Improves upsell and cross-sell
- Customer feedback system Improves brand image
- Customer feedback system Improve Services and retain your loyal customers
- Customer feedback system helps in creating customer Intimacy
- Customer feedback system helps in decision making related to product development
- Customer feedback system helps ion creating Brand Intimacy

DISCUSSION AND CONCLUSION

Customer service is a vital aspect of the hospitality industry. In fact, one can state that customer service is identical with the hospitality industry. As a significant part of the hotel industry, focusing on customer service in the hospitality industry is moving for thorough planning, more incoming customers, and increased customer satisfaction. The hospitality industry is a broader category and it covers imperative areas like accommodation, food and beverages, travel, and tourism. It is not easy to focus on every sector individually through manual operations. To overcome this, companies belonging to this developing industry have started investing in Customer Feedback software for the hospitality industry. Through this, they can effectively manage the different aspects of customer service and deliver a satisfactory service to the hotel guests.

The benefits of CRM in hospitality industry are more as a result, it is always advised the incorporation of hotel management business with a CRM platform for increased and required results. Good customer service is one of the outcomes expected from a CRM in the hospitality industry.

As per the latest research around 81% of customers say that they would be willing to leave feedback if they knew they would get a fast response.

Mailing thank you letters to the clients who gave you incredible feedback increases the chances of getting genuine feedback in the future.

Personalizing an email response genuinely thanking them for taking time out of their busy schedules to give feedback is also an effective way of getting genuine feedback.

The guess always feels that if their voice is being heard and that something will be done about it they aren't afraid to share their opinions.

Today hospitality organizations should take the responsibility to follow up with the customers who share feedback. If they fail to do so than, the guests won't share the feedback later on, and the organization will run a higher risk of business failure because they have failed to capture the good and bad feedback from our customers.

If a guest repeats the exact same feedback twice, it denotes that the organization didn't address the issue after they raised it in the first comment, by this way organization will lose its credibility and the guests may not be

interested and willing to give their genuine feedback in the future which could be detrimental to the organization.

REFERENCES

1. Cronin, J. J., Brady, M. K., & Hult, G. T. M. (2000). Assessing the effects of quality, value, and customer satisfaction on consumer behavioral intentions in service environments. *Journal of Retailing*, 76, 193-218.
2. Cunningham, P., Smyth, B., Wu, G., & Greene, D. (2010). Does TripAdvisor makes hotels better?. Technical Report UCD-CsI-2010-06, 1-10. Retrieved from: <http://www.csi.ucd.ie/files/ucd-csi-2010-06.pdf> on 14 May 2012.
3. Dyche, J. (2002). *The CRM Handbook "A Business guide to Customer Relationship Management*. Boston: Addison-Wesley. Fan, Y. W., & Ku, C. S. (2007). A case study for increasing customer relationship through information system in hotel industry, *Proceedings of the Sixth Conference on Enterprise Resource Planning*,
4. Taichung (ROC) Fornell, C., & Westbrook, A. (1984). The vicious circle of consumer complaints. *Journal of Marketing*, 48, 68-78. Gretzel, U. (2006). Consumer generated content – Trends and implications for branding. *E-Review of Tourism Research*, 4, 9-1
5. Prasad, K., Wirtzb Ph., & Yu L., (2013). Measuring hotel guest satisfaction by using online quality management system. In press, forthcoming *Journal of Hospitality Marketing and Management*
6. Samanta, I. (2009). The impact of e-customer relationship in hotel industry. *Communications in Computer and Information Science*, 49, 484-494
7. Zhang, Z. Q., Ye, Q., Law, R., & Li, Y. J. (2010). The impact of e-word-of-mouth on the online popularity of restaurants: A comparison of consumer reviews and editor reviews. *International Journal of Hospitality Management*, 29, 694-700.
8. Zhang, J.J., & Mao, Z.(2012). Image of all hotel scales on travel blogs: Its impact on customer loyalty. *Journal of Hospitality Marketing and Management*, 21, 113- 13.
9. Zineldin, M. (2006). The royalty of loyalty: CRM, quality and retention. *The Journal of Consumer Marketing*, 23, 430-437
10. Whitefield, J. (2011), *People will talk*, John Willey and Sons Alsop, R. (2013), *The 18 Immutable Laws of Corporate Reputation*, Free Press.
11. Gopikan, R. (2015), *Corporate Reputation*, Routledge Press.
12. Griffin, A. (2009), *New strategies for Reputation*, Management Kogan Press.
13. Griffin, H. (2013), *Rethinking Reputation*, Mcgraw-Hill Education. 5. Hardaker, G. and Houghton, M. (2013), *Weird Marketing*, John Willey and Sons, New York.

Identification of Metabolites from an Active Fraction of Paracetamol 500 mg Tablet Sample by Gas Chromatography Mass Spectrometry

Rohit S. Gupta* and R R Deshmukh

Department of Computer Science and IT, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (MS)

ABSTRACT

Paracetamol or Acetaminophen is commonly prescribed medicines by doctors and medicinal experts for relieve the body fever and worked as pain killer. Due to the more uses of this drug in pharmaceutical industry there are more chances for counterfeiting of paracetamol medicines. In this research work we analyzed the Ten different types of paracetamol tablets purchased from local market pharmacies by using Gas Chromatography Mass Spectroscopy (GCMS) technique. Results showed that spectra show retention time 8.045 of paracetamol with molecular formula $C_8H_9NO_2$ and weight 151.00 it given sharp single line it indicates presence of paracetamol with less amount of other micro-constituents, it was also observed that out of 10 samples, the sample number 2, 4, 5, 6, 8 spectra indicates 95% pure paracetamol with less amount of other excipients. In sample number 9 Spectra showed absent of paracetamol peak in given spectra that indicates no paracetamol contain is present and all excipients indicates there is no active components in the tablet.

INTRODUCTION

Counterfeiting or Falsfield medicines are common problem all over the world. According to the WHO, near about 10-15% medicines are substandard all over the world [1]. Substandard medicines are those medicine that having variations in the quantity of API and Excipients added in tablets [2]. Counterfeit medicines can be came into the category of Substandard, Un-registered/unlicensed and Falsfield. The medical product is authorized but does not meet its specification and fail to meet their quality standard called substandard product. Falsfield Medical products that are fraudulently misrepresented in terms of identity, content, or source. To detect Substandard and Falsfield medicines are very challenging and time consuming by traditional methods like visual inspection [3]. For Identification of Counterfeit medicines there are numerous techniques are available in pharmaceutical industry and this can be categorized in Chromatographic, Hyperspectral Imaging, and Spectroscopic technique [4][5][6]. The chromatographic technique has been widely used in the pharmaceutical industry for many decades, but it has numerous advantages. Chromatography techniques are divided into two types: liquid chromatography and gas chromatography [7]. Liquid chromatography is a technique for separating a sample into its constituent parts. This separation occurs as a result of the sample's interactions with the mobile and stationary phases [8]. Because there are numerous stationary/mobile phase combinations that can be used to separate a mixture, chromatography is classified into several types, those phases' physical states [9]. The most common and widely used chromatography technique is liquid-solid column chromatography. Gas chromatography, also known as gas liquid chromatography, is a technique used to separate, identify, and quantify components of a mixture of organic compounds by selective partitioning between the stationary phase and mobile phase within a column, followed by sequential elution of separated components [10]. The primary goal of gas chromatography is to separate compounds that have the High volatility, Low molecular weights and Thermal stability properties. Gas chromatography work efficiently when we attached Mass Spectroscopy to it and it becomes a GSMS [11]. The GC/MS instrument separates chemical mixtures and identifies the components at the molecular level. It is one of the most precise instruments for analyzing pharmaceutical samples. According to the previous researches and literature review, we found that the GCMS techniques give good results and useful in pharmaceutical applications [12]. Paracetamol is a long-established substance that is one of the most widely used drugs in the world. It has been shown to be effective in treating headaches and other aches, pain and fever, cold and flu in both children and adults [13]. For the treatment of various types of pain, paracetamol can be combined with other medications. Because of its extensive use for therapeutic purposes, quick methods for determining it during quality control are critical [14]. Many methods for determining paracetamol have been reported in recent years, including chromatographic, spectroscopic, spectrophotometric, and electrochemical techniques. We used Gas Chromatography Mass Spectroscopy techniques to analyze our paracetamol tablet samples in our research because of their benefits shown in previous research work in pharmaceutical area.

MATERIAL AND METHOD

Collection and Preparation of Paracetamol Tablet:

Collection of Samples

Ten (10) different types of Plain Paracetamol tablets having 500mg of paracetamol as Active Pharmaceutical Ingredients (API) was purchased from local pharmacies from various locations from Aurangabad City, Maharashtra.

Sample Preparation:

Individual tablets was crushed one by one using Pestle and mortal and converted into the fine powder and keep it individual tablet powder in air tight bag with proper labeling. After completing this process the all samples are taken for the GCMS analysis in laboratory.

Analysis Method:

Fractionations was done by Solvent extraction or Liquid - liquid extractions, then evaporations of solvent was manual done and condensed extract stored at -4°C . In this respects the obtained samples were made to analyze the volatile secondary metabolites from the selected medicinal plants by GC-MS. The GC-MS analysis were done in the Sophisticated Analytical Instrumentation Facility, MIT College, Aurangabad. The obtained results were interpreted as their medicinal properties and economically important values of those chemical constituents.

This is a separation and identification technique in which gas-chromatograph coupled with high resolutions mass spectrometer is a combined analyzer that has a superior ability in analyzing organic compounds qualitatively and quantitatively. It inherits the features of high resolution and accurate mass measurement with simple operation and high sensitivity. While gas-chromatographer doing separation and mass spectrometer is for identification of separated compounds.

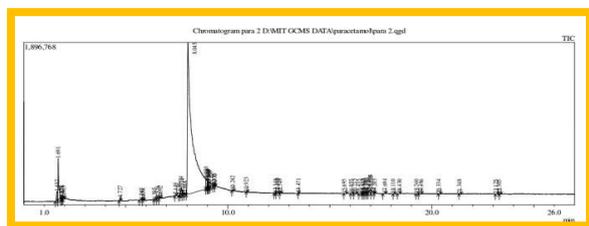
GC-MS Analysis

For each sample the analytical method is same while the oven temperature is variable, Injection port temperature is 250, Carrier gas is Helium 1ml /sec, Inter face temperature is 250, Ion source is at 200, Analysis was done by using E+ IONISATION WITH 70ev, The MS is Accu TOF GCV, Column through the sample passes is HP-5. The MS detection was completed in 36 minutes. The detection employed the NIST Ver. 2.0-year 2005 library.

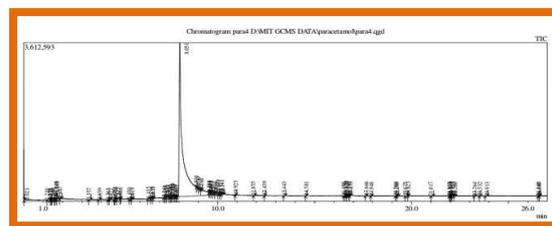
RESULTS AND DISCUSSION

The study involves analysis of ten different brands (sample) of 500 mg paracetamol tablets using GCMS spectra methods. The results obtained were compounds with that of sample spectra 1-10 with ten tables; it was obtained that how much pure paracetamol constituent present with excipients and micro-constituent by using GCMS spectra and its given table 1 to 10.

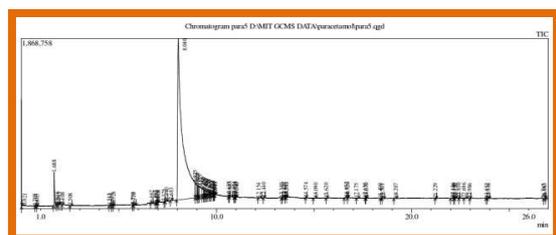
The results revealed that the presence of peak in spectra it indicates that name of compounds, structure of compounds, molecular formula and molecular weight and the spectrum profile of GC-MS confirmed the presence of major components with the retention time. It was observed that sample number 2, 4, 5, 6, 8 spectra indicates out of 10 sample, it contain 95 % pure paracetamol with less amount of other excipients see spectra and table



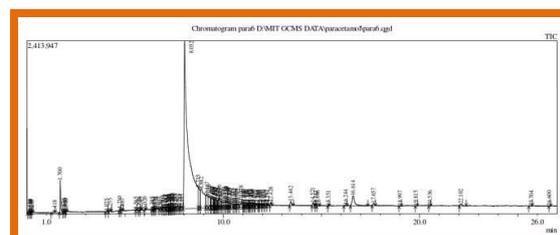
Sample 2



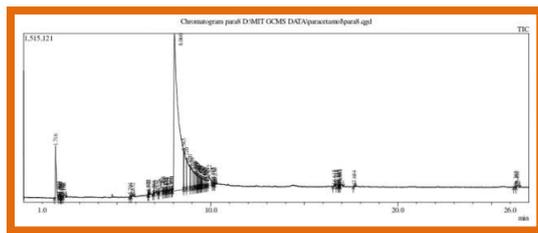
Sample 4



Sample 5



Sample 6



Sample 8

Figure Represented Counts versus Mass to Charge (M/Z) Ratio

These results indicate that spectra show retention time 8.045 of paracetamol with molecular formula $C_8H_9NO_2$ and weight 151.00. It gives a sharp single line, indicating the presence of paracetamol with less amount of other micro-constituents. See table number 2, 4, 5, 6 and 8.

Sample 2

Table 2 : Activity of identified in GC fractions of the sample paracetamol 2

Name of compound	Structure of compound	Retention time	Molecular formula	Molecular weight
1-chloro-1-fluoro ethane		1.690	C_2H_4ClF	82.00
paracetamol		8.045	$C_8H_9NO_2$	151.00

Sample 4

Table 4 : Activity of identified in GC fractions of the sample paracetamol 4

Name of compound	Structure of compound	Retention time	Molecular formula	Molecular weight
paracetamol		8.050	$C_8H_9NO_2$	151.00

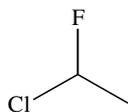
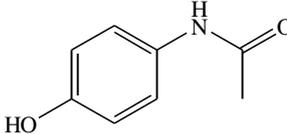
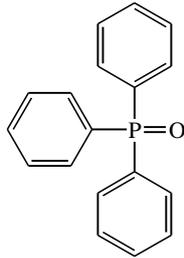
Sample 5

Table 5 : Activity of identified in GC fractions of the sample paracetamol 5

Name of compound	Structure of compound	Retention time	Molecular formula	Molecular weight
1-chloro-1-fluoro ethane		1.690	C_2H_4ClF	82.00
paracetamol		8.040	$C_8H_9NO_2$	151.00

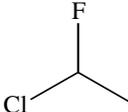
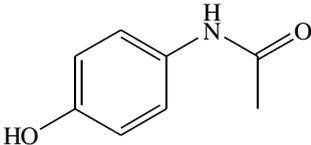
Sample 6

Table 6: Activity of identified in GC fractions of the sample paracetamol 6

Name of compound	Structure of compound	Retention time	Molecular formula	Molecular weight
1-chloro-1-fluoro ethane		1.700	C ₂ H ₄ ClF	82.00
paracetamol		8.030	C ₈ H ₉ NO ₂	151.00
Triphenylphosphine oxide		16.615	C ₁₈ H ₁₅ OP	278.00

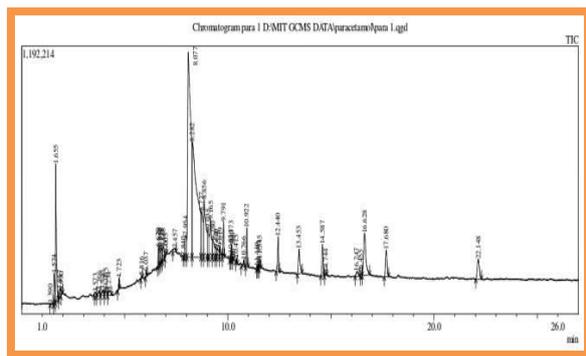
Sample 8

Table 8: Activity of identified in GC fractions of the sample paracetamol 8

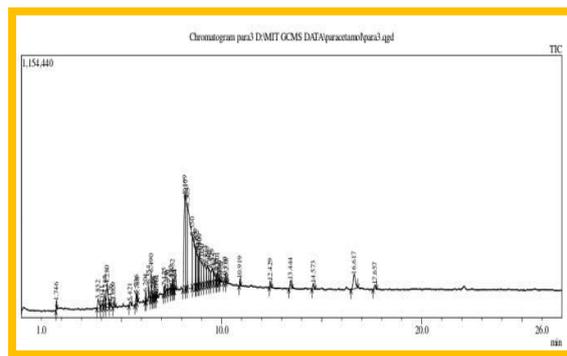
Name of compound	Structure of compound	Retention time	Molecular formula	Molecular weight
1-chloro-1-fluoro ethane		1.715	C ₂ H ₄ ClF	82.00
paracetamol		8.060	C ₈ H ₉ NO ₂	151.00

The individual fragmentation patterns of the components were illustrated in Figure 2, 4, 5, 6 and 8. The mass spectrum of the compound with retention time 8.075 (Hit-1) paracetamol gave 5 major peaks (m/z) at 151, 109, 80, 53, 43. This investigation is the first study reporting comprehensive metabolites profiling of active fraction of paracetamol of different brands of samples.

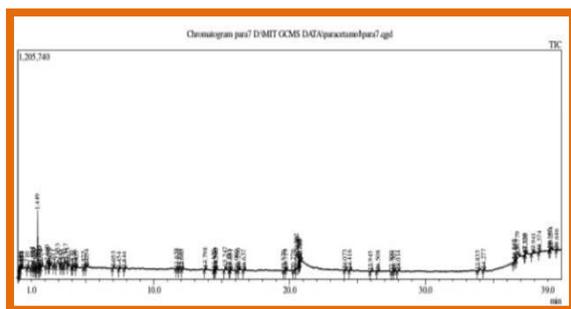
The remaining sample 1, 3, 7, 10 it indicates that given spectra show that less amount of paracetamol with high impurities or excipients present see spectra and tables.



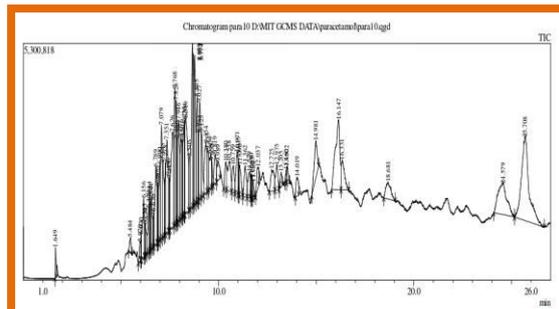
Sample 1



Sample 3



Sample 7



Sample 10

Figure Represented Counts Versus Mass To Charge (M/Z) Ratio

Sample1

Table 1 : Activity of identified in GC fractions of the sample paracetamol 1

Name of compound	Structure of compound	Retention time	Molecular formula	Molecular weight
1-chloro-1-fluoro ethane		1.655	C ₂ H ₄ ClF	82.00
paracetamol		8.075	C ₈ H ₉ NO ₂	151.00
Tetradecamethyl, hexasiloxane		8.280	C ₁₄ H ₄₂ O ₅ Si ₆	228.00
Cyclodecasiloxane		8.850	C ₂₀ H ₆₀ O ₁₀ Si ₁₀	740.00
Cyclooctasilone		9.790	C ₁₆ H ₄₈ O ₈ Si ₈	592.00
2-ethylhexyl ester		13.45	C ₂₂ H ₄₂ O ₄	370.00
Triphenylphosphine oxide		16.63	C ₁₈ H ₁₅ OP	278.00

Table 3 : Activity of identified in GC fractions of the sample paracetamol 3

Name of compound	Structure of compound	Retention time	Molecular formula	Molecular weight
1-chloro-1-fluoro ethane		1.745	C ₂ H ₆ OS	78.00
3,3,5-Triethoxy-1,1,1,7,7,7-hexamethyl-(tetrasiloxane)		3.825	C ₁₅ H ₄₂ O ₇ Si ₅	474.00
Tris(tert-butyl)dimethylsilyl succinamide		4.170	C ₂₂ H ₅₀ N ₂ O ₂ Si ₃	474.00
Cyclodecasiloxane, dodecamethyl		4.605	C ₁₂ H ₃₆ O ₆ Si ₆	444.00
paracetamol		8.170	C ₈ H ₉ NO ₂	151.00
Benzenamine, 4-propoxy		8.305	C ₉ H ₁₃ NO	151.00
5-[1-ethyl-1Hpyrazol-4-yl]-4-hydroxy-3-methyl-1,3thiazolidine-2-thione		8.550	C ₁₀ H ₁₅ N ₃ OS ₂	370.00
4-amino phenol		8.700	C ₆ H ₇ NO	109.00
2,5-furandione, dihydro-3-(2-methyl-2-propenyl)		8.845	C ₈ H ₁₀ O ₃	154.00
Tetradecanoic acid, 12-methyl ester		9.030	C ₁₆ H ₃₂ O ₂	256.00

Name of compound	Structure of compound	Retention time	Molecular formula	Molecular weight
Dicyclohexanol		9.735	C ₁₄ H ₂₄ O ₂	224.00
Cyclononasiloxane, octadecamethyl		10.920	C ₁₈ H ₅₄ O ₉ Si ₉	666.00
Hexanedioic acid, ester		13.445	C ₂₂ H ₄₂ O ₄	370.00
Triphenylphosphine oxide		16.615	C ₁₈ H ₁₅ OP	278.00

Sample 7

Table 7 : Activity of identified in GC fractions of the sample paracetamol 7

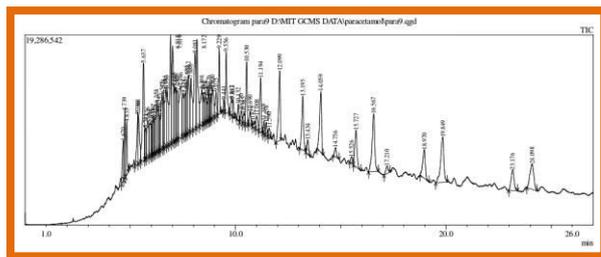
Name of compound	Structure of compound	Retention time	Molecular formula	Molecular weight
1-chloro-1-fluoro ethane		1.450	C ₂ H ₄ OS	78.00
paracetamol		20.500	C ₈ H ₉ NO ₂	151.00

Sample 10

Table 10: Activity of identified in GC fractions of the sample paracetamol 10

Name of compound	Structure of compound	Retention time	Molecular formula	Molecular weight
1-chloro-1-fluoro ethane		1.650	C ₂ H ₄ ClF	82.00
Pentatriacontane		5.485	C ₃₅ H ₇₂	492.00
1,1,6-trimethyl-3-methylene-cyclohexane		6.420	C ₃₃ H ₅₆	452.00
Stigmastane-3,6-dione		6.670	C ₂₉ H ₄₈ O ₂	428.00
Tetrapentacotane 1,54-dibromo		6.790	C ₅₄ H ₁₀₈ Br ₂	914.00
Tricyclo-triacontane diepoxy		6.875	C ₃₀ H ₅₂ O ₂	444.00
Friedelan-3-one		7.625	C ₃₀ H ₅₀ O	426.00
paracetamol		8.075	C ₈ H ₉ NO ₂	151.00
Cyclohexanemethanol		8.150	C ₁₃ H ₂₄ O ₂	212

Above result indicates that presence of 50 % paracetamol with 50 % other micro-constituents show in spectra and tables.



Sample 9

Table 9: Activity of identified in GC fractions of the sample paracetamol 9

Name of compound	Structure of compound	Retention time	Molecular formula	Molecular weight
Triacotane		4.83	C ₃₀ H ₆₂	422.00

In sample number 9 it is absent of paracetamol peak in given spectra it indicates that no paracetamol contain is present and all exicenpents indicates highly impure sample.

CONCLUSIONS

According to our knowledge, this investigation is the first study reporting comprehensive metabolites profiling of active fraction of paracetamol of different varieties by using GCMS. This method is highly sensitive and used for rapid identification of metabolites. The findings of this study suggest that paracetamol a different brands of sources of important metabolites contributing purity of paracetamol sample was detected in active fraction, which may lead to the biomagnifications which become another line of future prospect.

ACKNOWLEDGEMENT

This work is supported by Department of Science and Technology under the Funds for Infrastructure under Science and Technology (DST-FIST) with sanction no. SR/FST/ETI-340/2013 to Department of Computer Science and Information Technology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra, India. The authors would also like to thank Department of Science and Technology (DST) for providing financial support in the form of fellowship and Department and University Authorities for providing the infrastructure and necessary support for carryout the research.

REFERENCES

- Dégardin K, Guillemain A, Guerreiro NV, Roggo Y. Near infrared spectroscopy for counterfeit detection using a large database of pharmaceutical tablets. *Journal of pharmaceutical and biomedical analysis*. 2016 Sep 5;128:89-97.
- Muntean, Dana Maria, Cristian Alecu, and Ioan Tomuta. "Simultaneous quantification of paracetamol and caffeine in powder blends for tableting by NIR-chemometry." *Journal of spectroscopy* 2017 (2017).
- Pino-Torres, César, Santiago Maspocho, Rosario Castillo-Felices, Mónica Pérez-Rivera, Mario Aranda-Bustos, and Carlos Peña-Farfal. "Evaluation of NIR and Raman spectroscopies for the quality analytical control of a solid pharmaceutical formulation with three active ingredients." *Microchemical Journal* 154 (2020): 104576.
- Belal, Tarek, Tamer Awad, and Randall Clark. "Determination of paracetamol and tramadol hydrochloride in pharmaceutical mixture using HPLC and GC-MS." *Journal of chromatographic science* 47, no. 10 (2009): 849-854.
- Alhazmi, Hassan A., Waqar Ahsan, Mohammed Al Bratty, Asaad Khalid, Shahnaz Sultana, Asim Najmi, Hafiz A. Makeen et al. "Chemo-Profiling of Illicit Amphetamine Tablets Seized from Jazan, Saudi Arabia, Using Gas Chromatography-Mass Spectrometry and Chemometric Techniques." *Journal of Chemistry* 2021 (2021).

6. Alshehri, Ali Zaid, Mohammed saeed Al Qahtani, Mohammed Aedh Al Qahtani, Abdulhadi M. Faeq, Jawad Aljohani, and Ammar Alfarga. "GC-MS analysis of Adulterants in Captagon Tablet." *Journal of Chemistry and Nutritional Biochemistry* 1, no. 1 (2020): 14-21.
7. Chauhan, Ashish, Manish Kumar Goyal, and Priyanka Chauhan. "GC-MS technique and its analytical applications in science and technology." *J. Anal. Bioanal. Tech* 5, no. 6 (2014): 222.
8. Alnuwaiser, Maha Abdallah. "Utilization of both UV and GC-MS spectroscopy to track the estimation of caffeine and acetaminophen in a number of paracetamol analgesic drugs", *Multi knowledge Electronic Comprehensive Journal For Education and Science Publications*, ISSN:2616-9185, pp.1-13, 2021
9. Athenstädt, Behnusch. "Development of GC-MS methods for the identification and quantification of leachables from plastic packaging in dialysis solutions." PhD diss., Duisburg, Essen, Universität Duisburg-Essen, Diss., 2013, 2013.
10. Parys, Wioletta, Małgorzata Dołowy, and Alina Pyka-Pająk. "Significance of Chromatographic Techniques in Pharmaceutical Analysis." *Processes* 10, no. 1 (2022): 172.
11. Belal, Tarek, Tamer Awad, and C. Randall Clark. "Stability-indicating simultaneous determination of paracetamol and three of its related substances using a direct GC/MS method." *Journal of AOAC International* 92, no. 6 (2009): 1622-1630.
12. Pereira, Fernando J., Aida Rodríguez-Cordero, Roberto López, Luis C. Robles, and A. Javier Aller. "Development and validation of an RP-HPLC-PDA method for determination of paracetamol, caffeine and tramadol hydrochloride in pharmaceutical formulations." *Pharmaceuticals* 14, no. 5 (2021): 466.
13. Gupta Rohit S., Ratnadeep R. Deshmukh, and Akshay V. Kshirsagar. "Spectral Database of Pharmaceutical Common Excipients and Paracetamol API Using ASD Field Spec 4 Spectroradiometer." *Medico-Legal Update* 21, no. 2 (2021).

Socio-Economic Issues and Work-Based Health Ailments among the Flower Farming Labourers - A Case Study in a Village of North 24 Parganas District, West Bengal

Priyabrata Mondal, Suvankar Paul, Baishakhi Roy and Abhijit Das

Associate Professor, Department of Anthropology, West Bengal State University, West Bengal, India

ABSTRACT

The socio-economic milieu of flower cultivation under modernization is presently known as Floriculture. The present study tried to highlight the socio-economic issues of flower farming population in a holistic perspective, as well as the associated health problems faced by the flower farming workers along with their ways of healing process. The methods or techniques like participant observation, intensive interviews, and case studies have been utilized for collecting the contextual data from the village Sutia, in the District of North 24 parganas, West Bengal. Both male and female workers are engaged with this work. Various health issues have been found among the studied population which they suffer by working in the field. Various types of precautions have been used by the both male and female workers.

Keywords: Horticulture, Floriculture, Socio-economic, Work-related risk factors, Precaution use, Division of labour.

INTRODUCTION

Flowers please the mind and grant prosperity. Some flowers play a significant role on religious rituals on Hinduism as well as other religious purposes. Not only religious purposes but also marriage ceremony, birthday celebration, medicine making and so on flowers are extensively used daily (Mahalle, et al., 2020). Floriculture production may contain a wide variety of various types of flower plans and plant materials and they can be divided into cut flower and foliage, bedding plants in the field, gardening flower plants, potted flower plants, nursery flower plants, etc. (Kumar & Esaimalar, 2021; Ekhuemelo, et al., 2016). Flower cultivation is eco-friendly cultivation as well as it is also profitable business. In India, floriculture industry share 2% as compared to the total horticulture production (Kundu and Som, 2020). Flower cultivation is one most potential components of the Horticulture industry and it has an important role from aesthetic, social and economic point of view. There is a lot of demand of fresh and good quality flower for decoration of ceremonial places, for bouquets preparation and for floral baskets. For this the flower demand is increasing day by day as well as it is also improved the trade of flower. On the other hand, flowers are used to express the most sensitive, delicate and loving feelings (Huss, Yosef & Zaccari, 2017). Government and various NGO's are taken initiative to develop the floriculture industry like, Kishan Call Centre, Agriculture Technology Information Centre, National Agriculture Bio-computing Portal, E-choupal, India: m-krishi etc. (Mondal, 2017).

Labours are the backbone of any kind of industry, in floriculture industry is not exceptional. Different kinds of labourers are being there and they have different role in cultivating flowers. Seed bed making to marketing of flowers these labourers were engaged. As we know that more or less 53% population are professionally engaged with agricultural labour. In floriculture industry there were more than ten types of labourers engaged like, ploughing, laddering, weeds clearing, spading, flower plucking, garlanding etc. apart from this those jobs were done by both male and female workers. Male workers mainly engaged with spading, ploughing, seed bed making etc. on the other hand female workers engaged with flower plucking, garlanding, weeds clearing etc. The main purpose of this study is to unveiling the associated risk factors to cultivating flowers of the labourers at work time and how they overcome from these risk factors. A number of physical health problems were arose their body during work time. These health issues are allergic reaction, eyes irritation, skin infectious diseases, musculoskeletal problem, body pain, asthma, etc. The study also focused to the socio-economic issues and consequences under study. Female workers are generally work hard but did not get any satisfactory payment. They paid less than their male counterpart. In last two decades there are many floriculture units have been established and it offers a huge number of employments opportunities in both production and selling lines (Chetan and Yogish, 2020; Chakraborty, 2014). Since, the sector has a huge export potential the rising horticulture sector can provide a lot of opportunities to the farmers after proper skill (Biswas, 2013).

The Area of Study: An Overview

The **Sutia** village is located in the Sutia Grampanchayat of the North 24 Parganas district of West Bengal, India. The total population of the village is 2977 as per 2011 census. Here both Hindu as well as Muslim

communities are living together and their primary occupation is seasonal flower cultivation and agriculture. Most of the villagers are belonging to Hindu community. A least number of the Muslim families are living in the studied village.

Methodology and Sampling:

All the data for the present study have been collected from contextual observations using Intensive interview, Case study, Schedule & Questionnaire method. The Case Studies have been used to collect the different types and phases of flower cultivation. Intensive interviews have been used to know about the cultivable land, present economic conditions, and types of health problem during work time, etc. Schedule & Questionnaire methods also have been used to view the different socio-economic issues as well as physical health problems and how they overcome. All the primary data have been collected through purposive sampling. Only the flower cultivation labourers were included in this study who were engaged with different aspects of flower cultivation. The quantitative analyses have been done through Microsoft Excel.

Objectives of the Present Study:

The objectives of the present study are-

1. To observe the socio-economic status among the flower farming workers.
2. To unveiling the associated health problems faced by the flower farming workers while working and the solution of those problems.
3. To find out the patterns of production in the economic system along with the variegated relationships as prevailed around the flower cultivation under study.

RESULTS AND DISCUSSION:

A. The Socio-Economic Aspects: An Overview

Table 1: Age wise Sex distribution of studied population

Age Wise Sex Distribution Of Studied Population				
Age Group	Male	%	Female	%
10 to 19	0	0.00	20	22.47
20 to 29	6	14.63	20	22.47
30 to 39	4	9.76	18	20.22
40 to 49	14	34.15	17	19.10
50 to 59	11	26.83	13	14.61
60 & Above	6	14.63	1	1.12
Total	41	100.00	89	100.00

Table 1 shows the age wise sex distribution among the studied population. The present study has been done on the total 130 members of both sexes where 41 individuals are male and 89 individuals are female. Female members are massively engaged with this work than male members because lots of work like flower plucking, garlanding etc. are generally reserved for the female members. While excessive rigorous and energy needed works like soil cutting, ladder man etc. are reserved for male members. It has been observed from the above table that many female members whose age is 10 to 19 are engaged with the various type of works which is directly related with the flower cultivation. While not a single number of male members of the above mentioned age group are engaged with any types of flower cultivation related work. On the other hand 22.47%, 20.22%, 19.10% & 14.61% female members are engaged with flower cultivation work from the age group 20 to 29, 30 to 39, 40 to 49 and 50 to 59 respectively. While 14.63%, 9.76%, 34.15% and 26.83% male members are engaged with flower cultivation work from the age group 20 to 29, 30 to 39, 40 to 49 and 50 to 59 respectively. It has been noticed that old age workers are found among the studied population and they are generally male members (14.63%), whereas only 1 old age female member is found.

Table 2: Community & Sex wise distribution of the studied population

Community & Sex Wise Distribution Of Studied Population					
Male Worker			Female Worker		
Religion	No. Of Population	%	Religion	No. Of Population	%
Hindu	12	29.27	Hindu	38	42.70
Muslim	29	70.73	Muslim	51	57.30
Total	41	100.00	Total	89	100.00

Table 2 shows the sex wise religion distribution among the studied population. Hindu and Muslim community's people are more or less equally found among the studied population. Religious barriers are not present there. Muslim workers were more engaged for cultivation of flowers. They choose this work as their primary occupation for fulfilment the demands of flowers. It has been noticed from the above table that 29.27% and 42.70% Hindu workers are male and female respectively. On the other hand 70.73% male and 57.30% female are belonging from Muslim community.

Table 3: Sex Wise Marital Status

Sex Wise Marital Status					
Male Marital Status	No. Of Population	%	Female Marital Status	No. Of Population	%
Married	34	82.93	Married	53	59.55
Unmarried	7	17.07	Unmarried	27	30.34
Widower	0	0.00	Widow	9	10.11
Total	41	100.00	Total	89	100.00

Table 3 shows the distribution of sex wise marital status among the studied population. It has been found that the maximum no. of male workers is married while more or less half of the female workers out of total female workers are married. The percentage married male and female workers is 82.93% and 59.55% respectively. On the other hand only 17.07% male and 30.34% female workers are unmarried. Unmarried female workers have been largely found in respect of male workers. It is only happened because to earn pocket money and to give economic support to the family, many young girls have been joined with various types of flower cultivation related works beside their study. On the other hand young boys also engaged in various work except the works which are flower cultivation related. The young boys are not like the floriculture related work because the wages are very low and they do not want to work within their locality. Widower has been not found among the studied male population. Although 10.11% (9 female workers) widow have been found among the studied female population.

Table 4: Sex Wise distribution of Educational Levels of studied population

Sex Wise Distribution Of Educational Levels Of Studied Population					
Educational Status of Male	No. of Population	%	Educational Status of Female	No. of Population	%
Illiterate	2	4.88	Illiterate	24	26.97
Can Sign	7	17.07	Can Sign	11	12.36
Primary	8	19.51	Primary	5	5.62
Secondary	19	46.34	Secondary	39	43.82
Higher Secondary	4	9.76	Higher Secondary	8	8.99
Graduate	1	2.44	Graduate	2	2.25
Total	41	100.00	Total	89	100.00

Table 4 display the sex wise distribution of educational levels among the studied population. Among the male workers only 4.88% are illiterate while 26.97% workers among the female workers are illiterate. It has been observed from the above table that 17.07% workers can sign their name, 19.51% done their education up to primary level, 46.34% done their schooling up to secondary level, 9.76% completed higher secondary level and only 2.44% completed their graduation. On the other hand among the studied female workers 12.36% can sign their name, 5.62% done their schooling up to primary level, 43.82% completed their education up to secondary

level, 8.99% done their schooling up to higher secondary, and only 2.25% female workers completed their graduation. It has been also observed that the percentages of educational status among the both male and female are remain same. Only the percentage of illiterate has been mostly found among the female workers in respect to the studied male population.

Table 5: Sex Wise Division of Labours

Sex Wise Division of Labours					
Categories of Male Working Status	No. of Population	%	Categories of Female Working Status	No. of Population	%
Preparation Land	10	24.39	Preparation Land	6	6.74
Fertilization	2	4.88	Fertilization	0	0.00
Irrigation	4	9.76	Irrigation	0	0.00
Laddering	3	7.32	Laddering	0	0.00
Seed Bed Making	3	7.32	Seed Bed Making	0	0.00
Spading	16	39.02	Spading	0	0.00
Tractor Driving	3	7.32	Tractor Driving	0	0.00
Plucking Of Flowers	0	0.00	Plucking Of Flowers	48	53.93
Garlanding	0	0.00	Garlanding	32	35.96
Weeds Clearing	0	0.00	Weeds Clearing	3	3.37
Total	41	100.00	Total	89	100.00

Table 5 shows the sex wise division of labours. Many types of works have been found in the flower cultivation. It has been found from the above table that 24.39% male workers and only 6.74% female workers are engaged in preparation land. Actually these types of work need more muscle power than other works and only this reason very few female workers are engaged with this work. It has been also observed that 9.76% male workers are engaged with the irrigation work, 7.32% male are engaged with the laddering work. Actually the laddering works hard to break the soil into tiny pieces as like as powder. Apart from these 39.02% and 7.32% men are engaged with spading and tractor driving. On the other hand 53.93%, 35.96% and 3.37% women among the total studied female population are engaged with the work plucking of flowers, garlanding and weeds clearing respectively. Here it is worth mentioning that not a single number of female workers have been found working as a fertilizing, irrigation, seed bed making, spading and tractor driving work. The main reason behind this is the above mentioned works need more muscle power and more risky than others work, while not a single male worker has been found among the work type like flower plucking, garlanding, and weeds clearing because these works generally allocated only for female workers which not needed more muscle power and not so much risky.

Table 6: Sex Wise Daily Wages Distribution

Sex Wise Daily Wages Distribution					
Daily Wages Of The Male	No. Of Population	%	Daily Wages Of The Female	No. Of Population	%
> 100	0	0.00	> 100	76	85.39
101-200	9	21.95	101-200	12	13.48
201-300	22	53.66	201-300	1	1.12
301-400	4	9.76	301-400	0	0.00
401-500	6	14.63	401-500	0	0.00
Total	41	100.00	Total	89	100.00

Table 6 shows that the sex wise daily wages distribution. It has been observed that 21.95%, 53.66%, 9.76% and 14.63% male workers are belong to the category of 100-200, 201-300, 301-400 and 401-500/day respectively, while not a single male worker have earn 100 rupees and less than 100 rupees per day. On the other hand maximum female workers (85.39%) get 100 or less than 100 rupees per day, while only 13.48% and 1.12% female workers belong to the category 101-200 and 201-300/day respectively. It has been also observed that no male members are there in low wages category and no female members are there in high wages categories. The reason behind this is the female members are extensively engaged with flower plucking and garlanding work which requires less muscle power and their wages is very low. On the other hand male members are generally engaged in those works which need much muscle power and their wages is high.

Table 7: Sex Wise Distribution of Ailment of the studied population

Types of Ailment	Male		Female	
	No. of Population	%	No. of Population	%
Body pain	11	26.83	29	32.58
Fever, Cough & Cold	14	34.15	16	17.98
Allergic reactions	7	17.07	12	13.48
Liver problems	3	7.32	9	10.11
Skin infections	6	14.63	23	25.84
Total	41	100.00	89	100.00

Table 7 shows that the distribution of ailment among the studied population. It has been found that among male workers 26.83%, 34.15%, 17.07%, 7.32% and 14.63% were suffering from body pain, fever cough & cold, allergic reactions, liver problems and skin infections respectively. The main reason of skin infection are due to water pollution, pollen grains or glue of flowers. Female members are more prone to suffering from body pain and skin infections because they are plucking flower from trees bending their body and they are directly attached with tree and soil. The female workers need more effort than male workers during grass root level and that is why they are suffering from body pain more than male workers. Many people have allergic reaction with the pollen which was found from the flower. Here among the studied population 17.07% and 13.48% male and female workers are suffering from allergic reaction respectively. During field survey, informants informed that they suffered eye irritation, sneezing, coughing, as a result of allergic reactions. Few workers are suffered liver problem as because they are working under tremendous sunlight and abnormal diet pattern. Fever, cold & cough is normal among the human population. Many workers have been found that they are suffering from fever, cold & cough because their continuous working under rain and sunlight.

Table 8: Distribution of Precaution use Followed by the Workers during Work.

Sex Wise Distribution Of Precaution					
Precaution Used By Male			Precaution Used By Female		
Precaution	No. Of Population	%	Precaution	No. Of Population	%
Face Mask	2	4.88	Face Mask	5	5.62
Hand Gloves	7	17.07	Hand Gloves	22	24.72
Skin Ointment	0	0	Skin Ointment	2	2.25
Sunglass	27	65.85	Sunglass	22	24.72
Lemon Extract	0	0	Lemon Extract	28	31.46
Coconut Oil	0	0	Coconut Oil	17	19.1
Cap	30	73.17	Cap	12	10.68
Mulberry	13	31.71	Mulberry	25	22.25
Talcum powder	10	24.39	Talcum powder	24	21.36

Table 8 shows that the precaution followed by the workers during the work. It has been observed from the above table that 65.85% male members only used sunglass, while only 24.72% female workers used sunglass during their work to avoid the sun light from their eyes. Among the male workers 4.88% and 17.07% male members used face mask and hand gloves during their work. On the other hand 5.62% and 24.72% female members used face mask and hand gloves respectively. Face mask and hand gloves are very much needed for those workers who are plucking flower and spreading fertilizers in the field. They used these to avoid intake of toxic chemicals through their nose and mouth and skin problems. Skin ointment, lemon extracts and coconut oil has been found 2.25%, 31.46%, 19.10% respectively among the female members only as precautions. Lemon extract has been widely used as tan remover for a long time. Apart from this lemon extract has anti-bacterial properties which can help the workers from relieving skin problems. The same has been observed in the case of coconut oil. Generally coconut oil has been widely used by the workers in respect to the other skin ointment. They used it to overcome the skin problems because they need to close contact with fertilizers and flower trees. A large number of male cultivators (73.17%) used cap to avoid sunlight. Female cultivators also used cap but in a small number (10.68%). Cap is less important for female members as they are not working under heavy sunlight. They generally go to field during evening to pluck the flowers. Talcum powder and mulberry has been

also used by the both male and female workers to recover from the skin infections and their percentage is 24.39%, 31.71% for male and 21.36%, 22.25% for female accordingly.

Workers are the main support of this flower cultivation. A variety of works have been found in this cultivation process. The workers are living their lives by working at the field. They get wages from the owner directly. Various ranges of wages are also there. Here below some Case Studies have been cited to point out the division of labours and their contribution to the flower cultivation industry-

Phul Tola (Flower Plucking)-A Case:

Tajnur Bibi, a 37 years old woman who lived in **Sutia** village under the **Sutia** grampanchayat of North 24 parganas district. She worked as a labour for collection of flower from the flower cultivated land. She collected 40 buckets of flower daily in 2 times, in the early morning (from 6 am to 10 am) and the afternoon time (from 3 pm to 6 pm). Here it is important to mention that every bucket is containing 3 kg of flower. And for collecting 1 bucket of flower she is get 5-6 rupees as her payment. She is doing this work for her family because she belongs to a poor family and she have two children and she would want that her children get a good job after complete their education and get a good citizen as early as possible. Here it is also mentionable that when she plucked a special variety of marigold flower, named Raktoganda (a blackish-red variety), she had faced an itching problem in her both hands and hands were swelling to itching erection. At that situation she used lemon extract or coconut oil to reduce the itching erection.

Kodal Kopano (Spading): A Case

Anisur Sardar (Age: 31, Sex: Male) lives at **Jadavpur** Village. He worked as a labour on different farmland. By doing this work he earned Rs. 300/- per day. He earned by spading on different agricultural land throughout the year and the working time was 6 am to 3 pm. He also told that his family was not doing well at such a low income. Apart from this work he also involved different types of work like, 100 days' work, supplier of drinking water barrels etc.

Mala Gantha (Garlanding): A Case

Nilima Bala (Age: 42, Sex: Female) lives at **Sutia** village. She used to make a garland of different flowers like Akanda, Marigold, White & Yellow Cherry, Rajanigandha, Nayantara, etc. By doing this she earned 90 to 100 rupees per day. She runs her family by making garlands throughout the year as a supportive member of the family. She also told that she earns a little more money by making fancy garlands during wedding season and at this time she earned most money than the whole year.

Moi Deoa (Laddering): A Case

Azid Mondal (Age: 36, Sex: Male) lives at **Uttar Kachdaha** village. He worked as a labour and did laddering on different agricultural land. He has earned Rs. 250/- per day by doing this work. He told that the two cows have a wooden pole attached to their shoulders from which the rope is pulled and tied to the ladder. The local name of the wooden bar is **Jongal**. He also told that it is very difficult to run his family when there is not much work during the rainy season. This work is not sufficient earning for his family and that's why he did different types of works like, weeds clearing, engine van driving and sometimes as a mason labour, etc.

Agachha Porishkar (Weeds Cleaning): A Case

Fulmani Soren (Age: 48, Sex: female) lives at **Uttar Kachdaha** village. She worked as a labour and did weeds cleaning on different farmland. Her daily income was Rs. 200/- by doing this work. Apart from this she also worked as cut off the tip of marigold plants. And for this her daily income was Rs. 150/- per day. Her duty schedule was 8 am to 4 pm. There was no holiday for this kind of works. According to her, she has been involved in this work since ten years. She also told she did this whole year except during the monsoon season, because that time is not suitable for flower cultivation.

Langol Deoa (Ploughing): A Case

Lalan Biswas (Age: 43, Sex: male) lives at **Sutia** Village. He has cultivated the land with the tractor. By doing this work he earned Rs. 400/- per bigha. In seasonal time he earned more than Rs.1200/- per day. This work is done almost whole the year except the rainy reason. Only June to August there was no sufficient income by doing this work because this time is not suitable season to cultivate all flowers. And that time he preferred to a part time job as an electrician and this work was not the primary source of his income. He does this work for his personal interest.

B. The Phases and Variegated Relationships as Found Around the Flower Cultivation

The flower cultivation as studied also encompasses the same. Production is the main or key factors as found in the flower cultivation. The first priority of this flower cultivation is to find out good and various qualities of

seed and bring them from the market. Sometime they make seeds at their own land. Here it is worth mentioning that they choose small separate land for this seed making process. Cultivators buy seeds from the market and bring those through the transport. Actually male workers are involved in this process of seeds buying. And in the case of seed making in their own land, both male and female workers are involved through the whole process. Gender, caste and religious biasness has not been found among the entire process of flower cultivation. Both male and female workers have been found working among the entire process of this flower cultivation. In the case of production systems, there are lots of work have been allotted to both male and female workers and they work rigorously to carry out the entire process smoothly. It is worth mentionable matter that few works have been only allocated for male and few for female. Those works which needed more muscle power and very risky like spading, fertilizing, driving etc. have been distributed to the male workers, while those works which needed less muscle power and low risk like flower plucking, garlanding etc. have been distributed to the female workers. When the flower blossoming the female workers plucking flower and accumulate at a one place. After that the owners take some fresh flower and kept it for sacrificing for their ancestral spirits. This has been only found in the Hindu families. Any types of other religious activities in respect to the flower cultivation have not been found among the studied population. Then they sometimes give some flowers to their workers as a gift. Finally they sent the flowers to the markets. Here it is more valuable to point out that the owners who have small quantity of production they sent their flower to their local **Sutia** market. And on the other hand the owners who have huge production, they sent their flower to their nearest **Thakurnagar flower market**. This transportation sometime has been done by the owner own self or by the male workers who have only appointed for the transportation purpose. Both Hindu and Muslim workers have been found among the studied population who are actively engaged in the each and every process of this flower cultivation. Religious prejudice and even caste prejudice has not been observed among the studied population. Various types of caste people like SC, ST, OBC-A (MUSLIM) and OBC-B along with higher caste people are working together very gleefully. Outside workers have not been found around this flower cultivation. Local workers are enough to carry out the flower cultivation process without any obstacle, because the flower cultivation is not needed skilled workers. The owners never ever try to hire labours from outside of their area. There are few reasons behind this and those are high pay scale of the labours, provide fooding and lodging, become workless of many families etc. Friendly relationships or bonding have been appeared among the villagers by this work. It has been observed that the workers never think that they are working as a servant, rather they think as they are working in their own fields.

Concluding Observations:

Flower is very famous and useful things in our daily life. Flower bears many signs and symbols. It can be used in various functions like, marriage ceremony, funeral, worship of God and Goddess, and so on. Various types of flower cultivation have been started in our society. Flower farming or flower cultivation is also called floriculture. Floriculture is actually a discipline of horticulture which deals with the cultivation of flowering plants. Floriculture is not required skill labourer. To cultivate flower the main owner or cultivator needs to know which flower's has good market value and timing of the cultivation as well as the name and amount of fertilizers which are to be used during cultivation. Floriculture is very famous in India. Not only India but also many countries are now focusing on the floriculture. The present study has been done on the floriculture cultivation in the district of North 24 Parganas, West Bengal, India. The present study has been done among the workers of both Hindu and Muslim community. There are no religious or gender biasness present in the floricultural cultivation. Both Hindu and Muslim community's workers are working hard to blooming flowers for people. All age's people are engaged with this cultivation. Even many small children and school goers are helping their parents during field work although they all are not getting money for that. They intentionally work in the field just because they love flowers. Both married male and female workers are there. The studied workers who are attached with this cultivation, they are not so bad in educational status. Only few illiterate workers have been found who cannot sign their name. Many workers have been found who completed their graduation among the studied population. Large number of both male and female workers have done their secondary and higher secondary. Various types of works have been observed in this flower cultivation. Generally females are engaged with flower plucking and clearing land because these two types of work not needed muscle power and not too much risky work. On the other hand male workers are engaged with those types of work which needed muscle power and risky work. Floricultural work is their primary occupation. But many workers have chosen others work like mason labour, agricultural work, electrician etc. as their secondary occupation. The daily wages is very low for the female workers who are plucking flower. Only few male workers get accurate wages from this floriculture. They have chosen secondary occupation because they could not live their minimum life with the wages which they get from the flower cultivation. The male workers who always work under the sun light and heat used sunglass as the precaution from the sun rays. Apart from these

female workers used hand gloves during flower plucking to avoid skin problems. Various types of ointment, mustard oil and lemon extract have been used by the female workers to overcome from the skin problem. Some workers did not maintain their hygiene, they were suffering from different skin diseases and other health issues.

ACKNOWLEDGEMENT

I would like to thanks to my co-authors **Suvankar Paul** and **Baishakhi Roy** for their continuous support and involvement to complete the research. Completion of the research could not have been accomplished without support of the research participant who were continuously supported us to complete the present research. I would also like to show my heart felt gratitude to the supervisor **Dr. Abijit Das** his pearls of wisdom with us of this research.

REFERENCES

1. Mondal, B. (2017). "Problems Hindering the Development of Floriculture Information System in West Bengal: Overview". *International Research Journal of Multidisciplinary Science & Technology*. Vol. 02 (02), pp. 01-05.
2. Biswas N.K. (2013). "Floriculture in Chapra Village in Ranaghat-II Block, Nadia District, West Bengal". *IOSR Journal of Humanities And Social Science*. Vol.7, pp. 17-23.
3. Chakraborty, T. (2014). "Opportunity of floriculture and dry flower trade in rural India". *Journal of Intraademicia*. Vol. 1(3), pp. 488-498.
4. Chetan, K & Yogish, S.N (2020). "An Economic analysis of Floriculture in India". *Science, Technology and development*. Vol. 9, pp. 122-129.
5. De L.C. (2018). "Impact of Climate Change on Floriculture and Landscape Gardening". *International Journal of Agriculture Sciences*. Vol. 10, Issue 11, pp. 6253-6256.
6. Ekhuemelo, C. et al. (2016). "Impact of Floriculture and Landscaping on Sustainable Environmental Management". *Nigeria Journal of Education, Health and Technology Research (NJEHTR)*. pp. 75-81.
7. Huss, et al. (2017). "The Meaning of Flowers: A Cultural and Perceptual Exploration of Ornamental Flowers". *The Open Psychology Journal*. Vol. 10, pp. 140-153.
8. Kaur, N. et al. (2020). "Work-related risk factors by female workers engaged in flower cultivation". *The Pharma Innovation Journal*. SP-9(7). pp. 202-207.
9. Kumar, V.T & Esaimalar, M. (2021). "Floriculture and Marketing of Flowers". *International Journal of Economics, Commerce and Research*. Vol. 11, Issue 2, pp. 23-26.
10. Kundu, P. and Som, S. (2020). "A SURVEY ON FLORICULTURAL SCENARIO OF SOME POTENTIAL BLOCKS OF EAST MIDNAPORE DISTRICT OF WEST BENGAL" *International Journal of Scientific Research*. Vol. 11(9), pp. 39688-39703.
11. Mahalle, L.S, et al. (2020). "Prospect and Challenges of Flower in India". *Agriculture Letters*. Vol. 01, Issue 08, pp. 23-26.
12. Rakibuzzaman, M., et al. (2018). "Flower Industry in Bangladesh: Exploring Floriculture Potential". *International Journal of Business, Social and Scientific Research*. Vol. 7(1), pp. 50-56.
13. Majhi, S. (2015). "Changing Scenario of Present Floriculture System & Associate Problems in Bagnan Blocks I and II, Howrah District". *IOSR Journal of Humanities and Social Science*. Vol. 20, Issue 11, pp. 07-12.
14. <https://vikaspedia.in/agriculture/farm-based-enterprises/floriculture>.
15. <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=98560#aa>.

Microwave Assisted Synthesis of 3, 4-Dihydropyrimidin-2(1h)- Ones/Thiones Under Solvent Free Condition by Using Ecofriendly Nanocrystalline AlCl₃ Loaded ZnO Catalyst'

P. J. Unde¹, D. D. Anuse², S. D. Bhakare³, L.P Sutar⁴ and L. R. Patil^{1*}

^{1,2,3,4} Dahiwadi College Dahiwadi, Satara-415508

^{1*} M.J.S. College, Shrigonda, Ahmednagar-413701

ABSTRACT

An important area of study is the heterogeneous synthesis of nitrogen-containing heterocyclic compounds such as dihydropyrimidin-2(1H)-one/thione derivatives. Use of nanocrystalline AlCl₃ Loaded ZnO has demonstrated for heterocyclic compounds which are routinely used in medicinal chemistry due to their therapeutic and pharmacological properties. In this context the solvent free synthesis of pyrimidine derivatives are reported.

Keywords: Biginelli reaction, nanocrystalline AlCl₃ Loaded ZnO, heterogeneous catalysis, green synthesis.

INTRODUCTION

Because of their therapeutic and pharmacological properties, dihydropyrimidin-2(1H)-ones/thiones derivatives are a significant class of heterocyclic compounds¹. Dihydropyrimidinones (DHPMs Fig. 1A) many drugs and synthetic products contain moiety. Because they act as calcium channel blockers, also including antihypertensive agents, DHPMs and their derivatives are extremely important (R-SQ 32 926)², Alpha-1a adrenergic antagonists, fatty acid transporter inhibitors, and inhibitors of mitotic kinesin³⁻⁶ (Monastrol, Fig. 1B). Batzelladine (Fig. 1C 1D 1E) alkaloids contain a dihydropyrimidin core, which has been found to possess anti-HIV activity^{7,8}. DHPMs moiety exhibits antiviral⁹, antibacterial and antifungal¹⁰, anticancer^{11,12} (S-Monastrol) activity. They are also used as starting material for the synthesis of Rosuvastatin (Fig. 2), selective and competitive inhibitor of HMG-CoA reductase¹³, the enzyme responsible for the biosynthesis of cholesterol. As a result, the search for cost-effective and simple methods for DHPM synthesis has emerged as a hot topic in current research.

In the last few decades, many types of solid acids have been developed as an alternative for the mineral acids, including sulfated metal oxides¹⁴, zeolites¹⁵, hetero polyacids, silica supported acid¹⁶, metal phosphates, inorganic oxides^{17,18}. Now a days heterogeneous catalysis for organic synthesis has gained popularity due to desirable separation of product and eco-friendly nature. Nano sized catalyst for organic synthesis is expected to bridge the gap between homogenous and heterogeneous catalysis¹⁹.

PRESENT WORK:

A. Experimental Procedure for Synthesis of AlCl₃ Loaded ZnO Nanomaterials:

The method used for the Synthesis of AlCl₃ Loaded ZnO Nanomaterials is wet-chemical method, which is further used for synthesis of dihydropyrimidin-2(1H)-ones/thiones derivatives. Aromatic aldehydes (1), urea (2) and ethyl acetoacetate (3) were taken stoichiometric amount in beaker. In the reaction mixture 10 mmol percent nanocrystalline AlCl₃ Loaded ZnO powder was added as a catalyst which was subjected to heated at 55°C in microwave oven.

B. Experimental Procedure for Synthesis of 3, 4-Dihydropyrimidin-2(1h)-Ones /Thiones:

Microwave assisted synthesis of 3,4-Dihydropyrimidin-2(1H)-ones/thiones has been successfully carried out using eco-friendly AlCl₃ Loaded ZnO nanoparticles as catalysts. For the synthesis of AlCl₃ Loaded ZnO nanoparticles size in the range of 35-80 nm nanocrystalline ZnO nanoparticles are used as a precursor. XRD analysis clearly indicates the formation of highly crystalline hexagonal phase of AlCl₃ Loaded ZnO nanoparticles. In reported method Solvent free synthesis have confer 95% yield which is greater than organic solvents such as DMF, Di-oxane, THF, Toluene for heterogeneous synthesis.

EXPERIMENTAL:

Characterization of Powdered AlCl₃ Using ZnO Catalyst.

The thermal study of synthesized AlCl₃ loaded zinc oxide was carried out using Thermo Gravimetric Analyzer (TGA-DTA, Metler-Toledo Star System) up to 1000°C in air at the heating rate of 10°C/min. Powder X-ray Diffractograms (XRD) were recorded on X-ray diffractometer (Rigaku-D8/MaX-2200V)

using CuK α -radiation with Ni filter. The surface morphology and particle size were determined using a field emission scanning electron microscope (FESEM HITACHI S-4800).

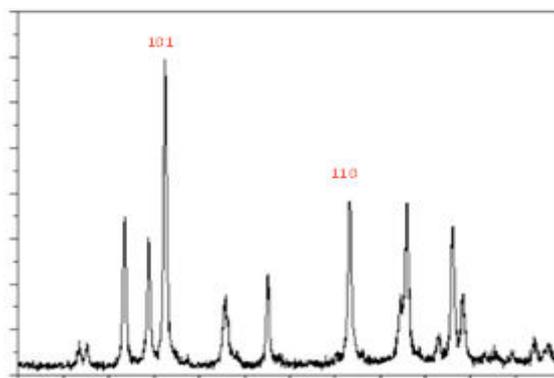
Measurement of Catalytic Activity to Biginelli Reaction

In a round bottom flask, aromatic aldehydes (1) (0.5g, 4.71mmol), urea (2) (0.28g, 4.71mmol), and ethyl acetoacetate (3) (0.61g, 4.71mmol) were added in stoichiometric amount (Scheme 1). Then, nanocrystalline AlCl₃ Loaded ZnO powder was added as a catalyst in the reaction mixture (10 mmol percent) which was subjected to heating at 55°C in microwave oven. Reaction was monitored by TLC technique. In order to separate the product after completion of the reaction, the resultant mixture was allowed to cool and then 10ml of ethyl acetate was added to it. The reaction mixture is filtered through Whatman 42 filter paper in order to recover the catalyst. Subsequently, catalyst was dried in an oven and recycled. Meanwhile, the filtrate was washed first with sodium bicarbonate followed by water, concentrated to get solidified compound and then recrystallized to get pure product to confirm the structural purity of the compounds ¹H-NMR and ¹³C-NMR spectral techniques were used.

RESULTS AND DISCUSSION

Biginelli reaction is homogenous acid catalyzed reaction. In Biginelli reaction Lewis acids are superior over Bronsted acids due to better selectivity and higher yields having less reaction time require for completion²⁰. Various Lewis acids, LiBr²¹, AlCl₃²², InBr₃²³, BF₃.OEt₂²⁴, FeCl₃ and LaCl₃²⁵ were reported for the synthesis of dihydropyrimidin-2(1H)-ones/thiones.

The synthesis of dihydropyrimidin-2(1H)-ones/thiones was carried out using nano crystalline AlCl₃ loaded ZnO catalyst. The synthesis of AlCl₃ Loaded ZnO catalyst was carried out by solution based precipitation technique in accordance with the protocol of our earlier report²⁶. We also showed that effect of morphology of catalyst is further useful for altering the photo catalytic activity²⁷. Hence, the synthesis of proposed catalyst is carried out using precipitation technique as described in the experimental section.



2 Theta

Fig. (2). Typical X-ray diffraction pattern of the resultant AlCl₃ Loaded ZnO powder

The crystallite sizes calculated from FWHM by using Scherer's formula³⁰ for the (101) and (110) XRD peaks were found to be in the range 35-80 nm.

Structural Study by Xrd

Figure 2 shows the typical X-ray diffraction spectra of a synthesized nanocrystalline AlCl₃ Loaded ZnO material. Formation of highly phase pure wurtzite structure is shown by XRD pattern. The lattice constant values obtained from the XRD patterns were in good agreement with the reported values²⁸. The XRD peaks in X-ray Diffractograms matched well with the reported data for AlCl₃ Loaded ZnO^{29, 28}.

Morphology by Fe-Sem

Figure 3 presents the FE-SEM, images of AlCl₃ Loaded ZnO catalyst as synthesized by solution based technique. The FE-SEM image of the 5 μ m resolution image showed irregular nanosheet formation (**Fig. 3A**). The 4 μ m resolution image showed a flower-like morphology (**Fig. 3B**). The high resolution images of AlCl₃ supported ZnO at 1 and 0.5 μ m scale show formation of small spherical particles with along large voids (**Fig. 3C**) and nanorods/nanosheets (**Fig. 3D**) like morphology. The average particle size of the nanosheets was found in the range 35-80 nm wide and 150-250 nm long. Overall particle morphology confirms the formation of nanocrystalline AlCl₃ Loaded ZnO powder.

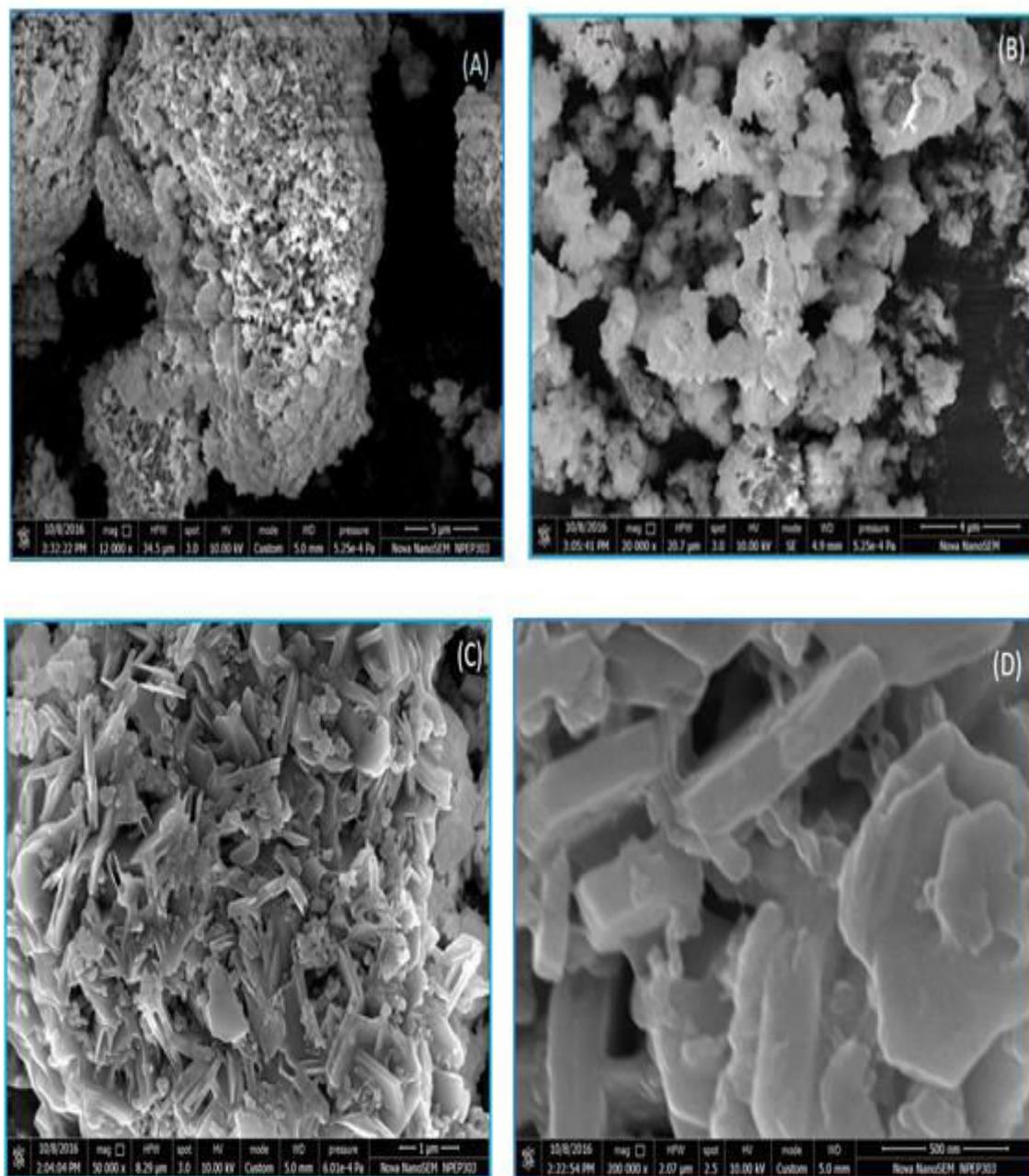
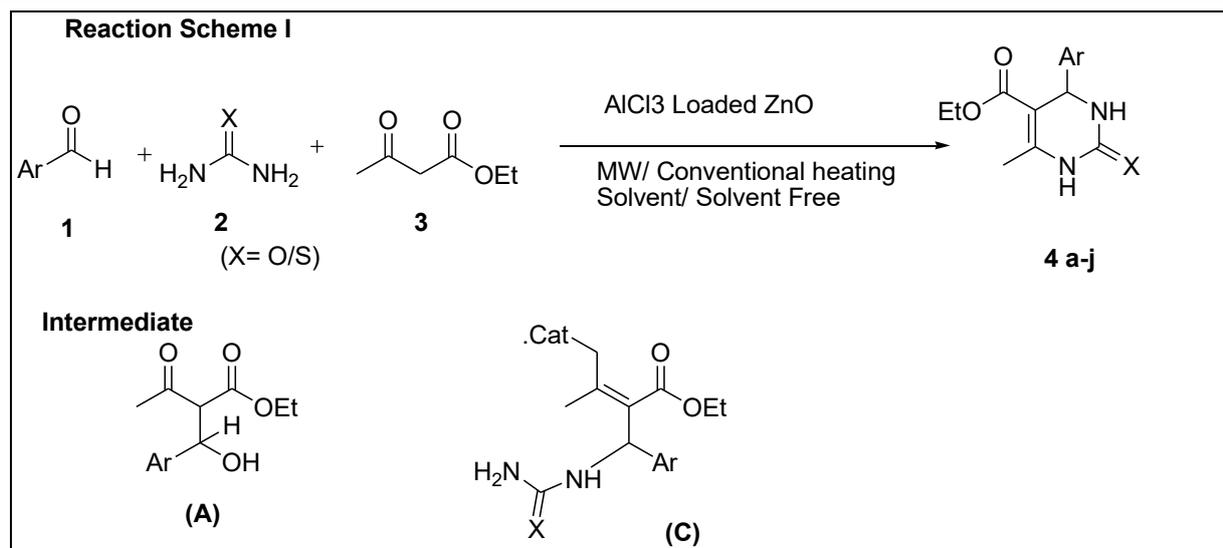


Fig. (3). FE-SEM images of AlCl_3 Loaded ZnO nano catalyst sample

Dihydropyrimidin-2(1H)-Ones/Thiones Derivative Synthesis

In general, routine homogenous Biginelli reaction process catalysis recovery is very tedious and also calls for efforts to minimize the hazards of chemicals. Hence, we have developed environmental friendly material AlCl_3 Loaded ZnO in order to synthesize the 3,4-dihydropyrimidin-2(1H)-ones/thiones derivatives. We observed that the catalytic activity of AlCl_3 Loaded ZnO nano material is excellent than organic homogenous catalyst. The recovery of catalyst is also good as well as it requires very short time for completion of reaction with high yield. The general mechanism of homogenous Biginelli reaction is a three component condensation reaction. A nucleophilic addition of an active hydrogen compound into a carbonyl group is followed by a dehydration reaction. The product is often α - β conjugated enone and then it reacts with urea to often produce 3,4-dihydropyrimidin-2(1H)-ones/thiones. In our technique, we used powdered heterogeneous catalyst for Biginelli reaction. The one pot synthesis by the proposed reactions using nano-sized catalysts may be in accordance with the following proposed mechanism. Initially, AlCl_3 Loaded ZnO catalyst facilitates the formation of β -hydroxy intermediate [A], which on dehydration gives α - β conjugated enone. Then it also enables easier attacks of amides on the β carbon of enone giving intermediate [C], which on further dehydration yields the desired product.



(Fig.4). Scheme for synthesis of 3, 4-Dihydropyrimidin-2(1H)-ones/thiones derivatives

In the proposed work, as synthesized nano AlCl₃ Loaded ZnO catalyst is used for synthesis of dihydropyrimidin-2(1H)-ones as per Scheme 1.

Before using the AlCl₃ Loaded ZnO catalyst for this reaction, we have checked the feasibility of reaction without catalyst and found trace amount of product (Table 1, entry 1). This clearly indicates that this reaction requires catalyst. Hence for optimization of the catalyst amount, we performed the reaction using different mole % of AlCl₃ Loaded ZnO and results are summarized in Table 1.

With increase in the amount of catalyst, yield is progressively enhanced up to certain value. Above 10 mol% of the catalyst amount, the reaction yield remained constant (92- 94% entry 4-6). Among the chosen amount of catalyst concentration range for this study, 10 mol% catalyst exhibits maximum 92% yield (Table 1, Entry 4). Hence, for further study, we have used 10 mol% catalysts.

To study the effect of solvent on product yield, we performed this reaction in different solvents such as Toluene, THF, DMF and 1,4-dioxane. The results obtained are tabulated in Table 2. We observed that the product yield in solvent free condition was 89% (entry5), which is better as compared to that of reported solvents (Table 2, entries 1-4). The solvent free reaction is a green synthesis becomes, an alternative way to overcome the environmental issue. Hence in proposed work we have synthesized different derivatives in solvent free condition.

For this reaction various substituted aromatic aldehydes used are shown in Table 3.

Table 3 shows in the proposed work for the plane benzaldehyde gives almost 90-92% yield (entries 4a and 4b) The presence of electron donating and withdrawing group on aromatic aldehyde affects the rate and yield of the reaction due to resonance and inductive effect. Presence of electron donating group like -OH and -OMe group on aromatic aldehyde gives less than 90% yield, (entries 4c, 4d and 4e). While, presence of electron withdrawing groups on aromatic aldehyde like chlorine, fluorine and nitro group gives almost 90 to 95% yield (entries 4f, 4g, 4h, 4i and 4j). Electron withdrawing group on benzaldehyde attack of nucleophile takes place more easily which increases the rate and yield of reaction.

The spectroscopic data of materials synthesized by Biginelli reactions are well matched with desired product material. At the end of reactions nanocrystalline AlCl₃ Loaded ZnO catalyst is separated using Whatman no. 42. For recycling, catalyst is activated at 120°C for two hours. In recirculation yield of desired product for catalyst is almost same. Our overall methodology showed recycling of catalyst is feasible, economical, environmental friendly than the routine homogenous Biginelli reaction.

In nutshell, we have performed environmental friendly Biginelli reaction using nanocrystalline AlCl₃ Loaded ZnO catalyst. The catalyst used can be recycled while the same reaction yield is still retained. We believe that our methodology becomes an alternative to the homogeneous Biginelli reaction and that it is simple to scale up in terms of end application.

Table 1. Preparation of 4a with different catalytic conditions under microwave irradiation.

Entry	Catalyst ^c (mol %)	Time (min)	Yield ^b
1	Nil	15	Trace
2	5	15	62
3	8	15	81
4	10	15	89
5	15	15	91
6	20	15	93

^aReaction conditions: 1 (0.5g, 4.71mmol), 2 (0.28g, 4.71mmol), 3 (0.61g, 4.71mmol) and ^ccatalyst at solvent free conditions, ^bIsolated yields.

Table 2. Effect of solvents on the synthesis of 4a under microwave irradiation.

Entry	Solvent ^s	Time (min)	Yield ^b
1	Toluene	15	80
2	THF	15	72
3	DMF	15	79
4	1,4- Dioxane	15	81
5	Solvent free	15	89

^{4a}Reaction conditions: 1 (0.5g, 4.71mmol), 2 (0.28g, 4.71mmol), 3 (0.61g, 4.71mmol) and catalyst (10mmol %), ^bIsolated yields.

Table 3. Synthesis of 3, 4-dihydropyrimidin-2(1H)-ones/thiones (4a-j) by AlCl₃ loaded ZnO catalyst at solvent free condition under microwave irradiation and conventional heating.

Entry	Comp. 4(a-j)	Ar.	X= O/S	Microwave Oven		Conventional Heating	
				Time (min)	Yield	Time (min)	Yield
1	4a	C ₆ H ₅	O	15	92	2.0	60
	4b	C ₆ H ₅	S	15	90	3.0	60
	4c	4- OH C ₆ H ₅	O	15	88	2.5	67
	4d	3, 4- OMe C ₆ H ₅	O	15	85	3.0	62
	4e	4- OH C ₆ H ₅	S	15	77	2.8	61
	4f	4- NO ₂ C ₆ H ₅	O	15	95	1.0	62
	4g	4- Cl C ₆ H ₅	O	15	92	1.5	70
	4h	4- F C ₆ H ₅	O	15	90	2.5	70
	4i	4- Cl C ₆ H ₅	S	15	95	2.2	70
	4j	4- F C ₆ H ₅	S	15	90	3.0	62

^{4(a-j)} Reaction conditions: 1(4a-j) (4.71 mmol), 2 (4.71 mmol), 3 (4.71 mmol) and catalyst (10 mmol %)

Spectral Data of Synthesized Compounds:

4a:-Ethyl-6-Methyl-2-Oxo-4-Phenyl-1, 2, 3, 4-Tetrahydro-Pyrimidine-5-Carboxylate

(Table 3, entry1): ¹³C NMR: (DMSO-d₆, 75 MHz) δ: 168.0 (EtOC=O), 152.5 (C-2), 148.0 (C-6), 145.0 (C-1'), 128.5 (C-3' & C-5'), 127.2 (C-2' & C-6'), 126.0 (C-4'), 100.0 (C-5), 59.0 (CH₂-CH₃), 54.5 (C-4), 18.0 (CH₃), 14.0 (CH₂-CH₃). ¹H NMR: (DMSO-d₆, 300 MHz): δ 9.25 (s, 1H, NH), 7.80(s, 1H, NH), 7.30 (m, 5H, H-2', H-3', H-4', H-5' & H-6'), 5.10 (d, J = 3.4 Hz, 1H, H-4), 4.00 (q, J = 6.7 Hz, 2H, CH₂-CH₃), 2.30 (s, 3H, CH₃), 1.10 (t, J = 6.7 Hz, 3H, CH₂-CH₃). Mp: 202°C (lit. [52] mp: 202-204°C).

4b:-Ethyl-6-Methyl-4-Phenyl-2-Thioxo-1, 2, 3, 4-Tetrahydropyrimidine-5-Carboxylate

(Table 3, entry 7): ¹³C NMR (DMSO-d₆, 75 MHz): δ 176.2 (EtOC=O), 165.2 (C-2), 143.0 (C-6), 141.90 (C-1'), 129.2 (C-3' & C-5'), 128.3 (C-2' & C-6'), 126.4 (C-4'), 100.8 (C-5), 60.0 (CH₂-CH₃), 54.3 (C-4), 28.0 (CH₃), 14.2 (CH₂-CH₃); ¹H NMR (DMSO-d₆, 300 MHz): δ 10.58 (bs, 1H, NH), 9.90 (bs, 1H, NH), 7.40-7.50 (m, 5H, H-2', H-3', H-4', H-5' & H-6'), 5.40 (s, 1H, H-4), 4.20 (q, J = 7.1 Hz, 2H, CH₂-CH₃), 2.40 (s, 3H, CH₃), 1.32 (t, J = 7.1 Hz, 3H, CH₂-CH₃); Mp 206°C (lit. [52] mp208-210 °C).

4c:-Ethyl-4-(4-Hydroxyphenyl)-6-Methyl-2-Oxo-1, 2, 3, 4-Tetrahydropyrimidine-5-Carboxylate

(Table 3, entry 4): ¹³C NMR (DMSO-d₆, 75 MHz): δ 167.3 (EtOC=O), 158.1(C-2), 154.9 (C-6), 146.1 (C-4'), 136.8 (C-1'), 127.3 (C-2' & C-6'), 114.9 (C-3 & C-5'), 100.7 (C-5), 59.3 (CH₂-CH₃), 54.4 (C-

4), 18.1 (CH₃), 13.9 (CH₂-CH₃); ¹H NMR (DMSO-d₆, 300 MHz): δ 8.62 (br s, 1H, NH), 7.15(d, J = 8Hz, 2H, H-2' & 6-H'), 6.8 (d, J = 8Hz 2H, H-3' & H-5'), 6.60 (s, 1H, NH) 5.15 (s, 1H, H-4), 4.20 (br s, 1H, OH), 4.02 (q, J = 7.2 Hz, 2H, CH₂-CH₃), 2.20 (s, 3H, CH₃), 1.10 (t, J = 7.2 Hz, 3H, CH₂-CH₃); Mp 246°C (lit. [52] mp245-247 °C).

4d:-Ethyl-4-(3, 4-Dimethoxyphenyl)-6-Methyl-2-Oxo-1, 2, 3, 4-Tetrahydropyrimid-5-Carboxylate (Table 3, entry 5): ¹³C NMR (CDCl₃, 100 MHz): δ 165.84(EtOC=O), 154.11 (C-2), 149.00(C-6), 148.69 (C-3'), 146.34 (C-4'), 136.54 (C-1'), 118.67 (C-6'), 111.19 (C-5'), 109.98 (C-2'), 101.43 (C-5), 60.05 (CH₂-CH₃), 55.19 (C-4), 18.55 (CH₃), 14.28 (CH₂-CH₃); ¹H NMR (CDCl₃, 400 MHz): δ 8.81 (s,1H, NH), 6.83 (d, J = 8 Hz, 2H, H-5' & H-6'), 6.78(s, 1H, H-2'), 6.42 (s, 1H, NH), 5.34 (s, 1H, H-4), 4.05 (q, J = 8.0 Hz, 2H, CH₂-CH₃), 2.31(s, 3H, CH₃), 1.16 (t, J = 8.0 Hz, 3H, CH₂-CH₃); Mp174°C (lit. [52] mp 174-176 °C).

4e:-Ethyl-4(4-Chlorophenyl)-6-Methyl-2-Thioxo-1, 2, 3, 4-Tetrahydropyrimidine-Carboxylate (Table 3, entry 9): ¹³C-NMR (DMSO-d₆, 75 MHz): δ 174.1 (EtOC=O), 165.20 (C-2), 145.20 (C-4'), 143.29 (C-6), 132.00 (C-1'), 128.50 (C-3' & C-5'), 128.20 (C-2' & C-6'), 100.10 (C-5), 60.00 (CH₂-CH₃), 53.40 (C-4), 17.10 (CH₃), 13.9 (CH₂-CH₃); ¹H NMR (DMSO-d₆, 300 MHz): δ 10.62 (s, 1H, NH), 9.95 (s, 1H, NH), 7.70 (d, J = 8.0 Hz, 2H, H-3' & H-5'), 7.50 (d, J = 8.0 Hz, 2H, H-2' & H-6'), 5.40 (s, 1H, H-4), 4.25 (q, J = 7.1 Hz, 2H, CH₂-CH₃), 2.80 (s, 3H, CH₃), 1.25 (t, J = 7.1 Hz, 3H, CH₂-CH₃); Mp 190°C (lit. [52] mp192-194 °C).

4f:-Ethyl-6-Methyl-4-(4-Nitrophenyl)-2-Oxo-1, 2, 3, 4-Tetrahydropyrimidine-5-Carboxylate (Table 3, entry 2): ¹³C NMR (DMSO-d₆, 100 MHz): δ 161.56(EtOC=O), 159.86 (C-2), 151.89 (C-6),149.28 (C-1'), 146.64 (C-3' & C-5'), 127.56 (C-4'), 123.75 (C-2' & C-6'), 98.10 (C-5), 59.30 (CH₂-CH₃), 53.58 (C-4), 17.77 (CH₃), 13.96 (CH₂-CH₃); ¹H NMR (DMSO-d₆, 400 MHz): δ 9.38 (bs, 1H,NH), 8.19 (d, J = 7.6 Hz, 2H, H-3' & H-5'), 7.89 (bs, 1H, NH), 7.48 (d, J = 7.6 Hz, 2H, H-2', & H-6'), 5.44 (s, 1H, H-4), 3.96 (q, J =7.1 Hz, 2H, CH₂-CH₃), 2.48 (s, 3H, CH₃), 1.07 (t, J = 7.1 Hz, 3H, CH₂-CH₃); Mp 204°C (lit. [52] mp201-202 °C).

4g:- Ethyl-4-(4-Chlorophenyl)-6-Methyl-2-Oxo-1,2,3,4-Tetrahydropyrimidine-5-Carboxylate (Table 3, entry 3): ¹³CNMR (DMSO-d₆, 100 MHz): δ 164.46 (EtOC=O), 151.75 (C-2), 147.20 (C-6), 142.4 (C-4'), 131.4 (C-1'), 127.18 (C-3' & C-5'), 127.08 (C-2' & C-6'), 98.46 (C-5), 58.37 (CH₂-CH₃), 52.99 (C-4), 17.08 (CH₃), 13.09 (CH₂-CH₃); ¹H NMR (CDCl₃, 400 MHz): δ 7.78 (s, 1H, NH), 7.26~7.32 (m, 4H, H-2', H-3', H-5' & H-6'), 5.71 (s, 1H, NH), 5.40 (d, J = 4.0 Hz, 1H, H-4), 4.10 (q, J =8.0 Hz, 2H, CH₂-CH₃), 2.37 (s, 3H,CH₃), 1.20 (t, J = 8.0 Hz, 3H, CH₂-CH₃) Mp 218 °C (lit. [52] mp217-218 °C).

4h:-Ethyl (4-Fluorophenyl)-6-Methyl-2-Oxo-1, 2, 3, 4-Tetrahydropyrimidine-5-Carboxylate (Table 3, entry 6): ¹³C NMR (CDCl₃, 100 MHz) : δ 165.7(EtOC=O), 163.7 (C-4'), 161.21 (C-2), 153.82 (C-6), 146.56 (C-1'), 139.78 (C-6'), 128.46 (C-3'), 128.38 (C-5'), 115.75 (C-2'), 101.39 (C-5), 60.21(CH₂-CH₃), 55.08 (C-4), 18.7 (CH₃), 14.3 (CH₂-CH₃); ¹H NMR (CDCl₃, 400 MHz) : δ 8.5 (s, 1H, NH), 7.18 (t, J = 8.0 Hz & 4.0 Hz 2H, H-2' & H-6'), 6.88(t, J = 12 Hz & 8.0Hz 2H, H-3' & H-5'), 6.17 (s, 1H, NH), 5.29 (s, 1H, H-4), 3.99 (q, J = 7.1 Hz, 2H, CH₂-CH₃), 2.25 (s, 3H, CH₃), 1.07 (t, J= 7.1 Hz, 3H, CH -CH); Mp 182°C (lit. [52] mp 182-184 °C).

4i:-Ethyl-4(4-Fluorophenyl)-6-Methyl-2-Thioxo-1, 2, 3, 4-Tetrahydropyrimidine-5-Carboxylate (Table 3, entry 8): ¹³C NMR (DMSO- d₆, 75 MHz) : δ 174.2 (EtOC=O), 165.0 (C-2), 163.1 (C-4'), 160.0 (C-6), 139.77 (C-2'), 139.73 (C-6'), 128.49 (C-3'), 128.38 (C-5'), 115.4 (C-1'), 100.6 (C-5), 59.6 (CH₂-CH₃), 53.39 (C-4), 17.14 (CH₃), 13.92 (CH₂-CH₃); ¹H NMR (DMSO-d₆, 300 MHz) : δ 10.60 (s, 1H, NH), 9.90 (s, 1H, NH), 7.40 (m, 4H, H-2', H-3', H-5' & H-6'), 5.20 (s, 1H, H-4), 4.20 (q, J = 7.1 Hz, 2H, CH₂-CH₃), 2.55 (s, 3H, CH₃), 1.25 (t, J = 7.1 Hz, 3H, CH₂-CH₃); Mp 182°C (lit. [52] mp 182-184 °C).

4j:- Ethyl-4-(4-Hydroxyphenyl)-6-Methyl-2-Thioxo-1, 2, 3, 4-Tetrahydropyrimidine-5-Carboxylate (Table 3, entry 10): ¹³C NMR (DMSO-d₆, 75 MHz): δ 166.8 (EtOC=O), 154.6 (C-2),147.0 (C-6), 146.5 (C-4'), 146.0 (C-1'), 138.7 (C-2'), 120.7 (C-6'), 109.3 (C-3'), 108.0 (C-5'), 101.0 (C-5), 59.6 (CH₂-CH₃), 55.3 (C-4), 17.1 (CH₃), 13.1 (CH₂-CH₃); ¹H NMR (DMSO-d₆, 300 MHz): δ 9.10 (br s, 1H, NH), 9.00 (br s, 1H, NH), 7.50 (br s, 1H, OH), 7.20 (d, J = 7.9 Hz, 2H, H-2' & H-6'), 6.75 (d, J = 7.9 Hz, 2H, H-3' & H-5'), 5.20 (s, 1H, H-4), 4.10 (q, J = 6.7 Hz, 2H, CH₂-CH₃), 2.30 (s, 3H, CH₃), 1.10 (t, J = 6.7 Hz, 3H, CH₂-CH₃); Mp 202°C (lit. [52] mp202-203 °C).

The spectroscopic data presented above for organic materials synthesised by Biginelli reactions are well matched with the desired product material. Nanocrystalline AlCl_3 Loaded ZnO catalyst is separated using Whatman no. 42 at the end of reactions. For recycling, catalyst is activated at 120°C for two hours. For recirculation of catalyst yield of desired product is almost same. Our overall methodology showed recycling of catalyst is economical, feasible, environmental friendly than the routine homogenous Biginelli reaction.

In nutshell, we have performed the facile and environmental friendly Biginelli reaction using Nanocrystalline AlCl_3 Loaded ZnO catalyst. The catalyst used can be recycled while the same reaction yield is still retained. We believe our methodology is alternative to homogenous Biginelli reaction and easy to scale up from the end-application point of view.

CONCLUSION

Use of nanocrystalline AlCl_3 Loaded ZnO is found to be an efficient catalyst for green synthesis dihydropyrimidone/thiones by Biginelli reaction. Small amount of catalyst is sufficient to facilitate the reaction. Solvent free reactions gave more yield compared to the use of organic solvents. Proposed methodology used is easy to handle and scale up. The catalyst used is environmental friendly and can be recycled without compromising on the yield at large.

ACKNOWLEDGEMENTS

The author would like to thank the Principal, Dahiwadi College Dahiwadi, Dist-Satara, Shivaji University Kolhapur, M.J.S. College, Shrigonda, Ahmednagar, Savitribai Phule Pune University, Pune and Director of Centre for Materials for Electronic Technology (C-MET), Pune for providing the research facilities.

REFERENCES:

1. Kappe, C. O. *Eur. J. Med. Chem.*, **2000**, 35, 1043.
2. Atwal, K. S.; Swanson, B. N.; Unger, S. E.; Floyd, D. M.; Moreland, S.; Hedberg, A.; O'Reilly, B. C. *J. Med. Chem.*, **1991**, 34, 806-811.
3. Mihael, M.; Cristian, D.; Niculina, D. B.; Ioana, D.; Lavinia, L. R.; Codruta, C. P.; Ileana, C. F.; Ion, B.; Daniel, P. F. *Tetrahedron*, **2009**, 65, 5949-5957.
4. Abdulkarim, M. A.; Nazeruddin, G. M. *J. Chem. Pharm. Res.*, **2010**, 2(3), 536-543.
5. Kappe, C. O.; Fabian, W. M. F.; Semones, M. A. *Tetrahedron*, **1997**, 53, 2803-2816.
6. Blackburn, C.; Guan, B.; Brown, J.; Cullis, C.; Condon, S. M.; Jenkins, T. J.; Peluso, S.; Ye, Y.; Gimeno, R. E.; Punreddy, S.; Sun, Y.; Wu, H.; Hubbard, B.; Kaushik, V.; Tummino, P.; Sanchetti, P.; Yu, S. D.; Daniels, T.; Tozzo, E.; Balanic, S.K.; Raman, P. *Bioorg. Med. Chem. Lett.*, **2006**, 16, 3504-3509.
7. Patil, A. D.; Freyer, A. J.; Taylor, P. B.; Carte, B.; Zuber, G.; Johnson, R. K.; Faulkner, D. J. *J. Org. Chem.*, **1997**, 62, 1814-1819.
8. Zachary, D. A.; Larry, E. O. *Chem. Comm.*, **2004**, 253-265.
9. Hurst, E. W.; Hull, R. J. *Med. Pharm. Chem.*, **1961**, 3, 215-229.
10. Mithun, A.; Bantwal, S. H.; Nalilu, S. K. *Eur. J. Med. Chem.*, **2007**, 42, 380-385.
11. Fewell, S. W.; Smith, C. M.; Lyon, M. A.; Dumitrescu, T. P.; Wipf, P.; Day, B. W.; Brodsky, J. L. *J. Bio. Chem.*, **2004**, 279(49), 51131-51140.
12. Mayer, T. U.; Kapoor, T. M.; Haggarty, S. J.; King, R. W.; Schreiber, S. L.; Mitchison, T. J. *Science*, **1999**, 286(5441), 971-974.
13. Carswell, C. I.; Plosker, G. L.; Jarvis, B. *Drugs*, **2002**, 62(14), 2075-2085, Discussion 2086-7.
14. Reddy, B. M.; Patil, M. K. *Chem. Rev.*, **2009**, 109(6), 2185-2208.
15. Clark, J. H. *Acc. Chem. Res.*, **2002**, 35, 791-797.
16. Ali, R. M. A.; Ferydoon, K.; Mahmoud, N.; Homeyra, A. A. *Tetrahedron*, **2007**, 63, 8723-8726.
17. Kazushi, A. *Green Chem.*, **2009**, 11, 1719-1728.
18. Corma, A. *Chem. Rev.*, **1995**, 95(3), 559-614.

19. Nasir, B. R. B.; Varma, R. S. Chem. Comm., **2013**, 49, 752-770.
20. Francesco, F.; Ferdinando, P.; Luigi, V. Tet. Lett., **2001**, 42, 1131-1133.
21. Maiti, G.; Kundu, P.; Guin, C. Tetra. Lett., **2003**, 44-13, 2757- 2758.
22. Shaikh, S. S. Res. J. Chem. Sci., **2014**, 4(11), 18- 22.
23. Nan, Y. F.; Yao, F. Y.; Zhong, C.; Shan, W. W.; Ji, T. W.; Clovis, P. Tet-rahedron, **2002**, 58, 4801-4807.
24. Essa, H. H.; Daniel, R. S.; Ulf, H. D. J.Org. Chem., **1998**, 63(10), 3454-3457.
25. Lu, J.; Bai, Y.; Wang, Z.; Yang, B.; Ma, H. Tetra. Lett., **2000**, 41, 9075-9078.
26. Kanade, K. G.; Kale, B. B.; Baeg, J. O.; Lee, S. M.; Lee, C. W.; Moon, S. J.; Chang, H. Mat. Chem. Phy., **2007**, 102, 98-104.
27. Kanade, K. G.; Kale, B. B.; Baeg, J. O.; Lee, S. M.; Lee, C. W.; Moon, S. J.; Chang, H. Mat. Chem. Phy., **2007**, 102, 98-104.
28. JCPDS card No. 36-1451.
29. Kanade, K. G.; Kale, B.B.; Aiyer, R. C.; Das, B. K. Mat. Res. Bull., **2006**, 41, 590-60.
30. Cullity, B. D.; Addison-Wesley: Reading, MA, **1977**, 102.

Factors Affecting Utilization of Maternal Health Care Services: A Literature Review

Dharaben P. Patel¹, K. K. Patel² and Jignesh C. Patel³

^{1,2} Department of Hospital Management, Hemchandracharya North Gujarat University, Patan, Gujarat

³ Department of Computer Engineering, Gujarat Power Engineering and Research Institute, Gujarat

ABSTRACT

According to estimation of World Health Organization (WHO) in the year 2015, there were approximately 303,000 women losing their lives in the process of reproduction globally each year and most of these deaths are preventable if mothers have access to maternal health care services [4]. There is decrement in the maternal mortality ratio according to Global trends. In last thirty years, there is a gradual decrement. There are considerable improvements in maternal health Due to Millennium Developmental Goals [1]. Successively, Sustainable Developmental Goals (SDGs) aims to reduce more maternal mortality and come down to 70 maternal deaths per 100000 live births by 2030 [1]. However, all over the world, there are approximately 830 death of women from pregnancy or childbirth-related complications each day [1]. According to new estimation, there are 113 maternal deaths per every 100,000 live births [1]. As maternal mortality is a public health problem, effective public health interventions must be implemented to combat this mortality.

Keywords: Adolescents, Maternal health, Utilisation of health services, Maternal health services, Ante-natal care (ANC), Delivery, socioeconomic factors, Postnatal care (PNC), Female Genital Mutilation (FGM), Mother and Child Tracking System (MCTS)

INTRODUCTION

Various nations have already announced a plenty of schemes and policies to enhance the availability and accessibility in the utilization of maternal health care services around the globe.

Many programmes and initiatives have been implemented in India for instance Janani Suraksha Yojana, Janani Shishu Suraksha Karyakaram, Matrima, Matrika and so on. Several studies have examined factors affecting utilization of maternal health services. Utilization of reproductive health services is in turn related to their availability and socio-economic, demographic and cultural factors such as women's age, education, employment, caste and autonomy. Access to health care facilities in terms of distance and who provided health care are major factors that influenced utilisation of services. Apart from above all factors women's autonomy is also a major determinant of utilization of maternal and child care services, women with greater freedom of movement are more likely to utilize antenatal and delivery care [1].

OBJECTIVES

- To find out the prevalence of maternal mortality as a public health problem.
- To analyse causative factors preventing or lowering accessibility and utilization of maternal health care services.

This study is based on secondary data and data is collected through various journals, books, and newspapers and web sources.

Maternal Mortality as a Public Health Problem

The World Health Organization (WHO) defined that the death of women due to any reason linked with or intensified by pregnancy or its management (except accidental or incidental causes) throughout pregnancy and childbirth or within 42 days of termination of pregnancy, regardless of the duration and place of the pregnancy [16].

Review of Prevalence and Factors Associated With Maternal Mortality

(Bal Govind Chauhan & Suresh Jungari) revealed that there is less consumption of maternal health services in states of India having more tribal population as compared to national level tendencies. In consumption of MCH services Jharkhand is the poorest performing state among the three tribal dominated states. Consciousness program via different mass media networks, micro level demonstration, approachability to distant tribal community, appropriate and frequent training of health care provider, solidification of the MCTS (Mother and Child Tracking System), and monitoring system can largely helpful to lessen thousands of maternal demises. Moreover, the authority should consider community level factors touching to maternal health care utilization while designing scheme especially for tribal dominated area [1].

(Kaniz Fatema & Joseph T. Lariscy) observed that the mass media could largely helpful to raise the utilization of maternal healthcare services at antenatal, delivery, and postpartum stages of pregnancy in South Asia as mass media has potential to reach low educated mothers and encourage them to utilize maternal healthcare services [2].

(Balhasan Ali & Shekhar Chauhan) revealed that the utilization of ANC, SBA and PNC are subject to education level and wealth of women. So all the efforts must be made to improve economic and educational level of these women. He suggest not only mass media exposure in rural part of the country but also raise education of mother [3].

(Sharmistha Self & Richard Grabowski) revealed that increased education level of women and men have significant positive impact on utilization of maternity health care. Since the usage of maternal health - care services became the norm, more women began to access and use them [4]. The employment of women is also important factor, which leads to greater utilization of maternal health care resources. The paid work allowed women for increased expenditures on health care and raise woman's autonomy in terms of taking health-care decisions. The investment in infrastructure in certain domain can be largely helpful for instance the provision of electricity in households [4].

(Won Ju Hwang & Yeon Mi Park) revealed that the remoteness of the health centres, traveling time and cost and way of transportation are major deciding factors for utilization of healthcare resources. In parallel, the measures to reduce poverty and developing infrastructure should be prime focus [5].

(Chopra Deepak, Jauhari N & Dhungana H) revealed that despite there is higher usage frequencies of antenatal maternal health services in city slums of Lucknow but the use of postnatal services is depressing. And this low PNC services leads to mother in risk of maternal mortality [6]. They emphasis on overall socio-economic development with focus on women empowerment, education and incorporation of religious norms and faith in the health policies [6].

(Pintu Paul & Pradip Chouhan) revealed that the major deciding factors for utilization of maternal health care services are Educational attainment of women, wealth status of household, location of resident (urban or rural), Caste and religion, marriage at lower age [7].

(Bikash Barman, Jay Saha & Pradip Chouhan) revealed that there is a strong connection between education level and the utilization of maternal health care services. The raised education level leads to treatment seeking behaviour and thus high fertility, pregnancy complication, maternal mortality as well as child mortality will be abolished [8].

(Babker El Shiekh & Anke van der Kwaak) revealed that the major factors restricting women's utilization of maternal health care services are early marriage, teen pregnancy, low level of education and awareness, gender inequality and mobile lifestyle in some cases [9].

(Digambar A. Chimankar & Harihar Sahoo) discovered that the major deciding factors for utilization of maternal health carer services birth order, wealth index, women's education level, exposure to mass media and place of residence [10].

DISCUSSION

There are many factors affecting utilization of maternal health care services and health standard of mother and child. The major factors include the distance to healthcare centers, travel cost, travel time, and transportation methods, educational level of women, exposure to mass media, birth order, wealth index and mobile lifestyle, Caste and religion, employment and atonomy of women.

CONCLUSION

The maternal healthcare is problematic beyond the realm of just healthcare. However there are a few suggestions that can help to solve the situation. The first suggestion is that the Policymakers, healthcare providers, and health organizations can implement mass media campaigns to publicize maternal health messages and motivate pregnant women to receive maternal healthcare services. The second step is micro level campaigning, accessibility to remote tribal villages, proper and frequent training of health care provider, strengthening the MCTS (Mother and Child Tracking System), and monitoring system can make a difference and can reduce thousands of maternal deaths. The another suggestioning is public health system in terms of infrastructure, human resources, and management needs to be upgraded. A woman's ability to earn wages allowed for increased expenditures on health care; and access to paid work likely increased a woman's

autonomy in terms of making health-care decisions Thus, the growth of employment opportunities for women remains crucial

REFERENCES

1. Bal Govind Chauhan & Suresh Jungari "Factors Affecting the Utilization of Maternal and Child Health Care Services in Tribal Dominated Population States of India".
2. Kaniz Fatema & Joseph T. Lariscy "Mass media exposure and maternal healthcare utilization in South Asia" .
3. Balhasan Ali & Shekhar Chauhan "Inequalities in the utilisation of maternal health Care in Rural India: Evidences from National Family Health Survey III & IV".
4. Sharmistha Self & Richard Grabowski "Factors influencing maternal health care in Nepal : The role of socioeconomic interaction"
5. Won Ju Hwang & Yeon Mi Park "Factors Influencing the Accessibility of Maternal Health Service in Cambodia"
6. Chopra Deepak, Jauhari N & Dhungana H "A Study on Utilization of Maternal Health Services and Factors Influencing the Utilization in Urban Slums of Lucknow"
7. Pintu Paul & Pradip Chouhan "Determinants of maternal health care utilization in India: Insights from the National Family Health Survey, 2015-16"
8. Bikash Barman, Jay Saha & Pradip Chouhan "Impact of education on the utilization of maternal health care services: An investigation from National Family Health Survey (2015-16) in India"
9. Babker El Shiekh & Anke van der Kwaak "Factors influencing the utilization of maternal health care services by nomads in Sudan"
10. Digambar A. Chimankar & Harihar Sahoo "Factors influencing the Utilization of Maternal Health Care Services in Uttarakhand"
11. Justin Oliver Parkhurst*, Loveday Penn-Kekana, Duane Blaauw, Dina Balabanova, Kirill Danishevski, Syed Azizur Rahman, Virgil Onama, Freddie Ssengooba "Health systems factors influencing maternal health services: a four-country comparison"
12. Desalew Zelalem Ayele, Bekele Belayihun, Kedir Teji & Desalegn Admassu Ayana "Factors Affecting Utilization of Maternal Health Care Services in Kombolcha District, Eastern Hararghe Zone, Oromia Regional State, Eastern Ethiopia"
13. Nitai Chakraborty, M. Ataharul Islam, Rafiqul Islam Chowdhury, Wasimul Bari & Halida Hanum Akhter "Determinants of the use of maternal health services in rural Bangladesh"
14. Oluwasola Eniola Banke-Thomas, Aduragbemi Oluwabusayo Banke-Thomas and Charles Anawo Ameh "Factors influencing utilisation of maternal health services by adolescent mothers in Low-and middle-income countries: a systematic review"
15. "Trends in maternal mortality: 1990 to 2015" Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division
16. WHO: - The Global Health Observatory. <https://www.who.int/data/gho/indicator-metadata-registry/imr-details/4622>

An Investigation into India's Financial Inclusion Status

Manisha Badgujar and Shital V Thakare
Sinhgad Institute of Management

ABSTRACT

Any emerging country's financial sector serves as its foundation. To ensure continued development, the emphasis must be on the expansion and stability of everyone's financial situation in the nation. As a result, financial inclusion is essential to the inclusive development of an economy. Simply put, financial inclusion aims to address the issue of India's rural population's limited access to financial services. The concept of financial inclusion can be traced back to the year when United Nations programmes were launched that called for all "bankable households" to have access to credit, insurance, savings, and other banking services. The Indian government has been working hard to increase the country's financial inclusion, and as a result, many initiatives have been launched. An effort has been made to present a summary of the state of financial inclusion in India during the previous few years in this report. Based on the analysis that was done, it can be said that India's financial inclusion is progressing in terms of branch penetration. However, several initiatives for inclusive growth are still in their infancy and require the joint efforts of the Indian government and the populace to take shape.

Keywords: banks, inclusive growth, financial inclusion, and the Indian economy.

INTRODUCTION

The financial sector facilitates and multiplies economic stability. In India, a sizable portion of the population lacks access to formal financial institutions, forcing them to rely on illegal sources of financing at great expense. Therefore, professionals from the banking industry and the government determined that there was a need for various initiatives aimed at providing banking services to the economically underprivileged groups in society. Financial inclusion was first used by Reserve Bank of India (RBI) Governor Sh. YV Reddy in 2005. In actuality, he accidentally used the phrase, mistaking it for one that the RBI had used to describe financial exclusion.

OBJECTIVE OF THE STUDY:

Through this paper, an effort has been made to gain insight into several facets of financial inclusion, with a particular focus on India's progress in the area during the previous few years.

The study's research methodology is descriptive in nature. The study made considerable use of secondary data that was made available in publications published by the Reserve Bank of India, the Ministry of Finance, and the World Bank. Various news stories, books, and reputable websites were used; these were listed and recorded. The secondary data were analysed using a straightforward percentage method to indicate the development and status of financial inclusion during the last 10 years.

What is financial inclusion?

The goal of financial inclusion is to make financial services available to all citizens of the country at a reasonable cost. In 2008, the Reserve Bank of India published the first official definition of financial inclusion. Since then, numerous studies have attempted to define the idea. A collection of several definitions suggested in various studies and by various researchers is provided in Table 1.

Table 1: Definitions of financial inclusion

Organization	Definition
Reserve Bank of India (2008)	Financial inclusion, according to the RBI, is the "process of guaranteeing access to suitable financial goods and services needed by all sections of the society in general and vulnerable groups such as weaker sections and low income groups in particular."
Planning Commission (2009)	"Financial inclusion" describes the broad availability of affordable financial services to all people. Along with banking goods, these also include other financial services including insurance and equity products.
Chakraborty (2011)	Financial inclusion is the process of ensuring that vulnerable groups, such as weaker parts and low income groups, have access to the financial products and services they need at an accessible price in a fair and transparent manner from mainstream institutional players.

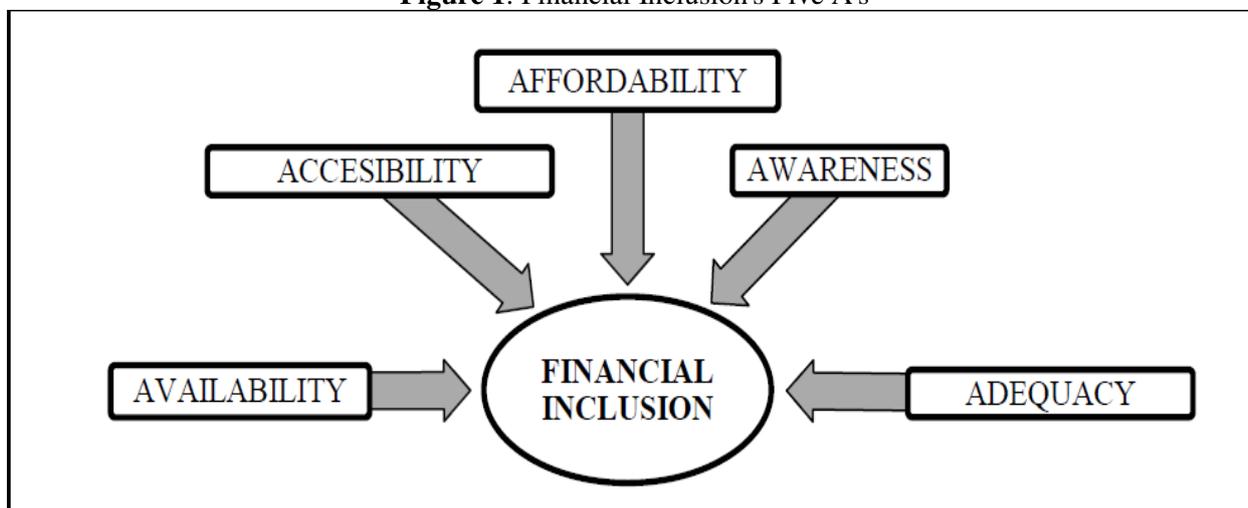
The United Nations initiatives that year set forth the provision of credit, insurance, savings, and other banking services to all "bankable households" were the beginning of financial inclusion. In India, the moves towards financial inclusion were gradual but relatively steady, as shown in table 2.

Table 2: Important Steps Toward Financial Inclusion in India

Year	Details of event
1956	Imperial Bank of India was nationalized.
1968	National Credit Council was set up.
1969	Lead bank scheme was introduced
1971	Priority sector lending norms were laid down.
1975	Regional Rural Banks (RRBs) were established.
1982	National Bank for Agriculture and Rural Development (NABARD) was established
1992	Self Help Groups Linkage Programme was launched to support females of rural areas.
2000	SIDBI foundation was established for making provisions of micro credit.
2004	Khan Committee was set up by Reserve Bank of India.
2005	Pilot project on financial inclusion was introduced in Mangalam village of Pondicherry by Chairman of Indian Bank Dr. K.C. Chakraborty
2007	Bill on Microfinance Regulation was proposed in parliament.
2012	Finance Department of Government of India passed Microfinance Institutions (Development and Regulations).
2012	Revised Guidelines on Financial Literacy Centres were introduced.

In India, microfinance institutions (MFIs) have been instrumental in improving the state of financial inclusion (Islam, 2012). Bandhan Microfinance, Cashpor Microcredit, Bharat Financial Inclusion Limited, Share Microfin Limited, Spandana Sphoorty Financial Ltd, Asmitha Microfin Ltd, Bhartiya Samruddhi Finance Limited (BSFL), and others are among the MFIs that have been established in India (Karmakar, 2008). Figure 1 shows a diagram of the five A's of financial inclusion from a recent study conducted in 2017. The first factor is "availability," which suggests that financial inclusion is providing all people with access to financial services, regardless of their income or credit capacity. The second aspect signifies that these services are accessible and reasonably priced. The third component suggests that services like credit, insurance, savings, etc. should not only be offered through banks but also be available to people living in even the most remote regions of the nation. Public sector banks established a variety of bank branches in rural areas as a result of this reason. The fourth component suggests that raising awareness of the issue is more important than simply making goods and services more affordable and accessible. This led to the organisation of several campaigns in rural areas, the launch of numerous public service announcements emphasising the value of insurance and savings, and the distribution of pamphlets in every nook and cranny of urban areas. The third but not least point suggests that all financial services must be adequate in the sense that, given that they are geared toward those from lower social groups, they will need loans in lesser quantities, and if large loans are being offered, such borrowers will not be able to accept them (Kaur et al, 2017).

Figure 1: Financial Inclusion's Five A's



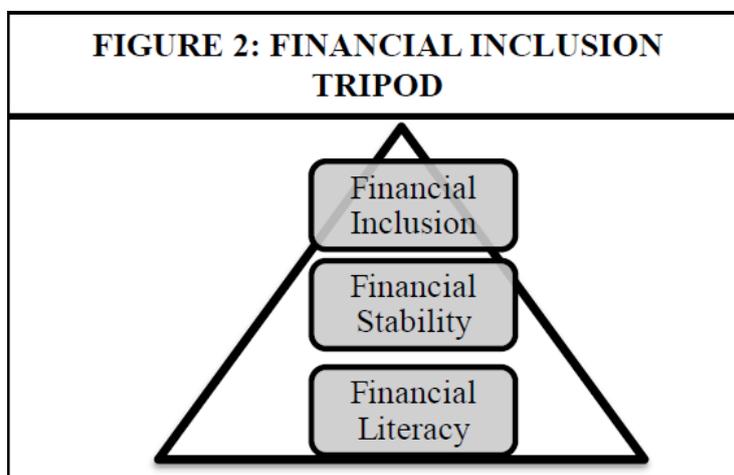
Source: Kaur et al (2017)

REVIEW OF LITERATURE:

It is possible to think about financial inclusion as a crucial tenet of economic growth. Initiatives toward financial inclusion are essential, according to research on the topic, if we are to improve the financial situation of the economically disadvantaged segments of society. It encompasses a number of activities, such as insurance and savings, and is not just the extension of credit facilities (Dev, 2006). Furthermore, a study conducted in 2005 shown that offering low-margin financial services to a sizable population could result in significant profits. It is crucial that banks review their current business methods in order to foster financial inclusion among low income groups. In addition, it is necessary to fully utilise all available resources, including technology, in order to achieve the goal of financial inclusion (Leeladhar, 2005).

In order to identify and examine several drivers of financial inclusion, Sriram and Sundaram performed a study in the rural Vellore district of Tamil Nadu in 2008. By gathering information from 20 village blocks in Vellore, the researchers also determined the causes of the lower number of bank accounts. Financial inclusion in Vellore was determined to be at a mid-range of 0.55 utilising the index of financial inclusion and percentage analysis. Unemployment, lower levels of literacy, and lower income levels were found to be the main causes of lack of financial access (Sundaram and Sriram, 2008). A different study that was done in Karnataka showed some significant information. The study was based on a report that said that the Gulbarga district had a financial inclusion rate of up to 100 percent. However, the analysis made clear that bank accounts were opened under the NREGP programme rather than the Financial Inclusion Program. As a result, the poor in rural areas were less aware of financial inclusion schemes. The study suggested that rural populations' financial literacy needs to be raised (Ramji, 2009). Figure 2 illustrates how the RBI has included financial literacy as one of the three pillars of financial inclusion. In order to achieve inclusive growth, the RBI established three principles or pillars that would serve as a roadmap. While financial inclusion was the primary focus, the other two principles/pillars served as the cornerstone for achieving the first goal.

Levels of financial inclusion and levels of human development were found to be strongly positively correlated in a cross-country study done by two academics. The researchers established a fact by employing Sarma's financial inclusion index that an individual's income, as determined by per capita GDP, is a significant factor in explaining the degrees of financial inclusion. Additionally, certain additional elements including adult literacy rates, urbanisation, and economic inequality were revealed (Sharma and Pias, 2011).



Source: financial stability: problems and difficulties 2009: Dr. D Subarao, then-Governor of the RBI, delivered the farewell speech

India has a need for financial inclusion since it can increase the financial system's resource base and encourage saving habits among a significant portion of the rural population. Additionally, by offering financial services to low-income people, we are assisting them in maintaining their financial security and utilising it in urgent situations. The vulnerable segments of society will be protected from usurious money by having simple access to formal credit. The following list includes the primary goals of financial inclusion in India:

- Providing official credit channels: A large portion of the population relies on family, friends, and moneylenders to meet their financial needs because they do not have formal access to credit. People from lower income groups will be able to stabilise their means of subsistence and raise their level of living with the help of formal banking channels.

- Establishing a framework for instilling the habit of saving money: The financial system is a key factor in the development of a country. By encouraging everyone to establish a bank account and so fostering the practise of saving, the Government of India hopes to broaden the base of financial resources (Singh and Singh, 2016).
- Providing direct benefits from subsidies and welfare programmes: The government faces a significant difficulty in that the money earmarked for rural populations under various programmes does not actually reach them. If every person living in rural areas has a bank account, the distribution of money will be efficient and open (Sehrawat and Giri, 2016). As a result, the government decided to make direct cash transfers to beneficiaries' accounts.

Indian Financial Inclusion Status: According to empirical data, specific measures must be identified in order to create effective financial inclusion programmes. As a result, specialists from the World Bank, the International Monetary Fund, and numerous other international organisations have established some reliable metrics of financial inclusion for an economy. These broad indicators include things like the number of bank branches, the number of ATMs installed, bank deposits, bank credit given, and so forth. Table 4 contains information about similar indicators for several economies. It demonstrates that despite having the most people per square kilometre, China has a robust system for financial inclusion, with 1428.98 bank branches.

Table 3: Measures the GOI, RBI, and NABARD have taken to promote financial inclusion

Customer Service Centres	Adhaar Scheme
National Rural Financial Inclusion Plan	Project on “e-Grama”
Project Financial Literacy	SHG-Post Office Linkage
Credit Counselling Centres	Micro Pension Model
Know Your Customer	General Credit Card
Farmers’ Club Program	Financial Inclusion Fund
Role of SHGs, NGOs and MFIs	Financial Inclusion Technology Fund
Pradhan Mantri Jan Dhan Yojna	No-frill Account
Separate Plan for Urban Financial Inclusion and Electronic Benefit Transfer Scheme	Nationwide Electronic Financial Inclusion System
Financial Literacy through Audio Visual medium - Doordarshan	Micro Finance Development Fund
Support to Cooperative Banks and RRBs for setting up of Financial Literacy Centres	The National Agricultural Insurance Scheme
Source: Dangi (2012), Paramasivan and Ganeshkumar (2013), Kumar (2013), Mehar (2014), Ambarkhane et al (2016), Gupta (2018)	

Table 4: 2018 Selected Financial Inclusion Indicators

S N	Country	Number of bank branches	Number of ATMs	Number of bank branches	Number of ATMs	Bank deposits	Bank credit
		Per 1000 KM		Per 0.1 Million		as % to GDP	
1.	India	30.43	25.43	10.64	8.9	68.43	51.75
2.	China	1428.98	2975.05	23.81	49.56	433.96	287.89
3.	Brazil	7.93	20.55	46.15	119.63	53.26	40.28
4.	Indonesia	8.23	15.91	8.52	16.47	43.36	34.25
5.	France	40.22	106.22	41.58	109.8	34.77	42.85
6.	Philippines	16.29	35.75	8.07	17.7	41.93	21.39
7.	Mauritius	104.93	210.84	21.29	42.78	170.7	77.82
8.	Sri Lanka	41.81	35.72	16.73	14.29	45.72	42.64
9.	Mexico	6.15	18.94	14.86	45.77	22.65	18.81
10.	Malaysia	6.32	33.98	10.49	56.43	130.82	104.23
11.	Switzerland	84.53	166.48	50.97	100.39	151.82	173.26
Source: Financial Access Survey, IMF							

Government of India has advised all public and private sector banks to develop a three-year financial inclusion plan (FIP) that will generally contain information about the number of brick-and-mortar bank branches in rural areas, branches opened through business correspondents, status of Kisan Credit Cards (KCC), number of General Credit Cards (GCC), and so on. This is being done to strengthen the financial inclusion drive in India. A brief overview of India's financial inclusion plans is provided in Table 5.

Table 5: Plans for financial inclusion have made progress.

(Scheduled commercial banks including RRBs)

S N	Particulars	March 2010	March 2011	March 2012	March 2013	March 2014	March 2016	March 2017
1.	Banking outlets in Rural locations - Branches	33378	34811	37471	40837	46126	51830	50860
2.	Banking outlets in Rural locations - Branchless mode	34316	81397	144282	227617	337678	534477	547233
3.	Banking outlets in Rural locations - Total	67694	116208	181753	268454	383804	586307	598093
4.	Urban locations covered through BC*	447	3771	5891	27143	60730	102552	102865
5.	Total Kisan Credit Cards (KCC, No. in million)	24.3	27	30	34	40	47.3	46
6.	KCCs -Total (Amount in Rs. billion)	1,240	1,600	2,068	2,623	3684	5,131	5805
7.	Total General Credit Cards (GCC, No. in million)	1.4	2	2	4	7	11.3	13
8.	GCC-Total (Amount in Rs. billion)	35	35	42	76	1097	1,493	2117
*BC: business correspondents								
Source: Compiled from Report on Trend and Progress of Banking in India of various years (issued by RBI)								

Progressive Trends of Banking Sector:

For the majority of a nation's population, banks are the primary source of all financial access. In general, scheduled banks and Non-scheduled banks make up the Indian banking system. Data from Reserve Bank of India annual reports from various years (table 6) demonstrates an increase in the number of scheduled commercial banks' offices over the last eight years. Table 7 demonstrates that the percentage of offices in the northern region increased from 2008 to 2014, however even though more offices were built in 2015, the rate of expansion was slower than in 2014. Additionally, the southern region has had the largest pace of growth in the percentage of scheduled banks.

Table 6: State-Wise Distribution of Scheduled Commercial Bank Office Locations

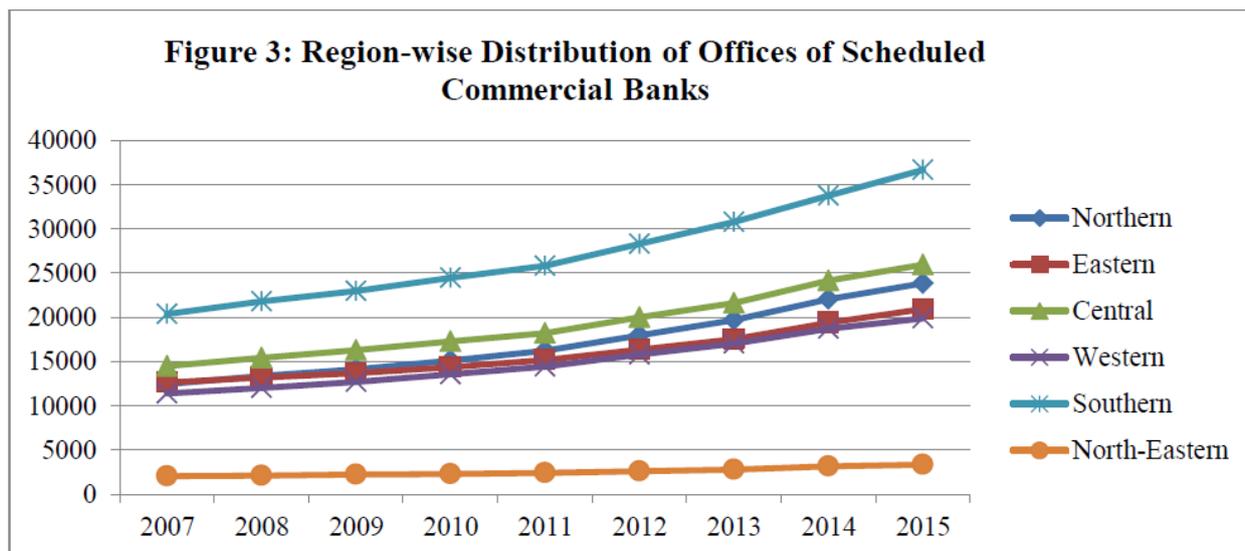
(Number of Offices as at end-March)

Regions	2007	2008	2009	2010	2011	2012	2013	2014	2015
Northern	12399	13325	14069	15087	16176	17905	19681	22000	23843
Eastern	12603	13152	13670	14359	15138	16345	17469	19376	20893
Central	14494	15383	16244	17280	18194	19948	21581	24096	25926
Western	11352	12003	12664	13543	14417	15751	17013	18673	19821
Southern	20348	21751	22974	24423	25814	28300	30766	33691	36654
North-Eastern	2003	2085	2181	2268	2378	2556	2769	3129	3345
ALL INDIA	73199	77699	81802	86960	92117	100805	109279	120965	130482

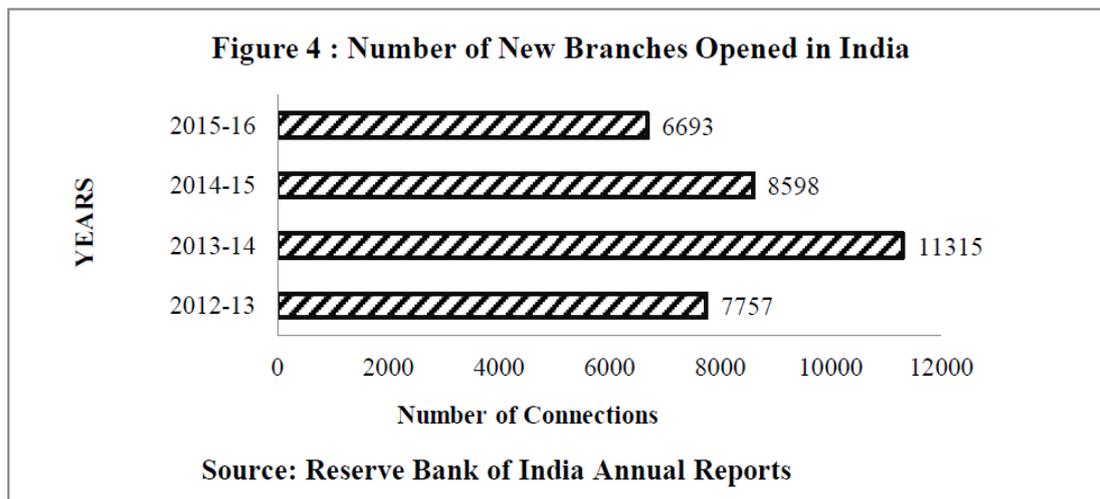
Table 7: Percentage Growth in the Number of Scheduled Commercial Bank Offices

Region/Year	2008	2009	2010	2011	2012	2013	2014	2015
Northern	7.5	5.6	7.2	7.2	10.7	9.9	11.8	8.4
Eastern	4.4	3.9	5.0	5.4	8.0	6.9	10.9	7.8
Central	6.1	5.6	6.4	5.3	9.6	8.2	11.7	7.6
Western	5.7	5.5	6.9	6.5	9.3	8.0	9.8	6.1
Southern	6.9	5.6	6.3	5.7	9.6	8.7	9.5	8.8
North-Eastern	4.1	4.6	4.0	4.9	7.5	8.3	13.0	6.9
ALL INDIA	6.1	5.3	6.3	5.9	9.4	8.4	10.7	7.9

Source: Self-created



The number of bank branches expanded significantly from 2013 to 2016 as a result of Reserve Bank of India's intensified efforts, but a key feature of this rise can be seen in figure 4. The most significant growth in connections over the previous few years occurred in 2013–2014.



One of the most crucial measures of financial inclusion for any country is the number of bank branches (Ranjani and Bapat, 2015). The number of public sector bank branches that are open for business is shown in Table 8. Table 9 demonstrates that the percentage of bank branches in rural areas stayed largely unchanged from 2011 to 2013 and increased by 1% in both 2014 and 2015. However, between 2011 and 2015, there were 2% fewer public sector bank branches in urban areas.

Table 8: number of public sector banks with open branches

(Population Group wise)

As on	Rural	Semi Urban	Urban	Metropolitan	Total
31.03.2011	20,658	16,217	13,450	12,612	62,937
31.03.2012	22,379	17,905	14,322	13,244	67,850
31.03.2013	24,243	19,642	15,055	13,797	72,737
31.03.2014	27,547	21,952	16,319	14,644	80,462
31.03.2015	29,634	23,549	17,387	15,325	85,895

Source: Department of Financial Services, Ministry of Finance, Government of India

Table 9: Indian Public Sector Bank Branches as a Percentage

	2011	2012	2013	2014	2015
Rural	33	33	33	34	35
Semi Urban	26	26	27	27	27
Urban	21	21	21	20	20
Metropolitan	20	20	19	19	18
Total	100	100	100	100	100
Source: Self Created					

SUGGESTIONS

In order to advance India's efforts to achieve financial inclusion, certain observations have been made based on the analysis that was done, and as a result, certain proposals can be implemented in the Indian banking system. First off, the RBI's initiative to advise banks to develop Financial Inclusion Policies resulted in a massive increase in the number of branches in 2011. (FIP). Therefore, RBI must continue adopting new rules for commercial banks in order to preserve this growth rate. Second, facts indicate that private banks do not contribute much to financial inclusion. The primary explanation given in the literature is that the business sector believes efforts to promote financial inclusion will not help them generate profits. However, private banks should actually recognise the unrealized potential in the rural banking industry as it can significantly expand their customer base. To determine the primary cause of the lack of banking services in rural India, the RBI must assemble a team including some industry professionals from private banks.

CONCLUSION

The provision of high-quality financial services in rural regions is essential for economic development as it will enable rural households to finance the expansion of their means of subsistence. The Indian government has made sincere attempts to include its citizens in the scope of financial services. Nevertheless, despite the fact that efforts to promote financial inclusion are progressing, some areas of the country continue to fall behind. Rapid technological advancement has also been essential in bridging the country's financial gap. Immediate Payment Service (IMPS), ATMs, and mobile banking are now being used by more people. In a nutshell, it can be claimed that India is moving quickly toward financial inclusion, and that this process can be sped up by the government, the reserve bank of India, and the people of the nation working together.

REFERENCES

1. Ambarkhane, D., Singh, A. S., & Venkataramani, B. (2016). Measuring financial inclusion of Indian states. *International Journal of Rural Management*, 12(1), 72-100.
2. Dangi, V. (2012). Financial Inclusion: A Saga of Indian Financial System. *Asia-Pacific Journal of Management Research and Innovation*, 8(2), 111-125.
3. Dev, S. M. (2006). Financial inclusion: Issues and challenges. *Economic and political weekly*, 4310-4313.
4. Garg, S., & Agarwal, P. (2014). Financial Inclusion in India—a Review of Initiatives and Achievements. *Journal of Business and Management (IOSR-JBM)*, 16(6), 52-61.
5. Gupta, J. (2018). Government Initiatives for Financial Inclusion in India. *Asian Journal of Research in Business Economics and Management*, 8(2), 32-41.
6. Islam M.N. (2012). The Microfinance Guarantee For Financial Inclusion: Evidence To Support In India, *Indian Journal of Commerce & Management Studies*, III(1), 130-134.
7. Kaur, M. S., Kaur, M. M., & Madan, M. P. (2017). Financial Inclusion in India. *International Education and Research Journal*, 3(5), 655-658.
8. Kumar, N. (2013). Financial inclusion and its determinants: evidence from India. *Journal of Financial Economic Policy*, 5(1), 4-19.
9. Mehar, L. (2014). Financial inclusion in India. *Innovative Journal of Business and Management*, 3(4), 42-46.
10. Paramasivan, C., & Ganeshkumar, V. (2013). Overview of financial inclusion in India. *International Journal of Management and development studies*, 2(3), 45-49.

11. Ranjani, K. S., & Bapat, V. (2015). Deepening Financial Inclusion Beyond Account Opening: Road Ahead for Banks. *Business Perspectives and Research*, 3(1), 52-65.
12. Sehrawat, M., & Giri, A. K. (2016). Financial development and poverty reduction in India: an empirical investigation. *International Journal of Social Economics*, 43(2), 106-122.
13. Singh, D., & Singh, H. (2016). Market Penetration by Indian Banks: Motives and Motivators. *Indian Journal of Finance*, 10(3), 28-42.
14. Sarma, M., & Pais, J. (2011). Financial inclusion and development. *Journal of International Development*, 23(5), 613-628.
15. Sriram, M., & Sundaram, N. (2015). Financial inclusion index: a customized regional model with reference to economically most backward districts of Tamil Nadu, India. *Mediterranean Journal of Social Sciences*, 6(6), 209.
16. Tamilarasu, D. A. (2014). Role of Banking sectors on financial inclusion development in India—An analysis. *Galaxy International Interdisciplinary Research Journal*, 2(2), 272-276.
17. Chakrabarty K.C (2011). Financial Inclusion: A Road India Needs to Travel, *RBI Bulletin*, November, 2011.
18. Chakrabarty, K. C. (2013). Financial Inclusion in India –Journey So Far and Way Forward. Keynote Address at the Finance Inclusion Conclave. Organized by CNBC TV, 18.
19. International Monetary Fund (2016). Financial Access Survey. Retrieved from <https://www.imf.org/en/News/Articles/2016/10/03/PR16441-IMF-Releases-the-2016-Financial-Access-Survey>
20. Karmakar, K. G. (Ed.). (2008). *Microfinance in India*. SAGE Publications India.
21. Leeladhar V (2005). Taking Banking Services to the Common Man –Financial Inclusion, Commemorative Lecture at the Fedbank Hormis Memorial Foundation at Ernakulam.
22. Ministry of Finance (2016). Overview and Progress on Financial Inclusion. Retrieved from <http://financialservices.gov.in/sites/default/files/Overview%20and%20Progress%20on%20Financial%20Inclusion%20.pdf>
23. Ramji, M. (2009). Financial inclusion in Gulbarga: Finding usage in access. Institute for Financial Management and Research Centre for Micro Finance. Working paper.
24. Reserve Bank of India (various years). Report on Trend and Progress of Banking in India. Retrieved from <https://www.rbi.org.in/scripts/AnnualPublications.aspx?head=Trend%20and%20Progress%20of%20Banking%20in%20India>

Floristic and Phytosociological Studies of Weeds in Some State of India: A Review

V.A. Jondhale and S.P. Giri

Department of Botany and Research Centre, Padmashri Vikhe Patil College of Arts, Science and Commerce, Ahmednagar, 413713 (M.S), India

ABSTRACT

Biodiversity refers to the wide variety of life on Earth, including the species, ecosystems, and biomes. An ecosystem is a complex, interconnected system of organisms and their environments that includes both natural and man-made components. Ecological, economic, and ecological stability all depend on the preservation of biodiversity. Several surveys in the floristic area, as well as a taxonomical investigation, have yielded information about former species that is helpful in supporting current research. To increase their plant variety, governments in poor regions have turned to research on floral diversity. For the preservation of rare, endangered, and vulnerable plant species, floral variety is critical. A taxonomic study of flora, especially of a large portion of flora, is called a "floristic study." Indian monocots are examined in this article.

Keywords: Plants, Taxonomy, Diversity, Floristic, Biodiversity

INTRODUCTION

The term "biodiversity" refers to the variety and variability of life on Earth's surface. Species variety is immensely beneficial to the expansion of the agricultural, medical, and future research industries (Knopf, 1992). The total number of Angiospermic plants reported by Indian writers is 2,205, which accounts for about 12.5% of the total number of Angiospermic plants in India (Glimpses of Forests in Gujarat, 2011). Taxonomy is the systematic classification and grouping of organisms based on their morphological and molecular similarities and differences. Taxonomy refers to the practice of grouping organisms based on shared traits and common ancestry. For taxonomic purposes, Floristic studies refer to the taxonomic study of a certain area's plant life. Prepare an exhaustive list of all the plants that make up a certain vegetation group (George, 1974). Correct scientific identification of the plant wealth found in that specific location is the most critical component of any floristic study (Jasrai et al., 2014). Since emerging and disadvantaged nations need to know how rich their plant biodiversity is, floristic studies have gained a lot of attention in recent years. Floral composition and the organic structure spectrum of individual plant components are the only factors that determine the appearance and existence of every plant community (Thakur, 2012).

Global Work On Floristic/ Monocot Family

In order to better comprehend the interplay between species, floral study plays a crucial part in this endeavor. There have been several research in this area. In order to identify the most frequent and prominent weeds associated with turf grass, a study was undertaken in Malaysia on 50 various types of turfgrass, including rugby fields, hockey fields, turf nurseries, lawn areas, landscaping areas, recreational park areas, green golf and fairway golf. This study found that there were total of 79 weed species, 43 annuals and 36 perennials, 30 grassy weeds, 17 Sedge plants and 32 broad-leaf plants, all of which belong to 16 families. *C. aromaticus*, *Fimbristylis dichotoma* (L.), *C. aciculatus* (Retz.) and *Borreria repens* were some of the most common species that covered more than half of the areas studied (DC.). According to the relative abundance indexes, perennials outnumbered annuals (Kamal et al., 2009).

According to a study by Thomas (1985), the relative abundance of weed species clearly suggested a small number of dominant species. Agricultural crops in Saskatchewan are surveyed using this method.

The major weed species in every agricultural field are normally approximately 10 species, with three to four being the most prevalent. Out of the ten most frequent species, *Cyperus rotundus* (L.) and *Digitaria sanguinalis* (L.) were more prevalent (Moody and Drost, 1983).

Turfgrass weeds, according to some research, are a problem. There are three basic biological types for turfgrass areas: grasses, sedges, and broadleaved across the Americas, Europe, and Australia (Bennet, 2004).

Perennial weeds, particularly grasses, were found to be more prevalent in Egypt than annual weeds, according to Al-Gohary (2008). This district's eleven surveyed wadis had 377 different species; 43.2% were annuals and 56.2% perennials. One hundred fourteen species are exclusive to this area, and 57 species have never been documented before. It was found that 34.7 percent of the Gebel Ebla species were plural-regional, followed by 30 percent tri-regional, 25.7 percent biregional, and 9.5 percent mono-regional species.

It was found that the monocot family predominated in Hangzhou, China, followed by the Poaceae family and the Cyperaceae family in a turfgrass field, according to Xing et al. (2000).

One Brazilian floristic study of weeds found only 45 species of weeds spread throughout 15 families, with the majority of those belonging to Asteraceae, Poaceae, Cyperaceae, Euphorbiaceae, and Fabaceae. The most common weed families in Brazil were Asteraceae and Poaceae (Maciel et al., 2008).

The environment, seraphic and biological elements that include soil structure, pH, nutrients, moisture condition, related crops, weed control strategies, and field history, particularly in local geographic variations, are all factors that influence weed growth in a given location. A new enhanced rice cultivar is being used to examine the effects on the weed flora in transplanted rice and the connection between weed communities and soil chemical characteristics. (Kim et al., 1983).

On the Cape Floristic Region, South Africa, Slingby et al. (2006) studied the Phylogenetic Relatedness Limits and Co-occurrence at Fine Spatial Scales. There are around 9,100 vascular plants in the Cape Floristic Region of South Africa, making it comparable to the most varied tropical regions in terms of floristic diversity per unit area. As a result, the bulk of the region's floral diversity is concentrated in only 33 lineages, which suggests that these locations had seen several large-scale radiations in the past.

This tribe of sedges, Schoeneae, might include as many as 700 species, including many species unique to the hemisphere (Goetghebeur, 1998 and Linder, 2003).

For the Cyperaceae, a genetic and morphological investigation shows that the tribe is monophyletic. The cape species of *Tetraria* is found in two separate and unconnected lineages of the genus (Muasya et al., 1998, 2000; Verboom, 2006).

Because therophytes included 36 percent of the studied area, it may be concluded that anthropogenic activities have taken a heavy toll on the area's ecosystems, as phanerophytes comprised 46 percent of the studied area (Barbero et al., 1990, Raunkiaer 1934).

The first of its type in the hemisphere was a comparable research revealing the relationship between phylogeny and fine-scale co-occurrence in the Cyperaceae lineage; hence, it was the first of its kind. In Southeast Asia, this research focused on biodiversity inventory and informatics (Webb, 2000; Losos et al., 2003; Cavender-Bares et al., 2004).

For the Jibat forest in Ethiopia's height gradient and species richness to be sustained, eight community types were identified (Bekele, 1994).

For his dissertation, Knight (1975) focused on the floristics of Panama's Barro Colorado Island's Tropical Forest. More than 300 species were found, and most of them were recognized. The data are used to analyze late secondary succession, to identify soil-vegetation trends, and to provide information. Some evidence suggests that wind-induced canopy gaps are critical to the long-term survival of a number of older forest species.

Floral and ecological surveys of springs in Trentino, Italy were conducted using the BraunBlanquet technique and taxonomic analysis. Cluster analysis was used to sort 139 Phytosociological Relives, comprising vascular plants and bryophytes. There were 23 different kinds of plants found, and they were all classed as either phytoene or at the association level where it was an option (Tomaselli et al., 2011).

Floristic Work of India/Monocot Family

The structure, vegetation, and species richness of distinct Indian ecosystems were studied with the use of floristic investigations on the Indian subcontinent.

Research by Tiwari and colleagues (2020) in Uttarakhand, India, focused on the weed communities in Mandakini Valley rice fields. The quadrat approach was used to gather field data throughout the year. The paddy fields yielded a total of 57 weed species from 45 genera and 19 families.

There are a number of weeds in the paddy fields, such as *Cyperus iria* and *Ageratum conyzoides*, that pose a significant threat. There are more weed species reported in the Poaceae and Cyperaceae families than any other known family (Rao et al., 2007).

These findings are consistent with previous analyses, which found that the most harmful weeds are monocot Cyperaceae. Paddy fields in Uttarakhand's Doon Valley were found to have the most common weed species, *Lindernia crustacean* (L.) and *Ageratum conyzoides* (L.). A list of the most frequent paddy weeds found in India includes *Cyperus difformis* (L.), *Echinochloa colona* (L.) and *Digitaria sanguinalis* (L.), as well as *Leptochloa*

chinensis (L.) Nees, and *Cynadon dactylon* (L.) Pers, and *Fimbristylis miliacea* (L.) Vahi (Rao et al., 2012-2013, Ramirez et al., 2015).

A grassland community in Odisha's Baliapal block called Devog has been the subject of more floristic research. In such grassland ecosystems, the monocots contributed the most (24 percent), followed by Cyperaceae (20 percent) (Mohanty et al., 2018).

Angiosperm studies were used to investigate the Angiosperm flora at the planned location of Aranmula international airport. During the post- and pre-Monsoon periods in Kerala, a variety of plant phenotypes were collected. The international airport Aranmula conducted an Angiosperm plant survey, and the results reveal that of the 247 types of plants found there, 59 were trees, 54 were shrubs, and 134 were herbaceous plants. In all, there are 109 medicinal plant species in this region, with 14 being indigenous and eight being very uncommon. Poaceae and Cyperaceae include 26 and 18 genera, respectively, among the families. More than 250 plant species from 67 families have been identified, with Poaceae and Cyperaceae being the most prevalent (Anto et al., 2016).

The macrophytic variety and environmental conditions of three lakes in Jammu have been documented in an investigation. There were total of 181 species, belonging to 142 genera and 52 families, recorded. Some 140 species and six monocotyledon families in India make up these families. Monocot groups like as Araceae, Cyperaceae, Poaceae, and Xanthorrhoeaceae investigate aquatic habitats to see how floristic information represents structural and functional complexity. Sulia et al. (2017) and Sharma, 2008).

Darlaghat Wild Life Sanctuary (DWLS), in Himachal Pradesh's district of Solan, is home to 302 plant species from 99 groups, according to Thakur et al. (2012). 27 percent trees, 24 percent shrubs, 35 percent herbs, 5 percent climbers, 5 percent ferns, 2 percent grasses, and 2 percent Sedges make up the majority of these. 5 Cyperaceae plant species were researched by the researchers.

Mango and tamarind trees had the highest importance value indexes out of the 110 species and 40 families studied. A total of 41 species of woody Angiospermic plants were identified in the research (Rao et al., 2015).

Tree species in the Eastern Ghats area of India were researched by Naidu and Kumar (2016) using floristic techniques, which found 129 species of plants from 44 families and 98 genera..

Floristic Work of India in Gujrat/Monocot Family

To far, only "Flora of Presidency of Bombay" has been published, which documents 626 plant species, including 450 from India and 176 from Sindh (Cooke in 1901-08).

Herbaceous plants in India make up about 93.33 percent of the country's total floral richness (Agrawal, 2001).

Taxonomic study in Sabarkantha district, Gujarat, India, was surveyed by Patel et al. (2014). It was recorded and depicted throughout the study the floristic account of emergent aquatic and marshland angiosperms. A total of 74 angiosperm species from 27 families and 54 genera were found during this investigation. With 13 species, Cyperaceae was the most common family, followed by Poaceae with eight, and Commelinaceae with four. Eighteen groups were represented by a single species. Three groups included two species apiece; the other fourteen groups consisted entirely of a single specie.

353 plant species from 95 Angiospermic families and 276 floral genera were discovered in the Vadali range forest district of Sabarkantha, Gujarat (Desai and Ant, 2012).

Floral diversity in Kalol taluka (Panchmahal), Gujarat was surveyed, and 312 plant species were detected, including 85 tree species, 62 shrub species (*Cyperus bulbosus* Vahl H., *Cyperus rotundus* (L.), 109 herb species, 15 grass species, and 41 climber species) (Patel et al., 2014).

Macrophytes in the chosen wetlands of Valsad District, Gujarat were studied by Patel and Saho, (2021). They addressed the macrophyte baseline state in the five selected wetlands. More than 50 species of macrophytes belonging to 42 genera and 28 families were found during the research period. Cyperaceae family comprised 5 species, *Cyperus alopecuroides*, *Cyperus articulata*, *Cyperrus compressus*, *Cyperus difformis*, and *Cyperus iria*, all of which belong to the *Cyperus* genus (L.).

Valsad's Kaprada Hills were examined for their floral variety; a total of 839 angiosperm plant species from 123 families and 134 plants of important ethnobotanical importance used by indigenous peoples were recorded during the investigation (Rao, 2012; Rao et al., 2013).

Studying Godhra, Gujarat's Panchmahal district, Charan et al. (2019) found that angiosperms were prevalent in the area. A total of 36 species from 32 genera and 23 families are included in the research. 24 herbs, four climbers, four shrubs, and four trees are among the 35 species that have been found. Whereas Cyperaceae displays a maximum of 14 percent of its species here, Cyperaceae only displays a maximum of 5 genera in this instance.

Researchers in the Sabarmati Riverbed and Riverbank in Ahmedabad, India, researched angiosperms from the Sabarmati riverbed and the riverside region, which comprises indigenous cultivated and naturalized plant species. A total of 21 monocot families and 83 species were found. Poaceae and Cyperaceae are the two monocotyledon families having 34 and 11 species, respectively.

The Attarsumba Range has a 78-item list of tree and shrub species, which comprises trees and shrubs. 66 species of plants and animals were discovered by the Gujarat Forest Division in Ahmedabad and Gandhinagar (Patel et al., 2013).

A study by Punjani et al. (2018) documented aquatic and wetland plant variety by field excursions near the Sipu dam in Banaskantha, Gujarat's downstream section of the Sipu river. There was a wide variety of aquatic and wetland plants found in this floristic survey. There were 22 species in 18 genera and 12 families of Angiosperms found in the initial survey undertaken in the study region. Monocotyledons, on the other hand, make up roughly 42 percent of all documented species. In this research, the liliopsid family and monocots were determined to be the dominating genera.

A study of Gujarat's Dhansura taluka, district Aravalli's floristic diversity was conducted by Bhagat et al., (2021). 591 angiosperm plant species belonging to 390 genera and 107 families were found in Dhansura taluka during his investigation. Out of the 591 species, 111 belonged to the tree family, 82 to the shrub family, and 309 to the herb family, according to plant habits.

Whereas, 21 species of Cyperaceae plants were reported in this region.

The floristic approach was used to examine the Banni Kutch grassland region, resulting in the discovery of 219 plant species in 158 genera in 51 families. Following 100 kinds of herbs, there were 45 grasses and 34 shrubs and 18 trees found in the area. For further information, see (Patel, 2013)

Roughly 100 new wild species were added to Saurashtra's existing flora by Menon (1979), who conducted floristic and Phyto-Sociological research in selected locations. This brought the total number of species found in Saurashtra up to about 800. There were 71 species of Gramineae among Monocotyledons, making it the most common family.

Phyto-sociological studies in the Dahod area's forests uncovered 65 species of plants belonging to 57 genera and 31 families, revealing a rich variety of species and genera. While the Shannon's index was 0.81 to 2.85, the evenness of species was 0.7 to 0.93, and the richness of species was

2.8 to 30.84, the dominance of species was 0.08 to 0.52. The *Prosopis juliflora* (Sw.) DC.

Species has the highest Important Value Index (IVI) in the study forest (Pilania et al., 2014).

A review of Narmada District's therapeutic plants identified 38 Angiospermic plants, each having a proven ethnobotanical use and belonging to one of 36 genera or one of 28 families. (Bansal and colleagues, 2016)

Traditional healers in the Waghai Forest, Dang, collected data on 120 medicinal plants belonging to 53 families, which were documented by Kokni et al. (2016). It was Leguminosae, with 16 species, that was the most common medicinal plant family, with 23 species of therapeutic plants from 19 different families. This research found several medicinally useful species of Cyperaceae and poaceae, two monocot families.

In the Valsad area, a weed infestation assessment was conducted in the wet, winter, and summer seasons. More than two-thirds of the dicotyledonous weeds and one-third of the monocotyledonous weeds found in the study region were classified as dicotyledons. Poaceae is a family of plants that includes 18 species. Families like Poaceae, Cyperaceae, and the like are among the most common plant weeds. (Patel and colleagues, 2015)

Rani Talav wetland in Idar, Sabarkantha district, was surveyed for its floral diversity. 35 plant species were found in 33 genera and 20 families, according to the research. There are 33 herbs, one climber, and one shrub among the 35 species. A total of 28 upper wetland species, 3 of which are obligate, and 4 of which are permissive, were identified. There are three genera and four species in the Cyperaceae family (Charan et al., 2019).

Weed flora was studied in Gandhinagar district. Weeds were studied using phytosociological approaches. Every season was taken into consideration while conducting weed surveys. Weed features and occurrence were noted with particular care throughout the fieldwork and collecting. Gandhinagar District's weed flora includes 116 species from 34 families and 93 genera. There are 20 Genera and 25 species of Monocots in these three families. The Poaceae family has the most species, with roughly 20. (Karlikar and colleagues, 2015)

Flowering plants in Gujarat's Tapi area are the focus of this study. In order to gather as many types of plants as possible that grow in the region, the area was explored under a variety of geographic and climatic circumstances. Flowers from 592 genera and 119 families are represented by 698 species and 5 variants found in the area. There are 138 monocot species, 102 genera, and 24 families in this group. In terms of Monocot families, Poaceae and Cyperaceae are the two biggest, with a total of 20 Cyperaceae and 41 Poaceae species. Gamit and co-authors (2015)

For Qureshimatva et al. (2016), the Panchmahal District in Gujarat was a source of floral variety. A wide range of topographical gradients and climatic conditions were investigated in order to gather the largest number of plant species in the area. According to the findings of this study, there are 752 species of Monocots in three types, 101 genera, and 616 species in all. There were 64 Fabaceae families, 34 Acanthaceae, 20 Cyperaceae families, and 41 Poaceae families in Panchmahal district. To our knowledge, these two families were underrepresented in this region before to our investigation.

There was a thorough investigation of the region around Ahmedabad for Palm species. Palms that are typically grown in gardens were used in this research. Ahmedabad has 198 gardens, all of which add to the city's radiance and allure. There were 71 species of palms discovered in this research, belonging to 38 genera and seven cultivars. Ahmedabad District is home to 25 genera and 61 species that have never been described before. This research found that 12 palms were claimed to be indigenous and unique to India, which are speared across the Eastern Himalayas, Western Ghats, and Andaman and Nicobar Islands in the Indian Ocean. The study by Qureshimatva et al.

Angiosperms found in Vishnagar Takuka, North Gujarat by Dabgar et al., (2010) were included in their study of plant diversity. Dicots were about five times more expensive than Monocots. It was clear that shrubby plant species had the upper hand over grasslands. Vascular plants from 314 genera and 101 families have been found in Visnagar taluka. 236 species of Herbs, 76 species of Shrubs, 69 species of Trees, and 58 species of Climbers were found in this research..

CONCLUSION

It is possible for the floral makeup of a grassland community to change through time and from one location to another. Local factors including terrain, population concentrations, soil type and composition, weather patterns and biotic interference all have an impact. Long-term bioresources researchers might utilize these principles as a starting point for their studies. An existing plant species in India was the source of inspiration for the present investigation. Changes in the local environment were a consequence of the changes in the habitat. Floral and faunal populations might be affected significantly by this. A floristic inventory's baseline information is also valuable for future ecological work, such as flora restoration and conservation.

FUTURE SCOPE

- More exploration for a floristic account.
- Reinvestigation of reported plant species India.
- Geotagging of rare species for conservation.
- Ecosystem and niche modeling for various species.
- Threats to Biodiversity of India.

REFERENCES

1. Agrawal, J.2001. GEER, National Biodiversity Strategy Action plan (NBSAP): A SubState Action Plan for Gujarat State (Gujarat Forest Department, Gandhinagar).
2. Al-Gohary, I. 2008. Floristic composition of eleven wadis in Gebel Elba, Egypt. *International Journal of Agriculture and Biology*, 10(2): 151-160.
3. Anto, M. and Jasy. 2016. T. Floristic diversity of angiosperm.

4. Barbero, M., Bonin, G., Loisel, R., and Quézel, P. 1990. Changes and disturbances of forest ecosystems caused by human activities in the western part of the Mediterranean basin. *Vegetatio*, 87(2): 151-173.
5. Bekele, T. 1994. Phytosociology and ecology of a humid Afromontane Forest on the Central Plateau of Ethiopia. *Journal of Vegetation Science*, 5(1): 87-98.
6. Bennet, S. 2004. Suggestions for the care of Seashore Paspalum. Retrieved august, 10, 2007.
7. Bhagat, A., Patel, K., and Jangid, M. 2021. Floristic diversity study of Dhansura taluka, district Aravalli, Gujarat, India. *Life sciences leaflets*, 138: 13-20.
8. Cavender-Bares, J., D. D. Ackerly, D. A. Baum, and F. A. Bazzaz. 2004. Phylogenetic over dispersion in Floridian oak communities. *American Naturalist* 163: 823-843.
9. Charan, R. R., & Solanki, K. J. G. H. A. 2019. Plant diversity of Bandhali lake wetland (Dumelav), Godhra, Panchmahal, Gujarat.
10. Charan, R. R., Oza, K., Maitreya, B. B., and Solanki, H. A. 2019. Angiosperms diversity of Rani talav wetland (Pavapuri), Idar, Sabarkantha, Gujarat.
11. Cooke, T. 1901-08. The Flora of Bombay Presidency, Vol. 2. London. Hooker, J. D. (1872-1897). The Flora of British India. London. Vols I-VII.
12. Dabgar, Y. B., Solanki, H. A., Mali, M. S., & Khokhariya, B. P. 2010. Plant diversity and its life forms of Visnagar taluka (N. Guj.), India. *Plant Archives*, 10(2): 589-593.
13. Desai R and Ant H. 2012. Study of Plant diversity in Vadali range forest district Sabarkantha, North Gujarat, India, *Life science Leaflets*, 1: 32-43.
14. Gamit, S. B., Maurya, R. R., Qureshmatva, U. M., & Solanki, H. A. 2015. Check list of flowering plants in Tapi District, Gujarat, India. *International Journal of Advanced Research*, 3(10): 1104-1123.
15. George Usher. 1974. A dictionary of plants used by man, London; constable, 619 p.
16. Glimpses of Forests in Gujarat. 2011. Dy. Conservator of Forest Publicity
17. Goetghebeur, P. 1998. Cyperaceae. Pages 141-190 in K. Kubitzki, Ed. The families and genera of vascular plants. IV. Springer, Berlin.
18. Jasrai, Y, Patel Y, Khokhariya N, Verma S and Chauhan S. 2014. Field Survey for Forest Resources in Gandhinagar Circle, Gujarat, India. Forest Department, Gujarat State, Aranya Bhavan, 1st Edn, ISBN: 978-93-82799-03-0, 1272.
19. Kamal-Uddin, M. D., Juraimi, A. S., Begum, M., Ismail, M. R., Rahim, A. A., and Othman, R. 2009. Floristic composition of weed community in turf grass area of west peninsular Malaysia. *International Journal of Agriculture and Biology*, 11(1): 13-20.
20. Karlikar, B. H., & Solanki, H. A. 2015. Quantitative and qualitative analysis of weeds in Gandhinagar district, Gujarat, India by Binny H. Karlikar and Hitesh A. Solanki. *Life sciences leaflets*, 68: 51-to.
21. Kim, S.C., R.K. Park and K. Moody. 1983. Changes in the weed flora in transplanted rice as affected by introduction of improve rice cultivar sand the relationship between weed communities and soil chemical properties. *Res. Rept. ORD.*, 25: 90-97
22. Knight, D. H. 1975. A Phytosociological Analysis of Species- Rich Tropical Forest on Barro Colorado Island, Panama. *Ecological Monographs*, 45(3): 259-284.
23. Knopf, F. L. 1986. Changing landscapes and the cosmopolitanism of the eastern Colorado avifauna. *Wildlife Society Bulletin (1973-2006)*, 14(2): 132-142.
24. Kokni, F. K., Solanki, H. A., and Patel, D. D. 2016. Study of ethnomedicinal plants and its documentation of Waghai Forest, Gujarat. *Life Sciences leaflets*, 81: 11-30.
25. Linder, H. P. 2003. The radiation of the Cape flora, southern Africa. *Biological Reviews* 78: 597-638.
26. Losos, J. B., M. Leal, R. E. Glor, K. de Queiroz, P. E. Hertz, L. Rodriguez Schettino, A. Chamizo Lara, T.
27. R. Jackman, and Larson, A. 2003. Niche liability in the evolution of a Caribbean lizard Community. *Nature*, 424: 542-545.

28. Maciel, C.D.G., J.P. Poletine, C.J.R. Aquino, D.M. Ferreira and R.M.D. Maio. 2008. Floristic composition of the weed Community in *Paspalum notatum* flügge turf grasses in Assis, sp. Planta DaninhaViçosa-MG, 26: 57–64
29. Maitreya, B. B. 2015. Floristic analysis of riparian angiosperms from sabarmati river of Gujarat state, India by Bharat b. Maitreya. Life sciences leaflets 60: 122-to.
30. Menon, A. R. 1979. Floristics and Phyto-Sociological studies of some parts of Saurashtra, Doctoral thesis, Sardar Patel University. 1011pp.
31. Mohanty, S., and Barik, K. L. 2018. Floristic Composition of a Grassland Community of Balasore District in Odisha. International Journal of Scientific Research & Review 7(7): 410416.
32. Moody, K. and D.C. Drost. 1983. The role of cropping systems on weeds in rice. In: Weed Control in Rice, pp: 74–88. Los Banos, Laguna, Phillipines, International Rice Research Institute.
33. Muasya, A. M., D. Simpson, M. W. Chase, and A. Culham. 1998. An assessment of suprageneric phylogeny in Cyperaceae using rbcL DNA sequences. Plant Systematic and Evolution 211: 257–271.
34. Naidu, M. T., and Kumar, O. A. 2016. Tree diversity, stand structure, and community composition of tropical forests in Eastern Ghats of Andhra Pradesh, India. Journal of AsiaPacific Biodiversity, 9(3): 328–334.
35. Patel. 2013. Contribution to the floristic and phytosociology of Banni region Kachchh district Gujarat India, Doctoral Thesis, Shri Jagdishprasad Jhabarmal Tibarewala University.
36. Patel Y, Patel N and Pandya H. 2014. A. Study for Tree Enumeration of Attarsumba Range, Gandhinagar Forest Division, India. International Journal of Innovative Research in Science Engineering and Technology, 3(4): 11185-11190.
37. Patel Y, Patel N and Pandya H. 2014. B. Study on ecological assessment parameters for Attarsumba range, Gandhinagar Forest division, Gujarat, India, International journal of science, engineering and technology, 2 (7): 1509-1513
38. Patel, D. D., and Solanki, H. A. 2015. Weed flora of Valsad district by Dilip d. Patel1 and Hitesh A. Solanki2. Life Sciences Leaflets, 66: 109-to.
39. Paliana, P. K., Gujar, R. K., and Panchal, N. S. 2014. Species diversity and PhytoSociological analysis of important plants of Tropical Dry deciduous forest of Dahod district of Gujarat, International Journal of Science & Medical Research, 1: 37–46.
40. Punjani, B., Panchal, B., Mali, N. B., Patel, A., and Pand, V. 2018. Observation on aquatic and wetland plant diversity in Sipu river bed near Sipu dam, Banaskantha district, Gujarat. by Bhasker Punjani, Baldev Panchal, Nikunj Patel, bhavesh Mali, Ankit Patel and Vinod Pandey. Life sciences leaflets, 100: 53-to.
41. Qureshimatva, U. M., Gamit, S. B., Muarya, R. R., Solanki, H. A., and Yadav, S. L. 2016. Research Article Checklist of Palms in Ahmedabad, Gujarat, India. International Journal of Recent Scientific Research, 7(3): 9413-9417.
42. Qureshimatva, U. M., Maurya, R. R., Gamit, S. B., and Solanki, H. A. 2016. Check List of Flowering Plants in Panchmahal District, Gujarat. India. Forest Res., 5(176): 2.
43. Rao, V. H. 2012. A floristic and ethnobotanical survey of kaprada hilly forest and umbergaon coastal talukas of Valsad district, Doctoral Thesis, VeerNarmad University, Surat. 392pp.
44. Rao, V. H., Gohil, T. G., & Thakor, A. B. 2013. Floristic study of Kaprada's hilly forest in South Gujarat. International Journal of Plant Sciences (Muzaffarnagar), 8(1): 100–102.
45. Rao, D. S., Murthy, P. P., & Kumar, O. A. 2015. Plant biodiversity and PhytoSociological studies on tree species diversity of Khammam District. Journal of Pharmaceutical Sciences and Research, 7(8): 518-522.
46. Rao A., Johnson D., Sivaprasad B, Ladha J., and Mortimer A. 2003. Weed management in direct seeded rice. Advances in Agronomy. 2007; 93: 153-255.
47. Ramirez S, Hoyos C, and Plaza T. 2015. Phytosociology of weeds associated with rice crops in the department of Tolima, Colombia. Agronomia Colombiana. 33(1): 64-73.

48. Raunkiaer, C. 1934. The life forms of plants and statistical plant geography. Oxford University Press, Oxford, England.
49. Sharma, Sulia et al. 2008. Macrophytic diversity and state environment of three lakes of Jammu province (J&K). Proceeding of Taal 2007: The 12th world lake conference: 2081-2087. 49) Slingsby, J., and Verboom, G. 2006. Phylogenetic relatedness limits co-occurrence at fine spatial scales: evidence from the schoenoid sedges (Cyperaceae: Schoeneae) of the Cape Floristic Region, South Africa. *The American Naturalist*, 168(1): 14-27.
50. Thakor, A. 2009. Economical uses of plants by tribals from Valsad district of Gujarat, India. *International Journal of Agricultural Sciences*, 5(2): 611–614.
51. Thakur, M., Santvan, V. K., and Nigam, A. 2012. Floristic composition and biological spectrum of Darlaghat wild life sanctuary Solan Himachal Pradesh, India. *New York Science Journal*, 5(12): 1-14.
52. Thakur K. 2012. Floristic composition and life form spectrum of Bandli Wild Sanctuary, District Mandi (H.P.) *Plant archives*;12(1): 57-62.
53. Tiwari, P., Rautela, B., Rawat, D. S., and Singh, N. 2020. Weed floristic composition and diversity in paddy fields of Mandakini valley, Uttarakhand, India. *International Journal of Botany Study* 5(3): 334-341.
54. Thomas, A. 1985. Weed survey system used in Saskatchewan for cereal and oilseed crops. *Weed Sci.*, 33: 34–43
55. Tomaselli, M., Spitale, D., and Petraglia, A. 2011. Phyto-Sociological and ecological survey of springs in Trentino, Italy.
56. Verboom, G. 2006. A phylogeny of the schoenoid sedges (Cyperaceae: Schoeneae) based on plastid DNA sequences, with special reference to the genera found in Africa. *Molecular Phylogenetics and Evolution* 38: 79–89.
57. Webb, C., Slik J. and Triono T. 2010. Biodiversity inventory and informatics in Southeast Asia. *Biodivers.Conserv.*19: 955-972.
58. Webb, C. 2000. Exploring the Phylogenetic structure of ecological communities: an example for rain forest trees. *American Naturalist* 156: 145–155.
59. Xing, A.C., Qiang W., Ping Z., Fen D. and Ming L. 2000. Survey of weeds in turf in Hangzhou. *Acta Agric. Zhejiangensis*, 12: 360–362

Beti Bachao Beti Padaho -An Effort by Government to Advance Gender Equality

Prabha Singh Parihar and Waseem Ahmad Khan
Galgotias University, Greater Noida, India

ABSTRACT

In a patriarchal society, men are viewed as having an advantage over women when it comes to making decisions and managing resources. The idea that women belong to their male counterparts is prevalent. They aren't even allowed to make decisions for their own lives or those of their families. The arrival of a girl child into a household is viewed as a curse because of women's inferior status in society and several traditional Indian practises, beliefs, culture, religious ceremonies, etc. The practise of dowry in India is one of the primary reasons for their ignorance of girl children. The outcome is an uneven sex ratio or a decline in the child sex ratio in India due to an increase in female foeticide, infanticide, and other types of homicide. Additionally, there is a lack of understanding of the value of a girl's education. Major causes is that there is a lack of awareness regarding girls' education due to how society portrays women's roles as good wives and mothers of male offspring. Therefore, an effort has been made in this article to analyse the "Beti Bachao Beti Padhao" programme of the Central government, which the government enacted in order to guarantee a balanced sex ratio and increase the literacy rate of girl children in India.

Keywords: Gender Equality, Girl Child, Education, Empowerment

INTRODUCTION

The "sex ratio at birth" , a sociodemographic indicator, displays the split between male and female births and also the level of gender equality and the position of women are shown. There are between 101 and 113 boys for every 100 girls in the world (UN World Population Prospects, 2019). In numerous nations around the world, worries have been expressed regarding the imbalance in SRB and the alarming number of missing girls as a result of excessive female foeticide. India has had an uneven sex ratio historically since the 1970s, which it shares with South-east Asian countries China, Vietnam, and more recently, Nepal (Chao et al., 2020).

Parents' preferences for sons can be connected to patrilineal inheritance, patrilocal residence, ongoing gender disparities in work, education, and property inheritance, as well as dowry customs (Kumar and Sinha, 2018);.The preference for sons is still present despite all social programmes and awareness raising efforts to eradicate sex selection in India. However, it has evolved into a more subdued form in recent years. Many Indian parents are choosing to keep having children until they have the ideal number of males. Girls frequently lack equitable access to the resources for which they are qualified under the many government-promised programmes. Families who have sons are more likely to cease having children than those who have daughters. This suggests that parents are using "stopping rules," according to the survey, which was overseen by Arvind Subramanian, chief economic advisor.

In our society men and women play very different role, with men's positions often being seen as superior to women's roles. Each boy and each girl go through a different socialisation process. Individuals can learn or acquire a variety of social norms, practises, beliefs, rules, values, ,and different way of thinking through the process of socialisation, and these learnings influence individual personalities. The values that males and girls are taught are blatantly biased towards young girls. In patriarchal, hierarchical Indian society, men are seen as superior and women as second-class citizens. A social and intellectual system known as patriarchy holds that men are more capable of managing resources and making decisions than women. The imbalances and hierarchies it produces hurt girls and women, families, and society as a whole. They are prohibited from participating in decisions that could have an impact on their families or even their own life. Due to the poor status of women in India, their rights are regularly infringed. The rights of women are frequently violated in India. The patriarchal framework that prevails in Indian society is mostly to blame. Women are exploited for a different kind of reasons, but their lack of knowledge of their rights is the main one (Das, 2005). Violence against women still occurs despite the creation of numerous national and international organisations. The advancement of women's rights in India is also essential to the development of the nation as a whole.

Beti Bachao Beti Padhao's Significance and Reasons for Adoption Are As Follows:

The phrase "Save the girl child, educate the girl kid" is the meaning behind the name Beti Bachao, Beti Padhao. It aims to increase the effectiveness of welfare services for girls and educate the public about gender bias.

In Indian culture, families favour paying for a daughter's wedding over her schooling. However, because they see the male child as their future and think that he alone would be accountable for the family, they place a high importance on their education (Sudhakar, 2018-19). But more importantly, education has a big role to play in improving women's general well-being. Their education will make it easier for them to land better positions with both commercial and public organisations. Parents should support their daughters in pursuing higher education instead of spending money on a "dowry," since this will ensure a secure future for them. The government has been working relentlessly, as have other volunteer organisations, to encourage women and girls to pursue higher education, and their efforts are beginning to bear fruit. Due of women's reduced status in this patriarchal society, most families place a lower priority on their daughters' education, which ultimately has a detrimental effect on the growth of the country as a whole. Additionally, a girl's battle starts even before she is born. She is considered "lucky" in Indian society if she is permitted to be born. Even after they are born, girls continue to experience discrimination and injustice. The initiative *Beti Bachao Beti Padhao*, which focuses on the education and security of young girls, was introduced by Prime Minister Narendra Modi in response (Parmar and Sharma, 2020). Panipat, Haryana, was one of the areas with the lowest child sex ratio in the nation when Prime Minister Narendra Modi introduced the BBBP programme (Parmar and Sharma, 2020). India's persistent preference for sons in Indian society is one of the key factors contributing to the country's falling and unbalanced child sex ratio (Dhanaraj and Sudha, 2019). The *Beti Bachao Beti Padhao* Scheme is a major initiative that the Prime Minister unveiled on January 22, 2015 at the national, state, district, and local levels with the goal of raising public awareness about the importance of protecting and educating young girls in order to empower Indian women. The phrase empowerment can be characterised as a multifaceted process that helps people live better lives by overcoming the challenges they encounter (Parmar and Sharma, 2020). The program's objectives are to prevent gender-based sexism, protect the girl child's survival and development, and ensure her education and involvement in society. The system has been expanded to include all of the country's districts through multi-sectoral activities. The *Sukanya Sam Riddhi Yojana* was created in conjunction with the BBBP programme to address the financial components of a female child's overall success by covering costs like health, education, and other related expenses (Parmar and Sharma, 2020).

Most people in society. However, social mobilisation and quick communication regarding the equal importance of girls and their education are still necessary in today's technologically advanced world. Additionally, everyone needs to be made aware of, to appreciate, and to support this social development and increased social integration, especially youth and women's groups. Women's participation in both the public and private spheres needs to be strongly promoted. With the aid of advantageous governmental policies and social programmes, society has a duty to create an environment that allows women to reach their full potential. The BBBP programme will advance females' education and contribute to universal education, lowering the dropout rate. In addition, there is a discernible change in how people feel about gender inequality.

LITERATURE REVIEW

It seems that the situation had been more than hopeless in the early days following independence. According to Burns et al. (2001), systemic discrimination exists, women are socialised to reach different conclusions than men, and the patriarchal role is still prioritised in democratic societies. Additionally, women have fewer resources than men to run for political office. Not simply having more women, but also having more women who stay healthy and take part in business and public governance, is what matters.

According to the World Health Organization, the "sex ratio at birth" (SRB) is considered to be 1.05. This shows that upon birth, there are generally 105 men for every 100 women. The sex ratio in India varies with each new baby, as shown in the graph above. The first child's sex ratio in Indian families with many children is 1.07, which is quite close to the naturally occurring sex ratio determined by biology. However, the survey's authors note that the final child among first-borns has a sex ratio of 1.82, which is heavily skewed toward boys. When India is compared to a nation like Indonesia, where the SRLC is close to the optimum sex ratio regardless of birth order and whether the child is the last to be born or not, the disparity is more obvious. Given the current situation, in which educated young people and older adults are both influenced by social media through focus groups and tweeting, it was important to investigate if there was an upward tendency in the sex ratio or a downward trend. Aside from the fact that the BJP and other regional parties have seen their electoral support eroded since 2014 due to the social media revolution, specifically Facebook, Twitter, and Whatsapp, it would be useful to determine whether people have their own informed opinions or are merely participating in the current of concretized public opinion. The study is concerned with the growing number of young and middle-aged people and their awareness of women in India who play a variety of roles.

CONCLUSION

India's past has been marked by the subjection of women, and we are still far from having a culture that values equality and is kind to our young women. Giving women equal rights is essential for the advancement of our nation and for enabling them to live happy, discrimination-free lives. The programme will assist in halting the ongoing sex ratio decline and, by eradicating prejudice against girls, will support the government's goal to empower women. A girl's education will also equip her to become financially independent, thus the programme will eventually be able to protect women's economic rights. However, there is still a lack of comprehension of the plan, which must be addressed for the plan to be implemented successfully.

REFERENCES

1. Chao F, Guilmoto CZ, Ombao H. 2020. Probabilistic projection of the Sex ratio at birth and missing females by state and union territory in India. *PLoS One* 15: e0236673.
2. Kumar S, Sinha N. 2018. Preventing More 'Missing Girls': A Review of Policies to Tackle Son Preference. New Delhi: The World Bank Group.
3. Banerjee, Priya R. (2014), "Dowry in 21st-Century India: The Sociocultural Face of Exploitation", *Trauma, violence, & abuse*, 15(1): 34-40.
4. Devi, Reeta et al., (2021), "Awareness of women regarding Beti Bachao and Beti Padhao scheme", *International Journal of Home Science*, 7(2): 181-183.
5. Dhanaraj, Ramani. and Sudha, Dr. T. Bhaskara. (2019), "Increasing The Sex Ratio Through Beti Bachao, Beti Padhao: Cross Analysis Of Critical Success Factors", *Think india journal*, 22(14): 3578-3584.
6. Deepalakshmi, K. (2018, January 30). 'India's "unwanted" girls: Economic survey highlights how preference for son is hurting daughters.' *The Hindu*. URL: <https://www.thehindu.com/news/national/indias-unwanted-girls-economic-survey-highlights-how-preference-for-sons-is-hurting-daughters/article22592533.ece>.
7. Parmar, Shiva. and Sharma, Dr. Amit. (2020), "Beti Bachao Beti Padhao Campaign: An Attempt to Social Empowerment", *Journal of Critical Review*, 7(13): 1242-1248.
8. Singh, Jaspreet. (2015), "Violence against women in cyber world: A special reference to India", *International Journal of Advanced Research in Management and Social Sciences*, 4(1): 60-76.
9. Sharma, B R et al., (2005), "Dowry – A Deep-Rooted Cause of Violence Against Women in India", *Med. Sci. Law*, 45(2): 161-168.
10. Sudhakar, G. J. (2018-19), "Conditions of Girl Child With Special Reference To Beti Bachao Beti Padhao Scheme." *Proceedings of the Indian History Congress*, 79(2018-19): 875-882.
11. Singh, Jaspreet. (2015), "Violence against women in cyber world: A special reference to India", *International Journal of Advanced Research in Management and Social Sciences*, 4(1): 60-76.
12. Sharma, B R et al., (2005), "Dowry – A Deep-Rooted Cause of Violence Against Women in India", *Med. Sci. Law*, 45(2): 161-168.

Secure and High Performance Hybrid Socket Based Approach for Cloud Environment

Radhika Garg and Kavita Mittal
Jagannath University, NCR, Haryana

ABSTRACT

Number of cloud-based apps is steadily rising, and cloud services are increasingly being used to transfer digital material across locations. As a consequence, digital stuff is still at danger while it is being sent. The performance of cloud systems has been shown to be reduced when security features are included into them. In order to increase the security and performance of the cloud environment, researchers conducted a thorough study. Without compromising performance, the suggested method should improve safety. The studies that have been published are being examined to see whether they have any limitations in terms of security flaws in cloud-based apps. An encrypted hybrid approach for improving cloud system and socket-based high-performance mechanisms' transmission latency, error and packet loss probability has been proposed in a research study. In terms of security, performance, and reliability, the proposed model is being compared to current approaches in the field. It is expected that this research would address the need, motivation, and obstacles of the proposed initiative. After reviewing the issue description, this study will look at how the planned task would be carried out in the real world.. The tools and methods utilized in research would be explained by the algorithm and mechanism applied in the Endeavour. The simulation's outcomes would be provided, along with an explanation of why this research is preferable to others that have been undertaken. It is possible to conduct the study in a number of ways, which are detailed below. New subjects may be discovered via exploratory study. Providing answers to an issue through doing study.

Keywords: Cloud computing, Distance learning, security, performance.

[1] INTRODUCTION

There is increasing demand for cloud-based applications and cloud services for transferring digital material from one place to another. Consequently, the transfer of digital material is still dangerous. The inclusion of security mechanisms in cloud systems has also been shown to affect performance. These studies are aimed at increasing the safety and efficiency of the cloud. Improved security without sacrificing speed is the goal of the offered technique.

1.1 Benefits of Cloud Computing

When compared to conventional IT infrastructure, the benefits of cloud computing are many. The advantages of cloud computing for distant education are discussed in the following paragraphs.

1. There are several ways in which online distance education might benefit from cloud computing.
2. As part of the online education program, cloud computing is assisting in the administration of data, apps, and services.
3. It provides round-the-clock assistance and has no downtime.
4. Educational materials may be accessed on a variety of hardware systems thanks to the cloud environment.
5. To provide both authentic and public access, cloud computing permits the use of a variety of private and public models, as well as hybrid models.
6. The learning environment is more adaptable, scalable, and efficient thanks to the cloud.

1.2 Challenges to Cloud Computing in Distance Learning

A cloud-based education system has many advantages, but it also has a number of drawbacks, including challenges with implementation, performance, and security. Some of the concerns are outlined below:

1. It is difficult to administer cloud services because of their complexity and difficulty. To create a cloud-based distance learning environment, you'll need a lot of people with a lot of experience.
2. The protocols, transmission medium, hardware, and software utilized all have an impact on the cloud system's operation.
3. Occasionally, low network performance prevents educational materials from being sent throughout the network. Transmission medium and content size may be to blame for these challenges.

4. Management of huge instructional data is another issue that occurs with a cloud-based learning system. Because moving large volumes of data from one place to another may be challenging.
5. Another concern is the safety of educational information due to the possibility of intrusion by network attackers and hackers. Many security measures may be used to safeguard a cloud-based education system, but their use might have an impact on the system's performance.

1.3 Influencing Factors

In a cloud-based education system, a number of elements influence its performance and security.

1.3.1 Security Factors

Viruses and other intrusions have compromised cloud security in the past. Consequently, there is a risk of instructional information being hacked over the internet. Data breaches without proper authentication are the fault of hackers. Crackers are on the other side, responsible for breaking the encryption. In order to keep data safe, encryption and firewalls are routinely used. However, there have been a number of assaults that might have an impact on security, such as

1. Brute force attack
2. Trojan horse attack
3. Man in Middle
4. Denial of services
5. SQL Injection

1.3.2 Performance Factors

In order to improve the system's security, it is necessary to use encryption techniques that take a long time to implement and have an influence on the system's performance. The cloud environment's performance is influenced by a number of factors, including:

1. **Transmission Media:** The system's performance is affected by the communication medium, whether wired or wireless. Wireless media sometimes falls behind when compared to the speed of a connected connection. In addition, both wireless and wired systems have their own subcategories.
2. **Bandwidth:** The quantity of data that may be transferred in a particular period of time is referred to as bandwidth. Increased bandwidth means that more data can be sent in less time.
3. **The Protocol Used For Transmission:** A protocol is a collection of rules that regulate the movement of data through a computer network. A connectionless protocol like user datagram protocol, which does not need acknowledgment, is more efficient than the transmission control protocol.
4. **Security mechanism:** The cloud network's performance may be negatively impacted by the implementation of a security mechanism since it takes a lot of time to verify whether or not a transmission is valid.
5. **Distance:** Depending on how far apart the transmitter and recipient are in the network, performance might be affected. Increasing the distance increases the transmission time and performance slows. Transmission time is reduced as the distance is closer, resulting in better performance.
6. **Attenuation:** This happens when a signal moves from one location to another. Attenuation is influenced by the distance and medium of transmission. Attenuation-related problems can only be solved using a signal regenerator.
7. **Compression Mechanism:** A method for reducing the amount of online learning material has been presented. While there are various compression methods available, data loss still occurs. Use a substitute table with smaller words in lieu of the huge ones. The size of a packet is lowered by substituting large words with shorter ones. That's an 80% reduction in the packet's transmission time. In addition, packets of a smaller size go over the network more quickly, reducing the risk of packet loss. The cloud-based online learning system might benefit from a compression technique that reduces packet transmission time.

[2] LITERATURE REVIEW

For digital material stored in a cloud, numerous studies have been conducted to increase security and speed.

E-learning in the cloud has been the subject of a study by Kumar, G. [2] in 2011. Theory and empirical investigations were used in the research. E-learning solution suppliers' cloud-based websites have been surveyed for empirical evidence. Text analysis of many studies on cloud security yielded a theoretical conclusion. Comparative methods have been devised by researchers in order to compare empirical results to the theoretical findings.

Table 1 Comparison of DES, AES and RSA considering contributor, key length, block size and security rate

Factors	DES	AES	RSA
Contributor	IBM 75	Rijman Joan	Rivest Shamir 78
Key length	56- Bits	128,192 and 256	Based on No. of bit in $N=A*B$
Block size	64 Bits	128 bits	variant
Security rate	Not Enough	Medium	Good

A data security model was developed by Meslhy [6] in 2013 to ensure the safety of cloud applications. Using a single default gateway to safeguard sensitive user information across many public and private cloud apps has been recommended in this research article. Encrypting sensitive data before sending it to the cloud is possible without crashing cloud apps with this gateway platform. A fast encryption technique and file integrity have been developed as a result of research. Additionally, it provides anti-malware, firewall, and tokenization capabilities. The security approach, on the other hand, has lowered performance by 7% as a result of the firewall and malware detection slowing down several application threads.

On behalf of online education, Asgarali Bouyer et al. [11] emphasised the need for cloud computing in 2014. It was discovered that cloud computing is a dynamically scalable technology over the course of their investigation. Web-based services may be provided. Virtual technologies are becoming more significant in online education as a result of technological advancements. Online training has been shown to be quite beneficial by academics. There is a lot of emphasis on both qualitative and quantitative improvement in online education. Research is beneficial to educational institutions as well as students in the fields of science and technology. The focus of the study was on the use of a cloud computing-based online education system.

Singh, S. K. [13] reported research in 2016 on the use of the RSA method to protect cloud data. It has been determined that RSA Algorithm's performance is dependent on three factors, which the author has investigated. These are Time Complexity, Space Complexity, and Throughput. Authentic users could only access the data once it was encrypted using the RSA method, according to the findings. Before being uploaded to the cloud, all data is encrypted. Users' identities are verified and their data is authorised for transmission when they request it from a Cloud provider. Performance has been slowed by 15% as a result of the time it takes to encrypt data.

Table 2 Time Complexity

Private key length(bits)	Time in (ms)
64	86.00
128	91.33
256	110.33
512	142.67
1024	363.67
2048	2748.67

Table 3 Space complexity

Private key length(bits)	Run Time Memory
128	345128
256	347224
512	347320
1024	348040
2048	348608
4096	349488
8192	351048

Table 4 Throughput

Data Bits	Throughput for different Private Key Length				
	128 bits key length	256 bits key length	512 bits key length	1024 bits key length	2048 bits key length

32	205.13	186.04	136.75	102.56	48.854
64	457.14	372.09	256	205.13	71.99
128	914.28	684.49	514.056	315.27	182.33
256	1641.02	1361.70	1094.02	684.49	443.67

Research reported in 2016 by P.suresh [30] used RSA ALGORITHM to safeguard the cloud environment. Algorithms like AES, DES, RSA, and others have been studied for their encryption and decryption capabilities. RSA has been implemented in this study using an asymmetric key algorithm. Different key sizes were used for encryption and decryption. Security mechanisms, on the other hand, reduce the system's performance by 20%.

In 2016, Osman, Saife [31] examined the performance of cloud-dependent web services required for virtual Learning Environment Systems. Research has shown that web services via cloud environments may be used in diverse contexts, enabling applications. Many protocols, including SOAP and REST, are available for these services. A wide range of high-quality services are being offered by protocols. The findings of the performance study provide a method for improving the web services environment in the cloud. Performance parameters, including as response time and throughput, have been studied in relation to cloud-based access to quiz services. Security mechanisms have increased response time by 5%.

For online education, Agah Tugrul et al. [32] discussed the attributes and characteristics of cloud systems in 2016. Because of advances in technology, it has been shown that the variety and value of data utilised in education are expanding. Study after study showed how important web technologies are to a remote education system. Mobile systems, which are extensively used in remote education, were also examined in the research. It has made web-based technology more accessible. Access to information on the internet is no longer limited by place and time thanks to web technology. Furthermore, it has been shown that storing and obtaining educational data and resources is critical for both

As of 2019, DNA Cryptography was applied by Pandey, G. P. [34] to protect the cloud application. The Huffman Algorithm has been used in research to compress data. For both sender and receiver apps, the author used socket programming to enable transmission. The cloud has been utilised in research to safeguard compressed data. The mechanism has impacted the system's performance by 13%. Specifically, this study examined the utilisation of cloud-based services in the education sector. It's looking at the cloud computing options that are available. The survey approach was used in this study.

It was reported in 2019 that Ananthi Claral Mary et al. [35] had discussed the implications and problems of Cloud Computing in academia. There are several advantages of integrating cloud computing into academia. It is possible to have security concerns if you use the cloud to store and process confidential data. This study has shown the security flaws in cloud computing and the defences in place to limit an attack's ability to spread across the cloud ecosystem.

Nist tests	RC6		RC4		DES		MARS		Two-Fish		Blowfish		3DES		AES	
	Reject	Accept	Reject	Accept	Reject	Accept	Reject	Accept	Reject	Accept	Reject	Accept	Reject	Accept	Accept	
1	1	127	1	127	1	127	1	127	1	127	1	127	0	128	0	128
2	1	127	2	126	3	125	4	124	1	127	1	127	1	127	2	126
3	1	127	2	126	0	128	1	127	1	127	1	127	2	126	0	128
4	3	125	1	127	1	127	1	127	0	128	2	126	1	127	0	128
5	2	126	0	128	1	127	1	127	3	125	1	127	3	125	1	127
6	1	127	1	127	0	128	1	127	0	128	3	125	1	127	0	128
7	0	128	0	128	1	127	2	126	1	127	1	127	2	126	3	125
8	0	128	1	127	2	126	2	126	2	126	1	127	0	128	1	127
9	1	127	2	126	1	127	1	127	0	128	1	127	1	127	1	127
10	1	127	1	127	2	126	1	127	3	125	2	126	1	127	2	126
11	51	77	51	77	52	76	62	66	50	78	51	77	54	74	48	80
12	53	75	50	78	51	77	59	69	48	80	52	76	56	72	47	81
13	2	126	2	126	0	128	0	128	3	125	0	128	2	126	1	127
14	1	127	2	126	1	127	1	127	3	125	1	127	0	128	2	126
15	0	128	2	126	0	128	1	127	1	127	1	127	2	126	1	127
16	4	124	0	128	1	127	3	125	2	126	2	126	2	126	1	127

Fig 1 Amazon EC2 rejection rate for modern encryption algorithms

Table 5 Literature Review

Sno	Author/ year	Objective of research	Mechanism	Benefits	Limitations
1.	G Kumar [2] /	Security concerns in cloud-based e-learning	Security protocols	Research has analyzed the	Work has ignored the data compression

	2011			security issue in a cloud-based e-learning environment.	concept
2.	Meslhy, Eman [6] / 2013	Data Security Model for Cloud Computing	Cloud computing	Research has proposed a security model for cloud	Work is generalized and did not focus on performance
3.	Bandara, I [8] / 2014	Cybersecurity concerns in e-learning education	Security protocols	Research has presented a security mechanism	Research has provided limited security solution and ignored the cloud performance.
4.	Asgarali Bouyer [10] / 2014	Affirming that cloud computing in education is a must	Cloud computing	The research considered the use of cloud in education	The research did not propose a mechanism for security and performance
5.	Singh, S. K. [28] / 2016	Cloud Computing Data Security using RSA Algorithm	RSA algorithm	RSA mechanism is enabling data security of cloud	Research ignored the performance factors.
6.	P.suresh [29] / 2016	Secure cloud environment using RSA algorithm	RSA algorithm	Researchers have proposed an RSA algorithm for the security of cloud data	No mechanism has been proposed to reduce the size of the packet to improve the performance of the cloud.
7.	Osman, Saife [30] / 2016	Integration of Virtual Learning Environment Systems Based on Performance Analysis of Cloud-based Web Services	Cloud computing	Work has considered the performance factors that are influencing cloud	Research has ignored security features.
8.	Agah Tugrul Korucu, [31] / 2016	Overview and Specifications of Educational Cloud Computing Platforms	Cloud computing	Research reviewed the role of the cloud in education	The security of the cloud has been ignored.
9.	Pandey, G. P. [33] / 2019	Implementation of DNA Cryptography in Cloud Computing and Using Huffman Algorithm, Socket Programming and New Approach to Secure Cloud Data	DNA cryptography	The research proposed DNA based security to secure the content of cloud	The research did not provide a solution to improve the performance of the cloud.
10.	Ananthi Claral [34] / 2019	Using Cloud Computing in the Academic Environment – A State-of-the-Art	Cloud computing	Risk and challenges to cloud application are considered	The research did not provide any solution for security risks

[3] Problem Statement

Research into cloud computing security has yielded numerous results, however the security mechanisms used have always resulted in decreased cloud performance. Furthermore, previous studies focused on a restricted subset of data. As previously mentioned, earlier tests had high error rates, slow speeds, and significant packet loss rates. Textual and graphical material must be protected without sacrificing efficiency in any way.

[4] Proposed Work

There has been several cloud based research that considered DES, RSA, AES cryptography mechanism. But proposed work has considered polynomial encryption after compression of dataset. Initially content has been

classified in textual and graphical then that content is compressed before encryption. Graphical content is split using splitting mechanism and restored and receiving end.

In this proposed work, it is initialized the transmission process of textual content and graphical content. research steps the digital content from sender side for classification of textual content and graphical content. In textual content, research compressed the data and applies polynomial encryption. Similarly, In graphical content, research split the graphical content (GD and GR) by using the spitting module and applying the exclusive based encryption mechanism to get the GDE and GRE. Now, research is performing the data transmission process on both the content. On receiver end, research get the data and decryption operation is performed on textual and graphical content. Then split graphical content would be merged and compressed textual content would be decompressed in order to restore the original content.

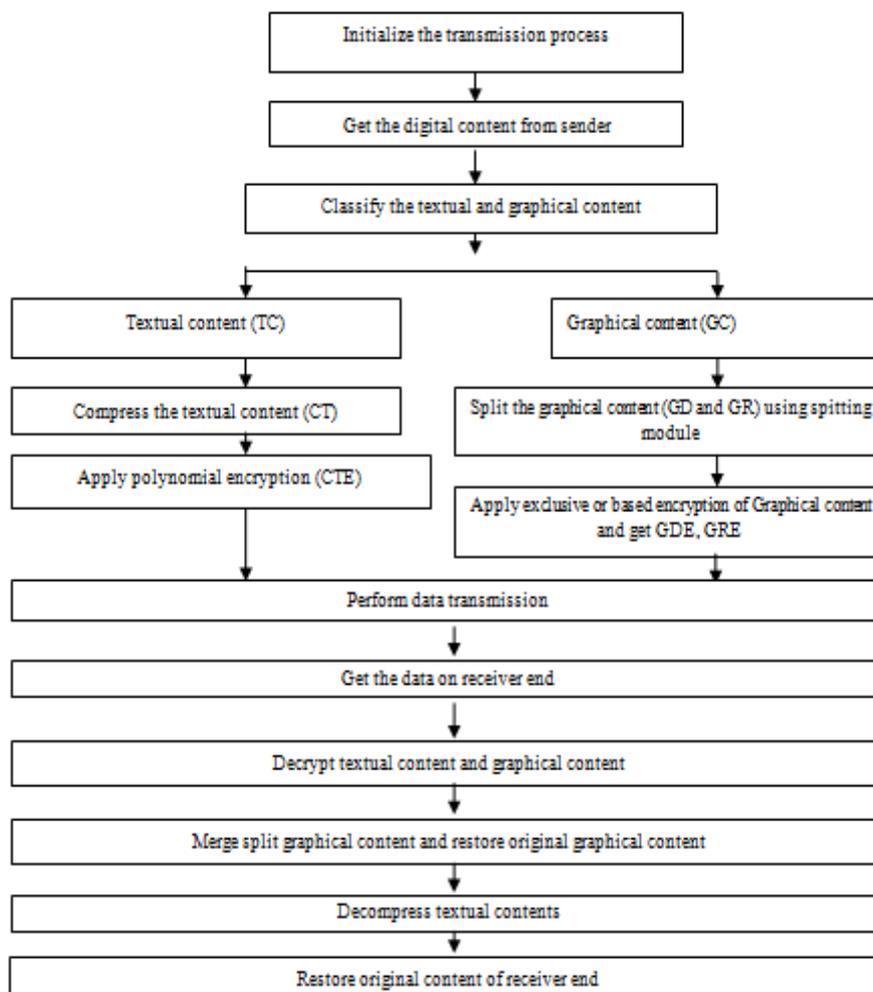


Fig 2 Process flow of Proposed Work

[5] RESULT AND DISCUSSION

5.1 Platform Used To Implement the Proposed Model

The sender and receiver module has been developed on Netbean platform using Java as programming tool. During simulation, the time consumption in the case of previous work and the case of proposed work is noted according to a different number of packets. Simulation work has been performed in a MATLAB environment.

5.2 Simulation for Time/Error/Packet Size

The amount of time it takes for a data packet to travel between the sender and receiver modules is taken into account.

5.2.1 Time Consumption

Time taken has been simulated in the case of the proposed system in comparison to previous RSA, DES and AES cryptography-based research are shown in figure 3. Proposed work is making use of exclusive order during encryption and compressed data has been encrypted. But the previous researches made of use RSA, AES mechanism that took more time to encrypt data. Moreover previous researches have not compressed the data

before transmission. Thus the time consumption is evidently less as compared to others due to the smaller size of the data packets.

Table 6 Comparative analysis of Time consumption

Number of attack	DES	RSA	AES	Proposed work
10	0.95	0.93	0.88	0.82
20	1.67	1.59	1.51	1.22
30	2.32	2.29	2.20	1.67
40	3.09	2.99	2.87	2.35
50	3.91	3.57	2.93	2.65
60	4.62	4.58	4.35	3.42

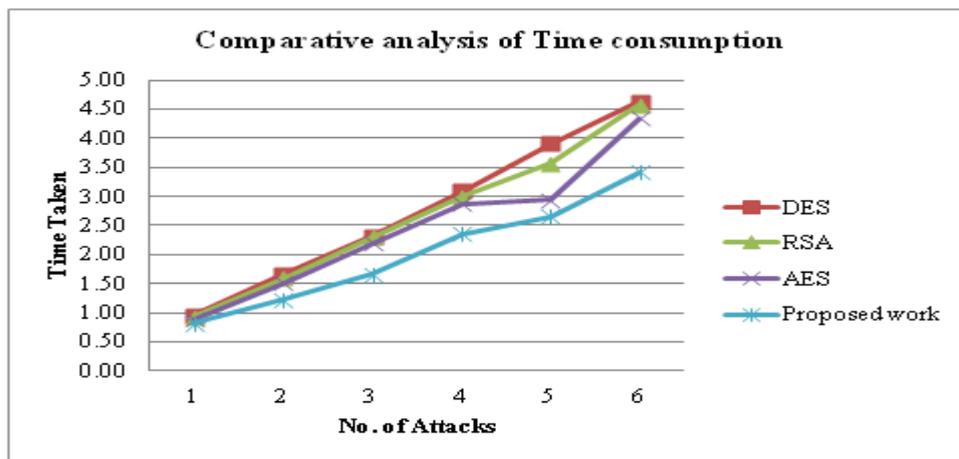


Fig 3 Comparison of time taken during transmission RSA, Advance RSA, and DNA cryptography with proposed work

5.2.2 Error Rate

There remain chances of errors during data transmission. But if the packet size is reduced and packet remains for less time on network than the probability of error is minimized. There remain less chances of error because the size string is reduced using replacement mechanism. But RSA and AES cryptography mechanism used in previous research have not reduced the size of packets. Thus, the present research can minimize the error rate. Figure 4 shows a comparative analysis of the error rate for previous RSA, DES and AES cryptography, and proposed work.

Table 7 Comparative analysis of Error rate

Number of attack	DES	RSA	AES	Proposed work
10	0.83	0.78	0.67	0.59
20	1.36	1.29	1.16	0.89
30	2.33	2.30	2.20	1.69
40	2.55	2.35	2.24	1.82
50	3.94	3.53	3.00	2.46
60	4.20	3.92	3.76	3.51

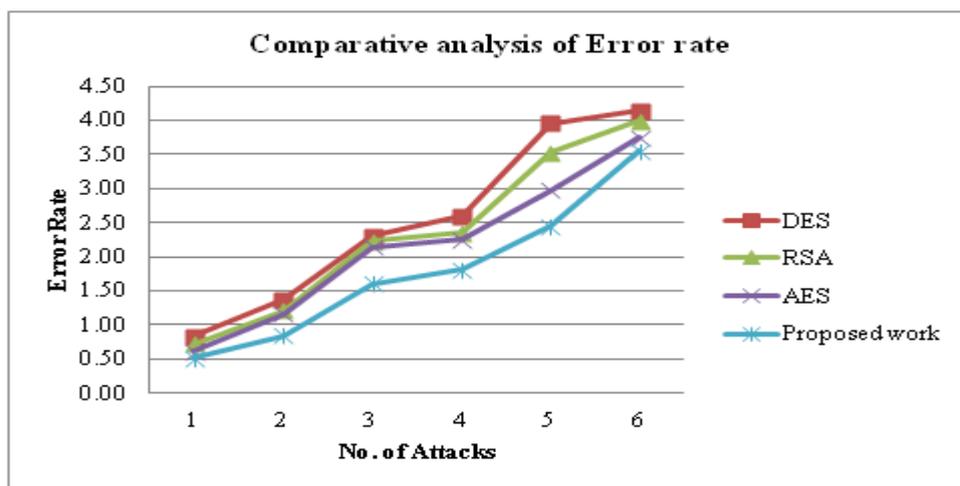


Fig 4 Comparison of error rates for RSA, DES, and AES cryptography with proposed work

5.3 Matlab Simulation for Comparative Analysis Of Security

In this part, we'll examine how the proposed changes would affect security. In case of the proposed work, the number of packets affected is less as the number of attacks increases. From previous researches, it has been found that AES cryptography is better as compare to RSA and DES. But proposed work is better than AES cryptography. From the following figures, it is concluded that the affected packets are less in the case of proposed work as compared to RSA and AES-based cryptography approaches.

5.3.1 Man-In-The-Middle

Its impact on the packet in the case of RSA, DES and AES cryptography and proposed work in case of these attack are shown below.

Table 8 Comparative analysis of Man in middle attack

Number of attack	DES	RSA	AES	Proposed work
10	9	8	7	4
20	13	11	9	6
30	20	13	11	9
40	25	17	15	11
50	29	25	19	14
60	32	31	27	17

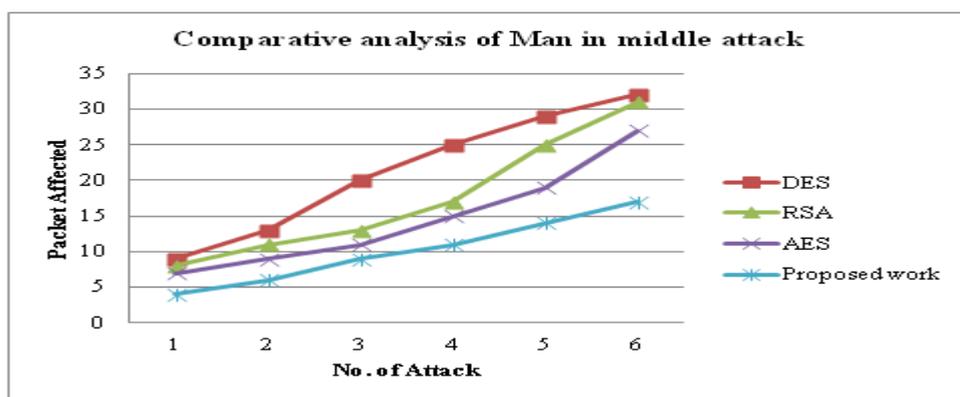


Fig 5 Comparative analysis in case of attack Man-In-The-Middle

5.3.2 Brute Force Attack

A brute force assault uses trial and error to try to figure out a user's login details. Encryption keys and a hidden web page are also used. Comparative analysis of this attack is shown below.

Table 9 Comparative analysis of Brute force attack

Number of attack	DES	RSA	AES	Proposed work
10	8	7	6	3
20	12	10	8	5
30	20	15	11	7

40	26	15	13	10
50	31	24	19	14
60	33	32	27	21

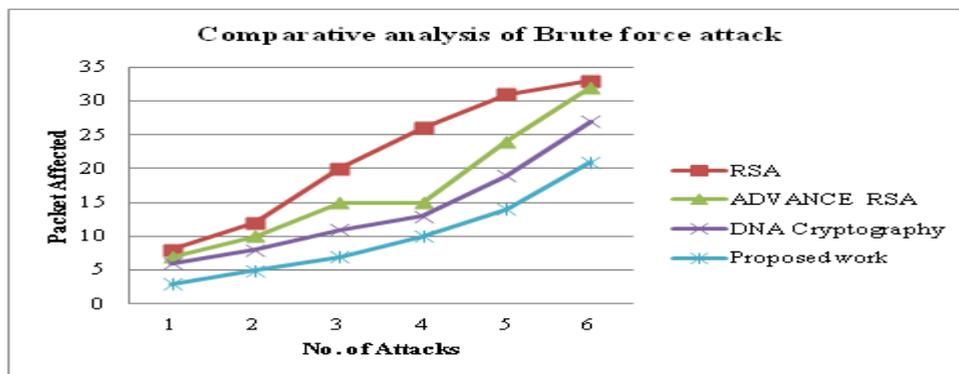


Fig 6 Comparative analysis in case of Brute force attack

5.3.3 Denial-of-Service

A (DoS) attack is a kind of cyber-attack that attempts to prevent people from accessing a computer or network resource. Due to reduced size of packet and less time taken during transmission over network the probability of denial of service get reduced. Thus the impact of denial of service is less in case of proposed work. The following figure is presenting a comparative analysis of Denial-of-Service.

Table 10 Comparative analysis of Denial of Service

Number of attack	DES	RSA	AES	Proposed work
10	9	8	7	4
20	13	11	9	6
30	21	16	12	8
40	27	16	14	11
50	32	25	20	15
60	34	33	28	22

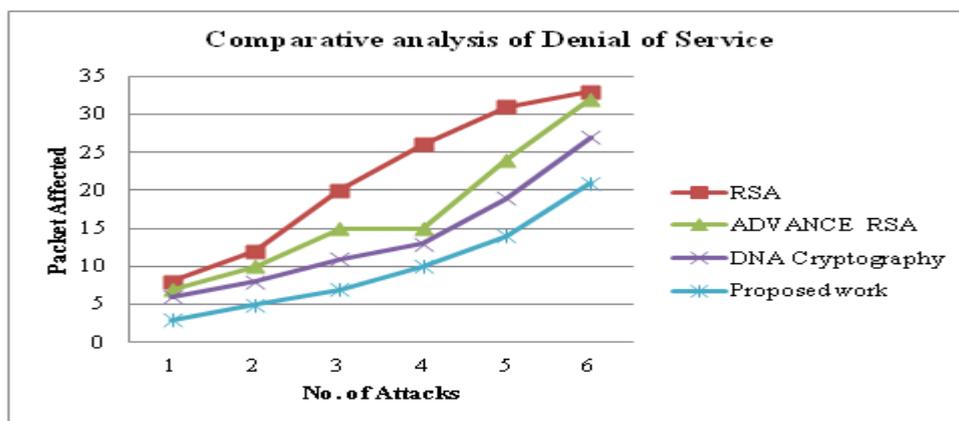


Fig 7 Comparative analysis in case of Denial-of-Service

5.3.5 Access Violation

Proposed work is making use of user defined port and security key for exclusive or get modified each and every time in different sessions. Thus access violation issues have been resolved in proposed work. Figure 8 presents the comparative analysis of access violation in the case of RSA, DES and AES cryptography, and proposed work.

Table 11 Comparative analysis of Access violation

Number of attack	DES	RSA	AES	Proposed work
10	8	7	6	4
20	13	11	9	7
30	20	15	12	9
40	26	18	16	13

50	29	24	21	15
60	33	32	28	16

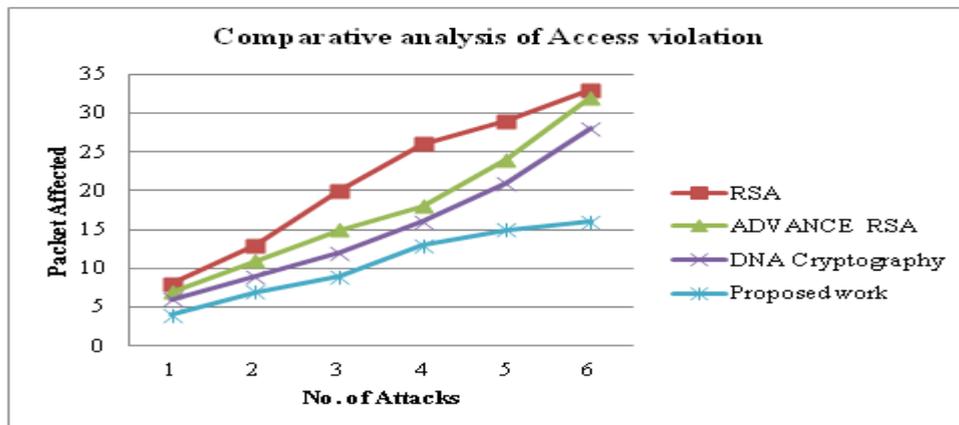


Fig 8 Comparative analysis in case of access violation

5.3.8 Attack on Cloud Services

Use of exclusive or after compression of data and user defined port number has reduced the chances of different attacks on cloud services. Figure 9 presents the comparative analysis of the attack on cloud service in the case of RSA, DES and AES cryptography, and proposed work.

Table 12 Comparative analysis of Attack on cloud services

Number of attack	DES	RSA	AES	Proposed work
10	14	10	9	7
20	19	13	11	9
30	27	22	19	15
40	29	25	23	16
50	39	31	24	15
60	43	38	31	18

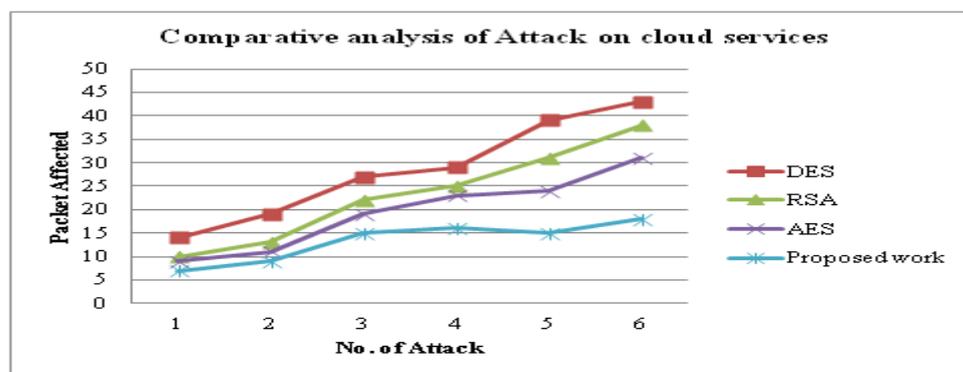


Fig 9 Attack on cloud services

[7] CONCLUSION

Cloud computing is making it possible for people to experiment with new ideas. Digital resources and content management need the development of a conducive environment. Existing studies have revealed a few security models that may be used. RSA, AES, DES, and DNA protection, among other technologies, have made it feasible to secure cloud-based data. Cloud-based instructional material has been the focus of several investigations. Only a small number of studies have looked at how well clouds perform. Researchers performed a comprehensive analysis to improve cloud security and performance. An improvement in security without a decrease in performance is the goal of the proposed solution. Cloud security and performance must be considered in the implementation of earlier activities that have already been studied.

[8] FUTURE SCOPE

This research will provide a real-world cloud solution might benefit greatly from this study. In cloud computing, data compression and security are commonly needed. Faster, more dependable, and less likely to

include errors are all benefits of this hybrid method to transmission. Education, healthcare, and business all stand to benefit from this sort of work.

REFERENCES

1. M. Armbrust, A. Fox, R. Griffith, A. D. Joseph, R. H. Katz, A. Konwinski, G. Lee, D. A. Atterson, A. Rabkin, I. Stoica, M. Zaharia (2009), Above Clouds: A Berkeley View of Cloud Computing, Electrical Engineering and Computer Sciences University of California at Berkeley, pp1-24, February 2009.
2. Kumar, G., & Chelikani, A. (2011). Analysis of security issues in cloud-based e-learning. University of Borås/School of Business and IT.
3. S. Malkowski, Y. Kanemasa, H. Chen, M. Yamamoto, Q. Wang, D. Jayasinghe, C. Pu, and M. Kawaba (2012), Challenges and opportunities in consolidation at high resource utilization: Non-monotonic response time variations in n-tier applications, in Fifth IEEE International Conference on Cloud Computing, Honolulu, HI, USA, 2012, pp. 162--169.
4. M. Georgescu and M. Matei (2013), The value of cloud computing in business environment, The USV Annals of Economics and Public Administration, vol.13, no.1, pp. 222--228, 2013.
5. E. Gorelik (January, 2013), "Cloud Computing Models", Massachusetts Institute of Technology.
6. Meslhy, Eman & Abd Elkader, Hatem & Eletriby, Sherif. (2013). Data Security Model for Cloud Computing. Journal of Communication and Computer 10 (2013) 1047-1062. 10. 1047-1062.
7. B.H. Bhavani and H.S. Guruprasad (2014), Resource provisioning techniques in cloud computing environment: A survey, International Journal of Research in Computer and Communication Technology, vol.3, no.3, pp. 395--401, 2014.
8. Bandara, I., Ioras, F., & Maher, K. (2014). Cybersecurity concerns in e-learning education.
9. K. A. Parane, N. C. Patil, S. R. Poojara and T. S. Kamble (2014), "Cloud based Intelligent Healthcare Monitoring System," 2014 International Conference on Issues and Challenges in Intelligent Computing Techniques (ICICT), Ghaziabad, India, pp. 697-701, doi: 10.1109/ICICT.2014.6781365.
10. Asgarali Bouyer, Bahman Arasteh (2014) "The Necessity Of Using Cloud Computing In Educational System" CY-ICER 2014, 1877-0428 © Elsevier.
11. Yinghui Shi, Harrison Hao Yang, Zongkai Yang and Di Wu (2014) "Trends of Cloud Computing in Education" S.K.S. Cheung et al. (Eds.): ICHL 2014, LNCS 8595, pp. 116–128, 2014. © Springer International Publishing Switzerland
12. Sudhir Kumar Sharma, Nidhi Goyal, Monisha Singh (2014) "Distance Education Technologies: Using E-learning System and Cloud Computing" (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (2), 1451-1454
13. Sanjay Karak, Basudeb Adhikary (2015) "CLOUD COMPUTING AS A MODEL FOR DISTANCE LEARNING" International Journal of Information Sources and Services, Vol.2: July-Aug 2015, issue 4
14. Arshad Ali, Amit Bajpeye, Amit Kumar Srivastava (2015) "E-learning in Distance Education using Cloud Computing" International Journal of Computer Techniques — Volume 2 Issue 3.
15. J. Skrinarova, M. Povinsky (2015), Comparative Study of Simulators for Cloud Computing, IEEE, pp.1-8, 2015.
16. K. Shenoy, P. Bhokare, U. Pai (2015), Fog Computing Future of Cloud Computing, International Journal of Science and Research (IJSR) Volume 4 Issue 6, pp.55-56, June 2015.
17. K.P. Saharan, A. Kumar (2015), Fog in Comparison to Cloud: A Survey, International Journal of Computer Applications, Volume 122 – No.3, pp.10-12, July 2015.
18. K. Jakimoski (2016), Security Techniques for Data Protection in Cloud Computing, International Journal of Grid and Distributed Computing, ISSN: 2005-4262, Vol. 9, No. 1, pp.49-56, 2016.
19. N.M. Murthy, Kavitha P B, P. Kasana, Vishnu S N (2016), Research Study On Fog Computing For Secure Data Security, ISSN 2394-1537 Vol. No.5, Special Issue No.01, pp.221-227, Feb 2016.
20. X. Ouyang (2016), Spotlight: An Information Service for Cloud, IEEE, pp.1-51, MAY 2016.

21. AgahTugrulKorucu, handanAtun (2016) "The Cloud Systems Used in Education: Properties and Overview " World Academy of Science, Engineering and Technology International Journal of Educational and Pedagogical Sciences Vol:10, No:4.
22. Dr. Pranav Patil (2015), "A Study of E-Learning in Distance Education using Cloud Computing" International Journal of Computer Science and Mobile Computing, IJCSMC, Vol. 5, Issue. 8, pg.110 – 113.
23. S.Khan, S.Parkinson, Y.Qin (2017), Fog computing security: are view of current applications and security solutions, Journal of Cloud Computing: Advances, Systems and Applications, Springer open, pp.2-22, 2017, DOI:10.1186/s13677-017-0090-3.
24. P.Dhiman (2017), Fog Computing Shifting from Cloud to Fog, International Journal of Engineering Science and Computing Volume 7 Issue No.3, pp.4993-4995, March 2017.
25. Esposito, C., Castiglione, A., Pop, F., Choo, K.K.R (2017), Challenges of connecting edge and cloud computing: A security and forensic perspective, IEEE Cloud Computing 4(2), pp.13-17, 2017.
26. Bushra Zaheer Abbasi, Munam Ali Shah (2017), Fog Computing: Security Issues, Solutions and Robust Practices, Proceedings of 23rd International Conference on Automation and Computing, University of Huddersfield, Hudders field, UK, 7-8September 2017
27. Vinay kumar Pant, Ashutosh Kumar (2016) "DNA Cryptography An New Approach to Secure Cloud Data".International Journal of Scientific & Engineering Research, Volume7, Issue 6, 890 ISSN 2229-5518.
28. Singh, S. K., Manjhi, P. K., & Tiwari, R. K. (2016). Data Security Using RSA Algorithm in Cloud Computing. International Journal of Advanced Research in Computer and Communication Engineering, 5(8), 11-16.
29. P.suresh(2016) Secure Cloud Environment Using Rsa Algorithm. 2016, IRJET
30. Osman, Saife & Eltahir Abdelhag, Mohammed & Abdelrahman, Saad. (2016). Performance Analysis of Cloud-based Web Services for Virtual Learning Environment Systems Integration. International Journal of Innovative Science, Engineering & Technology. 3.
31. Agah Tugrul Korucu, Handan Atun (2016) "The Cloud Systems Used in Education: Properties and Overview " World Academy of Science, Engineering and Technology International Journal of Educational and Pedagogical Sciences Vol:10, No:4.
32. Jyoti Prakash Mishra, Snigdha Rani Panda, BibudhenduPati, Sambit Kumar Mishra (2019) " A Novel Observation on Cloud Computing in Education" International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8 Issue-3.
33. Pandey, G. P. (2019). Implementation of DNA Cryptography in Cloud Computing and Using Huffman Algorithm, Socket Programming, and New Approach to Secure Cloud Data. Socket Programming and New Approach to Secure Cloud.
34. Ananthi Claral Mary.T, Dr.Arul Leena Rose. P.J (2019) "Implications, Risks And Challenges Of Cloud Computing In Academic Field – A State-Of-Art" International Journal Of Scientific & Technology Research Volume 8, ISSUE 12.
35. Jyoti Prakash Mishra, Snigdha Rani Panda, BibudhenduPati, Sambit Kumar Mishra(2019) " A Novel Observation on Cloud Computing in Education" International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8 Issue-3.

Mild and Efficient Synthesis of 4,4'-(Arylmethylene) Bis(1H-Pyrazol-5-Ols) Catalyzed by Boric Acid in Water at Room Temperature

Rupnar B. D., Shirsat A. J., Bhagat S. S., Jadhav S. B. and Pagore V. P.

Department of Chemistry, R. B. Attal College, Georai Dist. Beed

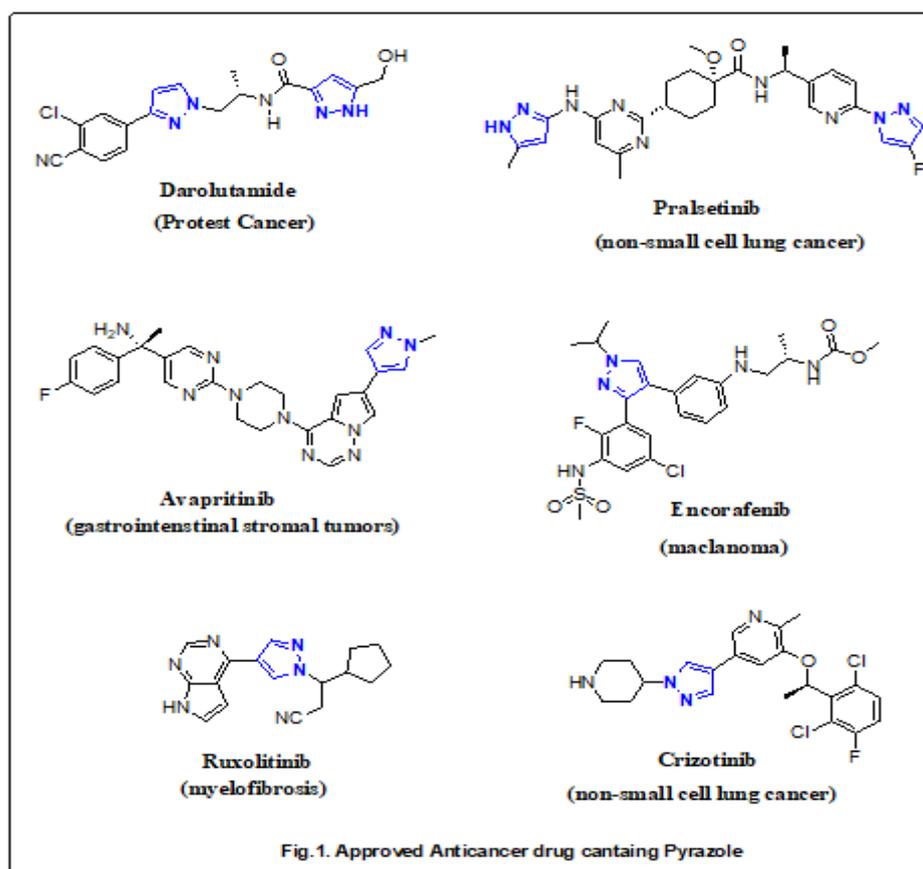
ABSTRACT

A simple and efficient protocol for synthesis of 4,4'-(arylmethylene)bis(1H-pyrazol-5-ols) through one-pot pseudo five multicomponent condensation of aromatic aldehydes, two molecules of ethyl acetoacetate, and two molecules of phenylhydrazine in ethanol at room temperature in presence of Boric acid as catalyst is developed. The present procedure offers several advantages such as simple procedure, high yields, easy work-up and eco-friendly reaction conditions.

INTRODUCTION

Heterocycles are widely distributed in nature and are common structural parts in marketed drugs in the drug discovery process. Heterocyclic compounds comprising nitrogen atom are of importance because of their biological activities and medicinal importance. Among all heterocyclic compounds Pyrazole derivatives are important classes of heterocyclic compounds having a 5-membered ring structure with three carbon atoms and two neighboring nitrogen atom. They have been widely attracted due to their significance as a class of bioactive drug targets in the pharmaceutical industry and the core-based organic molecules in various areas including pharmacy and agro-chemical industries.[1] Pyrazoles, exclusively 4,4'-(arylmethylene)bis(1H-pyrazol-5-ols) is a very significant class of compounds with numerous biological activities such as antipyretic, [2] antibacterial,[3] anti-inflammatory,[4] antiviral,[5] antidepressant,[6] antifilarial agents,[7] anticancer,[8] pesticides,[9] fungicides,[10] antiproliferative,[11] and antioxidant [12]. Pyrazoles moiety containing several drugs currently in the market some of them used as cytotoxic on several human cell lines [13-16][fig.1]

In recent years, to reduce the use and production of hazardous materials, green and sustainable chemistry motivate chemists to design chemical methods by using environmentally benign reagents that decrease and exclude the pollution. [17]



3-Methyl-1-phenyl-1H-pyrazol-5(4H)-one is an important building block with 4-position carbon atom showed highly nucleophilic nature. Recently this has been used in various multi-component reactions (MCRs) for the synthesis of broad range of heterocyclic compounds.[18]

The literature survey indicates that the synthesis of 4,4'-(arylmethylene)bis(3-methyl-1-phenyl 1H-pyrazol-5-ols) are developed by three Procedures: (i) 3-methyl-1-phenyl-1H-pyrazol-5(4H)-one with aldehydes to form the resultant arylidenepyrazolones through Knoevenagel reaction followed by Michael addition reaction in presence of base with second equivalent of 3-methyl-1-phenyl-1H-pyrazol-5(4H)-one, (ii) reaction of aldehydes with two equivalents of 3-methyl-1-phenyl-1H-pyrazol-5(4H)-one via one-pot tandem Knoevenagel–Michael addition under various reaction conditions and (iii) two equivalent of phenyl hydrazine derivatives and two equivalent of β -ketoesters with one equivalent of aromatic aldehydes via one-pot pseudo five component condensation.[19]

The general approach to synthesis 4,4'-(arylmethylene)bis(3-methyl-1-phenyl-pyrazol-5-ol) using one equivalent of aryl aldehydes with two equivalent of 3-Methyl-1-phenyl-1H-pyrazol-5(4H)-one via one-pot tandem Knoevenagel–Michael reaction and pseudo five-component has been carried out under various catalyst such as silica-bonded *s*-sulfonic acid [20], ceric ammonium nitrate, [21] cellulose sulfuric acid, [22] silica sulfuric acid (SSA) [23], diammoniumhydrogen phosphate [24], ionic liquid [HMIM]HSO₄ under ultrasonic irradiation [25], 3-aminopropylated silica gel [26], LiOH. H₂O in water [27], piperidine under ultrasound irradiation [28], 1,3-disulfonic acid imidazoliumtetrachloroaluminate [(Dsim)AlCl₄] [29], phosphomolybdic acid [30], 2-hydroxyethylammonium acetate (2-HEAA) as a task-specific ionic liquid [31], ionic liquid 1-sulfonylpyridinium chloride {[pyridine–SO₃H]Cl} [32], xanthan sulfuric acid (XSA) [33], ammonium acetate [34], melamine trisulfonic acid [35], 1,3,5-tris(hydrogensulfato) benzene (THSB) [36], silica-bonded *N*-propylpiperazine sulfamic acid (SBPPSA) under solvent-free conditions [37], pyridine trifluoroacetate [38], microwave irradiation (300 W) [39], sulfonated rice husk ash (RHA-SO₃H) under solvent-free conditions [40], poly(ethylene glycol)-bound sulfonic acid (PEG-SO₃H) [41], PEG-400 and catalyst-free [42],

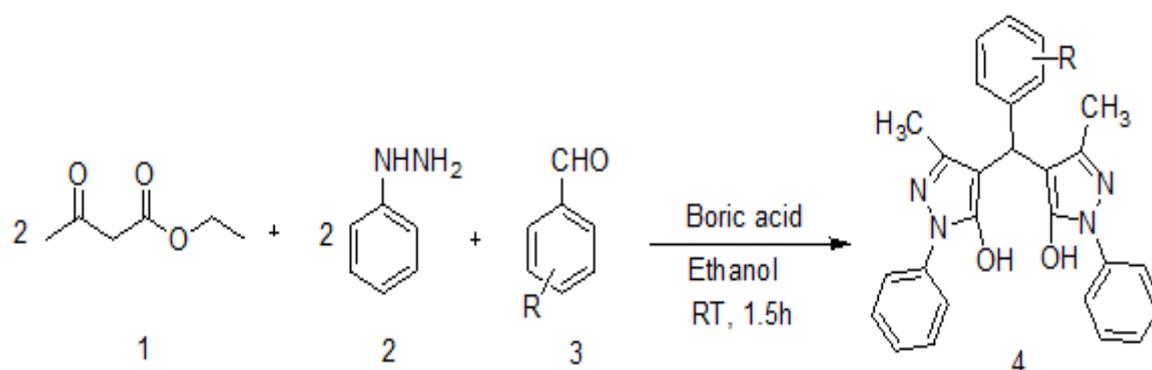
Boric acid is a monobasic inorganic acid it is also called orthoboric acid, in recent years boric acid has played an important role in various organic synthesis

Experimental

All chemicals purchased from S.D. fine chemicals and used without further purifications. All reactions carried out at room temperature otherwise noted. ¹H NMR and ¹³C NMR spectra were recorded on a Bruker-AV (400 MHz) instrument using DMSO d₆ as a solvent and TMS as an internal standard and resonances (δ) are given in ppm. Data are reported as follows: chemical shift (δ), multiplicity (s = singlet, d = doublet, t = triplet, m = multiplet). Infrared (IR) were recorded using a Perkin-Elmer FT-IR spectrometer in KBr pellets. Melting points were recorded using Electrothermal Mk₃ apparatus in open capillaries.

General Procedure for the Synthesis of 4, 4'-(Arylmethylene) Bis (1H-Pyrazol-5-Ols)

In a round bottom flask a mixture of aromatic aldehyde (1 mmol), phenyl hydrazine (2 mmol) and ethyl acetoacetate (2 mmol) were taken. Boric acids were added in the reaction mixture in presence of water. The reaction mixture was stirred at room temperature in open air for 1.5 h. The reaction was monitored by Thin Layer Chromatography (TLC). The reaction mixture was cooled to room temperature after completion of reaction, and poured onto 5 ml ice cold water and then the solution was filtered. The crude product was washed with cold water and further purified by recrystallization using ethanol. The products were obtained in 85-92% yields.



Scheme-1

RESULT AND DISCUSSION

Initially, phenyl hydrazine (2) (2 mmol) and ethyl acetoacetate (1) (2 mmol) and p-nitro benzaldehyde (3) select as a probe aldehyde to optimize reaction for the synthesis of 4,4'-(arylmethylene) bis(1H-pyrazol-5-ols) (4) (Scheme 1).

To develop the ecocompatibility of organic processes, among some catalysts were screened at different conditions and results are summarized in Table 1. At first the reaction was carried out in absence of catalyst and solvent at room temperature (Table 1, entry 1) no desired product formation was observed. We screened other inorganic catalyst such as Bi(NO₃), SnCl₂ and SrCl₂ for the condensation reaction at room temperature (Table 1, entries 2-3) but we did not find the desired product formation. By addition of Boric acid in ethanol (Table 1, entry 4) at room temperature results in formation of product 4.

Entry	catalyst	Time in hours	Yield %
1	--	3	--
2	Bi(NO ₃)	3	--
3	SnCl ₂	3	--
4	SrCl ₂	3	--
5	Boric acid	1.5	92

Table 1 optimization of catalyst in ethanol at room temperature

We also studied the effects of various solvents on the yields of the model reaction were examined. To our delight, a excellent yield (92%) of the desired product was obtained when the reaction was conducted in ethanol (Table 1, entry 5). After optimization of various solvents on model reaction find that the use of ethanol as the solvent led to a high yield in short reaction time (Table 2, entry 5). Poor yields of the desired product were obtained when the reactions were performed in DMF, acetonitrile and water, (Table 1, entries 2,3 and 6). Among all solvents, ethanol showed advantage over the other solvents.

Entry	Solvent	Time in hours	Yield %
1	Solvent free	3	--
2	DMF	3	5
3	Acetonitrile	3	5
4	Methanol	3	30
5	Ethanol	1.5	92
6	water	1.5	54

Table 2 Optimization of Solvents at room temperature

In order to determine amount of catalyst, we carried out model reaction with different amount of catalyst and found that optimum catalyst loading of boric acid to be 20mol % (Table 3). Decrease the amount of catalyst from 20mol% to 15mol %, 10mol % and 5mol % the yield of product 4 was low and take long reaction time; on other hand, by increasing the amount of catalyst from 20mol % to 25mol %, 30mol %, no noticeable change in the yield of product. The yields and the reaction time are measured the best results were obtained with boric acid (20 mol %) in 4 ml of ethanol as the reaction is completed within 1.5h with 92% yield (see entry 4) With these results in our hands, we examine the generality of these conditions to other aromatic aldehydes including electron donating and electron withdrawing, and the results are as shown in Table 4.

Entry	Amount of catalyst (mol%)	Time in hours	Yield %
1	5	1.5	40
2	10	1.5	60
3	15	1.5	75
4	20	1.5	92
5	25	1.5	92
6	30	1.5	90

Table 3 optimization of catalyst loading

Table 2: Synthesis of 4,4'-(phenylmethylene)bis(3-methyl-1H-pyrazol-5-ol) under optimized reaction conditions in the presence of boric acid.

Sr. No.	R	Time(h)	Yield %	MP °C
1	4-NO ₂	1.5	92	229-230
2	4-Cl	1.5	91	211-213

3	H	1.6	88	167-168
4	3-NO ₂	1.6	90	232-233
5	4-F	1.5	91	181-183
6	4-OH	1.7	85	230-231
7	2-OH	1.6	89	228-230
8	3-Cl	1.5	91	235-236
9	4-Br	1.6	90	183-184
10	4-Ome	1.6	91	179-180

Spectral Data:

1. 4,4'-((4-Nitro) Methylene) Bis(3-Methyl-1-Phenyl-1H-Pyrazol-5-Ol)

Yellow solid; Yield 92 %; MP 229-230 °C;

¹H NMR (400 MHz, DMSO-d₆, δ, ppm) 13.73 (s, 1H, OH), 7.72 (m, 4H, Ar-H), 7.39 (m, 6H, Ar-H), 7.21 (m, 4H, Ar-H), 4.87 (s, 1H, CH), 2.34 (s, 6H, 2CH₃).

FT-IR (KBr) ν_{\max} /cm⁻¹ 1158, 1222, 1294, 1371, 1416, 1457(C=C), 1504, 1579 (C=C), 1599 (C=N), 3066 and 2921 (CH), 3440 (OH).

2. 4,4'-((4-Fluorophenyl) Methylene) Bis(3-Methyl-1-Phenyl-1H-Pyrazol-5-Ol)

White cream solid; Yield 91 %; MP 181-183 °C;

¹H NMR (400 MHz, DMSO-d₆, δ, ppm) 13.80 (s, 1H, OH), 12.37 (br, 1H, OH), 7.70 (m, 4H, Ar-H), 7.38 (m, 4H, Ar-H), 7.19-7.29 (m, 6H, Ar-H), 4.92 (s, 1H, CH), 2.31 (s, 6H, 2CH₃).

FT-IR (KBr) ν_{\max} /cm⁻¹ 1268, 1349, 1413, 1502, 1524 (C=C), 1599 (C=N), 2923(CH), 3455 (OH).

CONCLUSION

In summary, boric acid in ethanol was developed as an efficient catalytic system for the greener synthesis of different 4,4'-(arylmethylene)bis(3-methyl-1H-phenyl-pyrazol-5-ol)s at room temperature in short reaction time. The most remarkable point for the inexpensive and readily boric acid in ethanol catalyst system was generation of the desired product in high yields without any unwanted side-products, besides the ease of work-up and purification.

REFERENCE

1. E. McDonald, K. Jones, P.A. Brough, M.J. Drysdale, P. Workman, *Curr. Top. Med.Chem.*, 6, 1193 (2006).
2. L.C. Behr, R. Fusco, C.H. Jarboe, A Series of Monographs. In *The Chemistry of Heterocyclic Compounds, Pyrazoles, Pyrazolines, Pyrazolidines, Indazoles and Condensed Rings*; Weissberger, A., Ed. Interscience Publishers: New York, NY, 1967.
3. R. N. Mahajan, F.H. Havaldar, P.S. Fernandes, *J. Indian Chem. Soc.*, 68, 245 (1991).
4. S. Sugiura, S. Ohno, O. Ohtani, K. Izumi, T. Kitamikado, H. Asai, K.J. Kato, *Med.Chem.*, 20, 80 (1977).
5. K. Sujatha, G. Shanthi, N.P. Selvam, S. Manoharan, P.T. Perumal, M. Rajendran, *Bioorg. Med. Chem. Lett.*, 19, 4501 (2009).
6. D.M.Bailey, P.E. Hansen, A.G. Hlavac, E.R. Baizman, J. Pearl, A.F. Defelice, M.E. Feigenson, *J. Med. Chem.*, 28, 256 (1985).
7. P.M.S. Chauhan, S. Singh, R.K. Chatterjee, *Indian J. Chem. Sect. B.*, 32, 858 (1993).
8. M.F. Brana, A. Gradillas, A.G. Ovalles, B. Lopez, N. Acero, F. Llinares, D. Munoz Mingarro, *Bioorg. Med. Chem.*, 14, 9 (2005).
9. M. Londershausen, *Pestic. Sci.*, 48, 269 (1996).
10. D. Singh, D.J. Singh, *Indian Chem. Soc.*, 68, 165(1991).
11. K.R. Kim, K. Ju-Lee, K. Ji-Sun, N. Zaesung, R.K. Hyoung, G.C. Hyaе, *Eur. J. Pharmacol.*, 528, 37 (2005).
12. P. Manojkumar, T.K. Ravi, S. Gopalakrishnan, *Eur. J. Med. Chem.*, 44, 4690 (2009), K. Kumar Siva, A. Rajasekharan, *Int.J. Res. Pharma. Chem.*, 2, 327 (2012), N. Parmer, T. Shashikant, P. Rikin, H. Barad, V. Thakkar, *J. Saudi. Chem. Soc.*, 19, 36(2015).

13. M.S. Mohamed, A.O. Abdelhamid, F.M. Almutairi, *Bioorg. Med. Chem.*, 26, 623 (2018).
14. S.K. Ramadan, K.N.M. Halim, S.A. Rizk, M.A. El-Hashash, *J. Iran Chem.Soc.* 17, 1575 (2020).
15. S.K. Ramadan, A.K. El-Ziaty, R.S. Ali, *J. HeterocyclChem* 58, 290 (2021).
16. K.N.M. Halim, S.A. Rizk, M.A. El-Hashash, S.K. Ramadan, *J. HeterocyclChem* 58, 636 (2021).
17. D. Tejedor, F. Garcia-Tellado, *Chem. Soc. Rev.*, 36, 484 (2007).
18. C. Simon, T. Constantieux, J. Rodriguez, *Eur. J. Org. Chem.*, 24, 4957 (2004).
19. X.L. Li, Y.M. Wang, B.Tian, T. Matsuura, J.B. Meng, *J. Heterocycl. Chem.*, 35, 129 (1998).
20. K. Niknam, D. Saberi, M. Sadegheyan, A. Deris, *Tetrahedron Lett.* 51, 692 (2010)
21. K. Sujatha, G. Shanthi, N.P. Selvam, S. Manoharan, P.T. Perumal, M. Rajendran, *Bioorg. Med. Chem. Lett.* 19, 4501 (2009)
22. E. Mosaddegh, A. Hhassankhani, A. Baghizadeh, *J. Chil. Chem. Soc.* 55, 41 (2010)
23. K. Niknam, S. Mirzaee, *Synth. Commun.* 41, 2403 (2011)
24. C. Yang, L. Pang, A. Wang, *Asian J. Chem.* 23, 749 (2011)
25. H. Zang, Q. Su, Y. Mo, B. Cheng, *Ultrason. Sonochem.* 18, 68 (2011)
26. S. Sobhani, A.R. Hasaninejad, M. F. Maleki, Z.P. Parizi, *Synth. Commun.* 42, 2245 (2012)
27. M.A. Gouda, A.A. Abu-Hashem, *Green Chem. Lett. Rev.* 5, 203 (2012)
28. A.A. Al-Mutairi, F.E. M. El-Baih, H.M. Al-Hazimi, *J. Saudi Chem. Soc.* 14, 287 (2010)
29. A. Khazaei, M.A. Zolfigol, A.R. Moosavi-Zare, Z. Asgari, M. Shekouhy, A. Zare, A. Hasaninejad, *RSC Adv.* 2, 8010 (2012)
30. K.R. Phatangare, V.S. Padalkar, V.D. Gupta, V.S. Patil, P.G. Umape, N. Sekar, *Synth. Commun.* 42, 1349 (2012)
31. S. Sobhani, R. Nasser, M. Honarmand, *Can. J. Chem.* 90, 798 (2012)
32. A.R. Moosavi-Zare, M.A. Zolfigol, M. Zarei, A. Zare, V. Khakyzadeh, A. Hasaninejad, *Appl. Catal. A: Gen.* 467, 61 (2013)
33. B.S. Kuarm, B. Rajitha, *Synth. Commun.* 42, 2382 (2012)
34. S. Bhavanarushi, V. Kanakaiah, G. Bharath, A. Gangagnirao, J.V. Rani, *Med. Chem. Res.* 23, 158 (2014)
35. N. Irvani, J. Albadi, H. Momtazan, M. Baghernejad, *J. Chin. Chem. Soc.* 60, 418 (2013)
36. Z. Karimi-Jaberi, B. Pooladian, M. Moradi, E. Ghasemi, *Chin. J. Catal.* 33, 1945 (2012)
37. S. Tayebi, K. Niknam, *Iran. J. Catal.* 2, 69 (2012)
38. E. Soleimani, S. Ghorbani, M. Taran, A. Sarvary, *C. R. Chimie* 15, 955 (2012)
39. Y. Xiaohui, Z. Pinghu, Z. Yonghong, W. Junsong, L. Hongjun, *Chin. J. Chem.* 30, 670 (2012)
40. M. Seddighi, F. Shirini, M. Mamaghani, *RSC Adv.* 3, 24046 (2013)
41. A. Hasaninejad, M. Shekouhy, A. Zare, S.M.S.H. Ghattali, N. Golzar, *J. Iran. Chem. Soc.* 8, 411 (2011)
42. A. Hasaninejad, A. Zare, M. Shekouhy, N. Golzar, *Org. Prep. Proced. Int.* 43, 131 (2011)

Study on Gender Differences in Investment Patterns

Yashoda Durge and Nitin Dongre
GNVS Institute of Management, SION, Mumbai

ABSTRACT

Inflation is a perpetual source of concern as it erodes the value of our savings and our ability to buy. Finding ways and means to protect the value of our capital and also the future value of money is hence important. Individuals find various mean of saving and investing their hard earned money in different instruments. The investment patterns of 150 respondents, male and female, were studied to understand their preferences towards investment in Shares, Debentures, Stock Futures & Options, Fixed Deposits, Real Estate, Gold, Mutual Fund, Public Provident Fund and Insurance. The Survey method was used to collect data. Variables were cross tabulated to study gender differences in investment patterns and the objectives of investments. Measures of association Chi Square and the correlation coefficient were used to evaluate the strength of the relationships between variables in the data. The results suggest that a spectrum of differences exist varying from low to moderate to negative, in type of investments between genders. Such results are useful to marketers of financial products to help them understand the gender differences in investment patterns.

Keywords: Investment Patterns, Gender Differences

1. INTRODUCTION

Differences in investment patterns between genders have been studied earlier. Over a period of time many more women have joined the workforce. Women are financial contributors to the households. Inflation is a perpetual source of concern as it erodes the value of our savings and our ability to buy. Finding ways and means to protect the value of our capital and also the future value of money is hence important. Individuals find various mean of saving and investing their hard earned money in different instruments. Stereotypes exist about the financial behaviour of men and women. Some of these are clichés others are generalizations about such behaviour. It is important to understand whether there are real differences between genders in terms of their investment patterns. Hence it is important to study the differences in investment patterns which will be useful to marketers of financial products.

2. REVIEW OF LITERATURE

Powell and Ansic (1997) argued as men and women are motivated by different needs they have different investment strategies. Zuckerman and Kuhlman (2000) found in their study that men engage in more overall risky behaviour than women. Matthew C. Sonfield, Robert N. Lussier and Joel Corman (1997) analyzed whether men and women had different strategic orientations and whether they differed in their strategic decision-making behaviour. The objectives of this paper are to study the differences in investment patterns between genders.

3. METHODOLOGY

The investment patterns of 150 respondents were studied to understand their preferences towards investment in Shares, Debentures, Stock Futures & Options, Fixed Deposits, Real Estate, Gold, Mutual Fund, Public Provident Fund, and Insurance. Variables were cross tabulated to study gender differences in investment patterns and whether there is a relationship between Gender, Age, Marital Status and the Type of Investment.

4. FINDINGS AND DISCUSSION

4.1 Profile of Respondents: The largest group were amongst the 36 - 45 years age bracket (28.0%) followed by 26 - 35 years (27.3%) (See Table 4.1)

Table 4.1

Age		N	%
1	18-25 Years	37	24.7
2	26-35 Years	41	27.3
3	36-45 Years	42	28.0
4	46-65 Years	22	14.7
5	Above 66 Years	8	5.3
6	Total	150	100.0

4.2 Gender: Males constituted 54% and Females 46% of the sample (See Table 4.2).

Table 4.2

Gender

		N	%
1	Male	81	54.0
2	Female	69	46.0
3	Total	150	100.0

4.3 Marital Status: Singles constituted 37.3% and Married 62.7% of the sample (See Table 4.3).

Table 4.3

Marital Status

		N	%
1	Single	56	37.3
2	Married	94	62.7
3	Total	150	100.0

4.4 Educational Background: Graduates and Post Graduated constituted 46.0% and 46.7% respectively. Very few respondents (7.3%) had studied up to class 12 only (See Table 4.4).

Table 4.4

Educational Background

		N	%
1	Up to 12 Class	11	7.3
2	Graduation	69	46.0
3	Post Graduation	70	46.7
4	Total	150	100.0

4.5 Occupation: Professionals constituted 36.7% followed by Salaried 32.7% of the sample (See Table 4.5).

Table 4.5

Occupation

		N	%
1	Salaried	49	32.7
2	Professional	55	36.7
3	Business	35	23.3
4	Retired	11	7.3
5	Total	150	100.0

4.6 Family Size: The largest numbers constituted a 3-4 member family unit (42.0%) (See Table 4.6)

Table 4.6

Family Size

		N	%
1	Upto 2 Members	21	14.0
2	3 - 4 Members	63	42.0
3	5 - 6 Members	44	29.3
4	> 6 Members	22	14.7
5	Total	150	100.0

4.7 Number of Earning Members: Families with above 3 Members earning were the largest group with 50.0% of the sample falling under this category (See Table 4.7).

Table 4.7

Number Of Earning Members

		N	%
1	One Member	18	12.0
2	Two Members	57	38.0
3	Above 3 Members	75	50.0
4	Total	150	100.0

4.8 Family Income Per Annum: Shows those earning 5-8 Lakhs to be the largest group at 38.0% and those in the lowest bracket of upto 2.5 Lakhs at 19.3% (See Table 4.8).

Table 4.8

Family Income Per Annum

		N	%
1	Upto 2.5 Lakhs	29	19.3
2	2.5 - 3.5 Lakhs	45	30.0
3	5 - 8 Lakhs	57	38.0
4	Above 8 Lakhs	19	12.7
5	Total	150	100.0

4.9 Individual Income Per Annum: Those earning between 2.5-3.5 Lakhs per annum were 53.3% of the sample (See Table 4.9).

Table 4.9

Individual Income Per Annum

		N	%
1	Upto2.5L	27	18.0
2	2.5-3.5L	80	53.3
3	5L-8L	43	28.7
4	Total	150	100.0

4.10 Owned / Rented House: A slightly larger number of respondents 52.0% lived in rented accommodation as compared to those who lived in owned accommodation (See Table 4.10).

Table 4.10

Owned / Rented House		N	%
1	Owned	72	48.0
2	Rented	78	52.0
3	Total	150	100.0

4.11 & 4.11.1 Relationship between Gender and Types of Investment:

Ho: There is no relationship between Gender and the Type of Investment

H1: There is a relationship between Gender and the Type of Investment

Table 4.11

Crosstabulation: Gender By Investments In Mutual Funds

Gender	Investments In Mutual Funds				Total	
	Invested		Not Invested			
Male	50	61.7%	31	38.3%	81	100.0%
Female	25	36.2%	44	63.8%	69	100.0%
Total	75	50.0%	75	50.0%	150	100.0%

% within Gender

Crosstabulation: Gender By Investments In Insurance

Gender	Investments In Insurance				Total	
	Invested		Not Invested			
Male	53	65.4%	28	34.6%	81	100.0%
Female	24	34.8%	45	65.2%	69	100.0%
Total	77	51.3%	73	48.7%	150	100.0%

% within Gender

Crosstabulation: Gender By Investments In Public Provident Fund

Gender	Investments In Public Provident Fund				Total	
	Invested		Not Invested			
Male	46	56.8%	35	43.2%	81	100.0%
Female	19	27.5%	50	72.5%	69	100.0%
Total	65	43.3%	85	56.7%	150	100.0%

% within Gender

Crosstabulation: Gender By Investments In Shares

Gender	Investments In Shares				Total	
	Invested		Not Invested			
Male	50	61.7%	31	38.3%	81	100.0%
Female	31	44.9%	38	55.1%	69	100.0%
Total	81	54.0%	69	46.0%	150	100.0%

% within Gender

In case of Mutual Fund, Public Provident Fund, Insurance, and Shares fewer females than males are invested in these types of instruments (See Table 4.11).

Table 4.11.1

Relationship Between Gender & Types of Investment

	Mutual Fund	Provident Fund	Insurance	Shares	Debentures	Futures & Options	Fixed Deposits	Real Estate	Gold
Effect Size: Phi Coefficient	0.25	0.29	0.31	0.17	0.14	-0.01	0.06	0.11	-0.06
Approx Sig	0.00	0.00	0.00	0.04	0.08	0.89	0.44	0.19	0.45

Interpreting Strength of Relationship Coefficients

Coefficient	Strength
0.00	No Linear Association
0.01 - 0.09	Trivial (Linear) Relationship
0.10 - 0.29	Low to Moderate (Linear) Relationship
0.30 - 0.49	Moderate to Substantial (Linear) Relationship
0.50 - 0.69	Substantial to Very Strong (Linear) Relationship
0.70 - 0.89	Very Strong (Linear) Relationship
0.90+	Near Perfect

These interpretations apply equally to positive & negative relationships

Source: Surveys in Social Research, David De Vaus 2002

The investments of Futures & Options and Gold show a negative relationship between Gender and Type of Investment.

With $\alpha = 0.05$ we conclude that in case of Debentures, Stock Futures & Options, Fixed Deposits, Real Estate, and Gold (all p values > 0.05) the proportion of Males who invest in these types of instruments is not significantly different from the proportion of females. Hence we fail to reject the null hypothesis.

With $\alpha = 0.05$ we conclude that in case of Mutual Fund, Public Provident Fund, Insurance, and Shares (all p values < 0.05) shows significant association between gender and investment in these types of instruments. Hence in case of these types of instruments we reject the null hypothesis i.e. there is no relationship between Gender and the Type of Investment. Measures of association evaluate the strength of the relationship between two variables in the data. A useful Chi-square based correlation coefficient is Phi used for 2-by-2 tables (both variables have just two categories). The coefficients range between 0 and 1.0 which makes it interpretable as a measure of the strength of the relationship. A figure near 0 indicates a very weak relationship while a figure nearer 1 indicates a very strong relationship (de vaus, 2002). It is observed that in case of investments in Mutual Funds, Provident Fund, Shares and Debentures a low to moderate linear relationship exists in case of Relationship between Gender and Type of Investment. In case of investments in Insurance a Moderate to Substantial linear relationship exists between Gender and Type of Investment (See Table 4.11.1).

4.12 Crosstabulation: Gender by Investments (Mutual Funds & Shares) By Age

The number of females below the age of 35 years investing in Mutual Funds (46.2%) and Shares (51.3%) is seen drastically decreasing in the age group of those Above 35 Years. This could possibly be due to investment decisions being jointly taken with spouses or taken over by spouses.

Table 4.12

Crosstabulation: Gender By Investments By Age

Age	Gender	Investments In Mutual Funds				Investments In Shares				Total	
		Invested	Not Invested	Invested	Not Invested						
Below 35 Years	Male	27	69.2%	12	30.8%	33	84.6%	6	15.4%	39	100.0%
	Female	18	46.2%	21	53.8%	20	51.3%	19	48.7%	39	100.0%
Above 35 Years	Male	23	54.8%	19	45.2%	17	40.5%	25	59.5%	42	100.0%
	Female	7	23.3%	23	76.7%	11	36.7%	19	63.3%	30	100.0%

% within Gender

4.13 Crosstabulation: Gender by Investments (Provident Fund & Insurance) By Age

The number of females below 35 years investing in Public Provident Fund (15.4%) and Insurance (25.6%) sees a drastic jump to 43.3% & 46.7% respectively among females above 35 years. Public Provident Fund and Insurance provide a safety buffer for the future.

Table 4.13

Crosstabulation: Gender By Investments By Age

Age	Gender	Investments In Public Provident Fund				Investments In Insurance				Total	
		Invested	Not Invested	Invested	Not Invested						
Below 35 Years	Male	20	51.3%	19	48.7%	24	61.5%	15	38.5%	39	100.0%
	Female	6	15.4%	33	84.6%	10	25.6%	29	74.4%	39	100.0%
Above 35 Years	Male	26	61.9%	16	38.1%	29	69.0%	13	31.0%	42	100.0%
	Female	13	43.3%	17	56.7%	14	46.7%	16	53.3%	30	100.0%

% within Gender

4.14 & 4.15 Crosstabulation: Marital Status by Investments by Gender & Association between Investments, Gender, Marital Status

It is of interest to note that twice the number of married males (42.9%) vs. singles (21.9%) have invested in Gold. In case of Fixed Deposits investment there is a sizeable drop in these from single vs. married in both males and females. Mutual Funds investments show a sizeable drop from single vs. married in case of females.

In case of Debentures there is an increase in investment in such instruments from single (46.9%) vs. married (69.4%) males probably due to more safety afforded in this financial instrument. The opposite is true in case of investment in Shares which sees a drop in investments amongst single (78.1%) vs. married (51%) males due to higher risk carried in such investment.

In case of females it is of interest to note that there is a sizeable jump in the number investing in Gold from single (29.2%) vs. married (46.7%). Investment in Fixed deposits see a drop from single females (66.7%) vs. married (40%) so does investment in Mutual funds, single (58.3%) vs. married (24.4%) (See Table 4.14)

Table 4.14
Crosstabulation: Marital Status By Investments By Gender

Male						Female							
Investments In Gold													
Marital Status	Invested		Not Invested		Total		Marital Status	Invested		Not Invested		Total	
Single	7	21.9%	25	78.1%	32	100.0%	Single	7	29.2%	17	70.8%	24	100.0%
Married	21	42.9%	28	57.1%	49	100.0%	Married	21	46.7%	24	53.3%	45	100.0%
Total	28	34.6%	53	65.4%	81	100.0%	Total	28	40.6%	41	59.4%	69	100.0%
Investments In Fixed Deposits													
Marital Status	Invested		Not Invested		Total		Marital Status	Invested		Not Invested		Total	
Single	21	65.6%	11	34.4%	32	100.0%	Single	16	66.7%	8	33.3%	24	100.0%
Married	24	49.0%	25	51.0%	49	100.0%	Married	18	40.0%	27	60.0%	45	100.0%
Total	45	55.6%	36	44.4%	81	100.0%	Total	34	49.3%	35	50.7%	69	100.0%
Investments In Mutual Funds													
Marital Status	Invested		Not Invested		Total		Marital Status	Invested		Not Invested		Total	
Single	21	65.6%	11	34.4%	32	100.0%	Single	14	58.3%	10	41.7%	24	100.0%
Married	29	59.2%	20	40.8%	49	100.0%	Married	11	24.4%	34	75.6%	45	100.0%
Total	50	61.7%	31	38.3%	81	100.0%	Total	25	36.2%	44	63.8%	69	100.0%
Investments In Debentures													
Marital Status	Invested		Not Invested		Total		Marital Status	Invested		Not Invested		Total	
Single	15	46.9%	17	53.1%	32	100.0%	Single	11	45.8%	13	54.2%	24	100.0%
Married	34	69.4%	15	30.6%	49	100.0%	Married	21	46.7%	24	53.3%	45	100.0%
Total	49	60.5%	32	39.5%	81	100.0%	Total	32	46.4%	37	53.6%	69	100.0%
Investments In Shares													
Marital Status	Invested		Not Invested		Total		Marital Status	Invested		Not Invested		Total	
Single	25	78.1%	7	21.9%	32	100.0%	Single	12	50.0%	12	50.0%	24	100.0%
Married	25	51.0%	24	49.0%	49	100.0%	Married	19	42.2%	26	57.8%	45	100.0%
Total	50	61.7%	31	38.3%	81	100.0%	Total	31	44.9%	38	55.1%	69	100.0%

% within Marital Status

Cross tabulating variables i.e. marital status by investments (Gold, Fixed Deposits, Mutual Funds, Debentures, Shares, Real Estate, Insurance, Public Provident Fund, and Futures & Options) by gender shows that investments in Gold, Debentures, and Shares show association amongst married vs. single males. Investments in Fixed Deposits and Mutual Funds show association amongst married vs. single females (See Table 4.15).

Table 4.15

Association Between Investments, Gender, Marital Status

Investments	Gender By Marital Status			
	Male: Single / Married		Female: Single / Married	
	Chi Square	Sig	Chi Square	Sig
1 Gold	3.77	0.05	1.99	0.16
2 Fixed Deposit	2.17	0.14	4.45	0.04
3 Mutual Funds	0.34	0.56	7.78	0.01
4 Debentures	4.11	0.04	0.00	0.95
5 Shares	6.02	0.01	0.38	0.54
6 Real Estate	2.38	0.12	0.08	0.77
7 Insurance	0.97	0.32	0.03	0.85
8 Public Provident Fund	2.12	0.15	2.18	0.14
9 Futures & Options	1.20	0.27	2.58	0.11

5. CONCLUSION

In case of Mutual Fund, Public Provident Fund, Insurance, and Shares shows significant association between gender and investment in these types of instruments, fewer females than males are invested in these types of instruments. Mutual Fund, Public Provident Fund, and Insurance are investments that provide a measure of safety for capital invested in these instruments. Educating females to invest in such instruments will help increase awareness about investment in the same. Investments in Shares hold a higher risk and an awareness of such risk is important before investing in these. Also the capacity to bear risk is necessary. It is heartening to note that the number of females below 35 years investing in Public Provident Fund and Insurance sees a drastic jump to among females above 35 years. Public Provident Fund and Insurance provide a safety buffer for the future. Mutual Funds investments show a sizeable drop from single vs. married in case of females. Marketers of financial products could micro target younger investors both male and female on social media platforms.

In case of Fixed Deposits investment there is a sizeable drop in these from single vs. married in both males and females. With banks collapsing due to mismanagement, share markets dipping due to external factors such as corona virus and low market sentiments investors have to find new avenues for investing their funds. Deposits in stronger and multiple banks help to reduce risk.

Gold, Exchange Traded Funds, Property, Commercial Property, Venture Capital investments are sources of investments for large investors. Active fund management by investors becomes essential but this requires a thorough study of the stock market. For small retail investors Mutual Funds, National Savings, Exchange Traded Funds & Gold Exchange Traded Funds, NPS are opportunities available depending on short and long term financial needs.

REFERENCES

- Powell, M. and Ansic, D. (1997) Gender differences in risk behaviour in financial decision making: An experimental analysis, *Journal of Economic Psychology*, 18, pp.605-628.
- Zuckerman, M. and Kuhlman, D. M. (December 2000) Personality and Risk Taking: Common Biosocial Factors, *Journal of Personality*, pp.999-1029.
- Matthew C. Sonfield, Robert N. Lussier and Joel Corman (1997), "Gender Differences in Strategic Decision-Making: An Empirical Study of the Entrepreneurial" Strategy Matrix.
- Vaus de. D. (2002), *50 Key Problems in Data Analysis*, Sage Publications Ltd, London

Secure Clustered Approach to Secure Big Data Transmission

Sugandha and Kavita Mittal
Jagannath University, NCR, Haryana

ABSTRACT

Big data has been built to store, analyze, & manage this vast quantity of data using new technology called Big Data. This technology may also be used for environmental protection and gaming. "Big data" refers to information that is more diversified, more abundant, and more rapidly arriving. Data sets that are large and complex, especially those that originate from new sources, are referred to as "big data" by the phrase. Existing data processing systems can't manage these massive datasets. According to literature study results, security risks associated with structured and unstructured data transfer are evaluated. In an effort to improve the security of enormous amounts of data that are sent more often, clustering and encryption methods are studied. A secure clustered strategy to securing massive data has been the focus of current research. Wherever data is being exchanged via a network, this level of protection is in place. During clustering, the majority of research have employed the map reduce method. This approach assures data security by using encryption and clustering to improve speed. Scientists are evaluating the security and performance of the suggested solution in comparison to currently used methods. Present research paper is considering Pig and Hive platform for big data processing. Python has been used to perform Map reduce operation.

Keywords: Big Data, Clustering, Map-Reduce, Security, Performance, Pig, Hive

[1] INTRODUCTION

In order to store, analyze, and manage such a large amount of data, a variety of technologies have been created. When we have so much information at our fingertips, it's an excellent time to discover trends and devise creative solutions. Additionally, it's being used in the gaming business and to safeguard the environment. "Big data" is the term of choice when discussing a large variety of data sets. Term "big data" refers to datasets that are huge and complicated, particularly those that come from new sources. Currently available data processing technologies can't handle the sheer volume of these datasets.

Big data is classified in three ways:

1 Structured Data.

The meaning of each item of information shown in a sequence of lines and columns is clear. Database management systems (DBMS) make it easy to access this specific subset of data, which accounts for around 10% of all information in the database. As an example, official records of government agency personal, business, & immovable data may be found in the official records of government agencies. The monitoring of liquid and gas flow, temperature, and location in facilities is one of the fastest-growing sectors.

2 Unstructured Data

To keep track of everything, there are two rows and two columns for every single item of information. Database management systems may access this sort of data, which makes up around 10% of all data. A few examples of structured data sources include government documents like personal and company files and real estate information. Sensor data is becoming more important as technology progresses. This data may be used to monitor anything from plant movement and light to temperature and pressure to vibration to flow.

3 Semi-Structured Data

It may be used to connect unstructured data to structured data. Most of the time, this results in unstructured data accompanied with meta data. The user's time, location, device ID, or email address may be included in this data.

Table 1 Big Data types based on the level of processing

Structured Data	Unstructured Data	Semi-Structured Data
SQL	User Data	Third Party
Excel, Txt	Likes, Followers, Comments, Tweets	POS
Oracle	Audio	POL
Db2	Video	IR
Main Frame	Geospatial	IMS,MSA

More than one source may contribute to the wide range of types of data that are available. More and more data is being acquired in a variety of forms other than only on tablets or databases such as e-mail and pdf files, as

well as social media posts. Businesses may benefit from Big Data's ability to provide important insights. The use of Big Data in marketing and technology is on the rise. It is used in machine learning projects for training computers, predictive modeling, & other advanced analytical applications. A certain data volume cannot be linked to a particular kind of big data.

1.1 Need of Big Data

Use of this aids businesses in generating useful data. It is being used by companies to improve their marketing efforts and strategies.. Predictive modeling and other advanced analytics applications may be used to train computers in machine learning initiatives. "Big data" is abstract concept that cannot be reduced to a precise number of data points. It wasn't until the early '90s that the phrase "big data" came to be coined. Influence is projected to rise in the future years as it gains traction and clout. In today's business environment, big data is becoming more vital. Big Data is referred to as datasets by MGI. Certain database software systems are incapable of obtaining, storing, administering, and analyzing large amounts of data. On a daily basis, the amount of data being generated throughout the globe is calculated. IoT relies on digital and social media to fuel its growth and development. Astonishing amounts of data are being generated. It's because of the equipment it originates from that it has offered so much information. In order to succeed in this market, you must have a distinguishing advantage.

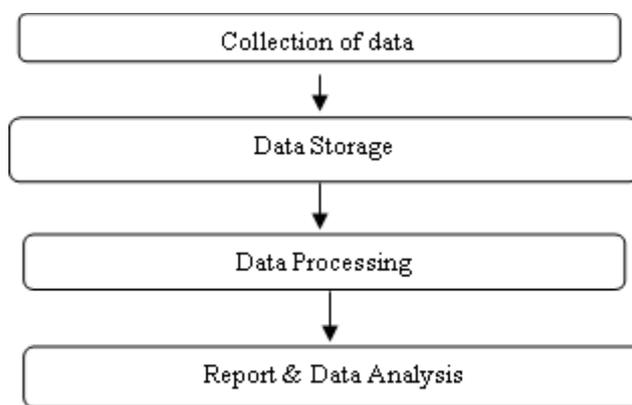


Fig 1 Big Data

1.2 Challenges to Big Data Management

Managing massive data is a major concern and difficulty.

- Professionals who lack the necessary competence. To keep up with today's rapidly evolving technology and vast amounts of data, businesses need data professionals who have received specialised training.
- Issues with Massive Data Growth are not widely understood.
- While selecting a Big Data Tool
- With regards to the selection of its tool, it is important to consider the challenges

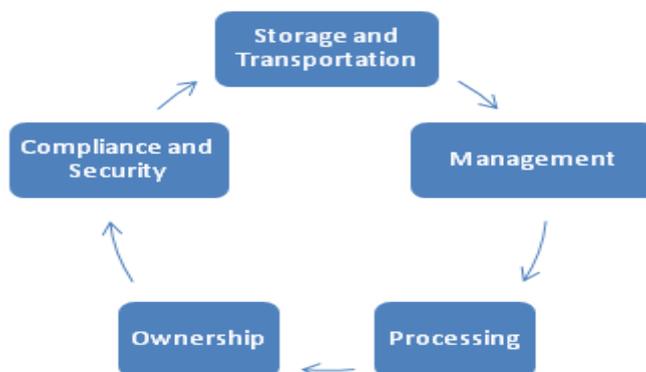


Fig 2 Challenges to Big data management

1.3 Map Reduce

It's a device that encrypts data. Using it is a way to get things done. Massive volumes of data are generated using a distributed parallel technique. This design was generated using the split-apply-combine technique of data analysis. It was born out of the mapping and function reduction. In functional encoding, this function is

often utilized. Structures like Map Reduce have a different goal in mind than their predecessors. The most essential part of the Map Reduce structure is not the functions themselves, but the scalability and fault tolerance that can be accomplished by improving the execution engine. '

This software was made possible thanks to the map approach. In a more efficient approach, it does the sorting and filtering. Summative acts may be performed by it. The processing is organized using distributed servers in this system. All messages are being handled simultaneously. This system's many components have now shared information with one another. The system has built-in fault tolerance and redundancy.

1.4 Clustering

This is all about breaking down large amounts of information into smaller and more manageable chunks. The distribution of data may be shown by a preprocessing method prior to the use of further algorithms. Cluster analysis, or clustering, may be used to group together a variety of things.

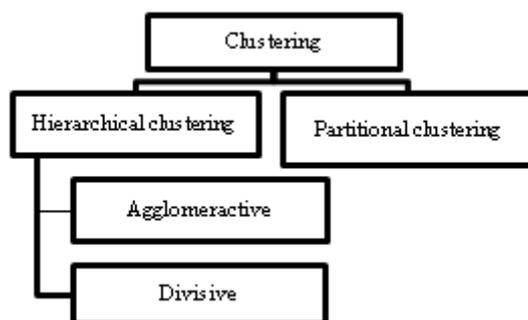


Fig 3 Clustering

1.5 Factors Influencing Big Data Performance

One-on-one and group interviews were utilized to identify 12 possible antecedents of the perceived value and motivation to use big data technology in this research. Listed below are the findings. They encompass everything from data storage and processing capabilities to functionality to performance requirements to security to privacy concerns to dependability to data analytics capability to enabling circumstances to output quality to necessary skills and training to cost efficiency. Qualitative research studies drew on the expertise of both big data and traditional data management experts. The outcomes of the qualitative study are used to build a quantitative model.

1.6 Need of Research

It is only possible to store, analyze, and handle massive volumes of data using a collection of technologies known as "Big Data." A map was used as a guide to construct this application. It does a better job at sorting and filtering than everything else I've tried. It's capable of doing summative actions, if you ask me. Businesses benefit from the generation of meaningful data via the utilization of Big Data. Big Data is used by organizations to better their marketing strategies and goals. Machine learning projects may benefit from predictive modeling & other applications. The term "big data" refers to a broad category of information that cannot be quantified numerically.

1.7 Big Data Network Security

Confidential and secure data must be stored on the network. Customers place a high value on the company's reputation. So, in order to protect data of its users, network provider must implement adequate security measures. Likewise, customers are responsible for their own security and should take the same precautions that we did, such as creating a secure password and not disclosing it to anybody. The network may be able to aid with certain difficulties if the data is beyond the firewall.

1.7.1 Threats To Big Data

In the context of analytics and data operations, security measures are called "big data security." Threats to big data systems include data theft, DDoS assaults, ransom ware, and other types of malicious software. Credit card details and other private information may be more susceptible in the case of a robbery. You might be fined if you don't follow the GDPR's fundamental data security and privacy protection rules.

1.7.2 Security Mechanism

Its security and privacy Conventional cannot keep up with the rise of big data in the digital world. Even if the data has been encrypted and safeguarded by access restrictions, and network security IDS, it is possible to hack data that has been de-identified and linked to a single individual. New laws is being advocated to address

privacy problems raised by Big data, including inference and aggregation, which allow individuals to be re-identified even after their personal information has been deleted from the dataset. The "security triangle," an issue that has plagued us for decades, is our present challenge. If, for example, a legislation prohibits access to raw data analysis and modification, users have a negative influence on system performance and usability. The whole Big Data ecosystem's safety and privacy regulations must be reexamined, from infrastructure and administration to data integrity and quality to confidentiality rules. Much work has to be done in the field of big data security and privacy. In order to protect Big Data technologies such as infrastructure, monitoring and auditing procedures, applications and data sources there must be security controls in place.

[2] LITERATURE REVIEW

Many researches have been done on big data security and performance.

D. Asir came up with the idea of conducting a study to see whether grouping ideas would be more successful. A study published in 2016 by Anthony Gnana Singh et al. According to the definition of clustering, a group of abstract things is transformed into a set of linked classes. Partitioning, hierarchical, density, grid-based, model-dependent, and constraint-based tactics are only a few of the clustering approaches.

In 2017, Kritwara Rattanaopas [2] used a new Hadoop compression option to speed up a wordcount operation. A study put the following two hypotheses to the test: Our studies show that using simply snappy and deflate in raw-text input file improves execution speed. Scenario I is referred to as "map compression" since it doesn't enhance computation time over uncompressed output.

In the charge-discharge process, Yongxin found that the formation of a passivation layer is connected to structural stability. The customised passivation layer reduces the interface impedance as well as shielding the electrode from dangerous side reactions at high voltage. The passivation layer is a good indicator of long-distance cycling performance. BD research articles that have benefited the BDA in both theoretical and practical aspects have been recognized by sivarajah [4] this year.

Using the findings of the survey, Ahmed Oussous [6] discovered new Big Data technologies. It is important to choose & execute right mix of Big Data technologies based on their technical demands and particular application requirements. All of the many layers of Big Data technology may be compared to each other, including data storage, processing, querying, and eventually data access.

Data storage, processing, querying, access, and administration were all explored by Tabary [7] in 2017 in terms of system levels. Different technologies' primary qualities, benefits, and disadvantages are categorised and examined.

The limitations of current machine learning methods, as stated by Muhammad UmerSarwar [8], are highlighted for the purposes of large data analysis in healthcare. Using enormous amounts of data, healthcare professionals may improve their decision-making by making a few adjustments to current machine learning algorithms.

In 2017, J. Kaur et al. launched an image processing system on a multi-mode Hadoop cluster [9]. Study shows that the amount of data being generated on the internet is expanding at an exponential pace. "Big Data" refers to inadequacy of current data processing technologies for dealing with data. Pig, Base, and other Hadoop technologies may be used to analyse text data.

An analysis of a patient's medical data is becoming more and more critical, as ArunPushpan [10] states, in order to avoid or take precautions for the future. Thanks to digital automation of equipment, data may now be examined more rapidly and correctly. When dealing with huge volume of data, security, integrity, & inconsistency all come into play. New techniques to illness diagnosis have been investigated via the use of process and data mining technologies.

For a particular application, it might be helpful to analyse and contrast the various clustering algorithms based on their key issues, benefits, and downsides. This data is provided by k. Chitral [11].

Improving Hadoop Maps was published in 2017 by K. Rattanaopas et al. [12]. A test to see whether adding a word count to the data compression process speeds things up. A map reduce engine on each node of the cluster distributes data. Compression codecs like deflate, gzip, bzip2, and snappy are often used in Hadoop. Hadoop employs a gzip or bzip2 compressed input file while performing map reductions. Improve the performance of a word count task in this study by using a new Hadoop compression option

Chen [13] made a presentation on clustering methods. It has been used in a variety of situations. Research into consumer behavior, pattern recognition, data analysis and image processing have all benefited from its

application. Marketers have taken use of clustering to their advantage. Groups may be found based on a user's profile.

In 2018, data analysis utilizing the Hadoop map-reduce environment was described by P. R. Merla and colleagues [14]. Using the YouTube data was agreed upon once the study was concluded. AWS's cloud architecture and the Hadoop map reduction tools allowed them to do this.

Table 2 Existing Researches

Sno	Author/ year	Objective of research	Mechanism	Benefits	Limitation
1	D. Asir Antony Gnana Singh [1] / 2016	Analysis of Gene Expression Data Clustering Performance	Clustering	Research is suitable to cluster big data content	Need to do more work on performance
2	Kritwara [2]/ 2017	MapReduce-based Hadoop Maps Data Compression: An Experiment with Wordcount Job	MapReduce	Research has provided efficient K-mean clustering mechanism.	Scope of research is limited.
3	Sivarajah [4] / 2017	Big Data difficulties and analytical approaches are examined critically.	Big Data	Work is playing significant role in field of data mining.	Need to improve the monitoring mechanism
4	Tabary [7] / 2017	A nationwide healthcare decision support system for the analysis and allocation of large amounts of data is being developed.	Big Data	Several clustering mechanism are systematically elaborated.	Lack of technical work
5	Kaur [9] / 2017	Hadoop multi-node image processing cluster	clustering	Clustering mechanism comparison has played significant role in research big data research	Research is providing just review.
6	Rattanaopas [12] / 2017	MapReduce-based Hadoop Maps Data compression reduces performance in a research employing a wordcount task.	MapReduce	Research supported data analysis over advanced platform	The advance tools requires special virtual environment.
7	Chen [13] / 2017	Soft clustering for very large data sets	Clustering	Work provided high performance solution for big data application.	There is need of highly qualified technical person
8	Merla [14] / 2018	Data analysis using hadoop MapReduce environment	MapReduce	Large volume of data has been managed.	Need to improve security
9	Xiong [22] / 2019	Privacy and Availability Enhancements for Data Clustering in IoT's Intelligent Electrical Service	Clustering	Research Work has contributed for data analysis.	Need to do work on performance and security.
10	Niveditha [28] / 2020	Using a Big Data Platform, Detect and Classify Zero-Day Malware	Big Data	Data clustering has been made for smart solutions.	Need to enhance the security.

[3] Problem Statement

Clustering has been advocated in a number of studies in the field of big data. Some academics suggested using big data platforms to identify malware, while others focused on data clustering in order to develop smart IoT solutions. In order to protect Big Data more effectively when data is transported across network, it is necessary

to offer a more secure clustering technique. It's possible to handle or not manage large amounts of data. Research on unmanaged large data has been restricted, according to the findings of this study. Despite the widespread usage of the map reduction environment in big data research, these techniques were not ideal for managing large amounts of structured data. Furthermore, clustering methods utilized in prior study are less effective. A number of studies have shown that big data management needs to be better protected against cyber-attacks.

[5] Proposed Work

In this proposed work, research is getting input dataset of queries and keywords. From this dataset; research gets the queries and keywords. Research is applying Map phase and reduce phase on that Queries and keywords. Now, work gets the frequency count of Keywords and collects the dataset of frequency. Research enhances K-mean clustering and gets the multiple clusters. Last, research is encrypting the clustered data and gets secured the data.

The rectangular rectangles are used to describe the real datasets containing the dataset and the frequency dataset which is generated after the map reduction procedure. The elliptical boxes are used to describe operations involved in original data flow. There are numerous procedures involved in the above illustrated data flow diagram. Firstly two concurrent processes are present to collect the keywords and queries accordingly from the dataset. The map reduction technique is then conducted on the collected keywords and queries in order to determine the frequency. The obtain frequency procedure is used to draw the frequency of the keywords and queries following the map reduce process. The frequency data set is used to store the obtained frequency. After that clustering process is performed to produce the clusters.

Dataset:

These are the major locations where unstructured data is kept. Consolidated dataset contains all of unstructured information.

Queries:

Views are examined in a query, which is a subset of the dataset. Map reduction logic is used to determine frequency of a keyword in an unstructured dataset.

Keywords:

These are terms that appear most often in the dataset. Different keywords used in this study

Map Reduce:

Map Reduce programmers, which can handle big datasets, may be used to find the frequency of a certain term in the dataset. Clusters of low-cost computers are used to do this. Nodes in a cluster are referred to as such since they are the individual computers that make up the cluster. Map Reduce is a two-phase computing approach. A significant amount of data was processed in a step-by-step manner.

Enhanced K Mean Clustering

When it comes to clustering, K mean is one of simplest unsupervised learning approaches. When it comes to categorising specific data, the procedure is simple and fast. There are a number of clusters, each with a defined apriority, that are used to do this. K centres are the most important part. For every cluster, there is a separate one of these. These hubs need to be strategically placed. The outcomes differ in a number of locations. Because of this, it is best to keep them apart. The next step is to go through each piece of information in the database and see what it contains. It's then connected to the nearest centre. The first stage is complete when there are no unresolved issues. Early group age may be ascertained in this manner. As a baricenter of clusters generated from the previous step, k new centroids must be recalculated at this time. The new centres will need the creation of a new link between comparable data sets & nearest centre. Tangle has been created. Result of this loop, k centres may be observed to move about. Once modifications have been made or the centre of gravity has no longer shifted, it will continue to be done.

Data Flow Diagram for Secure Clustered Approach for Efficient Protection of Big Data

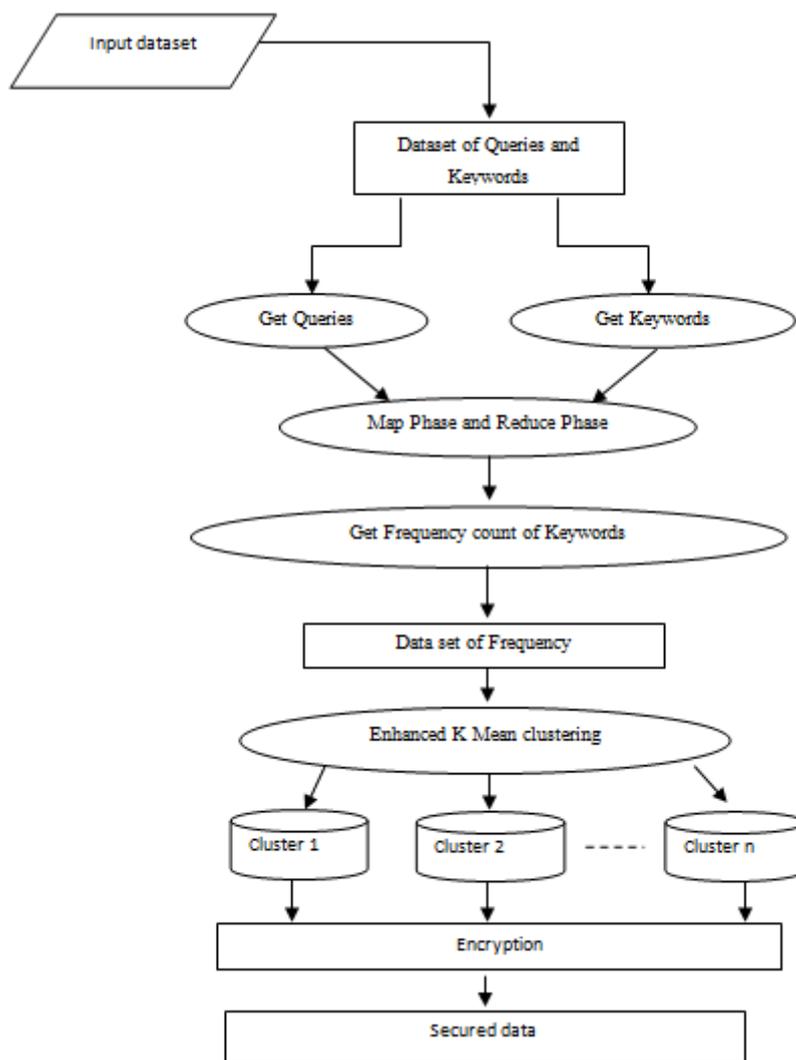


Fig 4 Process flow of secure clustering logic

Security Integration

Proposed work is securing clustered information by making use of AES encryption mechanism. The NIST in the US developed the Advanced Encryption Standard (AES) in 2001. It was formerly known as Rijndael. In the selection process for the AES, two Belgian cryptographers proposed a variation of the Rijndael block cypher called AES, which is based on the Rijndael algorithm. Different key and block sizes are available for Rijndael family cyphers. For AES, NIST selected three Rijndael members with a block size of 128 bits, but three differing key lengths: 128, 192, and 256 bits. AES has been selected by the US government. New standards have replaced the DES, which came out in 1977. AES defines symmetric-key encryption as the practise of encrypting and decrypting data using the same secret key.

AES Algorithm

Symmetric block-cipher algorithm AES takes normal text in 128-bit blocks and transforms it into encrypted data using 256-bit keys. As a result of its reputation for security, the AES algorithm has become the de facto global standard.

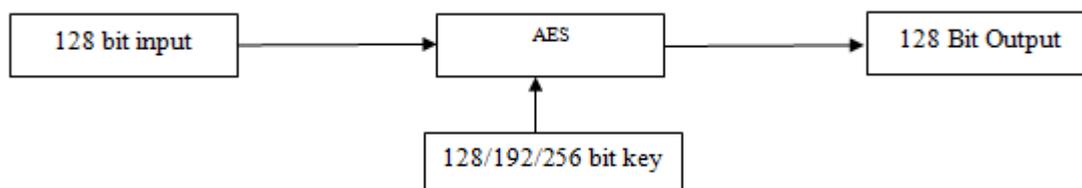


Fig 5 AES algorithm

Working of AES

Multiple rounds of substitution-permutation (SP) generate cipher text in the AES algorithm. Depending on the key size, the number of rounds varies. There are 10 rounds for a 128-bit key, 12 for a 192-bit key, and 14 rounds for a 256-bit key. Since only one key is entered into the method, it is necessary to extend this key in order to get round keys for each of the subsequent rounds, including round 0.

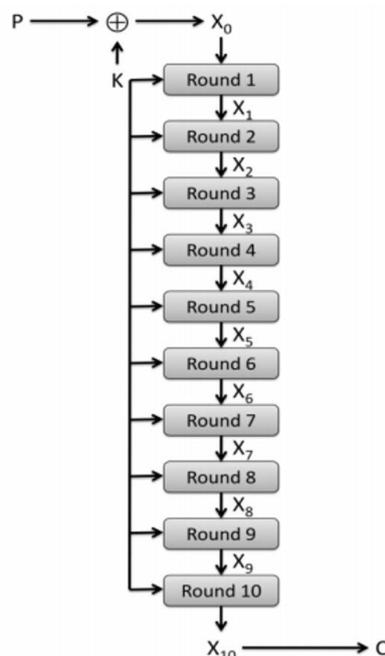


Fig 6 Working of AES

Integration of Map Reduce and Clustering:

K-mean clustering technique has been implemented here in a Map Reduce environment. System has offered a text file as an input. The data set has been mapped after that. (Key, value) pairs were used to store the results. Mapper function then stores the output in a temporary intermediate file. Such a file accepts input from the Reducer function. Data obtained from the mapper must be processed by the Reducer. It yielded a whole new set of results in the process. After that, the output was subjected to the mechanism.

Assume $X = \{x_1, x_2, x_3, \dots, x_n\}$ is set of data points. Along with this, $V = \{v_1, v_2, \dots, v_c\}$ has been take as set of centers.

Phase

- 1: In the first phase, choose the "c" cluster centers at random.
- 2: Second, calculate the distance between every cluster centre and every data point.
- 3: Allocate data point to cluster centre closest.
- 4: eq. (1) is applied to the new cluster centre in phase 4 of the calculation.
- 5: distance between each data point and the new cluster centers is calculated again.
- 6: if there is no reassignment, then end; if there is reassignment, repeat phase 3.
- 7: End.

4.5 Role of Map Reduce

Map Reduce is mostly used for parallel processing of large data sets. The Hadoop cluster is used to store this data. To begin with, it's a theory that Google came up with on its own. Fault tolerance and parallel processing of data dissemination are provided by the architecture of this system. When it comes to mapping elements, the key-value pair has been used. The key and value of it are intertwined, thus it sits in the centre of two related data points. It is common for a Map Reduce operation to split a large data set into smaller subsets. Map jobs parse these bits. All of these tasks are carried out in parallel. Maps are differentiated by their design. A file system is used to store all of the job's data, including its input and output. Tasks are scheduled by the structure. It keeps an eye on them and repeats tasks that have gone awry. The Map Reduce structure only uses key, value> pairs to carry out its operations.

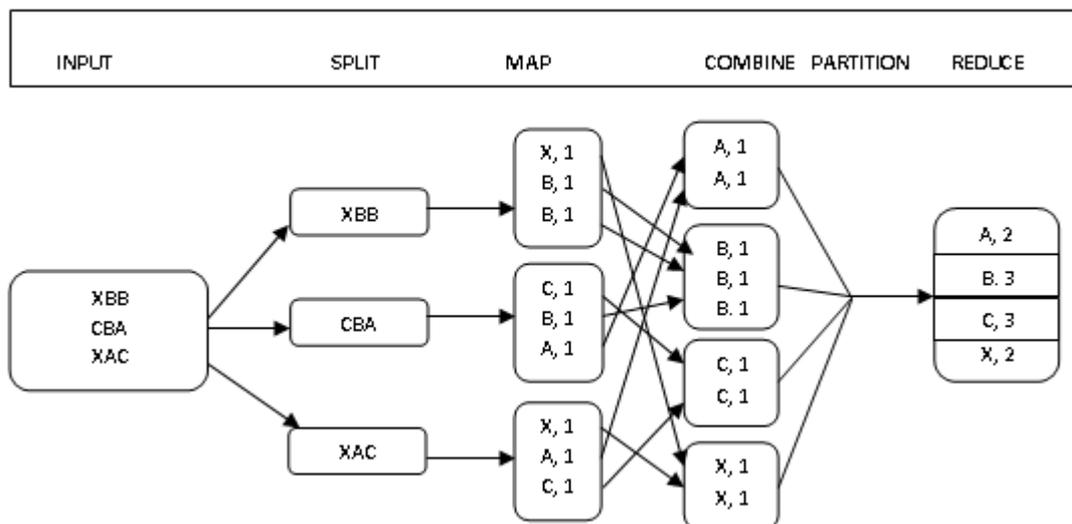


Fig 7 Map Reduce Process

The input to tasks is seen as collection of key, value> pairs. After that, collection of key, value> pairs is generated as consequence of the tasks that were run. There is the potential for a wide range of outcomes. Key and value classes were serialized in this format. Writeable interfaces must be implemented. In addition, the Writable Comparable interface is implemented using many important classes. Sorting is made easier as a result.

Proposed Design

There are five levels of organization in the architecture shown here. The first layer acts as a client-side layer from which the operator might attempt to transfer data to the server-side script. His data would be validated by the client-side script before being sent to the server-side script for processing. After validation, data would be stored in a database server using a server-side script in the second tier. In the third tier of data management, the database layer, the data is stored and maintained. Bi-directional connections exist between the second and third levels. The data is sent from the server to the database layer during the insertion query procedure. When a selection query is run, data is sent from the database layer to the server side. Map reduction and clustering are used in the fourth layer to produce frequency. Finally, encryption is used to protect the material.

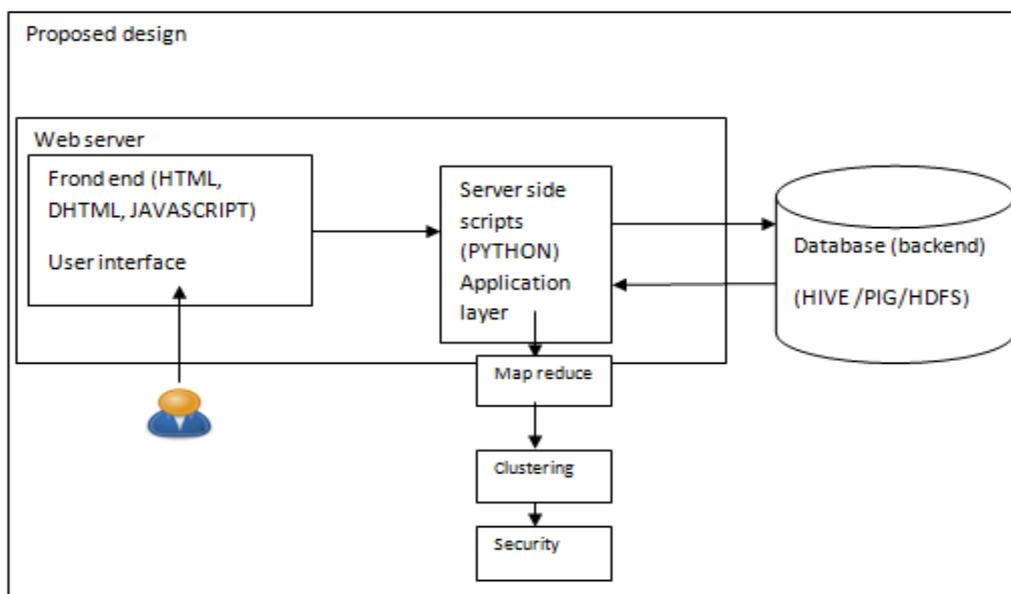


Fig 8 Proposed Works

Process Flow in Order to Implement Proposed Work

1. The first step is to install a virtual machine.
2. Second, the cloud era was installed.
3. Steps for Setting Up Cloud Era On A Virtual Machine
4. csv-based dataset allocation

5. Data set import to HDFS from a csv file in the cloud era.
6. Analysis of hive's performance after importing data into the database
7. A python library to read CSV files has been developed.
8. Analyzing the performance of imported data in pig environments
9. In a cloud era context, implementation of Map reduce and spark on supplied dataset
10. A python script was written and implemented to implement MapReduce on an Amazon dataset.
11. Analyze Map Reduce's and Spark's performance.

Dfd of Process Flow

The planned work is shown in the following DFD. From a data collection, contents have been gleaned. The data is then moved to a cloud-based storage system.

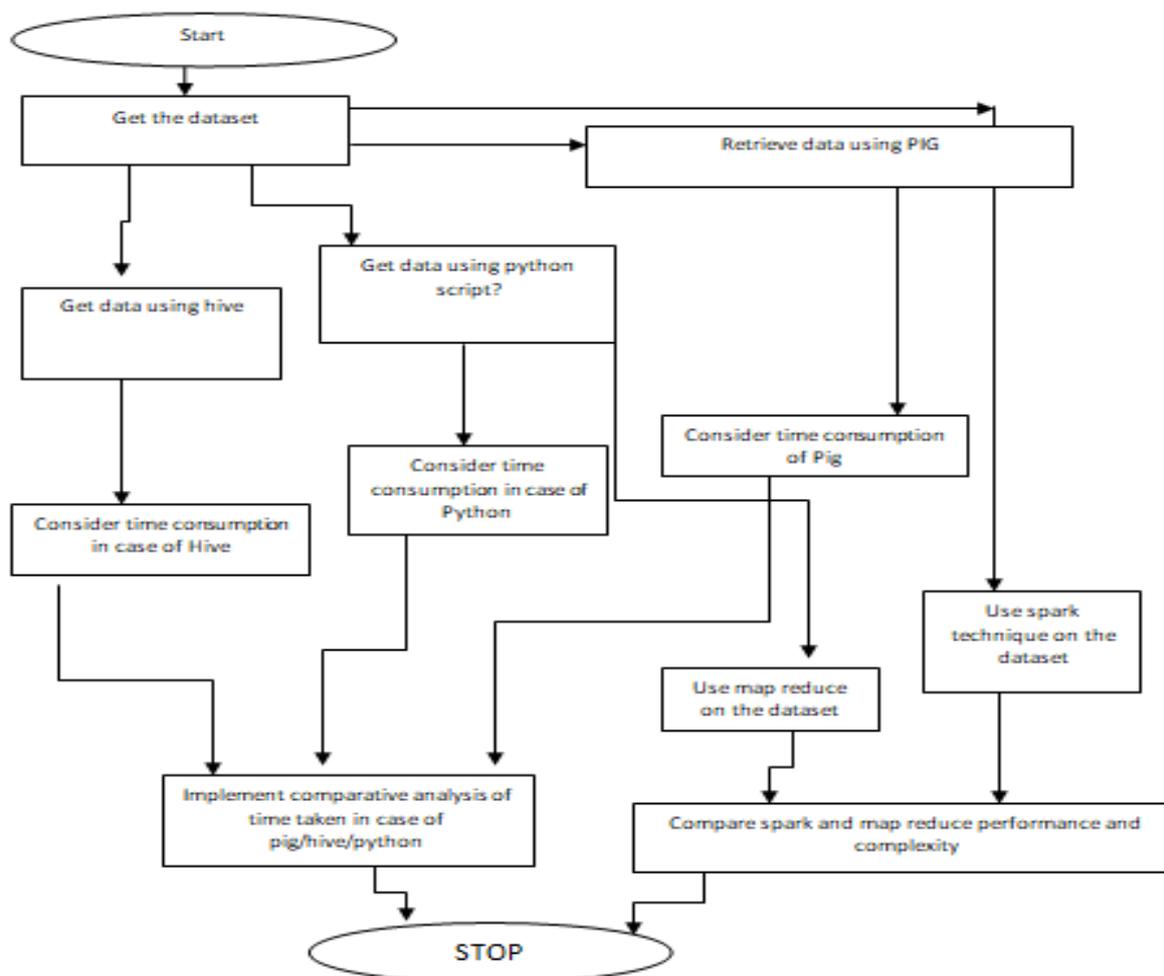


Fig 9 Process flow of proposed work

Hadoop, hive, and pig are all supported in this environment. With the help of gedit, the python script may be created here. It would be necessary to write a Python script to get the dataset's contents. Three methods would be used to get the data from the dataset. Hive is first. 100 times quicker than Pig, it is a well-known database in the Hadoop ecosystem. Both approaches, however, perform less well than python.

In addition, research in a cloudera-based system coupled with a Hadoop environment has used MAP Reduce and SPARK methodologies. We used database as our dataset.

[6] RESULT AND DISCUSSION

Hives and pigs are often used in experiments. These are used in the process of. The csv files above-mentioned observations of hive and pig performance is made. After comparing Pig and Hive, it can be concluded that hive consumed less time. Hive takes less time than a pig does to complete a task. Along with this, a slew of lines have been discovered in Pig. The hive, on the other hand, has only used one line.

Table 3 Execution times taken by hive and pig with MapReduce

Sno	Time Taken by PIG	Time Taken by Hive
Query 1	12.975	7.572
Query 2	11.327	3.128
Query 3	16.782	1.659
Query 4	20.527	5.366

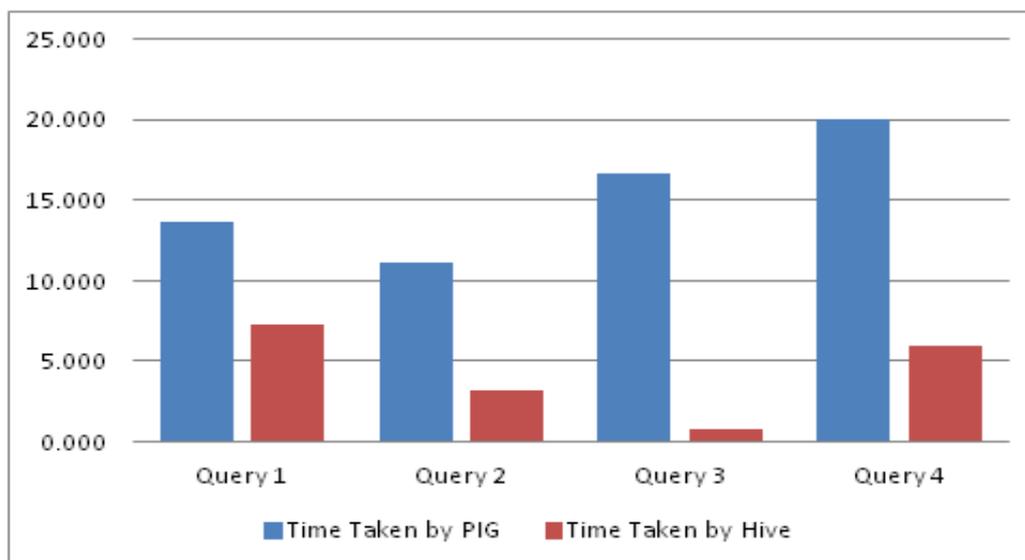


Fig 10 Execution time in case of hive and pig with MapReduce

It has been run in-memory using Spark. Because of this, Hadoop MapReduce needs to read & write data to & from discs. So there is a wide range of processing speeds. Spark has been shown to be 100 times quicker than MapReduce. As a result, the time needed for Hive and pig with Spark in same architecture has been seen.

In the following table, the amount of time it takes for a hive and a pig to get started is shown. A total of four questions are currently being evaluated.

Table 4 Time required in case of hives and pig with Spark

Query	Time Taken by PIG	Time Taken by Hive
1	0.12	0.04
2	0.17	0.01
3	0.21	0.06
4	0.15	0.03

In order to compare the hive's and the PIG's performance, they created the following graph.

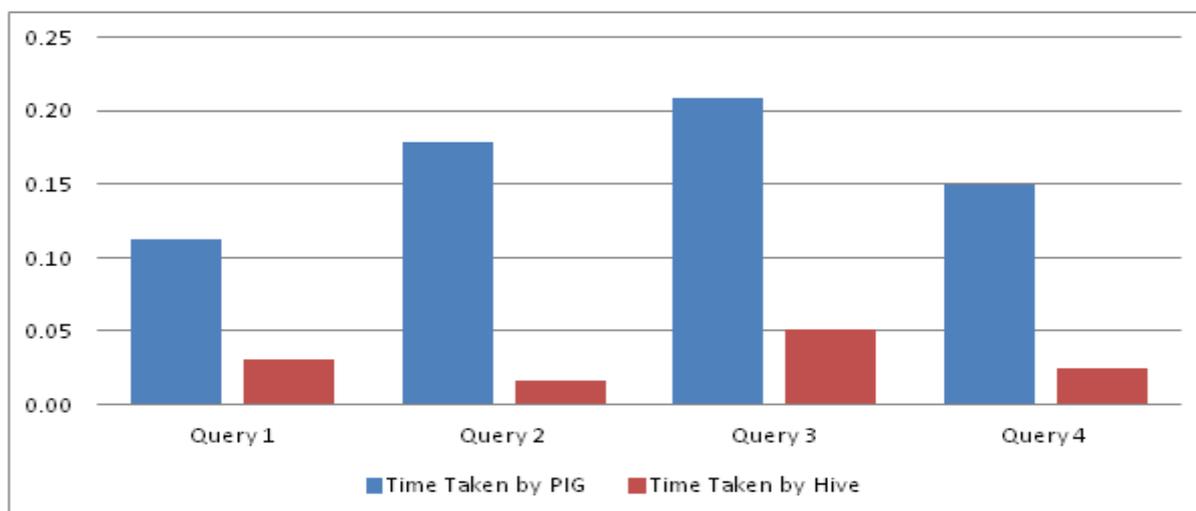


Fig 11 Execution by hive and pig with Spark

Comparative Analysis of performance of existing- hive, pig and Proposed-python script for Hadoop framework on cloud era

Tables of pig and python script material have been created after the hive simulation to aid in the examination of the two languages.

Table 5 Hive, pig and python script content have been stored

Cycle	Tim Taken by hive	Time taken by pig	Time taken by python script
1	0.218	0.405	0.045
2	0.182	0.531	0.058
3	0.188	0.284	0.122
4	0.117	0.308	0.101
5	0.172	0.463	0.117
5	0.184	0.418	0.122
6	0.126	0.374	0.089

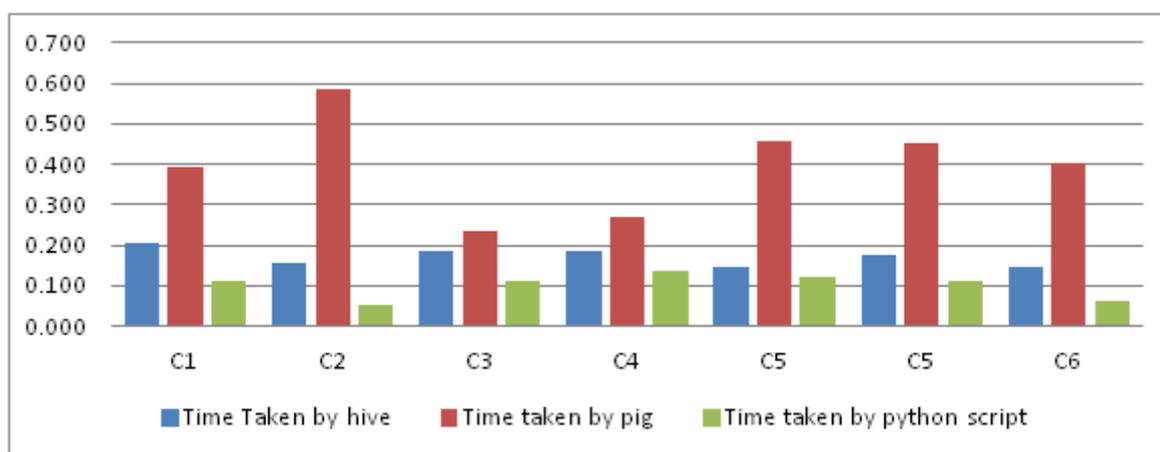


Fig 12 Hive, pig and python script content have been stored

[7] CONCLUSION

It is concluded that hive is consuming less time as compared to pig. On other hand user defined python script is consuming less time during Map reduce operations. Methods for analyzing and storing data are often used. It is also utilized to preserve the environment in addition to the gaming business. It is a word used to describe when great volume of data is received simultaneously. The computing industry uses the phrase "big data" to denote vast volumes of data, especially from previously untapped sources. Currently available data processing tools cannot handle these datasets. It has been determined that structured and unstructured data transmissions pose a significant security risk. Increasingly frequent exchanges of massive volumes of data need improved security measures like clustering and encryption. This design makes advantage of encryption and clustering to boost performance while also ensuring data security. There are currently comparisons between the security and performance of this methodology and other methods.

[8] SCOPE OF FUTURE

A clustered transmission method may be useful in realms of healthcare, AI, and the IOT. Research into unmanaged data, on the other hand, might have a big impact on massive data analysis. In order to boost performance while ensuring data security, this system combines encryption and clustering. There are currently comparisons between the security and performance of this methodology and other methods.

REFERENCES

1. D. Asir Antony Gnana Singh, A. Escalin Fernando, E. Jebamalar Leavline (2016) Performance analysis on Clustering Approaches for Gene Expression Data.
2. Kritwara Rattanaopas, Sureerat Kaewkeeree(2017) Improving Hadoop MapReduce Performance with Data Compression: A Study using Wordcount Job.
3. Yongxin Huang, ManXie, JiataoZhang(2017) A novel border-rich Prussian blue synthesized by inhibitor control as cathode for sodium ion batteries,

4. Sivarajah U, Kamal MM, Irani Z, Weerakkody V. (2017, January) Critical analysis of Big Data challenges and analytical methods. *J Bus Res*;70:263-286.
5. Llewelyn H. (2017) Sensitivity and specificity are not appropriate for diagnostic reasoning. *BMJ*;358:j4071.
6. Ahmed Oussous , Fatima-Zahra Benjelloun (2017) Big Data technologies: A survey.
7. Tabary MY, Memariani A, Ebadati E. (2019) Chapter 3 - Developing a decision support system for big data analysis and cost allocation in national healthcare. In: Dey N, Ashour AS, Bhat C, Fong SJ, editors. *Healthcare data analytics and management*. Cambridge, MA: Academic Press:89-109.
8. Muhammad UmerSarwar, Muhammad KashifHanify, RamzanTalibz, AwaisMobeenx, Muhammad Aslam (2017) "A Survey of Big Data Analytics in Healthcare", proceedings of *International Journal of Advanced Computer Science & Applications*, , vol. 8 (6), pp. 355-359.
9. J. Kaur, K. Sachdeva, and G. Singh (2017) "Image processing on multinode hadoop cluster," 2017 Int. Conf. Electr. Electron. Commun. Comput. Optim. Tech., pp. 21–26.
10. ArunPushpan, Ali Akbar N (2017) "Data Mining Applications in Healthcare", proceedings of *IOSR Journal of Computer Engineering*, pp. 04-07.
11. K. Chitra1, Dr. D. Maheswari(2017) "Comparative Study of Various Clustering Algorithms in Data Mining", proceedings of *International Journal of Computer Science and Mobile Computing*, 2017, vol. 6 (8), pp.109 – 115.
12. K. Rattanaopas and S. Kaewkeeree (2017) "Improving Hadoop MapReduce performance with data compression: A study using wordcount job," *ECTI-CON 2017 - 2017 14th Int. Conf. Electr. Eng. Comput. Telecommun. Inf. Technol.*, pp. 564–567.
13. Chen M. (2017) "Soft clustering for very large data sets", proceedings of *International Journal of Computer Science and Network Security*, vol.17 (1), pp. 102-108.
14. P. R. Merla and Y. Liang (2018) "Data analysis using hadoop MapReduce environment," *Proc. - 2017 IEEE Int. Conf. Big Data, Big Data 2017*, vol., pp. 4783–4785, 2018.
15. S. Kumar and Z. Raza (2018) "A K-Means Clustering Based Message Forwarding Model for Internet of Things (IoT)," 2018 8th International Conference on Cloud Computing, Data Science & Engineering (Confluence), Noida, pp. 604-609.
16. Ristevski B, Chen M. (2018) Big data analytics in medicine and healthcare. *J Integr Bioinform* 10;15(3):20170030
17. C.P. Patidar, NehaVerma (2018). Comparison of Visual Content for Different Browsers. *International Journal of Computer Science and Engineering*, vol. 6, no. 4, pp177.
18. Sitalakshmi Venkatraman andMamounAlazab(2108) "Use of Data Visualisation for Zero-Day Malware Detection", *Security and Communication Networks*, Article ID 1728303, 13 pages.
19. Deepak Gupta and Rinkle Rani(2018). Big Data Framework for Zero-Day Malware Detection", *Cybernetics and Systems*, DOI: 10.1080/01969722.2018.1429835.
20. Dhilip Kumar V, Vinoth Kumar V, Kandar D (2018), "Data Transmission Between Dedicated Short-Range Communication and WiMAX for Efficient Vehicular Communication" *Journal of Computational and Theoretical Nanoscience*, Vol.15, No.8, pp.2649-2654.
21. Jayasuruthi L,Shalini A,Vinoth Kumar V.,(2018) " Application of rough set theory in data mining market analysis using rough sets data explorer" *Journal of Computational and Theoretical Nanoscience*, 15(6-7), pp. 2126-213
22. J. Xiong et al. (2019, april). Enhancing Privacy and Availability for Data Clustering in Intelligent Electrical Service of IoT," in *IEEE Internet of Things Journal*, vol. 6, no. 2, pp. 1530-1540.
23. T. Farnham(2019). Indoor Localisation of IoT Devices by Dynamic Radio Environment Mapping," 2019 *IEEE 5th World Forum on Internet of Things (WF-IoT)*, Limerick, Ireland, pp. 340-345.

24. J. Jung, K. Kim and J. Park(2019), Framework of Big data Analysis about IoT-Home-device for supporting a decision making an effective strategy about new product design, International Conference on Artificial Intelligence in Information and Communication (ICAIIIC), Okinawa, Japan, 2019, pp. 582-584
25. Lee S, Mohr NM, Street WN, Nadkarni P. (2019, march). Machine learning in relation to emergency medicine clinical and operational scenarios: an overview. *West J Emerg Med*;20(2):219-227
26. Tabary MY, Memariani A, Ebadati E. (2019). Chapter 3 - Developing a decision support system for big data analysis and cost allocation in national healthcare. In: Dey N, Ashour AS, Bhat C, Fong SJ, editors. *Healthcare data analytics and management*. Cambridge, MA: Academic Press:89-109.
27. Freeman JD, Blacker B, Hatt G, Tan S, Ratcliff J, Woolf TB, et al. (2019). Use of big data and information and communications technology in disasters: an integrative review. *Disaster Med Public Health Prep*;13(2):353-367.
28. V. R. Niveditha, T. V. Ananthan , S.Amudha, Dahlia Sam and S.Srinidhi(2020), Detect and Classify Zero Day Malware Efficiently In Big Data Platform.
29. Abdulbaset Salem Albaour, Yousof Abdulrahman Aburawe (2021). *Big Data: Review Paper*.
30. Cunha W, Mangaravite V, Gomes C, Canuto S, Resende E, Nascimento C, et al. (2020, may). On the cost-effectiveness of neural and non-neural approaches and representations for text classification: A comprehensive comparative study. *Inf Process Manage*;58(3):102481.
31. C.P. Patidar and Harshit aKhandelwal(2019, january). ZERO DAY ATTACK DETECTION USING MACHINE LEARNING TECHNIQUES”, *IJRAR*, Volume 6, Issue.
32. Murat Kantarcioglu and Elena Ferrari (2019, February). Research Challenges at the Intersection of Big Data, Security and Privacy”, *SPECIALTY GRAND CHALLENGE article Front. Big Data*.
33. Mohammed S.Al-Kahtani (2017, February). Security and Privacy in Big Data. *International Journal of Computer Engineering and Information Technology*, VOL. 9, NO. 2, E-ISSN 2412-8856.
34. Ninny Bhogal, Shaveta Jain (2017, march). A Review on Big Data Security and Handling. *International Research Based Journal*, Vol(6)-Issue(1) , ISSN 2348-1943.
35. Naveen Rishishwar, Vartika, Mr. Kapil Tomar (2017, march). Big Data: Security Issues and Challenges. *International Journal of Technical Research and Applications*, e-ISSN: 2320-8163, Special Issue 42 (AMBALIKA), PP. 21-25.

Improvement of E-Healthcare System Using Advanced IoT Based Model

Niyati Jain and Kavita Mittal
Jagannath University, Haryana

ABSTRACT

The Internet of Things consists of physical things with sensors, computing power, and software that link to other devices or systems through the Internet or another communication network. Currently, IoT is being employed in health care research. Using a healthcare dataset, a trained network was used in this research to make judgments. The study uses the LSTM model for prediction in the present IoT system to produce a reliable and adaptable solution for healthcare. Connecting everything to the internet so people may live in a secure and comfy environment is the goal of the Internet of Things. Connecting everything in our environment is the main goal of the IoT. The internet might have an impact on computers that aren't directly connected to it. With the aid of the Internet of Things, patients who live distant from a healthcare centre are being helped. Researching the present IoT system's problems is essential in order to develop an effective, practical, and scalable solution for improving healthcare. There must be a strong basis for health-care apps to succeed. It has been anticipated that mankind would face increased health care issues in the future with the introduction of COVID 19. Healthcare solutions that are more trustworthy and precise will be needed, along with the capacity to treat health concerns remotely in a highly effective manner. Existing IoT-based studies are being analyzed for their effectiveness and accuracy by researchers doing in-depth analyses. The integration of LSTM-based intelligent approach to IoT system is being proposed as a method to increase the accuracy of the medical prescription and prescribing system. Research is focusing on improving the model's accuracy, precision, recall, and f1 score by comparing it to current methodologies.

Keyword: IOT, Health Care, LSTM, Accuracy, Performance.

[1] INTRODUCTION

It refers to devices with sensors, computers, software, and other technologies that are connected and exchange data through the Internet or other communication networks. Today's medical research employs the Internet of Things (IoT).

To make a choice based on a trained network, this study looked at a collection of healthcare data. For the current IoT system, the study employs the LSTM model for prediction in order to deliver a dependable and adaptable health care solution. App, network, and perception layers are all shown in Figure 1 of an Internet of Things device hierarchy. Networking devices such as routers and gateways handle the application layer, while sensors and actuators handle the perception layer.

IoT data and information are processed differently from conventional data and information. The Internet of Things' information component is small and readily disseminated. If a connection between the Internet of Things and regular PC processing is identified. The Internet of Things is made up of a huge number of devices, known as hubs. These will be included into the program. The Internet of Things is a term that has been bandied around a lot recently.

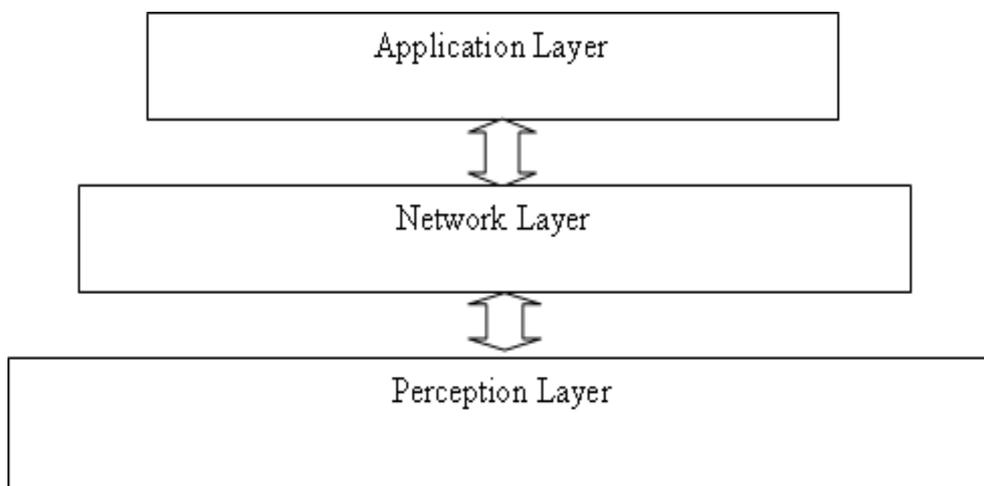


Fig 1 IOT devices

Linked objects have been existed for a long time, probably as long as the Internet or correspondences themselves. Modern cell phones and personal computers (PCs) are perhaps the best-known and most consistent instances of connected devices. They must remain separate goods, despite the fact that there is just one essential difference, due to the fact that they must be controlled by the client.

1.8 Need of IOT

Industrial, transportation, and utility industries employ sensors and other IOT devices most frequently; but IOT has also found uses in agriculture, infrastructure, and home automation. People will enjoy a safer and more comfortable environment as result of IoT. IoT attempts to connect everything in our surroundings. By connecting to the internet, embedded computers will be affected. With the aid of the Internet of Things, patients who live distant from a healthcare centre are being helped.

1.9 Characteristics of Iot

1. There's really not much to say here. In IoT, sensor-based devices have been linked to the internet.
2. Things are items that can be linked because they have been designed to be connected in this way. In most cases, sensors and other domestic gadgets are linked to animals.
3. Data is the lifeblood of the Internet of Things. After acquiring data, the sensor nodes share it with each other to aid in decision-making.
4. IoT devices are interconnected in such a manner that data may be sent and evaluated. Even short distances may be used to transmit data.
5. A key feature of IoT devices is their intelligence, which allows them to take in data and make intelligent decisions based on it.
6. Steps taken or tasks completed by an intelligent system are referred to as actions. Automated as well as human actions may be taken.
7. The Internet of Things (IoT) may be found here.

1.10 Challenges To Iot

The issues in implementation of IoT have been stated below

- IoT devices have security risks.
- There is no regulation at all for the Internet of Things.
- There are concerns with compatibility.
- Data transport capability is constrained.
- Customers' expectations.

1.11 Electronic Health Record

EHR contains the patient's medical history, with demographics, progress notes, problems, and medications, as well as other relevant clinical data. When this information is recorded into the EHR, it is available to the practitioner.

1.12 Role of IOT in Healthcare

It is possible for IoT to collect data from a broad range of sources and in a wide variety of locales in the context of patient health care. For example, an EHR may be used to collect data from a variety of devices, including activity trackers and biosensors that detect vital signs. In order to improve patient care, it may be possible to combine and analyze the data provided by these devices. It will be some time before the IoT can be widely used in electronic health records (EHR). A few examples have proved that using the Internet of Things may be beneficial.

1.13 Lstm Model

LSTM, a term often used in field of deep learning, is well-known recurrent neural network. The LSTM is capable of feedback interconnection. No, this isn't your average neural network. In this case, it's not only about looking at certain data points like graphs. You may also finish audio and video files using this program. According to some, classifiers like LSTM networks. It processes and generates projections based on time series data. Time series data may have unforeseen delays between important occurrences. LSTM networks classify recurrent neural networks. According to a study, it has been observed that a sequence prediction issue may teach

order dependence. Complex issues like machine translation need a certain level of caution. Long-term short-term memory has long been regarded as a challenging area of study. The idea of long-term memory is difficult to understand. There has been very little study on long short-term memory.

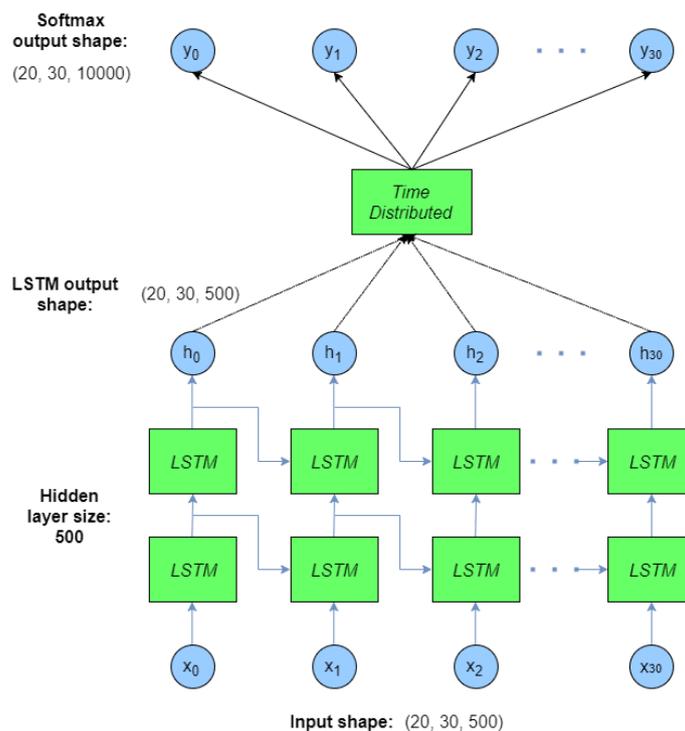


Figure 2 Working of LSTM

Recurrent neural networks have been classified as Long Short-Term Memory networks. In the instance of a sequence prediction issue, this has been shown to be capable of teaching order dependency. This is a necessary behaviour in complex problem areas such as machine translation. Long Short-Term Memory has long been thought to be a difficult area of deep learning. Long Short-Term Memory is a tough concept to grasp. In the area of Long Short-Term Memory, there has been minimal research. RNN [10] is another name for a recurrent neural network. This is classified as an ANN category. A directed graph is created by the connections between nodes. This was accomplished via the use of temporal sequence. The problem of disappearing and ballooning gradients plagues standard Recurrent Neural Networks. RNNs, such as LSTM networks, have been classified as RNNs [25]. Special units, in addition to conventional units, are supported by LSTM. An LSTM unit is made up of a 'memory cell.' These memory cells have the ability to store info for a long period of time. Users are switching from RNN to LSTM because it offers greater control options. They have the ability to control the flow and mixing of inputs using learned weights. As a result, it allows for flexibility in output management. As a consequence, LSTM provides the capacity to manage as well as excellent outcomes.

[2] LITERATURE REVIEW

Diverse studies have been conducted in an effort to improve the IoT's performance in healthcare. This paradigm is used for training and testing of intelligent systems in several researches. Some of them are discussed here:

When it comes to healthcare security, Gope emphasized the need of BSN-based modern healthcare systems in 2016. A healthcare system built on the IOT and based on BSN is what we call BSN-Care. [1]

An investigation was conducted a year later by Subhadeep Sarkar on how WBANs evolved in light of novel health care and nanotechnology. Until the mid-2000s, WPSN were gaining popularity, in which data was sent wirelessly from nodes to a hub. A WBAN is network formed by a group of WBAN. Central nodes and wireless body sensors make up each WBAN. Hubs collect data from all sensor nodes and send it to a central data collecting facility where it is processed further before being made available to the public. [2]

This past year, Tawalbeh was concentrated on cloud computing, networked healthcare, & big data analytics. Use of cloud computing in healthcare has sparked new interest in developing networked health applications and systems. Big data applications in healthcare are supported by this cloudlet-based mobile cloud computing infrastructure. Approaches, techniques, and applications related to big data analytics are explored in this article,

as well. Numerous insights have emerged from the use of big data and mobile cloud computing to develop networked healthcare systems. Health care delivery through a network is shown in this piece. [3]

In 2017, C. Arcadius Tokognon investigated and developed a framework for IoT-based intelligent and reliable monitoring of structural health (SHM). In an Internet of Things context, data routing techniques are explored, including the installation of IoT systems and the deployment of SHM systems. For the complicated and massive data produced by sensors installed on structures, new big data solutions are being developed to handle the volume and speed. [4]

The PPHM system infrastructure was put in place towards the end of 2017 by Abawajy. Because of the IOT and cloud computing, PPHM was conceived. By using real-time ECG monitoring, the proposed PPHM infrastructure may be proven to be appropriate for this purpose. PPHM's proposed infrastructure seems to be flexible, scalable, and energy efficient when used to remotely monitor patients' health, according to early findings from testing. [5]

In an attempt to monitor blood pressure, Nandu Selvaraj used chest-worn patch sensor that provided timing intervals for both pulse and blood pressure. All of the volunteers (N=14, ranging in age from 38 to 53) underwent a series of physiological tests, including deep breathing, hand gripping for extended periods of time, and a modified version of the Valsalva manoeuvre. [6]

In 2018, Stephanie Baker reviewed every facet of the idea, noting the concept's good points and bad points and whether or not they might be used to a wearable IoT healthcare system. Low-power operations are just a few of the issues that will require to be addressed in future healthcare IoT research. [7]

Invasive and non-invasive methods are used to measure blood pressure in the human vascular system. When it comes to doing so, Daniel Badran has the tools and approaches. For continuous monitoring, a hypodermic needle must be used, which requires inserting it beneath the skin and into an artery. Using a non-invasive technology, a patient's blood pressure may be measured in an artery on the skin. [8]

In 2020, Soe Ye Yint Tun will emphasise the research potential of robotics and integrated applications. Designers and developers of healthcare solutions may benefit from the results of this research in creating technology-enabled healthcare programmes for the elderly and enhancing their quality of life. [9]

Additionally to the academic literature, an in-depth study of IoT-based telemedicine architecture by A.S.Albahri will be released in 2020. IoT-based telemedicine categorization is also discussed in this study, which examines several methods to apply it. To conduct this research, the Science Direct, IEEE Xplore, and Web of Science databases were utilised. [10]

MostafaHaghi Kashani hopes to discover, analyse, and categorise current research in HIoT systems in 2021. Our taxonomy includes sensors, resources, communication, applications, and security mechanisms, all of which are broken down into five subcategories in the Internet of Things (IoT). [11]

Patients' health issues will be constantly monitored by Rezgar Hasan Saeed's smart IoT ecosystem in 2021. This will help to alleviate essential patient situations and stimulate personal satisfaction. [12]

Machine learning technologies for large data analysis in healthcare were thoroughly evaluated by Wei Li in 2021. As well as the benefits and drawbacks of present techniques, researchers are focusing on the associated difficulties. [13]

In 2021, Mohd Javaid plans to hang up his boots. We compiled the most significant IoT achievements into a flowchart. [14]

2.1 Literature survey

Table 1 Literature survey

Sno	Author/ year	Objective of research	Mechanism	Benefits	Limitations
1	Gope [5] / 2016	IoT dependent modern healthcare system's cloud computing for healthcare applications	Internet of Things	Proposed secure mechanism for modern health care	There is need to improve the performance

2	Subhadeep [6] / 2016	A Survey of IOT and Cloud Computing-Based Structural Health Monitoring Frameworks Using a patch sensor placed on the chest, noninvasive blood pressure measurements are possible as part of a comprehensive patient health monitoring system.	Health care	Provide efficient wireless sensor system for health care	Need to improve security.
3	Tawalbeh [7] / 2016	IOT in Healthcare: Innovations, Issues, and Possibilities	Health care	Provided suitable solution for data analysis	Lack of reliability and flexibility.
4	Arcadius [10] / 2017	Taking a reading of one's systolic	Internet of Things	Proposed well organized monitoring system for health care	There is lack of technical work.
5	Abawajy [11] / 2017	Applications of IoT in healthcare	Health Monitoring System	Provided suitable approach to monitor health of patient	Need to improve the security and performance of work.
6	Nandakumar [19] / 2018	IoT Frameworks' Influence on Healthcare and Medical System Performance	Health Monitoring System	Suitable for blood pressure measurement	The scope of research is limited.
7	Stephanie [20] / 2018	A Comprehensive Survey of IoT-Enabled Smart Healthcare System Big Data Analytics	Internet of Things	Evaluated the issues related to smart healthcare	Need to provide technical solution for issues.
8	Daniel [25] / 2019	COVID-19 Pandemic issues may be overcome with the aid of IoT-enabled healthcare.	Health Monitoring System	Contribution of research is significant in field of health care	Research is limited to blood pressure measurement
9	MostafaHaghi [28] / 2021	In an IOT dependent modern healthcare system, wsn cloud computing & big data analysis in case of healthcare applications	Internet of Things	Research has reviewed the application of healthcare	There is lack of technical implementation in research.
10	Rezgar [29] / 2021	Survey of IOT and Cloud Computing-Based Structural Health Monitoring Frameworks Using a patch sensor placed on the chest, noninvasive blood pressure measurements are possible as part of a comprehensive patient health monitoring system.	Internet of Things	Research did work on performance issue	Concept of security is ignored.
11	Wei [30] / 2021	The Internet of Things in Healthcare: Innovations, Issues, and Possibilities	Healthcare System	Suitable work for big data analytic has been made for IoT based health care system	System is complex to manage
12	Mohd Javaid [31] / 2021	Taking a reading of one's systolic	Internet of Things	Research supported in real life issues.	Need to do more work on performance

					and security factors.
--	--	--	--	--	-----------------------

[3] Problem Statement

One study on IoT in health care found that the technique utilized hindered IoT performance, which means that further research is needed. The Internet of Things has already been studied in the healthcare sector. A lack of credibility, a small scope, and technological difficulties were some of the drawbacks of previous investigations. A high-performance IoT system is required for the prediction and diagnosis of health concerns. As a consequence, more inquiry is necessary.

[4] Proposed Work

Training an LSTM model for tracing from unauthentic user has been recommended. Sender and receiver details, and failure or success, are included in training dataset. These transactions may fail more frequently than normal if the system is regularly assaulted by an outside force. When a transaction is flagged, the system will prevent the user from using any of system's resources in the following step. The technique built by this well-trained model increases security by enabling transaction authentication on the user side.

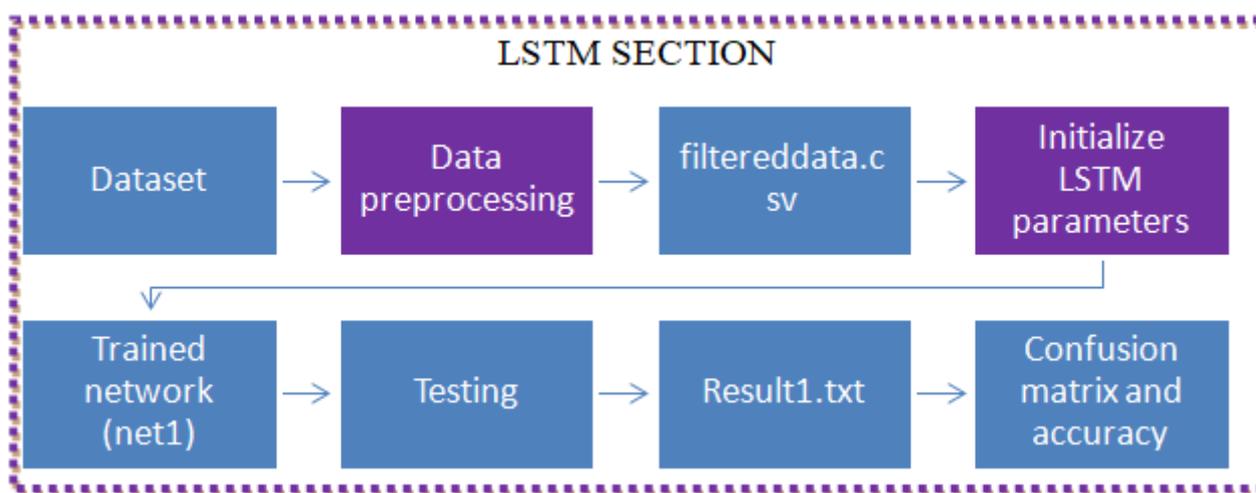


Fig 3 LSTM Trained model

1.1 Gist of Process Flow of Proposed Work

- A transaction dataset is first investigated for training purposes. Traditional approaches are used to train and test datasets in order to get the error values.
- By taking into account scenarios of ed and id, naïve classifier is used to determine accuracy after receiving the error values (nd).
- We'll also look at how well we did with both (ed) and (nd). Accuracy (ed) is filtered if it is higher than Accuracy (nd) else the dataset is filtered based on Accuracy (nd).
- To increase accuracy of model, we use LSTM model to train on filtered dataset. After the model has been trained, a dataset of transaction records is run through the testing module to provide predictions for three different classes. Results from three classes are classified using the KNN classifier and a confusion matrix is shown. Class 1 represents extremely authentic IP, Class 2 represents systems requiring authentication, and Class 3 represents restricted IP. Class 1 is clearly the most secure.
- Confusion matrix is used to determine f1score, recall, accuracy value, and precision. Compare these variables.

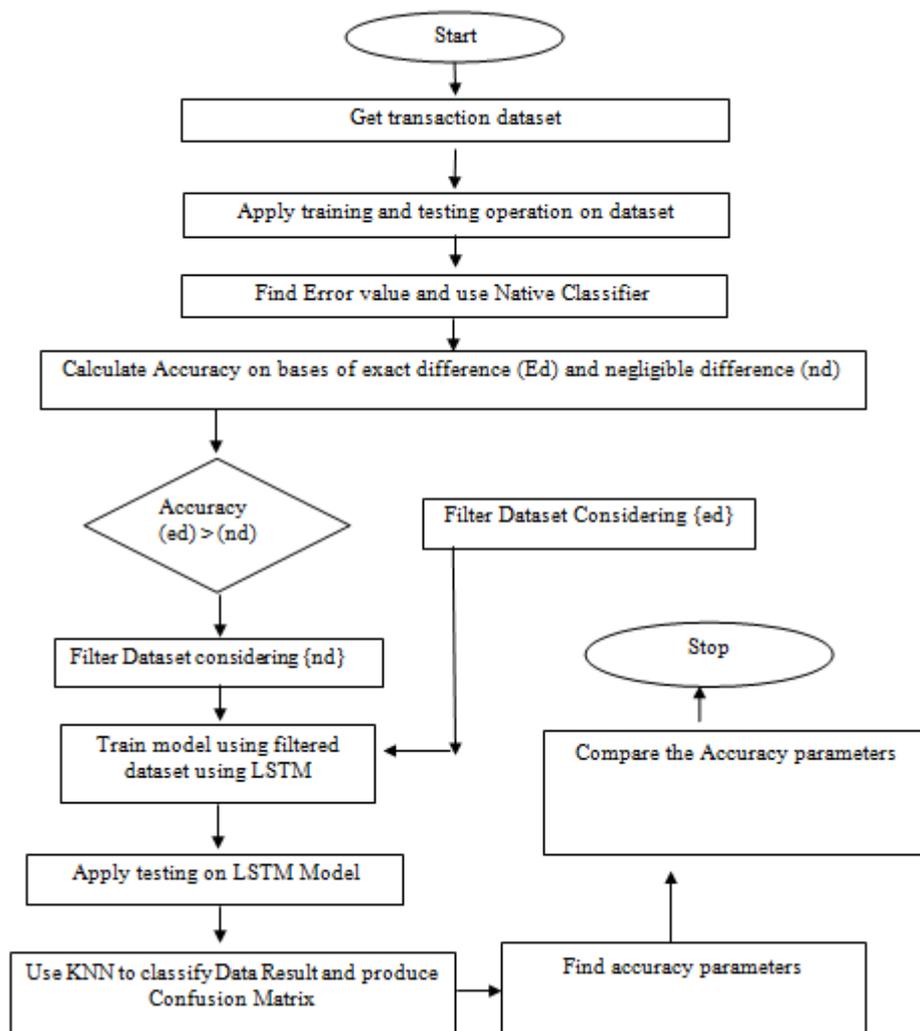


Fig 4 Flow chart of proposed work

[5] RESULT & DISCUSSION

This section has discussed source of dataset and its attributes and records along with training of LSTM network model. finally confusion matrix in case of conventional network model and proposed LSTM network has been simulated in order to get accuracy, f-score, recall value, precision.

5.1 Dataset

Dataset of diabetes has been considered to train LSTM model. This data set is consisting of 9 columns.

Several limits were imposed on the selection of these cases from a broader database. In specifically, all patients here are girls at least 21 years old of Pima Indian descent.

The 9 fields of dataset are as follow

- Pregnancies
- Glucose
- Blood Pressure
- Skin Thickness
- Insulin
- BMI
- Diabetes Pedigree Function
- Age
- Outcome

Sources of data set is original owner and donor of database

(a) Original owners

(b) Donor of database

There have been 768 instances in dataset and 500 record have outcome 0 where as 268 record have outcome 1

5.2 Simulation Result for Traditional Model

During this simulation, a dataset of 712 records was used for training purposes. And a total of 712 records were tested. There are 461 entries in the '0' category, whereas there are 251 items in the '1' category. Out of 768 entries, 712 predictions were correct, while 56 were incorrect.

Table 2 Error and Accuracy in Previous Work

TRUE	712
FALSE	56
TOTAL	768
ACCURACY	92.71%
ERROR	7.29%

Table 3 Confusion Matrix in Case of Previous Work after Simulation

	0	1
0	461	39
1	17	251

Matrix chart on the above confusion matrix is shown below. Overall accuracy is 92.71%.

Table 4 Calculation of confusion matrix in Case of Previous Work

Class	n(truth)	n(classified)	Accuracy	Precision	Recall	F1 Score
1	478	500	92.71%	0.92	0.96	0.94
2	290	268	92.71%	0.94	0.87	0.90

5.2 Simulation Result for Proposed Model

In this case, a training dataset of 768 entries was used. And a total of 768 records were tested. At a point where 476 records are 0, and 261 records are 1. 737 of the 768 predictions made in the simulation were correct, while just 31 were incorrect.

Table 5 Error and Accuracy in Proposed Work

TRUE	737
FALSE	31
TOTAL	768
ACCURACY	95.96%
ERROR	4.04%

Table 6 Confusion Matrix in Case of Proposed Work after Simulation

	0	1
0	476	24
1	7	261

Matrix chart on above confusion matrix is shown below. Overall accuracy is 95.96%.

Table 7 Calculation of confusion matrix in Case of Proposed Work

Class	n(truth)	n(classified)	Accuracy	Precision	Recall	F1 Score
1	483	500	95.96%	0.95	0.99	0.97
2	285	268	95.96%	0.97	0.92	0.94

5.3 Comparative Analysis

A confusion matrix is used to compute accuracy, which is a measure of the accuracy of the findings. A classifier's ability to accurately predict the correct response is measured by its recall. By calculating the measurement's accuracy, one may calculate the measurement's precision. For accuracy, the test's F1 score is used. Accuracy of existing model is compared to conventional work.

Table 8 Comparison of accuracy

Class	Conventional	Proposed LSTM
-------	--------------	---------------

1	92.71%	95.96%
2	92.71%	95.96%

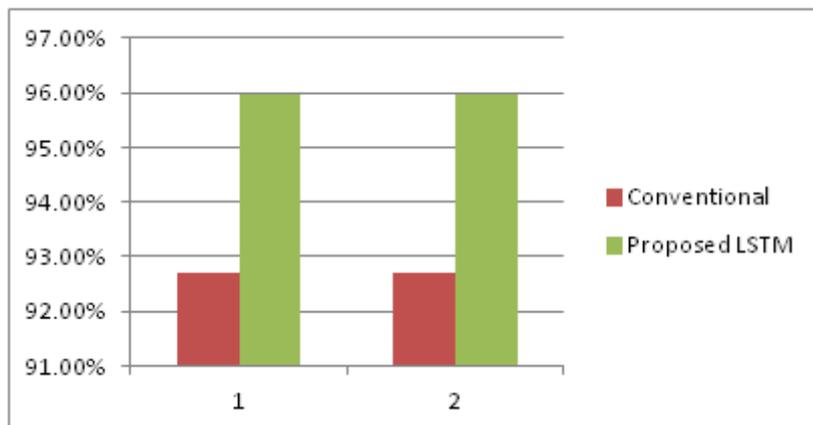


Fig 5 Comparison of accuracy

Precision of existing model is compared to conventional work.

Table 9 Comparison of precision

Class	Conventional	Proposed LSTM
1	0.92	0.95
2	0.94	0.97

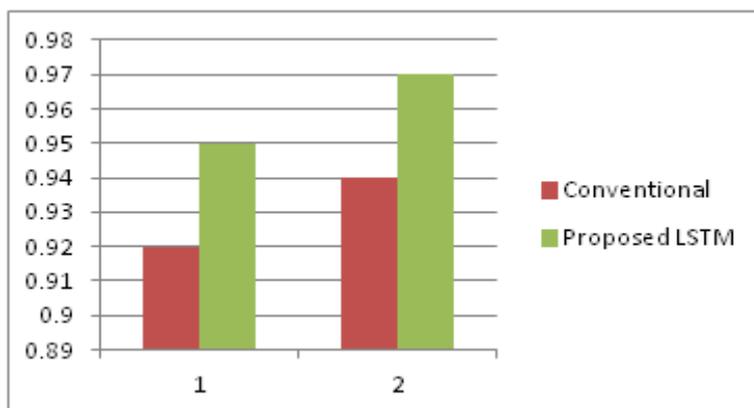


Fig 6 Comparison of precision

Recall of existing model is compared to conventional work.

Table 10 Recall Value

Class	Conventional	Proposed LSTM
1	0.96	0.99
2	0.87	0.92

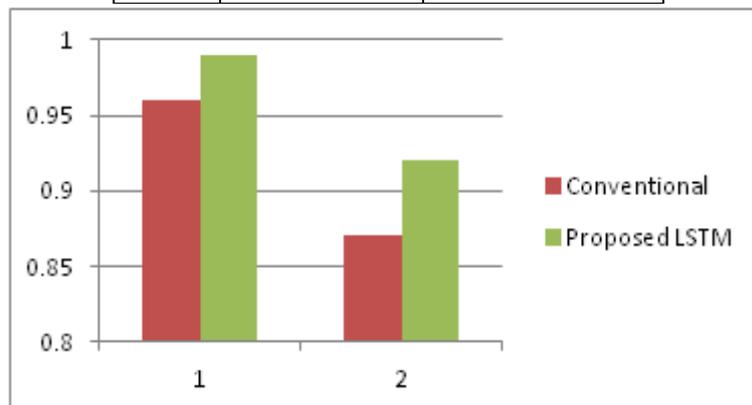


Fig 7 Recall Value

F1 score values of current model are compared to conventional work.

Table 11 F1 Score

Class	Conventional	Proposed LSTM
1	0.94	0.97
2	0.90	0.94

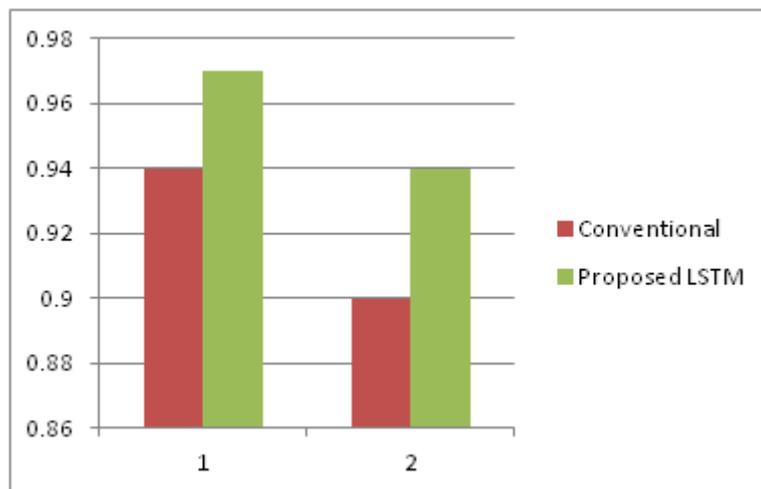


Fig 8 F1 Score

[7] CONCLUSION

The term "Internet of Things" refers to any physical object that contains some form of sensor or processing capacity and is capable of interacting over the Internet or another network. Today, medical researchers are making use of IoT. In this research, a trained network was used to examine a healthcare dataset and make judgments. The LSTM model is used in the existing IoT system to provide a reliable and adaptable health care solution. It is the goal of the Internet of Things to connect everything to internet so that people may live in secure & cozy environment. IoT aims to connect everything in our surroundings. Internet would have impact on devices with embedded computer capabilities. To help patients who reside distant from a healthcare facility, researchers are turning to the IoT. Researching the present IoT system's inadequacies is essential to developing a sustainable and scalable solution for better healthcare. To create a solid basis for health-care applications, the research is necessary. Health-care difficulties are expected to rise in the years to come as a result of COVID 19's adoption. The need for more reliable and precise health-care solutions, as well as the capacity to manage health-related issues remotely with great speed, is essential. Reviewing previous IoT-based studies and looking at factors that affect performance and accuracy are part of the study. It is possible to improve the accuracy of medical prediction and prescription systems by merging an IoT system with an LSTM-based intelligent technique. The study's objective is to enhance performance while also comparing suggested model to currently used approaches. Research will be used to demonstrate the need, motivation, and obstacles of the proposed task. The proposed work is the subject of the investigation.

[8] FUTURE SCOPE

IoT-based healthcare delivery is made possible in large part because to studies like these. Distance education, online education, and the business sector and real-world applications all employ this approach. It will be more beneficial, more reliable, and less complicated to utilise in the future because of this research. This methodology improves the ability to identify health issues earlier.

REFERENCES

1. K. Srinivas, B. Kavitha Rani, Dr. A. Govrdhan (2010), "Applications of Data Mining Techniques in Healthcare & Prediction of Heart Attacks", proceedings of International Journal on Computer Science & Engineering, vol. 2 (2), pp. 250-255.
2. Wen-Chen Lee, Bor-Wen Cheng (2011), "An Intelligent System for Improving Performance of Blood Donation", Journal of Quality, vol. 18 (2), pp. 173-177.
3. Chirag M. Shah, et al (2014), "Smart Security Solutions based on Internet of Things (IoT)," International Journal of Current Engineering and Technology, Volume 4, pp. 3401-3404.

4. A. R. Biswas and R. Giaffreda(2014), "IoT and Cloud Convergence : Opportunities and Challenges," IEEE pp. 375–376.
5. P. Gope and T. Hwang (2016), "BSN-Care: A Secure IoTBased Modern Healthcare System Using Body Sensor Network," IEEE Sensors Journal, vol. 16, no. 5, pp. 1368–1376.
6. S. Sarkar and S. Misra (2016), "From Micro to Nano: The Evolution of Wireless Sensor-Based Health Care," IEEE Pulse, vol. 7, no. 1, pp. 21–25.
7. L. A. Tawalbeh, R. Mehmood, E. Benkhelifa, and H. Song (2016), "Mobile Cloud Computing Model and Big Data Analysis for Healthcare Applications," IEEE Access, vol. 4, pp. 6171–6180.
8. K. Lam and C. Chi (2016), "Identity in the Internet-of-Things (IoT): New Challenges and Opportunities," School of Computer Science and Engineering, Volume 1.
9. M. A. Iqbal, O. G. Olaleye, and A. Bayoumi (2016), "A Review on Internet of Things (Iot): Security and Privacy Requirements and the Solution Approaches," Global Journal of Computer Science and Technology: E Network, Web & Security, Volume 16 Issue 7.
10. T. C. Arcadius, B. Gao, G. Tian, and Y. Yan (2017), "Structural Health Monitoring Framework Based on Internet of Things: A Survey," IEEE Internet of Things Journal, vol. PP, no. 99, p. 1,.
11. J. H. Abawajy and M. M. Hassan (2017), "Federated Internet of Things and Cloud Computing Pervasive Patient Health Monitoring System," IEEE Communications Magazine, vol. 55, no. 1, pp. 48–53.
12. Mahdi H. Miraz, Maaruf Ali (2017), "A Review on Internet of Things (IoT), Internet of Everything (IoE) and Internet of Nano Things (IoNT) " , Department of Computer Science and Software Engineering pp. 219–224.
13. A. Tiwari and H. Maurya (2017), "Challenges and Ongoing Researches for IOT (Internet of Things): A Review," , Volume 5, no. 2, pp. 57–60.
14. ArunPushpan, Ali Akbar N (2017) "Data Mining Applications in Healthcare", proceedings ofIOSR Journal of Computer Engineering, pp. 04-07.
15. Muhammad UmerSarwar, Muhammad KashifHanify, RamzanTalibz, AwaisMobeenx, Muhammad Aslam (2017) "A Survey of Big Data Analytics in Healthcare", proceedings of International Journal of Advanced Computer Science & Applications, vol. 8 (6), pp. 355-359.
16. Akanksha Bali, MohitaRaina, SimranGupta (2018) "Study Of Various Applications Of Internet Of Things (IOT)," International Journal of Computer Engineering & Technology, Volume 9, Issue 2.
17. E. P. Yadav (2018), "IoT : Challenges and Issues in Indian Perspective," 3rd Int. Conf. Internet Things Smart Innovative Usages, pp. 1–5.
18. S. Kumar and Z. Raza, "A K-Means Clustering Based Message Forwarding Model for Internet of Things (IoT) (2018)," 2018 8th International Conference on Cloud Computing, Data Science & Engineering (Confluence), Noida, pp. 604-609.
19. Nandakumar Selvaraj; Hitesh Reddivari (2018), Feasibility of Noninvasive Blood Pressure Measurement using a Chest-worn Patch Sensor.
20. Stephanie Baker, Wei Xiang, Senior Member, IEEE, and Ian Atkinson (2018), Internet of Things for Smart Healthcare: Technologies, Challenges, and Opportunities.
21. S. Durga, Mr. Rishabh Nag, Esther Daniel (2019), "Survey on Machine Learning and Deep Learning Algorithms used in Internet of Things (IoT) Healthcare" IEEE
22. J. Xiong et al. (2019), "Enhancing Privacy and Availability for Data Clustering in Intelligent Electrical Service of IoT," in IEEE Internet of Things Journal, vol. 6, no. 2, pp. 1530-1540.
23. T. Farnham (2019), "Indoor Localisation of IoT Devices by Dynamic Radio Environment Mapping," 2019 IEEE 5th World Forum on Internet of Things (WF-IoT), Limerick, Ireland, pp. 340-345.
24. C. Han et al. (2019), "A Multi-objective Service Function Chain Mapping Mechanism for IoT networks," 2019 15th International Wireless Communications & Mobile Computing Conference (IWCMC), Tangier, Morocco, pp. 72-77.

25. Daniel Badran; Paulo Abreu; Maria Teresa Restivo (2019), "Blood Pressure Measurement".
26. Soe Ye Yint Tun, Samaneh Madanian & Farhaan Mirza, (2020) Internet of things (IoT) applications for elderly care: a reflective review.
27. A. S. Albahri^{ab} Jwan K. Alwan^c Zahraa K. Taha Sura F. Ismail^c Rula A. Hamid^c A. A. Zaidan^a O. S. Albahri^a B. B. Zaidan^{ag} A. H. Alamoodi^a M. A. Alsalem (2020), IoT-based telemedicine for disease prevention and health promotion: State-of-the-Art.
28. Abdullah, P. Y., Zeebaree, S. RM., Shukur, H. M., and Jacksi, K. (2020). HRM System Using Cloud Computing for Small and Medium Enterprises (SMEs). *Technology Reports of Kansai University*, 62(4), 1977–1987.
29. Abdulraheem, A. S., Salih, A. A., Abdulrahman, I. A., Sadeeq, M. AM., Salim, N. OM., Abdullah, H., Khalifa, F. M., and Saeed, R. A. (2020). Home Automation System Based on IoT. *Technol. Rep. Kansai Univ*, 62(5), 2465–2476.
30. Abdulla, A. I., Abdulraheem, A. S., Salih, A. A., Sadeeq, M. AM., Ahmed, A. J., Ferzor, B. M., Omar, S. S., and Mohammed, S. I. (2020). Internet of Things and Smart Home Security. *Technol. Rep. Kansai Univ* 62(5):2465–2476.
31. Mostafa Haghi Kashani^a, Mona Madanipour^b, Mohammad Nikravan^a, Parvaneh Asghari^c, Ebrahim Mahdipour (2021), A systematic review of IoT in healthcare: Applications, techniques, and trends.
32. Rezgar Hasan Saeed, Hivi Ismat Dino (2021), Impact of IoT Frameworks on Healthcare and Medical Systems Performance.
33. Wei Li, Yuanbo Chai, Fazlullah Khan, Syed Rooh Ullah Jan, Sahil Verma, Varun G. Menon, Kavita & Xingwang Li (2021), A Comprehensive Survey on Machine Learning-Based Big Data Analytics for IoT-Enabled Smart Healthcare System, 2021.
34. MohdJavaid (2021), Internet of Things (IoT) enabled healthcare helps to take the challenges of COVID-19 Pandemic.
35. K. Anitha Kumari, Avinash Sharma, Chinmay Chakraborty and M. Ananyaa, (2021) Preserving Health Care Data Security and Privacy Using Carmichael's Theorem-Based Homomorphic Encryption and Modified Enhanced Homomorphic Encryption Schemes in Edge Computing Systems.
36. Akkaş, M. A., Radosveta, S., and Hüseyin, E. Ç. (2020). Healthcare and Patient Monitoring Using IoT. *Internet of Things* 100173.
37. Alzakholi, O., Haji, L., Shukur, H., Zebari, R., Abas, S., & Sadeeq, M. (2020). Comparison Among Cloud Technologies and Cloud Performance. *Journal of Applied Science and Technology Trends*, 1(2), 40-47. doi:10.38094/jastt121
38. Shukur, H., Zeebaree, S., Zebari, R., Ahmed, O., Haji, L., & Abdulqader, D. (2020). Cache coherence protocols in distributed systems. *Journal of Applied Science and Technology Trends*, 1(3), 92-97.
39. Shukur, H., Zeebaree, S., Zebari, R., Zeebaree, D., Ahmed, O., & Salih, A. (2020). Cloud computing virtualization of resources allocation for distributed systems. *Journal of Applied Science and Technology Trends*, 1(3), 98-105.
40. Tuli, S., Basumatary, N., Gill, S. S., Kahani, M., Arya, R. C., Wander, G. S., & Buyya, R. (2020). Healthfog: An ensemble deep learning based smart healthcare system for automatic diagnosis of heart diseases in integrated iot and fog computing environments. *Future Generation Computer Systems*, 104, 187-200.

The Suffering of Subaltern in the Sub-Saharan Culture

Angelitta Joanne Devika. A

St. Xavier's College, Palayamkottai, (Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

ABSTRACT

The genesis of suffering of Afro-American women has multi-layered factors they are race, class, gender and sexual abuse. But the struggle of these women is still underrepresented. The lawlessness in the country should be eliminated. Superficially, the writers have come up with juxtaposed images of black women – Alice Walker's Celie victimized because of her poverty, race and gender. Alice Malsenior Walker is an African-American author and feminist. Her works focus on the role of women of color in culture and history. She is an open bisexual, and sympathetic towards people of all sexualities, ethnicities, and races. She has described how both the African-American men and women have faced oppression in terms of race, class, and ethnicity. "The Color Purple" has represented the very bottom structure of the society. Celie, the downtrodden, degraded, despised, abused, is transformed into an independent and liberated woman at the end of the novel. She has moved from being ugly to a figuratively beautiful swan. She has moved from being the beast of burden to physical and mental declarations of independence, to a reunion with her children and her sister. Over the centuries, the role of men and women are regarded according to their society's perception of living. Imagine that half of the little girls and the adult women you meet have been raped or molested in their home, school, or church, or in some other place where they should be safe. That's the reality faced by a large portion of the global poor. And that's the disturbing picture that Gary Haugen and Victor Boutros paint in "The Locust Effect" an indispensable book that urges readers to confront the massive epidemic of sexual violence, forced labor, illegal detention, land theft, assault, police abuse that strikes poor people throughout the developing world and prevents them from escaping poverty.

Keywords - oppression, sexual violence, poverty.

INTRODUCTION

Gary A. Haugen, the International Justice Mission, founder writes in his book, "The Locust Effect" thus: "places like the Eastern Congo, where, in 2011, armed conflict in the region reportedly gave rise to an epidemic of sexual assaults against women at the stunning rate of 48 rapes every hour." (LE,1). Gary also accounts a story through Sashmeeta that women are abducted, enslaved, raped and tortured in the country side of the "Silicon Valley of India". Then the author of the Locust Effect swoops over into East Africa and uncovers a pitiable yet powerful narration of Laura in Nairobi, Kenya. He pens these paintings with a singular purpose. Everyday predatory violence only adds to the problem of poverty. To the author of the book, without alleviating the predatory violence, poverty cannot be eliminated.

This paper concentrates on the suffering of African women in the hands of men. The existential suffering of Celie's and Laura's will continue because lawlessness in Africa is understandably real. An African woman can live a meaningful, normal life, only if the justice system of Africa is transformed. India was able to abolish Sati, the Devadasi system only through the law of the land. Millions of women's lives have been made to continue because of the social transformation that has taken place through the lawful acts of the country.

Gary Haugen presents many case histories of sexual assaults in his book "The Locust Effect". For the present paper I would like to use two of his case studies, one from Kenya and one from India. Laura of Kenya was used, was abused by her own father. Laura's case was a parallel we see in Celie, the protagonist of the novel, "The Color Purple" by Alice Walker. Mariammal was a brick factory worker who was raped by the brick factory owner. Both in Laura's case and in Mariammal's case, they did not get any justice. The have-nots of the developing countries are failed to get justice because the law enforcement is pretty weak in the developing countries. Naomi fought for Laura and Sashmeeta fought for Mariammal. Both of them went through the process with care for the details. Yet their efforts failed miserably. The judiciary system of the developing countries is to be blamed squarely in both these cases.

The African women go through unbearable pain and the unfathomable sufferings in their everyday lives because of the sexual abuse and sexual violence they undergo. Celie in Walker's "The Color Purple" and Laura in real life were not aberrations who went through agonizing pain. Literary people strongly criticized Walker for beginning her novel through rape. Walker told her critics that "rape" could not be portrayed in unobtrusive terms. And she also gave them a stunning statistic that for every three minutes a girl is raped in Africa. And it

should not be painted mildly or gently.

Walkers and Hagen's have unearthed the anguishing pain of Celie's and Laura's. The pain and suffering of these subalterns should be ended. Apart from the law enforcement, educating the other gender about the evils of rape and sexual assault are equally crucial. The suffering subalterns in the sub-Saharan culture should be made to live healthy, meaningful lives.

Celie lives as a slavish wife to her brutal husband. She is sexually used, abused and raped by her step-father. And she is sold to her present husband Mr.----- with four children. Like many African women, Celie becomes silent. She writes letters to God about her predicament. She feels helpless and powerless and endures her hell. Hatred and violence have almost killed the protagonist. Walker, the novelist, regenerates Celie through Shug, her husband's mistress, her sister Nettie and her daughter-in-law Sofia. Celie's character is built on endurance, faithfulness, vitality and rebirth through the power of nurturing love. The brief scenario of the novel paints the regeneration from a brutalized victim to an entrepreneur.

The blue-eyed Laura's sexual assault began in her home through her father. After a period of time, Laura's tears dry up. She goes to buy a bathing sponge, Joseph Irungu grabs her and rapes her and throws 50 cents. In the world of Laura, the home is not safe. In the absence of effective Law enforcement Laura's school will not protect girls from violence.

Laura, like Celie in the novel, becomes silent about her agony. As a recent UN study concluded a "significant, though rarely mentioned factor behind low school enrolment in poor urban neighborhood is a perceived lack of safety, especially for girls" (LE,10) knowing all this, Laura, one day, steps into in her fourth-grade class, when Antonia Mutokia pulls her into a shanty room and rapes her and tosses 75 cents at her. Thus, Gary Haugen portrays the miserable life of Laura in his book "The Locust Effect".

The shame, the fear, the hopelessness silence Laura as we see in Walker's Celie, in *Color Purple*. Predators around her know too well about Laura's predicament and relentlessly assault her. Fortunately for Laura, a social worker named Naomi comes to her rescue. Naomi fights for Laura tooth and nail but in vain. Naomi feels utterly defeated.

Laura's story presents the readers clearly that lawlessness and chaos are rampant in Nairobi. It only proves the appalling neglect of the basic criminal justice system in Kenya.

Sashmeeta, in Bangalore goes through the same ordeal in India for Mariammal. She represents her world of billions of poor people who are worn out by the criminal justice system in India. Sashmeeta fights Mariammal's case with absolute sincerity but only in vain.

Laura and Mariammal are poor. They remain poor because of predatory violence, argues Gary A. Haugen. He portrays this problem thus, "the way our world works, poor people-by virtue of their poverty – are not only vulnerable to hunger, disease, homelessness, illiteracy and a lack of opportunity; they are also vulnerable to violence." (LE, 12). Common everyday violence does make a great impact on the plight of the global poor, argues Paul Collier, in his "The Bottom Billion". "Violence in the developing world is like grief in the developed world – it's everywhere, but we just don't see it." Writes Gary (LE,13) (*Poverty Hidden Terror* chapter 2)

Gary analyses three reasons for the hidden nature of violence. To him, behind the violence there is an intelligent, willful perpetrator who is working hard – frequently very hard – to hide it. Secondly, both the perpetrator and the victim want to hide it.

What did the world learn from listening to the poor? The study provided many insights about poverty, but when the World Bank released the press release, it "headlined two overarching realities: powerlessness and violence, especially violence against women and girls." (LE, chapter 2) The findings from "Voices of the poor" confirm that the poor "experiences much higher rates of everyday violence than the rest of us, that people who live in impoverished urban areas increasingly fear violence more than anything else, and that the poor frequently name violence as their 'greatest fear' or 'main problem.'

Through Celie in Walker's "The Colour Purple" and Laura in "The Locust Effect" the problem of predatory violence against girls and women are well established. Now, we need to find ways of resolving the problem of violence against women.

Shug Avery, Nettie and Sofia rescue Celie and regenerate her in Walker's "The Color Purple". Initially, Avery is repulsed by Celie. But it is Celie who helps Avery to recover from her illness. The love in Celie comes to the

fore in nursing Avery. Celie has always idolized Avery for her sheer beauty. When Shug Avery sees through Celie, she is able to bring out the best in Celie. It is Avery who gives her a meaningful sexual experience. Both her step-father and her husband thoroughly used her as an object. Probably, Celie hates the world of sex with both the men. When Avery touches her with love and warmth, Celie understands the real value of sex for the first time. It is Avery who carefully builds her self esteem and self-confidence in Celie. It is Avery who makes Albert stop using her as a sex object. It is Avery who takes Celie with her and makes her see the world in all its beauty. Thus, Avery rebuilds the totally destroyed character of Celie.

A line in Letter No.81 sums up the relationship of Nettie with her sister Celie: "But all things look brighter because I have a loving soul to share them with" (CP,214). It is Nettie who helps Celie to write letters to God. Nettie always urges Celie to be strong and to keep fighting. The amazing aspect of their relationship is in their selfless love for each other. She often acts as a protector for her sister Celie. Celie's love for Nettie provides her with a great source of vibrant youth. Celie always appreciates Nettie's faith in her. She happens to constantly teach her sister Nettie. Nettie has a very different experience from Celie. Her letters reveal the oppression of women by men, of blacks by whites and even of blacks by blacks which is universal in nature. The imperial, racial and cultural conflict and oppression Nettie encounters in Africa parallel the smaller-scale abuses and hardships that Celie experiences in her place.

Sofia is a strong, fierce and daring person. She does not come to terms with the oppression of the black women. A black woman was a virtual prisoner in the system. White men controlled the state and black men controlled the black house-holds. Sofia constantly fights the system, goes to prison for nearly twelve years.

The black women become doubly subaltern in nature. The black women not only become subservient to whites but also to black men. Hence, the suffering of the black women becomes unparalleled in the world history. Dalit women in India can be compared with the black women in Africa. Thus, the suffering of subalterns of sub-Saharan culture is unique and unfathomable. The black women's life is plainly unlivable. Celie accepts her place and submits to the beatings that go along with it in her home. Celie's situation is so bad that Nettie describes it as a burial, "It's worse than that". Celie thinks, "If I was buried, I wouldn't have to work". (CP,26)

Sofia being bold shows the whites and the black men not to take black women for granted. Her courage gives the Celies and the Lauras the strength and the boldness to fight back. Walker's women characters like Nettie, Shug Avery and Sofia show the black women to keep themselves in the fight through education, creativity and courage. They not only rebuild Celie but transforms Mr. Albert. They put Albert in his place. When Avery leaves for

Memphis, she does not take with her Mr. Albert but Celie. When Celie returns a regenerated personality the unruly, wicked Mr. Albert becomes a changed man. Thus, Walker resolves the problem of Celie in her Novel through acts of love. Walker uses love in transforming Celie.

Julie Bindel, a journalist from 'The Guardian' visits the Kenyan village Umoja. Only black women live there. It was "a refuge for survivors of sexual violence" (Guardian 2020). The journalist is able to realize that Umoja's inhabitants thrive in the single-sex community.

Jane 38, tells her story which is 'alive with pain'. She shows a 'deep scar on her leg' when she is raped by "men in Gurkha uniforms". When she revealed the incident to her husband, he beat her with a cane. So, Jane is in Umoja with her children now.

Women in Umoja make jewellery and sell them to tourists. They live frugally in huts made in bamboo. Birds sing gloriously in the typical Samburu village, where no men live. They greet the journalist's arrival by singing and dancing from the women. They wear patterned skirts, brightly colored shirts and a Kanga (a colorful wrap tied on their shoulders).

"The village was founded in 1990 by a group of 15 women who were survivors of rape by local British soldiers" (Guardian,2020). The village has become a refuge for many black women who suffer at the hands of men. Rebecca Lolosoli is the founder of Umoja and the village matriarch. Lolosoli has faced repeated threats and attacks from local men but she is undeterred. The Samburu culture is "deeply patriarchal" in nature. Now there are 47 women and 200 children in Umoja. The enterprising women have a regular income which helps them to sustain their lives.

These suffering subalterns from sub-Saharan culture need such out-of-the box thinking to live a meaningful and happy life. Celie's and Laura's need more Umoja. 'Women in Umoja have freedom' but outside Umoja women are ruled by men. The African government itself can think of creating such Umoja's for black women who need

refuge from sexual abuse and sexual assault. The readers of the Guardian support the Umoja black women.

African educational institutions, both schools and colleges need to be protected from sexual abuse and sexual assaults. The law enforcement at least for the protection of school and college going children becomes mandatory. The schools and colleges should have a curriculum, especially for boys, about the safety of women in particular. We need more IJM's to work diligently for the upliftment of the black women through the protective wings of the organizations.

The international institutions like W.H.O, World Bank need to take initiatives to address the safety of the black women. As Gary A. Haugen writes in his book "The Locust Effect", the issue of predatory violence needs to be addressed along with the issue of alleviating poverty. The police, the judiciary, the medical personnel in the developing world need to be transformed to develop a holistic mission. The international court of justice, if they can, can help to build a solid justice system in place all through the developing world. The suffering of the subalterns of the sub-Saharan culture can be eliminated. The white men and the black men ought to be a part of the transformation of the culture.

CONCLUSION

"The Guardian" reports that the British soldiers have played havoc in the lives of the black women. Will the British Government take responsibility for undermining a culture and redress it? "The Guardian" also reports its readers that the British Government is not willing to own up to the havoc made by the British soldiers who stayed there over a period of three decades. The colonialism has ended but the after-effects of colonialism continue to haunt sub-Saharan culture. Umoja is a living proof of the residuals of British colonialism.

WORK CITED

1. Bindel, Julie "The village where men are banned." The Guardian, 15th October 2020 Published.
2. Haugen, Gary A and Victor. The Locust Effect: Why the End of Poverty Requires the End ... Boutros. 2014
3. Walker, Alice The Color Purple. New York: Harcourt, 1992

Self- Efficacy, Burnout and Sex Roles among Women Employees: A Psychological Analysis

Nirmala Kaushik and Ramnath

Department of Psychology, CMG, GCW, Bhodia Khera, Fatehabad
Department of Psychology, Govt. College, Bhuna

ABSTRACT

In the present scenario the working women are facing different kinds of problems like stress and burnout at work place as well as at home. They have their multiple roles to play Sex role and self efficacy are also contributing in increasing the burnout. Burnout is a state of physical, emotional, and mental exhaustion caused by long term exposure to demanding work situations. Keeping all these views in mind the present study was conducted on 200 women employees in Haryana and Delhi region. The results depicted that positive correlation was found between self efficacy and personal accomplishment. A significant negative correlation was explored between self efficacy and emotional exhaustion in women employees.

INTRODUCTION

Burnout is a state of physical, emotional, and mental exhaustion caused by long term exposure to demanding work situations. Burnout is a chronic affective state comprised of emotional exhaustion, physical fatigue, and cognitive weariness (Shirom, 1989, 2003). Burnout is defined as a negative psychological experience that is the reaction to job-related stress (Deutsch, 1984; Ratlif, 1988). Burnout happens when people who have previously been highly committed to a job lose all interest and motivation. (Maslach, 1993), burnout is described as " a psychological syndrome of emotional exhaustion, depersonalization, and reduced personal accomplishment that can occur among individuals who work with other people in some capacity. Burnout in an individual is inferred to result from job strains, which may lead to maladaptive coping responses and poor work performance (Tang & Yeung, 1999). Burnout is not simply excessive stress. Rather, it is a complex human reaction to ongoing stress, and it relates to feeling that your inner resources are inadequate for managing the tasks and situations presented to you. Burnout includes an emotional exhaustion and an increasingly negative attitude toward your work, perhaps, the life. It is the exhaustion of physical or emotional strength or motivation usually as a result of prolonged stress or frustration. Emotional exhaustion as being caused by high emotional demands (emotional labour) necessitated by a particular job. Prior work has argued that emotional demands are in fact the most likely to cause stress (Zapf et al., 1999), and such demands have together been labelled emotional labour (Ashforth and Humphrey 1993). Emotional labour refers to the necessity of service operatives to display certain emotions that are seen as appropriate to that role.

It is an open truth that working women have to face problems just by virtue of their being women. The social attitude considers women fit for certain jobs and not others. Thus women find employment easily as nurses, doctors, teachers the caring and nurturing sectors, secretaries or in assembling jobs-the routine submissive sectors. But even if well qualified women engineers or managers or geologists are available, preference will be given to a male of equal qualification. Women has to almost always shoulder the burden of household chores besides working outside from home as well. A woman could still bear up with these problems if she had control over the money she earns. But in most families even now her salary is handed over to father, husband or in-laws. So the basic motive for seeking employment of getting independence is nullified in many women's case. Sex roles and lack of self efficacy due to the maltreatment at work and home leads to the burnout among women. Problems of gender bias beset women in the working sector. The psychological pressure of all this can easily lead to a woman quitting her job. Most of the problems that beset working women are in reality rooted in the social perspective of the position of women. Traditionally men are seen as the bread winner and women as the house-keepers, child bearers and rearers. This typecast role model continues to put obstacles before the working women. A fundamental change is required in the attitudes of the employers, policy makers, family members and other relatives and the public at large.

When the individual is stressed, he cares too much, but when he is burned out, he doesn't see any hope of improvement. It results when individuals experience increasing amount of negative stress. Tracy (2000) describes this as "a general wearing out or alienation from the pressures of work". One potential result of an extended exposure to a single or to multiple stressors is burnout, defined by Maslach, Schaufeli, and Leiter (2001) to include exhaustion, feelings of cynicism and detachment, a sense of ineffectiveness, and lack of accomplishment. High stress jobs can lead to more burnout than normal ones. Maslach, Schaufeli, and Leiter

(2001) noted that individuals with high MBI scores tend to also exhibit higher levels of job dissatisfaction and lower workplace effectiveness. Work by Lee and Ashforth (1990) supports the argument that high and consistent exposure to stress can lead to burnout. Cropanzano, Rapp, and Bryne (2003) find that long-term exposure to high levels of stressors can lead to emotional exhaustion, which has been shown to degrade organizational commitment and increase turnover intentions. Teacher burnout is a condition caused by depersonalization, exhaustion and a diminished sense of accomplishment (Schwab et al. 1986). While "work appears as a major source of stress for working people, teachers appear to experience more stress through work than non-teachers" (Cox and Brockley 1984). In-depth studies have established a clear linkage between prolonged stress and burnout (Blasé 1986). Numerous studies of American teachers, particularly those in urban schools, have documented the high level of stress and burnout among teachers (Cunningham 1983). Burned out teachers are not effective in the classroom because "burnouts who remain use significantly less task oriented behavior (i.e. less hands-on, active learning), and provide fewer positive reinforcements to their students (Koon, 1971). The research supports the contention that stress affects teachers' effectiveness with students (Blase 1982). The most influential description of burnout is the operational definition by Maslach & Jackson (1986), describing burnout as a syndrome with three components, emotional exhaustion, depersonalization and reduced personal accomplishment. Burnout is defined as a process, starting with emotional exhaustion, then leading into feelings of depersonalization and later the feeling of reduced personal accomplishment. Freudenberger suggested that a person attempting to achieve unrealistic expectations, whether imposed socially or internally, may become exhausted both physically and mentally (Miller, 1995). At about the same time, Maslach was studying the ways in which people coped with emotional arousal on the job (Maslach & Schaufeli, 1993).

Soares and Sundin (2007) revealed that 21% of the women had high burnout, and compared to those with low burnout, they were more often younger, divorced, blue-collar workers, lower educated, foreigners, on unemployment/retirement/sick-leave, financially strained, used more medication and cigarettes, reported higher work demands and lower control/social support at work, more somatic problems (e.g. pain) and depression. Women with high burnout were apparently faring poorly financially, emotionally and physically.

A gender role is defined as a set of perceived behavioral norms associated particularly with males or females, in a given social group or system. Gender is one component of the gender/sex system, which refers to "The set of arrangements by which a society transforms biological sexuality into products of human activity, and in which these transformed needs are satisfied" (Reiter, 1975). A gender role is a theoretical construct in the social sciences and humanities that refers to a set of social and behavioral norms that, within a specific culture, are widely considered to be socially appropriate for individuals of a specific gender. Gender here refers to an individual's inner sex or psychological sense of being a male or female irrespective of one's (outer) sex identity as determined by one's sexual organs. There are two main genders: masculine (male) or feminine (female). Gender roles refer to the set of attitudes and behaviors socially expected from the members of a particular gender identity. Gender roles, unlike natural human genders, are socially constructed. They may reflect natural gender aspirations of the members of that gender identity, or they may be politicized and manipulated, which then result in the oppression of people. A person's gender role is composed of several elements and can be expressed through clothing, behavior, choice of work, personal relationships and other factors.

Self-efficacy is a person's belief in his or her ability to succeed in a particular situation. A self-efficacy belief in human functioning is that "people's level of motivation, affective states, and actions are based more on what they believe than on what is objectively true" (Bandura, 1997). Perceived self-efficacy is defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. Self-efficacy beliefs determine how people feel, think, motivate themselves and behave. Such beliefs produce these diverse effects through four major processes. They include cognitive, motivational, affective and selection processes. Self-efficacy relates to a person's perception of their ability to reach a goal. People generally avoid tasks where their self-efficacy is low, but will engage in tasks where their self-efficacy is high. People with high self-efficacy in a task are more likely to expend more effort, and persist longer, than those with low efficacy. Self-efficacy has been defined in a variety of ways: as the belief that one is capable of performing in a certain manner to attain certain goals (Ormrod, 2006). It is a belief that one has the capabilities to execute the courses of actions required to manage prospective situations. It has been described in other ways as the concept has evolved in the literature and in society: as the sense of belief that one's actions have an effect on the environment (Steinberg, L. (1998)., as a person's judgment of his or her capabilities based on mastery criteria; a sense of a person's competence within a specific framework, focusing on the person's assessment of their abilities to perform specific tasks in relation to goals and standards rather than in comparison with others' capabilities.

OBJECTIVES

1. To find out significant correlation between Self efficacy and burnout among women employees
2. To find out significant correlation between Burnout and sex roles among women employees.

METHOD

Sample

The present study is conducted on a sample of 200 female employees working in the industrial sector. The sample was comprised on females having age range from 25 to 50 years. The sample was collected from industries in Haryana State and Delhi region.

Tools used

1. **Bem Sex Roles Inventory** (Bem, 1974). The BSRI was developed by Sandra Bem in 1974 to measure masculine, feminine and androgynous personality traits among men and women. The Bem Sex Role Inventory (BSRI) provides independent assessments of masculinity and femininity in terms of the respondent's self-reported possession of socially desirable, stereotypically masculine and feminine personality characteristics. This can also be seen as a measurement of the extent to which respondents spontaneously sort self-relevant information into distinct masculine and feminine categories. The self-administering 60-item questionnaire measures masculinity, femininity, androgyny, and undifferentiated, using the Masculinity and Femininity scales. A total of sixty questions--twenty regarding masculine characteristics, twenty feminine, and twenty neutral. Participants rate each item on a 7-point scale on how true each of these characteristics is for them. The manual published in 1978 with some updated information on the BSRI reported internal consistencies between .75 and .90. Test retest reliabilities for the Femininity and Masculinity scales for the original BSRI were .82 and .94 respectively among females and .89 and .76 among males.
2. **Maslach Burnout Inventory** (Maslach et al., 1996). A set of 19 items from the latest version of the Maslach Burnout Inventory Form ES (MBI) (Maslach et al., 1996) which has been developed especially for educational institutions was used to provide a self-assessment of each teacher's perceived burnout level. The original 22-item MBI has three factor-analytically derived scales: emotional exhaustion, depersonalisation and personal accomplishment. Whereas emotional exhaustion and depersonalisation are positively related to burnout, personal accomplishment is negatively related to burnout. A five-point Likert response format ranging from Almost Never to Almost Always was used to score each item.
3. **Self Efficacy Scale**, (Schwarzer, 1981). The scale contains 10 items and is a four-point scale. The scale was created to assess a general sense of perceived self-efficacy with the aim in mind to predict coping with daily hassles as well as adaptation after experiencing all kinds of stressful life events. The scale is designed for the general adult population, including adolescents not below the age of 12. Reliability coefficient ranged from .76 to .90. Criterion-related validity is documented in numerous correlation studies where positive coefficients were found with favorable emotions, dispositional optimism, and work satisfaction. Negative coefficients were found with depression, anxiety, stress, burnout, and health complaints.

Procedure

The participants were taken from different industries of Haryana state and Delhi region. Before administering the test rapport was establish. Instructions were made clear to all the subjects. Questionnaires were administered individually as well as in groups as per the conveniences of participants.

RESULTS AND DISCUSSION

The present research paper is aimed to investigate the relationship of burnout, self efficacy and sex roles among the working women employees. Like most human services professionals, teachers are prone to experience burnout due to their intense, everyday interaction with students, colleagues, administration and parents (Friedman, 2006; Schaufeli and Enzmann, 1998). This result is in line with (Friedman, 2006; Lee and Ashforth, 1996). They explained that teacher efficacy is a key component in the burnout process. The present results explored that female faculty members have higher mean scores on emotional exhaustion. This has been supported (Lackritz, 2004) that female faculty members have higher mean scores on emotional exhaustion.

A significant positive correlation was found between Self Efficacy and Personal Accomplishment. This result represented that women lecturers have higher Self Efficacy that increases the sense of Personal Accomplishment. This is in line with the results of (Betoret, 2006; Evers, Brouwers, and Tomic, 2002). They explained that teachers with high beliefs in their teaching ability (i.e. teacher efficacy) have demonstrated less burnout than teachers with low levels of efficacy A high level of perception of self-efficacy enhances effective

stress management and coping with professional duties; it also facilitates changes in the working environment and prevention of the burnout causes (Warszawa 2000). Maria Brudnik, 2009, suggested that a high level of general self-efficacy most effectively prevents the loss of sense of personal accomplishment in the teachers.

Further results indicated that there is significant negative correlation between Self Efficacy and Emotional Exhaustion among female lecturers. This result shows that the participants who have higher Self Efficacy have lesser feeling of burnout. Individuals with a stronger sense of perceived self-efficacy experience low stress in threatening or taxing situations, and experience situations as less stressful owing to their belief in their ability to cope (Bandura, 1997). Exposure to chronic occupational stressors, with low sense of efficacy to manage job demands and to enlist social support in times of difficulty, increases vulnerability to burnout (Leiter, 1992; Schmitz, 2000). Teachers' perceived lack of support from colleagues and principals had a significant effect on their self-efficacy beliefs in eliciting support from them, while these self-efficacy beliefs were shown to predict their level of burnout. (ANDRÉ BROUWERS, 2001).

A significant positive correlation was found between Emotional Exhaustion and Masculinity. This result shows that participants having more characteristics of males have more feeling of emotional exhaustion on their work.

CONCLUSION

This paper is to investigate the relationship of burnout, self efficacy and sex roles among the working employees. Results indicated that participants having higher Self Efficacy have more sense of Personal Accomplishment. Further results indicated that there is significant negative correlation between Self Efficacy and Emotional Exhaustion which is a sub dimension of Burnout. This result shows that participants having higher Self Efficacy have less feeling of burnout. There exists a significant positive correlation between Emotional Exhaustion and Masculinity. This result shows that participants having more characteristics of males, have more feeling of emotionally exhausted by their work.

Table : Correlation between burnout and self efficacy and sex roles.

	Mean	SD	Depersonalization	Personal Accomplishment	Emotional Exhaustion	Masculinity	femininity	Self Efficacy
Depersonalization	4.64	5.08	1.00	-.103	.526**	.107	.015	-.012
Personal Accomplishment	39.32	6.42		1.00	-.223**	.016	.024	.259**
Emotional Exhaustion	16.70	9.29			1.00	.164*	.034	-.162*
Masculinity	96.18	19.54				1.00	-.003	.131
Femininity	102.14	17.16					1.00	.064
Self Efficacy	30.17	4.89						1.00

** Significant at 0.01 level

*Significant at 0.05 level

REFERENCES

1. Ashforth, B.E. & Humphrey, R.H. (1993). Emotional labour in service roles: The influence of identity. *Academy of Management review*, 18:88-115.
2. Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W. H. Freeman/Times Books/ Henry Holt & Co.
3. Betroret, F.D. (2006). Stressors, self efficacy, coping resources and burnout among secondary school teachers in Spain, *Educational Psychology*, 26,519-539.
4. Blasé, J.J. (1986). A qualitative analysis of sources of teacher stress: Consequences for performance. *American Educational Research Journal*, 23(1), 13-40.
5. Brouwers, A. Evers, W., & Tomic, W. (2000). A longitudinal study of teacher burnout. *Teaching and Teacher Education*, 20, 713.
6. Cox, T. & T. Brockley, (1984). The experience and effects of stress in teachers. *British Educational Research Journal*, 10, 84.

7. Cropanzano, R., D. Rapp, and Z. Byrne. (2003). The Relationship of Emotional Exhaustion to Work Attitudes, Job Performance, and Organizational Citizenship Behaviors, *Journal of Applied Psychology*, Vol. 88, No. 1, pp. 160-169.
8. Cunningham, W.G. (1983). Teacher burnout: A review of the literature. *The Urban Review*, 15, 37-51.
9. Deutsch, C. (1984). Self reported sources of stress among psychotherapists. *Professional Psychology: Research & Practice*, 15, 833-45.
10. Evers, W.J., Brouwers, A., & Tomic, W. (2002). Burnout and self-efficacy: a study of teachers' beliefs when implementing an innovative educational system in the Netherlands. *British Journal of Educational Psychology*, 72(2), 227-244.
11. Friedman, T. (2006). *The world is flat*. New York: Farrar, Straus and Giroux.
12. Koon, J.R. (1971). Effects of expectancy, anxiety and task difficulty on teacher behavior. Syracuse University, Syracuse, New York: *Unpublished Ph.D. Dissertation*. University Microfilms, 71-18492, p.32.
13. Lackritz, J. R. (2004). Exploring burnout among university faculty: incidence, performance and demographic issues. *Teaching and Teacher Education*, 20, 713.
14. Lee, R.T., & Ashforth, B.E. (1990). On the meaning of Maslach's three dimensions of burnout. *Journal of Applied Psychology*, 75, 743-747.
15. Lee, R.T., Ashforth, B. E., 1996. A meta-analytic examination of the correlates of the three dimensions of job burnout. *Journal of Applied Psychology* 81 (2), 123-133.
16. Maslach, C (1993). Burnout: A multidimensional perspective. In W. B. Schaufeli, C. Maslach, & T. Marek (Eds.), *Professional burnout: Recent developments in theory and research*. Washington DC: Taylor & Francis.
17. Maslach, C. (1976). Burned-out. *Human Behavior*, 5(9): 16-22.
18. Maslach, C. (1978). The client role in staff burn-out. *Journal of Social Issues*, 34(4), 111 -124.
19. Maslach, C. (2003). Job burnout: New directions in research and intervention. *Current Directions in Psychological Science*, 12, 189-192.
20. Maslach, C., & Jackson, S. E. (1981b). The measurement of experienced burnout. *Journal of Occupational Behaviour*, 2, 99-113.
21. Maslach, C., & Jackson, S. E. (1986). *Maslach Burnout Inventory* (2nd Eds.). Palo Alto, CA: Consulting Psychologists Press.
22. Maslach, C., Schaufeli, W., & Leiter, M. (2001). Job burnout. *Annual Review of Psychology*, 52, 397-422.
23. Miller, D. (1995). Stress and burn-out among health-care staff working with people affected by HIV. *British Journal of Guidance and Counseling*, 23(1), 19-31.
24. Ormrod, J. E. (2006). *Educational Psychology: Developing Learners* (5th ed.), *glossary*, N.J., Merrill: Upper Saddle River.
25. Rakowska, A., Sitko-Lutek, A. (2000). *Doskonalenie Kompetencji Menedzerskich*, PWN, Warszawa.
26. Ratlif, N. (1988). Stress and burnout in the helping professions, *Social Casework*, 69, 147-154.
27. Schaufeli, W.B. & Enzmann, D. (1998). *The Burnout Companion to Study and Practice: A Critical Analysis*. London: Taylor and Francis.
28. Schwab, R. L., Jackson, S. E., & Schuler, R. S. (1986). Educator burnout: Sources and consequences. *Educational Research*, 10(3), 14-30.
29. Shirom, A. (1989). Burnout in work organizations. In: C. L. Cooper and I. Robertson (Eds.) *International review of industrial and organization psychology*. (pp. 25- 48), Chichester, U.K.: Wiley.
30. Shirom, A. (2003). Job-related burnout: A review. In J.C. Quick & L. E. Tetrick (Eds.). *Handbook of Occupational Health Psychology*. (pp. 245-265) Washington, DC: American Psychological Association.

31. Steinberg, L. (1998). Adolescence. New York: McGraw-Hill College companies. Cited in Matsushima, R., & Shiomi, K., (2003). Social self-efficacy and interpersonal stress in adolescence. *Social Behavior and Personality*, 729.
32. Tang, T.; Yeung, A. S. (1999). *Hong Kong teachers' sources of stress, burnout, and job satisfaction*. Paper presented at the International Conference on Teacher Education (Hong Kong, February 22-24).
33. Tracy, S. (2000) Becoming a Character for Commerce Emotion. *Management Communication*, 14, 113.
34. Zapf, D., Vogt, C., Seifert, C., Mertini, H& Isic, A. (1999), Emotion work as a source of stress: the concept and development of an instrument, *European Journal of Work and Organizational Psychology*, Vol. 8 No. 3, pp. 371-400.

Glutamic Acid as an Efficient Catalyst Used for the Synthesis of 5-Arylidene-2, 4-Thiazolidinediones

Prashant G. Kumdale¹ and Nana V. Shitole^{2*}

¹Department of Chemistry, Shivneri College Shirur Anantpal Dist. Latur- 413544 MS, India

²Department of Chemistry Shri Shivaji College, Parbhani- 431401 MS, India

Swami Ramanand Teerth Marathwada University Nanded-431606, Maharashtra State, India

ABSTRACT

Knoevenagel condensation of aromatic aldehydes and active methylene compounds catalyzed by glutamic acid was performed. The developed protocol was found to be applicable for the preparation of 5-arylidene-2,4-thiazolidinediones using glutamic acid as an efficient catalyst in ethanol solvent under reflux conditions.

Keywords: Glutamic acid, Thiazolidine-2, 4-diones; 5-Arylidene-2, 4-Thiazolidinediones, Knoevenagel condensation.

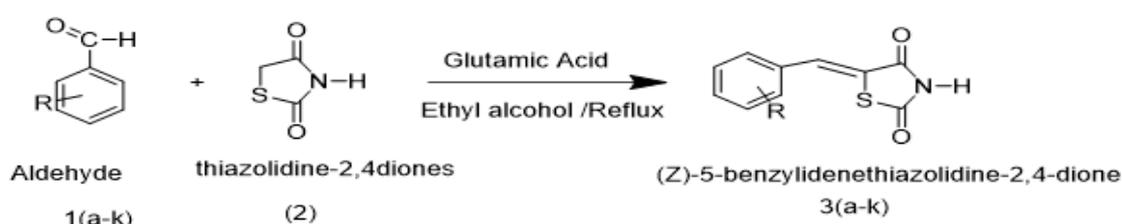
I. INTRODUCTION

Knoevenagel-catalyzed glutamic acid condensation of aromatic aldehydes and active methylene compounds (thiazolidine-2,4-diones) was performed. Knoevenagel condensation is a multicomponent reaction leading to the formation of new C–C bonds. The reaction is applicable for the synthesis of substituted alkenes, α , β -unsaturated cyanide, acid, esters, dyes and polymers.[1-4]

Glutamic acid is an α -amino acid used by almost all living things in protein biosynthesis. Glutamic acid is non-essential Amino acid. In the last year, glutamic acid has received considerable attention as an effective corrosion inhibitor for aluminum in HCl solution [21]. Glutamic acid occurs naturally in many foods, the flavor contributions of glutamic acid and other amino acids were only scientifically discovered in the early twentieth century. The substance was discovered and identified in 1866 by the German chemist Karl Heinrich Ritthausen [22]. When glutamic acid is dissolved in water, the amino group (-NH₂) may gain a proton (H⁺) and/or the carboxyl groups may lose protons, depending on the acidity of the medium [23-25]. By considering this activity of glutamic acid, we have described an efficient way to use glutamic acid as an efficient catalyst for the synthesis of 2,4,5-triaryl-1H-imidazoles.

The condensation of 2,4-thiazolidinediones with aldehydes is of considerable interest. 5-Arylidene-2,4-thiazolidinediones products are important structural elements in medicinal chemistry and have been found to have significant hypoglycemic,[5] anti-inflammatory,[6] antitumor,[7] antifungal, [8] antidiabetic,[9]] and antimicrobial [10]activities. Several methods have been reported in the literature for the synthesis of benzylidenethiazolidine-2,4-dione derivatives, such as baker's yeast, [11] piperidine in ethanol under reflux conditions [12], piperidinium acetate in DMF under microwave irradiation, [13] milling with ammonium acetate in absence of solvents, [14] sodium acetate in acetic acid under microwave irradiation [15], KAl(SO₄)₂·12H₂O in H₂O at 90 °C, [16] polyethylene glycol-300 at 100–120 °C, [17] L- proline,[18] thiourea,[19] sodium acetate in acetic acid under reflux conditions, [20] hydrochloric acid,[21] without glycine/solvent under microwave irradiation, [22] (DABCO) in aqueous medium, [23] ethylene diamine acetate, [24] without catalyst/water as green solvent under microwave irradiation, [25] L-tyrosine/water [26] acidic ionic liquid, [27] calcium hydroxide, [28] tungstic acid, [29].

However, most of the reported methodologies still have some limitations, such as expensive catalysts, solvent toxicity, limitations for large-scale applications, critical product isolation procedures, difficulties in obtaining high-boiling solvents, excessive amounts of catalysts. It would therefore be highly desirable to develop a simple and efficient method for the synthesis of 5-arylidene-2,4-thiazolidinediones derivatives.



Scheme 1: Synthesis of substituted Benzylidenethiazolidine-2,4-dione derivatives.

II. RESULTS AND DISCUSSION

During the reaction conditions and optimization of the solvent, it is achieved that the reaction does not take place at room temperature or at 50 °C, but at 100 °C in ethyl alcohol, the reaction is faster and takes less time. Other solvents such as water, DMF, DMSO effluent, ethyl alcohol: water.

Table 1: Optimization of different solvents for the synthesis of the 3c model product

Sr.No	Solvent	Time (Hrs)	Yield (%)
1	Ethyl alcohol	10	86
2	Ethyl alcohol:Water	26	55
3	Water	20	30
4	DMF	19	60
5	DMSO	18	64
6	Solvent less	24	62

To determine the exact concentration of the catalyst, model reactions were investigated at 2.5, 5, 7.5, 10, 12.5 mol% glutamic acid in ethyl alcohol at reflux temperature. The products were obtained in 24, 50, 60, 86 and 86%, respectively. This shows that the reaction can be accelerated with only (10 mol %) glutamic acid (**Table 2**).

Table 2: Effect on catalyst concentration^a

Entry	Concentration of catalyst in Mole (%)	Time (hr)	Yield ^b
1	2.5	16	24
2	5	14	50
3	7.5	12	60
4	10	10	86
5	12.5	10	86

^aReaction conditions: 1 (1 mmol), 2a (1 mmol), 3 (2 mmol) and (10 mol%) Glutamic acid reflux temperature.

^bIsolated yields.

Table 3: Glutamic acid catalyzed synthesis of 5-arylidene-2,4-thiazolidinediones derivatives in ethyl alcohol.

Sr.No	Product	Aldehyde	Time (Hours)	Yield (%)	M.P (°C)	M.P Lit. (°C)
1	3a	C ₆ H ₅ -	30	80	240	240-241[26]
2	3b	2-(Cl)C ₆ H ₄ -	28	77	209	210-212[29]
3	3c	4-(Cl)C ₆ H ₄ -	24	76	110	109[23]
4	3d	3-(NO ₂)C ₆ H ₄ -	28	79	187	186-188[26]
5	3e	4-(NO ₂)C ₆ H ₄ -	30	74	182	182-183[26]
6	3f	3-(OH)C ₆ H ₄ -	26	70	116	118-120[23]
7	3g	4-(OH)C ₆ H ₄ -	18	63	112	111-113[23]
8	3h	4-(OCH ₃)C ₆ H ₄ -	19	68	236	235-237[26]
9	3i	Furan-2-CHO	20	70	241	240-242[29]
10	3j	Thiophene-2-CHO	21	74	225	-----
11	3k	Pyridine-3-CHO	23	78	218	-----

III. EXPERIMENTAL

All chemical compounds used had been purchased from industrial providers and used without purification. The reaction was monitored by TLC on ethyl acetate and n-hexane mobile phases. Melting points are recorded by the open capillary method and are uncorrected.

3.1. General Procedure for the Synthesis of Benzylidenethiazolidine-2,4-Dione Derivatives:

A mixture of substituted aromatic aldehyde (1 mmol), active methylene compound (thiazolidine-2,4-dione) (1 mmol) and ethanol (10 ml) was stirred at reflux temperature for a predetermined time in the presence of a Glutamic acid catalyst. The development of this reaction turned into monitored with the aid of TLC After completion of the reaction, the reaction mixture was cooled to room temperature and ice-cold water was added. The solid product was filtered, washed with cold water and recrystallized from ethanol to give a pure benzilidenethiazolidine-2,4-dione derivative.

IV. ACKNOWLEDGEMENTS

We're grateful to the Principal & Head Dept. of Chemistry of research center S.C. Parbhani for given opportunity to work in the laboratory. We also gratefully acknowledgment to School of Chemical Science, Punyashlok Ahilyadevi Holkar, Solapur University for providing spectroscopic data.

V. REFERENCES

1. F. Freeman, *Chemical Reviews*, 80, pp. 329–350, (1980).
2. L. F. Tietze, *Chemical Reviews*, 96, pp. 115–136, (1996).
3. J. Zhang, Y. Zhang, Z. Zhou, *Green Chemistry Letters & Reviews*, 7, pp. 90–94, (2014).
4. J. R. Harjani, S. J. Nara, M. M. Salunkhe, *Tetrahedron Letters*, 43, pp. 1127–1130, (2002).
5. L. Fernanda, C. C. Leite, R. H. V. Mourao, M. C. A. Lima, S. L. Galdino, M. Z. Hernandez, F. A. R. Neves, S. Vidal, J. Barbe and I. R. Pitta, “”, *European Journal of Medicinal Chemistry*, 42, 1239, (2007).
6. R. Ottana, R. Maccari, M. L. Barreca, G. Bruno, A. Rotondo, A. Rossi, G. Chiricosta, R. D. Paola, L. Sautebin, S. Cuzzocrea and M. G. Vigorita, *Bioorganic & Medicinal Chemistry*, 13, 4243, (2005).
7. B. R. Bhattarai, B. Kafle, J. Hwang, D. Khadka, S. Lee, J. Kang, S.W. Ham, I. Han, H. Park, H. Cho, *Bioorganic Medicinal Chemistry Letters*, 19, pp. 6161 (2009).
8. M. C. A. DeLima Costa, A. J. S., Goes Galdino, I. R. Pitta, C. Luu-Duc Pharmazie, 47, 182, 1992.
9. F. L. Gouveia, R.M.B. De Oliveira, T.B. De Oliveira, I.M. Da Silva, S.C. Do Nascimento, K.X.F.R. De Sena, J.F.C. De Albuquerque, *European Journal of Medicinal Chemistry*, 44, pp. 2038–2043 (2009).
10. C. Nastasa, M. Duma, B. Tiperciuc, O. Oniga, Vol.10, No.3, pp. 716–17 (2015).
11. D.O.V. Rodrigo, N.D.S. Edson, C. Gabriela, S.A.P. Mauri, *Organic & Medicinal Chemistry International Journal*, 5(3), pp. 555668, (2018).
12. M.M. Chowdhry, D.M.P. Mingos, A.J.P. White, D.J. Williams, *J. Chem. Soci. Perkin Transact. 20* 3495–3504 (2000).
13. S.R. Pattan, P. Kekare, N.S. Dighe, *Asian Journal of Research in Chemistry*, 2, 123–126 (2009)
14. N. Shimazaki, N.T. Hanai, M.T. Isoyama, K. Wada, T. Fujita, K. Fujiwara, S. Kurakata, *European Journal of Chem.* 44, 1734–1743 (2008).
15. L.V. Sonawane, S.B. Bari, *International Journal of Biological Chemistry*, 5, 68–74 (2011).
16. M.M. Chowdhry, D.M.P. Mingos, A.J.P. White, D.J. Williams, *J. Chem. Soci. Perkin Transact. 20* 3495–3504 (2000).
17. S. Riyaz, A. Naidu, P.K. Dudev, *Synth Commun.* 41, pp. 2756–2762 (2011).
18. S. Shah, B. Singh, *Bioorganic & Medicinal Chemistry Letters*, 22, 5388–5391 (2012).
19. Patil, K. Tilekar, S.M. Munj, R. Mohan, C.S. Ramaa, *European Journal of Medicinal Chemistry*, 45, pp. 4539–4544 (2010).
20. V.S. Jain, D.K. Vora, C.S. Ramma, *Bioorganic & Medicinal Chemistry*, 21, pp. 1599–1620 (2013).
21. B.Y. Yang, D.H. Yang, *Journal of Chemical Research*, pp. 238–239 (2011).
22. A. R. Bhat, *Journal of Materials and Environmental Sciences*, , Volume 9, Issue 8, Page 2478–2482, (2018).
23. Y. Zhang, Z. Zhou, *Hindawi Publishing Corporation Organic Chemistry International*, pp. 1–5 (2012).
24. A.R. Bhat, M.H. Najjar, R.S. Dongre, M.S. Akhter, *Current Research in Green and Sustainable Chemistry*, 3 (100008), (2020).
25. G. Thirupathi, M. Venkatanarayana, P. K. Dubey, Y. Bharathi Kumari, *Der Pharma Chemica*, 4(5), pp. 2009–2013 (2012).
26. K.F. Shelke, S.S. Idhole, A.D. Badar, J.B. Devhade, *Der Pharmacia Lettre*, 8 (5), pp. 72–75 (2016)
27. P. Kulkarni, *Bulletin of Chemical Society of Ethiopia*, 33(1), pp. 381–387 (2019).
28. N.D. Punyapreddiwar, G.D. Satpute, D.B. Zade, S.B. Dhawas, M.J. Tondare, *International Journal of Scientific Research in Science and Technology (IJSRST)*, (4)1, (2018), pp. 202–206 (2018).

Cybercrime: Youth Awareness Survey in Mumbai, India

Yogita A. Bhagwat and P. Dolly Diana

Chhatrapati Shivaji Maharaj University, Panvel, Navi Mumbai, Maharashtra, India

ABSTRACT

These days cybercrime is quickly expanding step by step with the development of innovation where we make a stride towards the computerized world. With each step, new difficulties and obligations are additionally emerging regular schedule. The concentrated populace for the assault is Youth and young people. They are the significant populace of the world who are partaking in the digitalization. Cybercrime is a significant danger to the developing society. Each country on the planet elevating digitalization to get by in this advanced world and to get information government and non-government associations assuming liability to get our information from the aggressors. To get government and other associations' comprehension and dissecting what to get information. In India, most of the populace has a place with rustic regions and they are the obvious objective for the aggressors to control. Many individuals have hardly any familiarity with cybercrimes and security, so did an overview in Mumbai, India to examine about the cybercrime.

Keywords: cybercrime, digital assault, mindfulness, security

INTRODUCTION

By and large of we have exceptionally limited data on wrongdoing happening in "the internet", known as cybercrime, which happens on the PC and the Internet, notwithstanding, cybercrime has a serious potential for an outstanding impact on the existences of individuals and our general public. At the point when we discuss the information and its insurance, information requirement, and data security chances into a major concern. There is no vulnerability that these days for all intents and purposes all office suppliers have made life loose by utilization of innovation be it Banking, Insurance, Ecommerce, and so on innovation interfaces the distance as well as conveys a better support of the clients. With the quick advancement of Information innovation in business, purchasers are currently defence less to numerous risks. New and refined cybercrime instruments could work to permit a country state or fear monger gathering to proceed namelessly while they direct digital assaults over the Internet. Many expert's realities out that previous occasion of regular psychological oppression have proactively been associated with cybercrime, and that PC openings might cause organization and resident serious foundation frameworks to seem alluring as focuses for cyberattack. The impression of cybercrime isn't simply assessed exclusively as far as costs endured yet additionally as far as the break of data security which can influence numerous buyers. The normal misfortunes for the ventures constantly 2019 because of cybercrime are projected to be in the space of \$2 trillion. While the quantity of network protection flare-ups in large organizations has been declining, in medium and little measured organizations it is developing expressively, which could be the primary worry for agricultural countries.

Cyber-Crime: As a general rule, cybercrime might be defined as "Any unlawful demonstration where PC or specialized gadget or PC network is utilized to guarantee or empower the order of wrongdoing". Around 3.24 million flare-ups were coordinated by cybercriminals in 2006. A few web-based wrongdoings have even surpassed their partners in the actual world. Meanwhile, experts assess that close 90% of the digital violations go unreported. Cybercrime shifts across different occasions. Toward one side, are violations that incorporate fundamental breaks of an individual or common protection, for example, assaults on the trustworthiness of information held in computerized assortments and the utilization of unlawfully found advanced data to coercion a form or a person. At the opposite finish of the assortment are those wrongdoings that contain attempts to interfere with the genuine systems of the Internet. Cybercrimes can be for the most part separated into four primary classifications.

Cybercrimes against People: Cyber-violations devoted against individuals comprise of various wrongdoings like the transmission of youngster porn, digital pornography, the disturbance of a person by a PC, for example, through email, fashioned escrow tricks. The moving, spreading, posting, and dispersal of hostile material with sexual entertainment and rude openness lays out one of the most significant Cybercrimes identified these days.

Cybercrime against Property: Another association of Cyber-violations is that, Cybercrimes against all types of resources. These wrongdoings incorporate PC defacement (destruction of others' property), Intellectual Property Crimes, Intimidating, Salami Attacks. This sort of wrongdoing is for the most part prevailing in monetary foundations or for the assurance of committing monetary violations. A crucial component of this kind

of bad behaviours is that the change is insignificant to such an extent that it would normally slip through the cracks.

Cybercrime against Organizations/Associations: This is one of the most regular types of digital wrongdoing today. At the point when an organization's web-based event or any of its merchandise are hacked, it changes over a difficult issue that can outcome in an enormous number of punishments for the organization, as well as their faculty, partners, and clients. Models incorporate data breaks, digital crushing and warez spreading, and so on.

Cybercrime against Government: The development of the Internet has uncovered that the norm of the internet is being involved by people and gatherings to hide the legislatures as likewise to compromise the people groups of a state. This wrongdoing shows itself into savagery when a singular hack into an organization or military protected site.

Cyber Attack

Digital Attack is finished by cybercriminals. They use PC situation or organizations to control, take, or gain unapproved admittance to the information. Digital Crime is a danger to data security because of development towards digitization our principal concern is to get computerized resources by Cybercriminals. They utilize different security instruments and strategies to control information.

MATERIAL AND METHODOLOGY

Tools of Data Collection

An instrument is help with required and related information that could be gathered deliberately to the subject material. Google Form was utilized to record reactions. In an informational index, we gathered 151 reactions in light of that we close the information. The Survey cycle was the means for data gathering, which was involved by the researchers for the assurance of collecting data from the respondents. The Survey procedure is the most effective way for social occasion the greatest information in a coordinated strategy.

Data Collection and Procedure

The examination is developed on essential data gathering from Google structure and the information for the review was obtained from the respondents. The data was made by a basic irregular testing process. Conviction and understandings of the respondents were formed through the Survey technique. The researcher in the wake of building a comprehension with the respondents defined the assurance, significance, and importance of the review.

RESULT AND DISCUSSION

In Figure 1 we show the age collection of respondents. The age of the respondents. 68.2% of the respondents belong to the age group of 16-21years, 29.1% of the respondents belong to the age group of 22-28 years, only 2.6% of the respondents belong to the age group of 29-35% years.

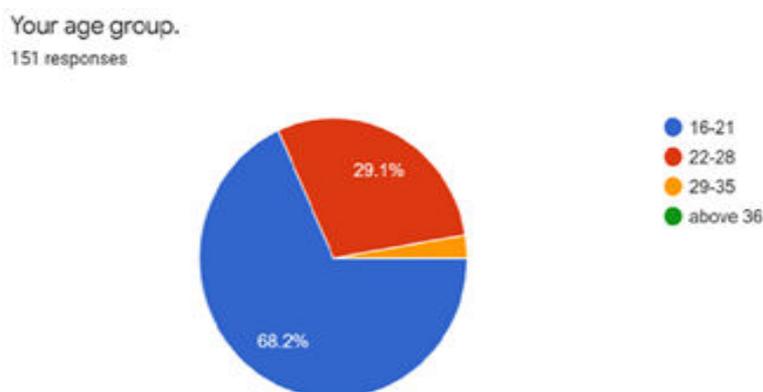


Figure 1: Age group of male & Females.

Response Based on Gender

In Figure 2 respondents were categorized according to gender Respondents based on gender, 60.3% of the respondents were male and 39.3% of the respondents were female.

Awareness about Cyber Crime

In Figure 3 respondents were asked they know about Cybercrime/ Cyberterrorism, 98% of the respondents were about Cybercrime/ Cyber terrorism, only 2% of the respondents don't know about Cybercrime/Cyberterrorism.

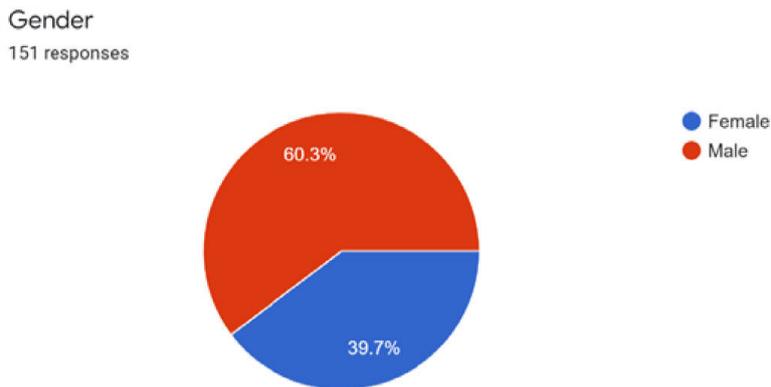


Figure 2: Response based on gender.

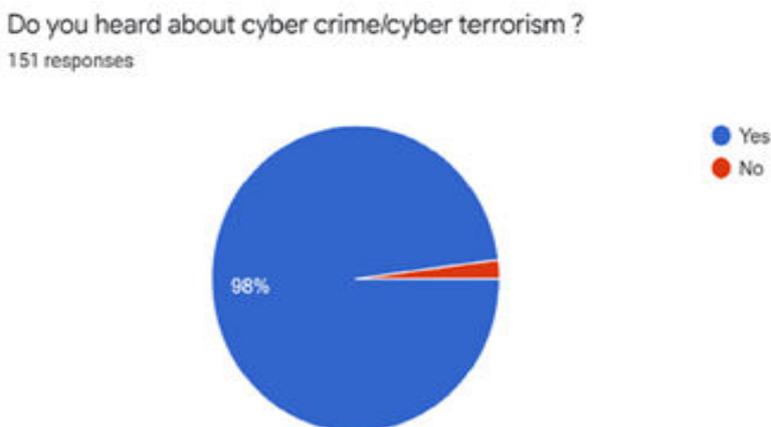


Figure 3: People awareness about cybercrime.

Source of Awareness about Cyber Crime

In Figure 4 respondents were asked about from where they heard about cyber-crime in multiple-choice question form in which 78.8% of the respondents knew about this from internet, 41.00% of the respondents were heard from the friends, 22.5% of the respondents were heard from their family members, 49.00% of the respondents were read from newspaper, 47.7% of the respondents were heard from television, 18.5% of the respondents heard from any other sources.

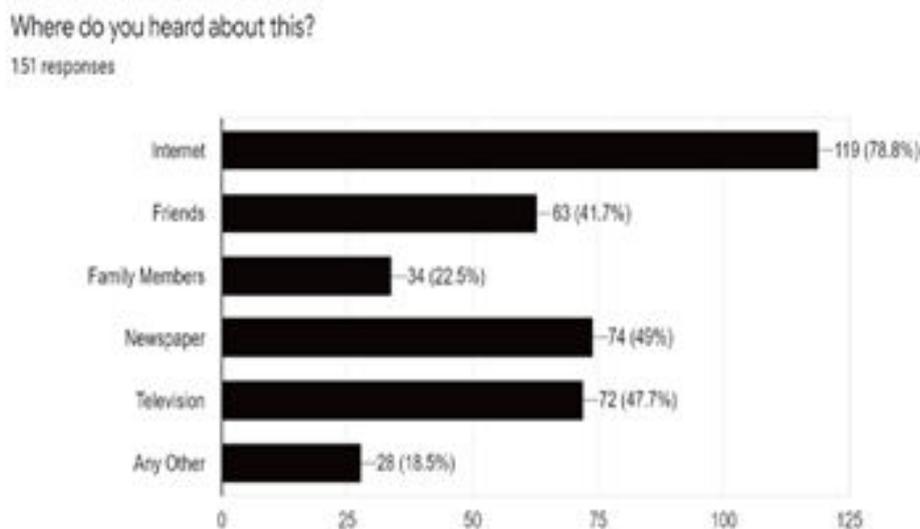


Figure 4: Source of awareness about cybercrime.

Awareness about Cyber Attack

In the Figure 5 respondents were asked about them about cyberattack, 77.5% respondents were heard about cyber-attack, 16.6% of the respondent where they may be heard about cyber-attack, while 6% of the respondents about don't about the cyber-attack.

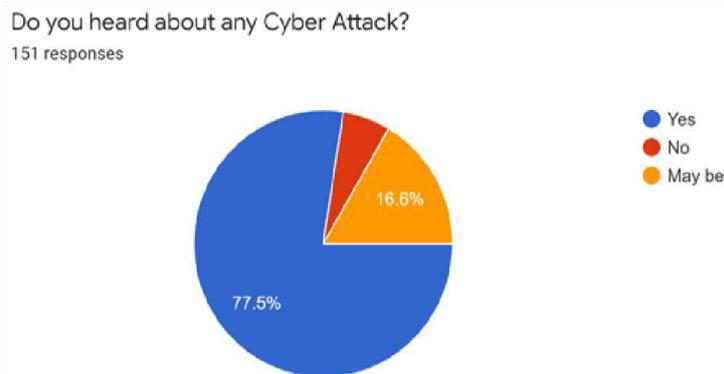


Figure 5: Awareness about cyber-attack.

Awareness of Different Cyber Attacks

In the Figure 6 respondents were asked about they know about cyber-attacks in multiple-choice question form in which 66.3% of the respondents know about Phishing, 15.9% of the respondents know about Eavesdropping attack, 20.5% of the respondents know about SQL Injection, 49.00% of the respondents know about Malware, 17.2% of the respondents know about DDoS, 57.0% of the respondents know about Spamming, 51.7% of the respondents know about Cyber Stalking, 44.4% of the respondents know about Software Privacy, 18.5% of the respondents know about Social Engineering, 49.7% of the respondents know about Computer Virus, 60.9% of the respondents know about Child Pornography, Only 3.3% of the respondents don't know about any of the above cyber-attacks.

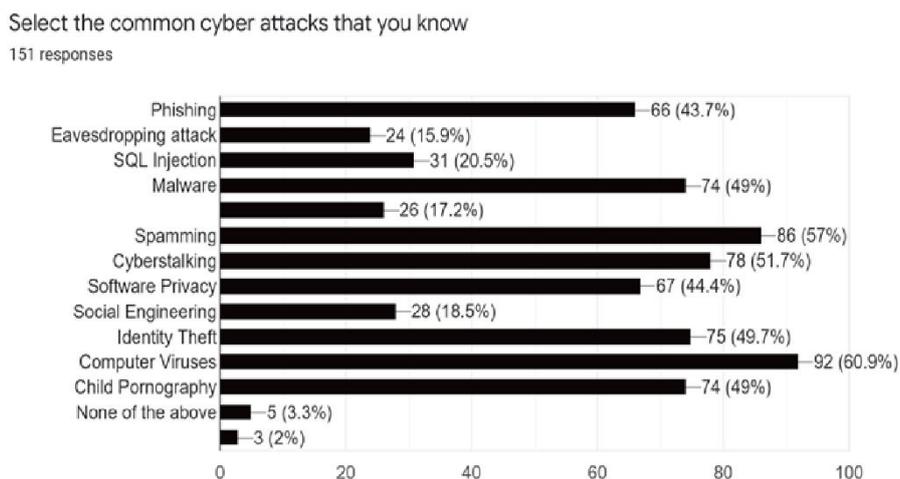


Figure 6: Awareness of different cyber-attacks.

Awareness about Any Agency For Cyber Security

In the Figure 7 respondents were asked about they know the government or non-government or group of hackers related to cyber security, 43.7% of the respondents were know about agency related to Cyber security, while 56.3% of the respondents did not know about agency related to cyber security.

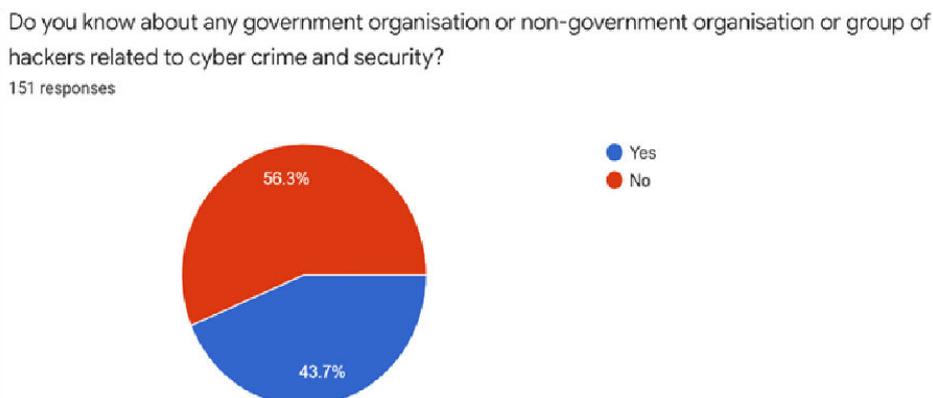


Figure 7: Awareness about any agency for cyber security.

Awareness about Major Cyber Attacks

In the Figure 8 respondents were asked about from where they heard about major cyber-attacks in multiple-choice question form in which 33.1% of the respondents know about Wanna Cry ransomware attack, 13.2% of the respondents know about Marriott Starwood data breach, 22.5% of the respondents know about Denial-of-Service attack, 34.4% of the respondents know about Yahoo data breach, 25.8% of the respondents know about South Korea Cyber Attack, 33.8% of the respondents don't know about any of the above-listed cyber-attacks.

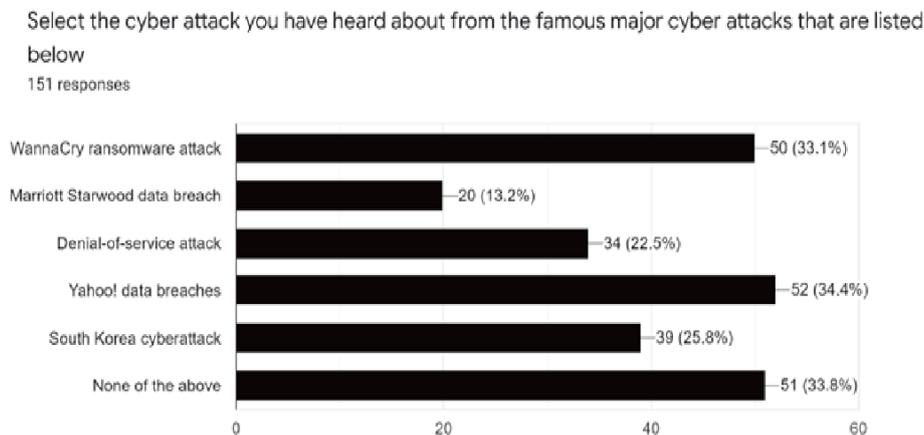


Figure 8: Awareness about major cyber-attacks.

Awareness about the Prevention of Cyber Attack

In the Figure 9 respondents were asked about from where they about in multiple-choice question form in which 45.0% of the respondents know about Firewall, 70.9% of the respondents know about Antivirus/Malware Software, 13.2% of the respondents know about Penetration Testing, 23.2% of the respondents know about IDS, 9.3% of the respondents don't know about any of the listed security software.

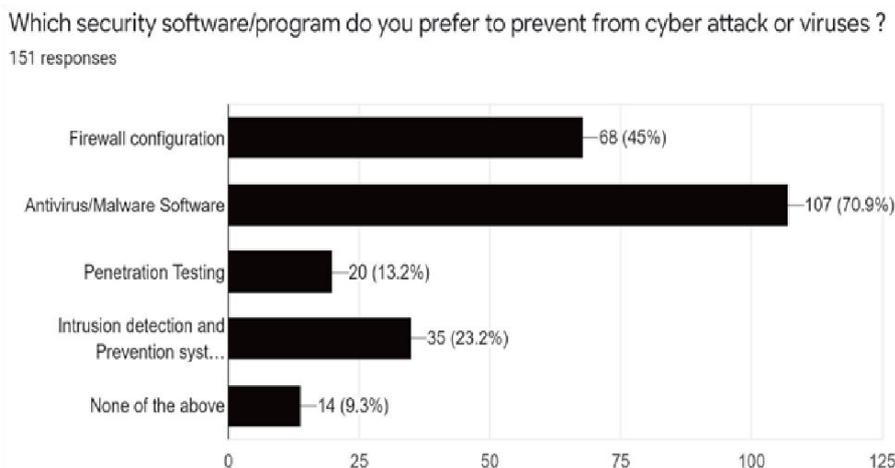


Figure 9: Awareness about the prevention of cyber-attack.

CONCLUSION

In the Google structure, we have requested to make reference to ideas from the respondents to spread mindfulness towards cybercrime and what they anticipate from the public authority and security specialists to stop cybercrime. From the respondent's ideas, we finish up their ideas.

What do you think About Cybercrime, Cyber Terrorism and Cyber Security?

There are such countless various assessments about cybercrime wrongdoing illegal intimidation and digital protection. We have recorded 91 reactions out of 151 respondents. Cybercrime is a crime that is performed by the person to take data or to get unapproved admittance to the framework with the assistance of organization and PC frameworks utilizing hacking devices. Digital psychological warfare is the criminal behaviours performed by a gathering over the web to acquire data from people or associations to malign, obliterate, or get significant data. Digital protection is the security to avoidance from cybercrime and utilizing dauntless organization and internet is everybody's right. Cybercrime is an escape clause to Cyber Security. Respondents contrast digital conflict and actual conflict. The quick development of web clients adds dangers to the internet and it can to excessively perilous to ordinary web clients.

Your Suggestions how can We Prevent Cybercrime?

Respondents have proposed numerous strategies to forestall cybercrime. We have recorded reactions out of 151 respondents. Respondents were gotten some information about how might we forestall cybercrime; respondents gave various ideas to forestall cybercrime. They recommended that a mindfulness mission ought to be begun to spread mindfulness among individuals. Information on data innovation ought to be obligatory for all individuals. India is the second biggest number of web clients. What do you anticipate from the public authority or other non-government associations to diminish this sort of digital assaults? There are a wide range of thoughts and assumptions for the respondents to decrease digital wrongdoing. We have recorded 77 reactions out of 151 respondents. The public authority ought to make severe regulations and guidelines for wrongdoings and begin mindfulness programs in rustic as well as metropolitan regions in light of the fact that in provincial regions individuals are generally impacted by spam calls and messages. Adolescents and matured individuals are obvious objectives for assailants. Associations and specialists make useful assets and programming to get frameworks and data. An information break is the primary worry of the respondents because of the new exercises acted in the country. There ought to be an eye on dubious exercises on the web and View distribution details make a move as quickly as time permits. Respondents take the main pressing issue to ideas on lady's security, youngster porn, and against public exercises performed over the web which harms our general public, government and non-government association ought to come to together to track down the arrangement of such issues.

REFERENCES

1. Jonathan Clough. Principles of Cybercrime. Cambridge, 2. 2010.
2. Dhruva KB, Kalita JK. DDoS Attacks: Evolution, Detection, Prevention, Reaction, and Tolerance. CRC Press/Taylor & Francis Group; 2016.
3. Reddy KS. Cybercrimes in India and the mechanism to prevent them. IJIRIS. 2014;9(3):29–32.
4. Tim Greene. Storm Worm Strikes Back at Security Pros. Network World. com. 2007.
5. Brian Krebs. Three Worked the Web to Help Terrorists. The Washington Post. 2007.
6. Juniper Research. Cybercrime will Cost Businesses Over \$2 Trillion by 2019 - Juniper Research. 2019.
7. Symantec. Attackers Target Both Large and Small Businesses. 2016.
8. <https://cybercrime.gov.in/Webform/CrimeCatDes.aspx>
9. Cyber Crime Overview. 2008.
10. Wadhwa A, Arora N. A Review on Cyber Crime: Major Threats and Solutions. International Journal of Advanced Research in Computer Science. 2017;8(5).
11. Poonia AS. Cyber Crime: Challenges and its classification. International Journal of Emerging Trends & Technology in Computer Science (IJETTCS). 2014;3(6):119-121.
12. <https://securitytrails.com/blog/types-of-cyber-crime>
13. <https://www.legistify.com/qna/answer/1912-cyber-crime-againstgovernment/>
14. Afrozulla KZ, Vaishnavi RT, Arjun. Cyber Crime Awareness among Msw Students, School Of Social Work, Mangaluru. J Forensic Sci & Criminal Invest. 2018; 9(2):555757.

Emotional Intelligence in Indian Organizations

Devika Suryavanshi and Rinkesh Chheda
JJT University, Rajasthan, India

ABSTRACT

The capacity to understand people on a deeper level has turned into a significant piece of each and every association in the present period. It is of most extreme significance in the administration area. Associations these days are requesting a mix of a person's emotional, enthusiastic and actual gifts, accordingly it turns into every one of the more fundamental that people know the shrewd use of their feelings as and when required. Since associations include people in various jobs, the ability to appreciate anyone on a deeper level has turned into the game changer for compelling administration. The capacities and skills moved by people at working environment will decide the degree to which they can use their ability to appreciate anyone on a deeper level. It surveys how individuals can successfully make due their contemplations and ways of behaving to accomplish the best result. Various associations are on the edge of catastrophe, outrageous cutting back has prompted representatives getting themselves depleted and undervalued. Competition in the workplace is furious and various rookies want to swing to strong procedures to propel their partners or chance falling behind. Business pioneers are beginning to comprehend that such gloomy sentiments among their laborers are not valuable for the organization and its possibilities for finding success. Various organizations are searching for ways to deal with change these pessimistic sentiments into positive, hence being helpful for the organization. The ability to understand anyone on a profound level influences crucial parts like administration in an association and consequently the investigation of the capacity to understand people on a profound level is fundamental. The ability to understand anyone on a profound level isn't as it were about you and your feelings it likewise incorporates the appraisal of others' feelings. This examination has been finished to analyse the connection between the ability to appreciate people on a deeper level in Indian associations with the skills of people working in the association.

Keywords: emotion, catastrophe

INTRODUCTION

The capacity to appreciate people on a deeper level has been characterized as the capacity to perceive, oversee as well as grasp the feelings of oneself too as individuals around us. There is a close to home cerebrum in the human body which is known as the limbic framework and it is the spot of beginning of our feelings. It is not the same as the reasonable cerebrum yet the two of them are interlinked and grow together. This infers that an individual's ability to reason and his sentiments are planned to be used at the same time, but in light of our cerebrum's plan, all the data at first goes into our close to home focus and later on to our reasoning community. Feelings go before thought and conduct. Consequently, it has become essential to comprehend what we are feeling, as well as what others are feeling. It is additionally fundamental to comprehend viable administration of our sentiments and the executives of associations with other individuals in the association. This is the premise of Emotional Intelligence, which is the mind-boggling capacity to control and deal with our motivations, understand others and to be strong when confronted with misfortunes. At times the representatives respond on specific activities and later on lament making it happen. This prompts relational struggles which are chiefly because of his failure to deal with his feelings. The ability to appreciate people on a deeper level was found by James Dozier in 1981. It was an idea that saved his life. Dozier was a U.S. Armed force Brigadier General and was hijacked by the Red Brigades, which was an Italian fear monger bunch. In the midst of the beginning days his hostages were euphoric with energy and unreasonable and he began feeling that his life was in harm's way. To save his life, he remembered something he had before found out about feelings in an Executive Development Program at a Centre for Creative Leadership in North Carolina. He reviewed how an individual can impact the feelings of a gathering by displaying. For accomplishing this, from the outset, he needed to fix his own feelings. He consequently attempted to quiet himself and show his smoothness to his capturers through his way of behaving and activities. He saw that after his capturers saw how quiet he was, they additionally became quiet and reasonable. At the point when Dozier thought back on this occurrence, he understood that it was the ability to understand anyone on a deeper level that saved his life. The term "the ability to appreciate individuals at their core" wasn't instituted until 1981. It wasn't long after a genuine encounter that James Dozier had, that he made sense of it as "the capacity of seeing and communicating feelings, absorbing feelings in contemplations, understanding and prevailing upon feelings and controlling feelings in oneself and others". Research shows serious areas of strength for a between the capacity to understand people at their core and

occupation execution of a person. By underlining on the idea of the ability to appreciate anyone on a profound level in recruiting as well as teambuilding and preparing programs, the senior administration and human asset experts can work on as far as independent direction, critical thinking as well as the capacity to adapt to change among its representatives. Genuinely wise organizations augment the potential for their prosperity and accordingly increment efficiency.

OBJECTIVES OF THE STUDY

- To evaluate Emotional Intelligence in Indian associations.
- To recognize the powerless areas of Emotional Intelligence in representatives to distinguish their Training Needs.
- To discover the connection between Emotional Intelligence and Job Stress.

The capacity to understand individuals on a deeper level is an idea in light of series of explores as well as hypotheses on character and social brain science. The three most usually involved approaches in the field of the ability to appreciate people on a profound level were given by Reuven Baron, Daniel Goleman, and Jack Mayer, Peter Salovey and David Caruso. While the speculations and practices of the capacity to appreciate individuals on a profound level keep on developing, the focal thought that social and individual capabilities are fundamental for a useful life stays a typical thought in each model. Moreover, research about EI continues to show EI's importance to the two individuals and affiliations.

Pillars of Emotional Intelligence

- **Mindfulness:** People who have areas of strength for an of mindfulness can be depicted as "OK with themselves." These people have a feeling of figuring out about their characteristics, deficiencies, sentiments, and their effect on others. A valid judgment of a singular's mindfulness should be visible in the manner he answers useful analysis.
- **Self-Regulation:** The genuinely keen people perceive their feelings, yet additionally show a feeling of development and control in show of their feelings. They don't crush their feelings, rather they impart them in a way that shows a serious level of judgment and control.
- **Relationship building capacities:** Sincerely astute overseers are by and large respected by their managers, sidekicks, also, laborers. They like people and are adequately skilful to perceive what is most important to them. Their ability to quickly construct a feeling of similarity and entrust with those on whom they depend easily falls into place for them.
- **Inspiration:** Emotional knowledge includes interrelated parts of inspiration which are, at first being self-roused and then inspiring everyone around you. These individuals who stay upbeat perform uncommonly at their work environment and procure acknowledgment among their partners.
- **Sympathy:** It is wrong to say that supervisors with compassion are kind with their workers. In any case, they really do have the characteristics of sympathy and comprehension of others that assists them with interfacing genuinely with others.

Measurement of Emotional Intelligence

The Bar-On Emotional Quotient Inventory (EQ-I®) is the very first experimentally evolved proportion of the ability to appreciate individuals on a profound level. Reuven Bar-On is a worldwide perceived master and trailblazer in ability to understand people on a deeper level and has characterized, estimated and applied different parts of this idea beginning around 1980. He named "EQ" ("profound remainder") in 1985 to depict his way to deal with evaluate close to home and social capability of people and made the EQ-I, that was the main trial of the capacity to appreciate anyone on a deeper level to be distributed that too by a mental test distributor (1997). Today EQ-I tests are the most ordinarily involved proportion of EI on the planet, moving toward 2 million duplicates which have been appropriated around the world, subsequently making it among the most well-known mental tests.

The EQ-I Gives Data to Every Person on Five Composite Scales and 15 Subscales:

- Intrapersonal Scales: dignity, care, certainty, opportunity, self-acknowledgment
- Relational Scales: compassion, social commitment, relational correspondence
- Flexibility Scales: reality testing, versatility, decisive reasoning
- Stress Administration Scales: stress opposition, command over motivations
- Mind-set Scales: certainty, fulfilment

SELF REPORT - A couple of tests utilize oneself report strategy. Self-report is the most generally perceived way to deal with check character qualities in a person. These qualities incorporate warmth, compassion, sympathy and so on.

OTHER REPORT - Emotional Intelligence is for the most part about relationship building abilities, this strategy thinks about what others think about us. This is by all accounts a legitimate strategy for testing the capacity to understand individuals on a deeper level.

Capacity TESTS - Emotional insight involves a bunch of capacities. Accordingly, it very well may be estimated like different capacities.

Challenges Faced by Organizations

- Adjusting to the huge change that is occurring in the workplace.
- Laborers ought to be more creative remembering the ultimate objective which is to drive improvement.
- Overseeing gigantic measures of data successfully.
- Further developing client steadfastness.
- Representatives should be committed and inspired towards their work.
- Utilization of representative's ability at the perfect locations and time.
- All representatives should be urged to cooperate.
- The organization needs to recognize likely trailblazers in its positions and rouse them to succeed.
- The organization needs to perceive and enrol top entertainers.
- The organization needs to utilize good instinct about new business sectors, things, and indispensable participations.
- The organization needs to get laborers ready to do abroad tasks.

These and various more worries are looked by associations nowadays, both public and private. Since a prevailing piece of these concerns remember people for different work positions, the capacity to understand individuals on a profound level should transform into a choosing part for their strong organization. Additionally, in essentially every case, the ability to appreciate people on a deeper level should expect a basic part in dealing with such worries. To be convincing in offering their affiliations some help with overseeing change, trailblazers should be aware of and regulate feelings of strain and shakiness of their delegates. They moreover should have the ability to esteem the energetic reactions of various specialists and assist them with adjusting up to change. Other than the trailblazer, substitute people from the affiliation should be similarly prepared to screen and manage their own specific close to home reaction and furthermore of their accomplices. Ultimately it is these social and energetic abilities that we need to perceive and quantify, it is then that we will have the ability to expect execution at work space in this way achieving its feasibility.

Role of Emotional Intelligence in Organizations

Creating research exhibits the way that capacity to understand people on a deeper level is a prevalent sign of "accomplishment" than regular proportions of mental knowledge likewise called IQ. The working environment gives an optimal climate for people to foster their social as well as profound abilities, as individuals are persuaded to improve those capacities to make progress. The thought is similarly as crucial for supervisors, as their essential concern which is productivity, lays on the capacity to appreciate people on a profound level of the whole organization. At the point when representatives work to work on their capacities in the areas in which they are powerless, it is useful for the whole association, as it helps in further developing correspondence and expanding efficiency. The EQ-I assists with making a profile of an individual's capacity to understand people on a deeper level, reflecting both the solid areas as well as shortcoming. Individuals can involve this information in regions that should be gotten to the next level. Associations can utilize the profiles to show in the event that a potential recruit would make a useful expansion to the group. An action plan can be made once an individual or affiliation has this information, which upholds development in wanted regions. The capacity to appreciate people on a profound level permits people to think even more imaginatively and utilize their sentiments to handle issues. In accomplishing the outcome of individual connections, sympathy and relational abilities alongside friendly and administration abilities are believed to be most basic factors. One more element of the ability to understand people on a profound level is the ability to supervise feelings and handle pressure. Sympathy is a will be a basic piece of the capacity to understand people on a deeper level as sentiments are

more successful in fill in as well as in public activity. A supervisor is a person who needs to deal with the states of mind of the whole association. Fruitful corporate pioneers achieve this by utilizing a mix of different mental capacities and abilities otherwise called capacity to understand individuals on a profound level. A supervisor should be mindful and sympathetic towards individuals. With the objective that he can peruse and deal with his own feelings while immediately measuring how others feel. The ability to understand people on a profound level will fluctuate for different sorts of positions. For example, progress in the field of deals requires the capacity to check a client's perspective and the relational mastery to pick when to pitch a thing and when to remain quiet. In business related navigation, feelings should be kept at a lower level and each and everything should be founded on data furthermore, consistent thinking, with feelings at an absolute minimum.

Stress at Workplace

Unwell perspective or mileage of mind because of tension is known as pressure. Stress is likewise broadly known as when the pressures on us are more than the assets accessible available to us. We as a whole concur that some degree of positive pressure is expected in our lives with the goal that we fulfil all our time constraints. People experience the pressure under specific circumstances which are beyond his control also, challenging to deal with. People tend to oppose change and when they are experienced with transforms, they experience level of stress. In 21st century the outside climate is changing so quickly concerning a dangerous atmospheric devotion, innovation upgradations, psychological warfare. Stress is expanding and time for self and good time is diminishing. Different body parts impacted as a result of pressure are heart, resistance, issues connected with stomach and gas, fruitlessness and different skin related issues. One of the significant difficulties to the worker's wellbeing is Stress. It is achieved by strain at home and at work environment which is an issue to the organization and its representatives. Stress has been ordered in two significant classes individual and hierarchical. Stress comes from different sources like the business-related tensions or issues in private life. People who are sticklers what's more, who have assumptions which they can't meet additionally experience pressure. Poor capacity to understand anyone on a profound level likewise is the justification for stress. Ecological variables like contamination and unnecessary temperatures bring about people not ready to adapt to it. For the best sort of pressure evasion in an association then there should be a good organization and a sound working environment. Assuming workers are anxious then their administrators should know about their pressure and should assist them with conquering it. Businesses can't help workers in the event of private matters yet they unquestionably can help them in the event of any pressure from the association. Work related pressure is the response of the representatives when they face difficulties to adapt to pressure at work. Stress is a slow executioner. In the event that pressure isn't controlled it transforms into melancholy. Stress occurs in a broad assortment of work conditions anyway is often disturbed when agents feel that they have little sponsorship from heads and partners, where they have little command over work pressures. Stress results from struggle between their work interest and tensions on one hand and their knowledge what's more, limit on the other. It moves their ability to adjust to the work. Stress involves not just the circumstances wherein work stress surpasses the worker's capacity to adapt yet additionally wherein the representative's information and capacities are inadequately used. The workplace has turned into an exceptionally upsetting one where associations cut across businesses. Workers experience tremendous degree of stress because of different factors, for example, high responsibility, tight due dates, high targets, kind of work, nonappearance of business satisfaction, long working hours, tensions to perform, and so on. Relational conflicts at the work, like manager subordinate connections and relationship with peer gatherings, are additionally a significant wellspring of stress. Specialists say that the broken parts of pressure straightforwardly influence on an association's result and furthermore representative prosperity. Stress at the work prompts non-participation, higher misfortune, and reduced effectiveness. Stress incited weariness, prickliness, unfortunate correspondence, and quality issues by representatives. Expanded feelings of anxiety likewise impacted the inspiration and certainty of the representatives. Expanded openness to stretch without powerful survival strategies might prompt numerous physical and mental issues. For instance, stress might prompt pressure-initiated stomach issues, corrosiveness, sleep deprivation, sadness, coronary failures, and so on. Stress could initiate the person in question towards high gamble ways of behaving like smoking and drinking. Stress-related sickness prompts expansion in representative non-attendance and whittling down, hence influencing the benefits of the organization. Associations are equipping in giving its representatives a calm and solid climate. The undertakings to resolve this issue were more certified in a couple of business endeavours than others. That's what specialists feel, however stress at work environment is a peculiarity experienced worldwide, experts in couple of enterprises are more helpless to encounter stress than others.

Strategies for Coping with Stress at Workplace

- Worker's ought to be shown using time effectively.
- Associations can guarantee that representative wellbeing the executives is done appropriately.
- Hopeful methodology ought to be embraced instead of negative way to deal with critical thinking.
- Representatives ought to figure out how to find some kind of harmony among work and individual life.
- Different worker preparing and wellbeing projects ought to be coordinated.
- Associations ought to target giving a sound workplace to the representatives.
- Work Design ought to be such where in different jobs and obligations are appropriately made sense of.
- Associations ought to coordinate vocation directing meeting and give different help to the workers.
- Group building ought to be the focal point of the association.

Strategies for Coping Stress at Individual Level

- At individual level, one ought to do actual activity on the grounds that solid brain dwells in sound body as well as the other way around.
- Actual activities incorporate strolling, running, cycling, swimming, vigorous exercise.
- Yoga, pranayama and reflection are the best unwinding methods for the psyche and body.
- People ought to further develop their social emotionally supportive network that is make old buddies and mingle more.
- People to oversee time appropriately and reserve out margin for themselves.
- One ought to apply 80-20 rule in life which expresses that 80% consideration ought to be paid to things which are most significant and 20% consideration on things which don't make any difference.
- In three circumstance choices ought not be taken by a person when forceful imprudent choices ought not be taken, when an excess of energized choices ought not be taken and never give composed correspondence when irate.
- One ought to pay attention to melodies and read uplifting books.
- Be hopeful, remain positive and face all circumstances as it comes.

Stress in Indian Organizations

In India, associations are depending on techniques like showing the representatives dance and music, experience sport, and so on, to diminish the level of pressure at working environment. Goodbye Consultancy Services (TCS) Ltd. has various clubs, for example, Bibliophile Club, Theatre Club, Safe-haven Club, Adventure Club, Fitness Club, Music Club, Community Services Club, and so on. Infosys Technologies Ltd. focused on growing mindfulness on pressure and provided the agents guidance on the most effective way to adjust to pressure through a movement of studios by subject matter experts. Other than directing studios on pressure the executives, organizations were likewise leading off-site picnics, between departmental rivalries and games. A few associations utilize an arrangement of coaches and furthermore elevate open correspondence to further develop work environment interactions. Employees of the vast majority of the laid-out associations approach in-house advising division. A few organizations too utilized nutritionists for quality food at office bottles and furthermore counsel their workers on smart dieting propensities and a decent way of life. A couple of associations were in like manner considering using specialists to prompt their laborers. Specialists feel that associations should turn to imaginative and creative ways of dealing with pressure really. It's undeniably trues that people work under tension yet a lot of strain becomes pressure and can hurt the general capacity of the labourer to perform well. Each individual requirements to oversee pressure in the most ideal way conceivable. Many organizations have recognized ways of diminishing the level of stress at working environment and make the work fascinating and less testing. Presently a day's representatives deal with issue to strike a right balance between their own life and work life. It is a greater amount of work and less of time for family. Organizations likewise put together the yearly comprehensive gatherings in gorgeous area so the workers get time for entertainment and new themselves. Numerous association neglects to understand that when one objective is met by the worker other greater and really testing objective is given which further expands tension and level of

pressure in light of the fact that the representative couldn't savor the accomplishment of the objective rather new also, more troublesome targets are given. Associations can likewise the rule of the board by objective wherein the workers ought to take self-drives and set focus without anyone else. As this will build the responsibility of representatives towards associations. Without remunerations and acknowledgment no singular will be spurred to work. Kiran mazumdar Shaw the CEO of Biocon formulated a technique for propelling representatives to buckle down by expressing that anything business they bring a specific level of benefits will be compensated as reward to the representatives and this guaranteed that the representatives really buckle down since it was straightforwardly corresponding to the rewards. It's the need of great importance for all huge players to recognize the elements that influence the exhibition of the workers and attempt to gadget strategies to diminish pressure at work and give right preparation so representatives are serious areas of strength for genuinely they can deal with all assignment within reach with full efficiency.

Link between Emotional Intelligence and an Individual's Competencies

As man takes action from the worth-based framework to a ground breaking method for managing closeness of people around him, the nature of the capacity to understand individuals on a profound level transform into a reality. The resultant connection between individuals assists the two sides with developing trust taking into account their normal premium, goals, and mission, making the fundamental circumstances for achievement of individual and definitive targets. Basically, for interfacing with individuals, the individual must have a mix of specific individual, hierarchical and social capabilities in a commonly OK blend to accomplish authoritative greatness. Along these lines, genuinely canny way of behaving of people resolves the essential issues to achieve work environment viability and furthermore helps in achieving prevalent degrees of authoritative development. This aides during the time spent fostering a cordial workplace in the organization, prompting productivity and improvement in this way upgrading the value of human resources. With the opening up of Indian economy through progression, privatization and globalization and a push towards information development, the occupation of Indian business authorities has ended up being all the seriously requesting. The hardships get expanded when the Indian overseers need to work in different work groups. The variety in labour force has not just given close to home strength to the representatives and chiefs yet has likewise affected initiative way of behaving and adequacy of the associations. Innovation and development just address 5% of the change cycle; while the other 95% of an organization's change is reflected in the changes that happen in hierarchical way of behaving and culture which are the core of administration. The capacity to understand people on a profound level is an answer for larger part of the issues that associations face today. Each individual necessities to comprehend that just having the canny remainder isn't sufficient in this day and age. One who is major areas of strength for genuinely can endure all the deterrents which comes in their manner. The primary motivation behind why a great deal of people ends it all is on the grounds that they need close to home remainder or the ability to appreciate people on a profound level and they abandon life with such ease. One might have knowledge, administration quality, physical strength however on the off chance that an individual is sincerely frail, all the rest characteristics are of no utilization. There is a need to develop the most raised norm of initiative abilities, consistently expanding requests of customers for good quality of labour and products, radically changing business climate, and raising expenses. What associations need is people who have both specialized information, social and profound skills which would empower them to satisfy the clients. Individual abilities impact the capacity to appreciate people on a profound level of chiefs and representatives in each association.

The Components of Individual Abilities Considered Are: -

- Individuals' achievement
- Task achievement
- Framework achievement
- Self-achievement

Individuals' Achievement - This ability remembers grasping individual way of behaving for relational setting, wherein individuals need to interface with others to achieve and expand shared objectives. Communication means between relationship that exists among individuals and states how individuals connect with each other. The capacity to understand people on a deeper level is significant with regards to each individual's conduct inside the association. With the levelling of association structure nowadays, the range of control has now increased for the pioneer who should show sincerely insightful way of behaving for creating individuals' achievement. It is tracked down that relationship estimation of person direct is basic to be a convincing pioneer and adds to his thriving. The ability to appreciate people on a profound level is straightforwardly connected with bunch execution and feelings likewise contribute straightforwardly to group execution.

Task Achievement - This alludes to the expertise of a person to concentrate upon the assignment close by and have a go at finishing it with productivity and exactness. This likewise includes the utilization of imaginative considerations and development to reasonably get done with the responsibility. There are sure parts of the ability to understand anyone at their core which are connected with challenge and better execution, and furthermore increment task achievement. Workers who are high on capacity to understand people on a deeper level get more prominent legitimacy increments and have a higher organization rank than their partners. They likewise got better manager appraisals of relational assistance and stress resistance. There are areas of strength for a that exists between the capacity to understand people on a profound level and the presentation of workers which prompts task achievement.

Framework Achievement - A connection between the capacity to understand individuals on a deeper level and a work place proportion of viability will improve framework achievement.

Self- Achievement - It comprises of mindfulness that decides how a singular will take choices in his day-to-day existence.

FINDINGS AND CONCLUSIONS

- The review showed that Emotional Intelligence is fundamental in Indian Organizations and that it is deficient in the people of our country.
- The young people of our nation are driven by feelings, and there is a need to achieve an equilibrium of feelings in the youthful brains of India.
- This concentrate on ability to understand anyone on a profound level at work environment has recognized that, assuming the representative deals with his capacity to appreciate people on a deeper level, it straightforwardly affects his work.
- In Indian organization's kin can't remain positive in difficult situations and this unfavourably influences their work.
- The representatives can't act in pressure and this is a significant issue. To succeed, one should have the option to actually oversee pressure.
- Most people can't lay out testing objectives for themselves since they need to follow the customary ways and not face any challenge.
- Individuals likewise neglect to concede their errors rather they ought to move forward and assume complete ownership of their doing as this would just increment their validity.
- The capacity to understand anyone at their core is connected with better execution in administration, pulling individuals calm at work, balance between individual and expert life, straight forward conduct and going up against issues of representatives.
- The majority of the organizations these days are taking those representatives who are genuinely clever, with the goal that they can confront issues effectively and can be a resource for the association by improving efficiency.
- Genuinely insightful associations must be made through viable authoritative systems, expanded self-mindfulness and self-administration, upgraded initiative abilities as well as advancement programs.
- In the ongoing situation, the associations have begun giving more significance to the capacity to understand people on a profound level than IQ in light of the fact that they require those workers who are sincerely steady. Thus, for progress of any organization the capacity to understand individuals at their core plays an indispensable job.

SUGGESTIONS AND RECOMMENDATIONS

- In prior times, significance was simply given to IQ of an individual while the capacity to understand people at their core was not given significance be that as it may, these days the situation has changed and associations have begun giving more significance to the capacity to appreciate individuals on a deeper level than IQ.
- Man is impacted by different requirements and societies. Prior associations used to give unmistakable advantages to their clients yet nowadays clients need something else, they need satisfaction of their feelings. Associations should keep up with client unwavering quality and act in a humane manner with their clients.

- Associations lean toward recruiting representatives with high capacity to appreciate people on a deeper level since they have a genuinely steady casing of mind and thus can concentrate more.
- Associations should give preparing to their representatives for the ability to understand anyone on a deeper level on the grounds that capacity to appreciate people at their core can be learnt at whatever stage in life by any person.
- Managers ought to test the degree of the ability to appreciate individuals on a profound level occasionally and give workers input and subsequently get better execution from them since when there is powerful correspondence between them, there will be expanded efficiency furthermore, execution.
- The capacity to understand people on a deeper level is critical to progress of any association. It very well may be created by openness and preparing.
- Individual abilities of people should be created.
- There should be open sharing of thoughts and considerations in an association.
- Representatives should be urged to work upon their interactive abilities which would prompt their being acknowledged by their associates subsequently smoothening the work and achieving progress in the association.
- The executives need to urge its representatives to explore different avenues regarding the framework and cycles, in this way prompting individual as well as hierarchical development.

REFERENCES

1. Emotional intelligence - Wikipedia, the free encyclopaedia. 2016. Emotional intelligence - Wikipedia, the free encyclopaedia. [ONLINE] Available at: https://en.wikipedia.org/wiki/Emotional_intelligence.
2. Emotional Intelligence | Psychology Today. 2016. Emotional Intelligence | Psychology Today. [ONLINE] Available at: <https://www.psychologytoday.com/basics/emotional-intelligence>.
3. The 4 Fundamental Pillars of Emotional Intelligence. 2016. The 4 Fundamental Pillars of Emotional Intelligence. [ONLINE] Available at: <http://www.theemotionmachine.com/the-4-fundamental-pillars-of-emotional-intelligence>.
4. Emotional Intelligence. 2016. Emotional Intelligence. [ONLINE] Available at: http://www.unh.edu/emotional_intelligence/ei%20Measuring%20EI/eiMeasure%20How%20do%20you.htm.
5. Addressing 21st Century Issues with Emotional Intelligence: A conversation with Daniel Goleman and The Six Seconds EQ Network • Six Seconds. 2016. Addressing 21st Century Issues with Emotional Intelligence: A conversation with Daniel Goleman and The Six Seconds EQ Network • Six Seconds. [ONLINE] Available at: <http://www.6seconds.org/2011/08/08/goleman-eq-solving-problems/>.
6. Why EI is important in the workplace | EI at work. 2016. Why EI is important in the workplace | EI at work. [ONLINE] Available at: <http://www.emotionalintelligenceatwork.com/resources/why-emotional-intelligence-is-important-in-the-workplace/>.
7. The Role of Emotional Intelligence in Organization Development by Sangeeta Yadav: SSRN. 2016. The Role of Emotional Intelligence in Organization Development by Sangeeta Yadav: SSRN. [ONLINE] Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2637221.
8. About Emotional Intelligence. 2016. About Emotional Intelligence. [ONLINE] Available at: <http://www.Talentsmart.com/about/emotional-intelligence.php>.
9. Stress at Work: Tips to Reduce and Manage Job and Workplace Stress. 2016. Stress at Work: Tips to Reduce and Manage Job and Workplace Stress. [ONLINE] Available at: <http://www.helpguide.org/articles/stress/stress-at-work.htm>.
10. The Top 10 Emotionally-Intelligent Fortune 500 CEOs. 2016. The Top 10 Emotionally-Intelligent Fortune 500 CEOs. [ONLINE] Available at: http://www.huffingtonpost.com/entry/the-top-10-emotionallyint_b_911576.html?Section=India.
11. Business Case for Emotional Intelligence. 2016. Business Case for Emotional Intelligence. [ONLINE] Available at: http://www.eiconsortium.org/reports/business_case_for_ei.html.

The Decision-Making Capabilities of Women in Daily House-Hold Purchases

Sayed Amjad Kadri¹ and Devika Suryavanshi²

¹AIAIMS- Mumbai, Maharashtra, India & JJT University, Rajasthan, India

²BMS, Siddharth College of Commerce and Economics, Maharashtra, India & JJT University, Rajasthan, India
{Under guidance of Dr. Rinkesh Chheda }

ABSTRACT

In our daily life we see a lot of women in the market place, busy purchasing goods and products for the daily requirement of their family. Be it vegetables, fruits, dairy products, or even toys and clothes for their children and loved ones. We at times wonder as to why particular women selected this particular product only and not the other. This pondering has encumbered the inquisitiveness to identify what made this women make a particular decision.

A sincere attempt has been made to decipher the decision making ability of women and understand their pattern for decision-making and identify whether they have been influenced by any other individual in their purchase decisions.

In order to reach to a probable conclusion, a group of 50 females from the age group 12 years to more than 50 years are targeted and a survey is conducted where they are asked pre-designed questions from the questionnaire and analysis is made on that basis.

Keywords: Decision-making, house-hold, groceries, influence, multi-tasking

INTRODUCTION

Today's world is the world where women have been identified as an individual capable of making sound decisions and at times have surpassed their male counterparts even in multi-tasking abilities. It has not been an unusual sight today to find women leading the team of an MNC company, or a successful women entrepreneur, or a successful inventor / innovator. The transformation of this image of women, who just half a century ago was being held in the boundaries of their sweet homes, shackled in the bonds of societal pressure or in some cases the love and care of their loved ones, has now excelled in all the fields may it be education, job, technical field and even in various managerial capacities.

An attempt is being made in this paper to understand certain aspects of this transformation and the ability of taking decisions at root level in their daily house-hold chores is on their personal capacity or some influence whether out of love or otherwise coerces their decision making ability. Though this study is made on women of all the strata's of society, chances are high that the results may vary if the target is set on a particular strata, and what influences their decision- making capacity.

Our study targets mostly non-expensive products required for their daily house-hold chores. This is especially to identify how a woman decides as to which product to buy today – the criteria she selects and the yard stick she uses to analyze the price worthiness of the product she plans / identifies to buy. These products though bought by her are not meant for her personal consumption alone, they are for the consumption of the entire family and when knowing that these products are for the consumption of the entire family the pattern of decision making is the area of our study.

It has been highlighted in the past that women do not possess the decision making ability / women lack the attributes of decision making. The conservative society of this vast nation was no exception to these thoughts few decades ago. The transformation of this vast nation from being a conservative society to a liberal society, has not yet been fully converted, especially in rural areas, where women are subjected to the same treatment as that was perceived few decades ago.

The identification of certain women from various strata's of life exercising their decision making ability for daily house hold chores of the family and their impact on their family in regards to the selection made by her, the price paid and overall impact on the standard of living of their family can be identified.

HYPOTHESIS

H0: The Decision taken by women for the purchase of daily house-hold products is influenced by others.

H1: The decision taken by the women for the purchase of daily house-hold product is not influenced by others.

REVIEW OF LITERATURE

Shikha Khare (2021) mentioned the importance of decision making amongst women especially between the educated and uneducated women. In her paper she could clearly derive to the fact that the more the women were educated the more participating they were in the decision making process for their children. The educated women were more participating in the decision making process whilst the uneducated women were not actively able to do so.

Dev R Acharya et al., (2021) in his paper 'Women's autonomy in house- hold decision-making : a demographic study in Nepal', mentions that Autonomy is the ability to obtain information and make decisions about one's own concerns. It facilitates access to material resources such as food, land, income and other forms of wealth, and social resources such as knowledge, power, prestige within the family and community. Women's autonomy in health-care decision-making is extremely important for better maternal and child health outcomes, and as an indicator of women's empowerment. Gender-based power inequalities can restrict open communication between partners about reproductive health decisions as well as women's access to reproductive health services. This in turn can contribute to poor health outcomes. Women's age and family structure are the strongest determinants of women's authority in decision making. Older women and women in nuclear households are more likely than other women to participate in family decisions.

Purnima Pandey et al., (2021) in her paper has attempted to identify the decision making capability of women based on 6 parameters viz. Age, Religion, Social Group, Level of Education, Occupation and Income. Deriving how these factors played a role in the decision making abilities of a women, especially, the increase in age which directly corresponded to the decision making ability of a women.

METHODOLOGY

Use of primary data, generated through a set of questionnaires, aimed to identify the output whether the decisions of women in case of purchase of house-hold products are totally theirs or are influenced by others. The survey aims not only to identify the decision making ability of women, but also emphasizes on the fact that women by nature are caring for their family members and prefer usually to purchase those products which are beneficial for the health / well being of their family and loved ones. Data was collected from 51 women participants of various strata and how their decision making criteria emerged were analyzed. The women of today's India, has emerged beyond the veils of control enforced by her parents and male siblings initially and the shackles of her husband and In-Laws post her marriage. She has grown enough to take decisions wisely and support her family not only through her job, but also through her ability to save through the purchase of the products required daily for her house-hold needs.

Scope and Limitations of Research

The scope of this research was to identify the decision-making ability of women in respect to house-hold purchases. The research was carried out in the city of Mumbai, a metropolitan city and financial capital of India. It can be stated that the outcomes of the research may defer if the same are carried in tier two cities.

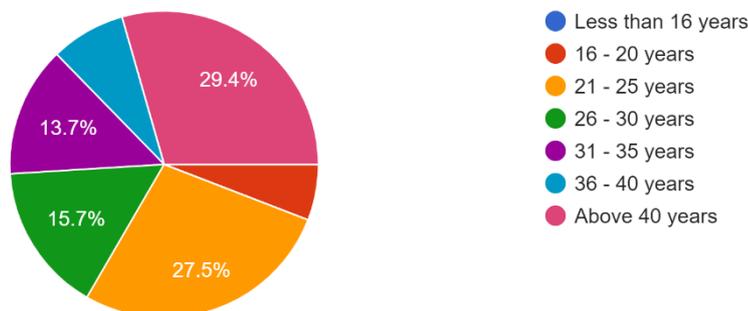
RESEARCH AND FINDINGS

When a questionnaire was floated to women of all strata , so as to understand their decision making criteria towards the commonly gesture of house-hold purchase, which was once the forte of elderly people of the family.

Age

The women who participated in this research the majority of them were of the age group above 40 years that constituted to a strong 29.4% which can be stated that as a woman gets mature the risk and decision taking ability of theirs increases. The close second was age group 21-25 years which constituted 27.5%, indicating that young ladies also entering the fray of decision making which will enable them to be good decision makers as they grow mature in age.

Age
51 responses

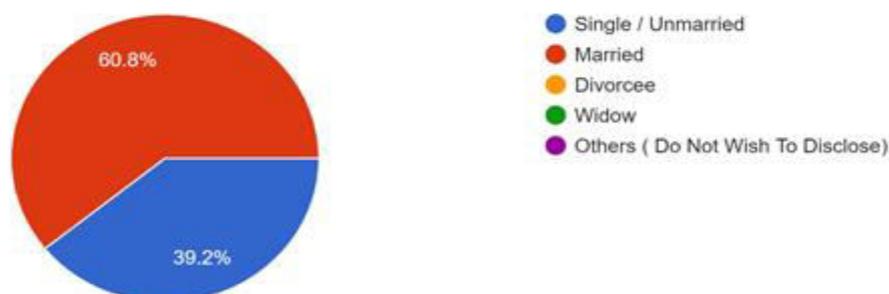


The third group 26 -30 years stays a little too behind at 15.5%.

Marital Status

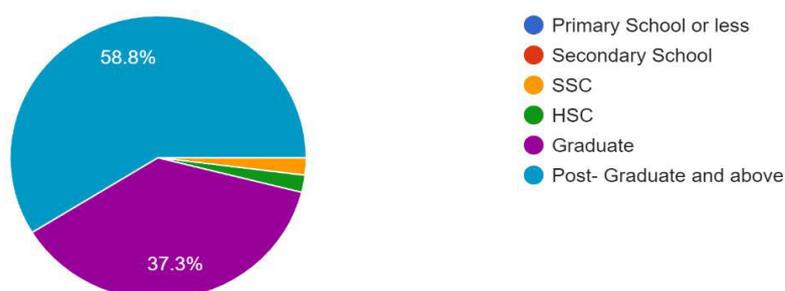
Around 60.8% women were married, indicating that their spouse did not have any problem they taking decisions for house-hold purchases. Also indicating that our society is being progressive and not being a stagnant male dominant society.

Marital Status
51 responses



Education

Education
51 responses

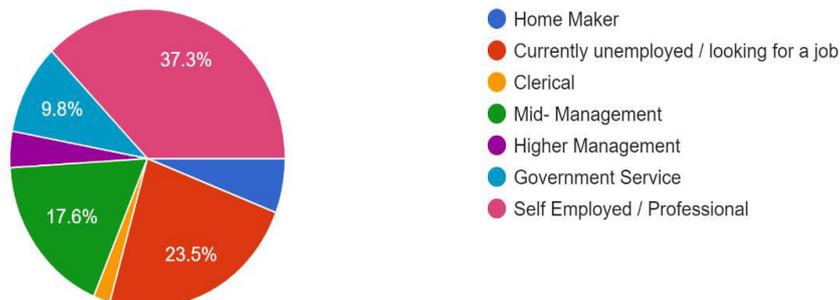


Today's women have given more emphasis on education and that can be understood from the fact that a sizeable 96.1% of the women who responded are either graduate or post graduate. Those who have done their post- graduation contributed to a strong 58.8%.

Occupation

Occupation

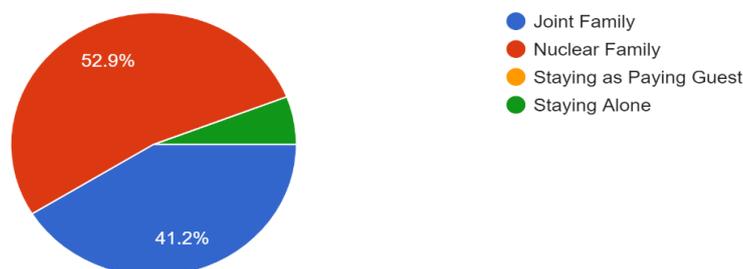
51 responses



The majority of the women who responded were self-employed / Professional viz. 37.3%, that means they were independent working women having the ability and capacity to take their own decisions. A sizeable portion i.e. 17.6% were women who were working in the capacity of mid-management implying that organization trust their decisions worthiness.

Your family Structure

51 responses

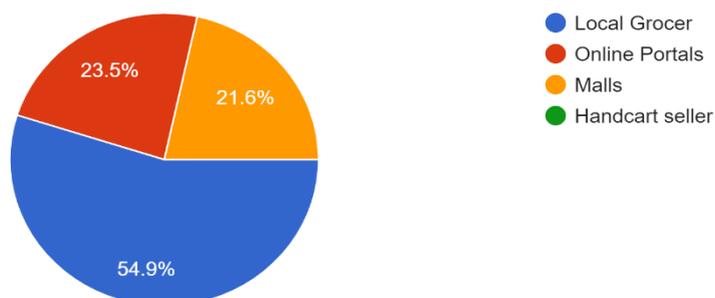


The demography of the family structure identified that 52.9% are members of nuclear family and 5.9% live alone, whereas 41.2% lived in joint family.

Preference for Grocery Shopping

Where do you prefer to do the shopping of groceries from?

51 responses



When asked their preference for grocery shopping, a whopping 54.9% preferred to deal with local grocers, whereas, online portals and malls followed the list.

The reason for them buying from these places were responded by 43 participants where they identified the following:

Convenient = 19

Cheap and Affordable = 7

Home Delivery = 2

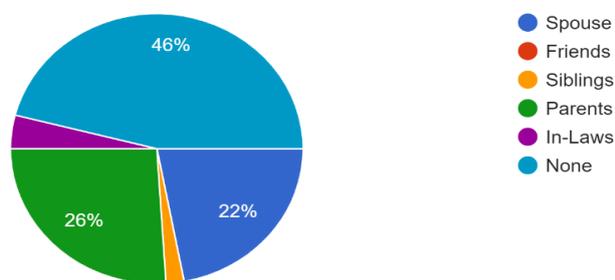
Discounts and other offers = 8

Can Bargain = 2

Can see and select the product = 8

Grocery Purchase

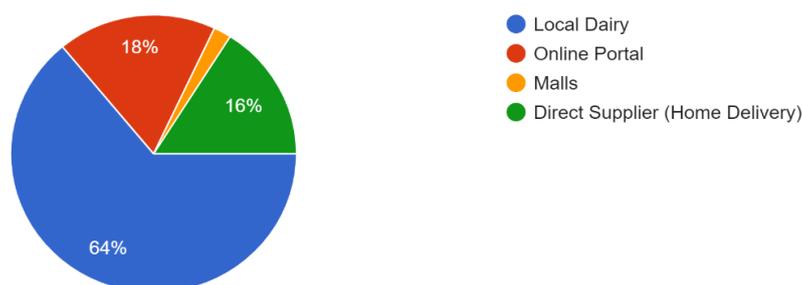
Who accompanies you while buying groceries
50 responses



In most cases women were accompanied by their spouses which amounted to 46%, those who preferred to go for such shopping were accompanied by their parents accounted to 26% and 22% preferred doing such shopping alone.

Purchase of Milk and Dairy Products:

Where do you buy Milk and Dairy products from
50 responses



In case of purchase of dairy products 64% preferred local dairies, whereas 18% depended on the supplies from online portals and 16% preferred direct supplier to provide home delivery.

When asked the reason of their purchase it was identified as below:

Convenient = 29 responses

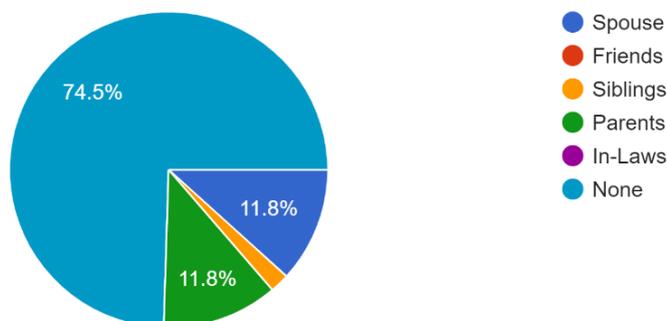
Quality = 12

Trust = 3

Home delivery = 2

And most single response mentioned customer relations, eco-friendliness, need specificity, discount and offers as their reasons.

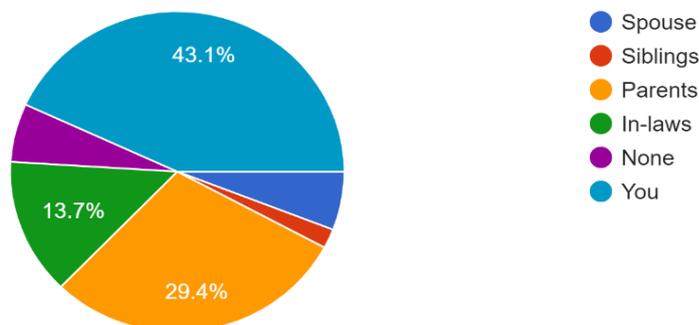
Who accompanies you while buying Milk and Dairy Products
51 responses



Most of the women (74.5%) preferred to go alone for buying dairy products, where as 11.8% each preferred to go either with their spouse or parents.

Cooking Decisions

Who decides as to what should be cooked in the house?
51 responses



Most women (43.1%) preferred to cook the dishes of their own choice whereas 29.4% cooked the preference of their husband.

CONCLUSION

Women are a decisive figure in today's decision-making criteria for the purchase of house-hold products. Though their decision-making approach is not limited to this alone. Their decision can be trusted for far more complex situations then these. The effectiveness of their decisions in more complex situation will require separate research to confirm the facts. However, their importance in purchase of house-hold purchases stands unilateral in their favor.

Outbound Tourism and Trends in Online & Offline Bookings

Gaurav Raman Arora and Kishor Bhanushali
Karnavati University, Gandhinagar, India

ABSTRACT

Technological development has assisted in reducing costs, boost operational productivity, expand services & customer experiences. Both customers and businesses can get benefitted from better communication, reservations & guest service systems that is functioning through two diverse approaches, online and offline respectively.

Whether it is to meet a relative settled abroad, a shopping trip, a global sport event or just for leisure, Indians have been increasingly travelling abroad before Covid. And in the post-pandemic world; India is poised to emerge as a very important contributor to outbound tourism. According to the United Nations World Tourism Organization (UNWTO), India will have 50 million outbound tourists by 2020, growing at a compound annual growth rate (CAGR) of around 7.23 percent over the last seven years and projected to rise at a CAGR of around 10 – 12 percent during 2016 – 21. This number will surely go through some short-term downward revisions because of the current Covid pandemic. As per the 'World Travel and Tourism Council' (WTTC) report; an Indian's expenditure outside the country while traveling abroad has doubled in the past 10 years, from \$7.5 billion in 2005 to around \$16 billion in 2015. The purpose of this study is to contribute toward an analytical study about Outbound tourism and trends in online & offline bookings and understanding the current usage of internet as a travel information searching and travel service booking channel. Technology permits quicker, efficient communication amid tourism businesses and travelers. With travel across different segments (business, leisure, meetings & conferences, wedding related, Government delegations etc.) increasing; the future of outbound tourism looks bright. The two major threats to travel in general and outbound tourism in particular are future pandemics (if any) & geo-political factors.

Keywords: Indian tourism, outbound travel, travel service booking channel, technology, pre and post pandemic travel

INTRODUCTION

The tourism industry in India is growing and it has vast potential for generating employment and earning large amount of foreign exchange besides giving a fillip to the country's overall economic and social development.

The ministry of Tourism takes care of the promotion of tourism in India, and the development of tourism throughout the country. On the same note there are foreign tourism boards present in India which drive tourism from the India market to their respective destinations.

The rapid advance in information technology (IT) and the proliferation of technology-based systems, especially the Internet, are leading fundamental changes in how companies are performing business and interacting with customers. Electronic commerce (e-commerce) has become an important business model with these great changes. There is unlimited progress & the extensive usage of e-commerce in business. The way travel organizations bring their travel products to the market and customers' travel; we can say that tourism industry has been deeply impacted by the internet. Consumers can conduct travel information searching and travel service booking online. Online travel service reservation has constituted one of the largest and fastest growing segments of e-commerce in B2C arena. The Internet has developed as a new middle in travel industry and the traditional travel agencies, or tour operators are fast adapting to this change. They are increasingly moving online and making their presence felt across all social media & also driving transactions on Whatsapp, Facebook, Instagram etc.

LITERATURE REVIEW

Elizabeth S (2000) has thrown light on the development and uses about technology. According to her study, it is technology which permits quick and effectual communication amid tourism businesses & travellers. Both consumers and businesses can benefit from advances in communication, reservations and guest services systems. For changes in tourism Internet, Reservations Systems, Computer Systems, Mobile Communication are considered as important sources. Effective use of Internet technologies can generate revenue for the hospitality and tourism business. Booking devices allow easy access by consumers and travel professionals. The bookings machines changed costs for travel business by increasing coverage and giving the traveller more

control over their buying procedure. For bookings, connected computer systems are used extensively. Many tourism and hospitality businesses are using mobile communication to keep customers advised of changes.

Bethapudi (2013) additionally reconnoitred the role of internet for Indian tourism. The research identified that information communication and technology has very crucial role for tourism industry. Tourist can access any kind of information about tourism destination and tourism products from any part of the world. Tourism comprehends with social media. ICT can also be considered as main source for boosting up of tourism industry. ICT takes advantage of examining the location, exploration for information on tourism products, e-booking of airline tickets & hotel reservation. The researcher recommended that all the organisations in connotation with tourism industry should continue rationalized use of latest technology. As per research more Technology up gradation is recommended.

Smaranda et al. (2014) explained about online v/s offline tourist behaviour & projections. They emphasised on qualitative and exploratory research. By using online portal 'isondaje.ro' the data has been collected. With the association with Chinese portraits the word association technique was used. Total 346 interviewees were asked various questions & snowball sampling technique was used. Tourist behaviour profile was found identical in online as well as offline mode. It was noticed that tourists discover more material which is consistent & they can design their outings well. In online mode tourists can single-handedly get good access of information. While in offline mode they have to rely on somebody else and need others for information.

Begum (2014) offered a case study on the development of e-retail in Indian tourism Industry. It was specified in the study that e-retail is the firmest rising sector of India with 12% annual growth rate and 12% aid in the GDP in the year 2010. Upcoming forecasts of online travel industry in India are growing users of internet, accessibility of debit cards & credit cards, extended spread to customers, India emerging as an IT hub, and more secured operations. However, there are some challenges to Indian online travel industry which are problems in shipping and payment system, offline presence of tour operators offering products at discounted rates, language problems and new emerging business models. The study also offered SWOT analysis of E retail travel Indian industry. Strengths are convenience as it saves time and cost, people have more power to expand and get good discount and lower prices. Opportunities are growth in low-cost carrier and approval of FDI in retail by government, increase in consumer spending and income. The flaws recognized are absence of big investment for development, attentiveness in metropolitan areas, fewer assurance on payment mechanism. Threats are lack of qualified personnel, poor security in cyber system, high investments and lack of rural coverage.

Katarina. P (2015) in her article recommends marketing ideas for other travel agency businesses. Nowadays clients can make their individual travel plans online; travel agencies must focus on more digital marketing & outreach if they want to grow, Previously, travel agencies could center on raising interest in the ideas of tourism or in certain destination. Agents now need to contemplate on how to make their communication interesting in order to upsurge traveller's business. At last, she has assumed some advertising ideas to do real online and offline business such as to produce a mobile app for your travel agency, produce a sports travel group, influence social media to form your brand, engrave articles for native magazines & papers.

OBJECTIVE OF THE STUDY

1. To understand the various travel segments that contribute to outbound tourism.
2. To understand the growth drivers and challenges in outbound tourism that impact online & offline bookings

RESEARCH METHODOLOGY USED

1. Secondary data was collected from different sources including Ministry of Tourism data & also from various national & international journals.
2. This data was then reviewed & observations were made to arrive at conclusions that are in line with the objectives of this study. This is a Review Paper.

Travel Motivation and Purpose of Visit:

Experience-Based Travel

One of the vital trends in the Indian travel industry is personalisation of travel. Many travellers are looking for spot-on and modified programmes; and don't mind paying extra for a package that is exclusively designed for them to enhance their travel experience. Also, the Indian travellers are increasingly turning away from just sight-seeing and moving towards experiential travel, not just in the familiar destinations like Europe or North America, but also in Less explored and unknown from tourism prospects like Jordan, Tunisia, Azerbaijan or Mexico. After years of being an also-ran in the market, Indian travellers are emerging as a significant chunk of

business for many cruise companies, operating not just in the vicinity but also literally across the seven seas. This has been impacted because of the pandemic but cruise companies are counting big on Indian travellers' business in the post pandemic phase. Most destinations are thrilled.

Weddings & MICE

One of the key travel segments that has caught on in a big manner in India over the past 15 years is MICE, as practically all companies – from hospitals and pharmaceuticals to automobile and cement makers have begun to pamper and incentivise their distributors and dealers by taking them on fully sponsored junkets overseas. India is projected to produce over two million outbound luxury & MICE tourists yearly by 2020, strengthening the country's effect as a main basis market for MICE & luxury travel, according to a report. It is expected that the MICE travel market in India can hit USD 9 billion (INR 630 billion) by the year 2025. The pandemic has of course impacted this forecast and the numbers will see some medium-term downward revision.

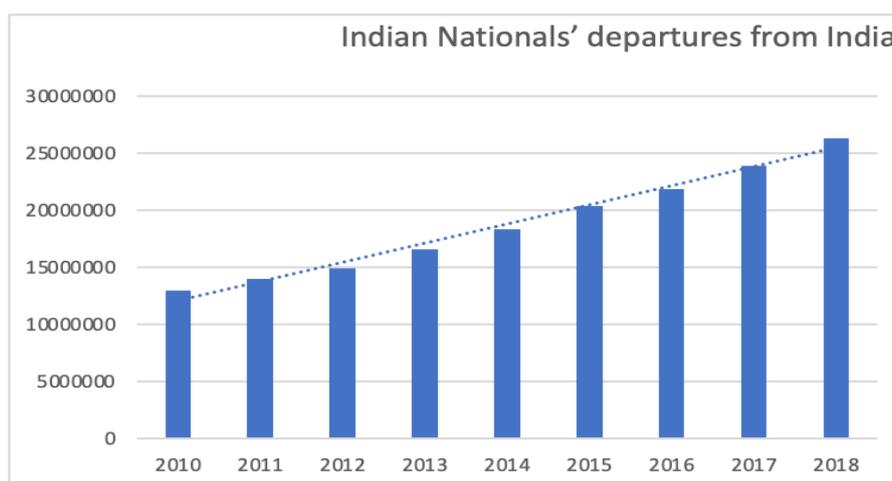
Destination Weddings

It is yet another segment of outbound travel from India that will continue to grow strongly, and many countries are already betting on presenting themselves as the ideal setting for the next Big Fat Indian wedding. With over 10 million weddings each year held in India, if even a small fraction of these is relocated to overseas, it could mean billions of dollars in revenues for the beneficiary destinations. This is not only due to the high number of weddings, but the relatively large budget for wedding set aside by an Indian family.

Number of Indian Nationals' Departures from India, 2010 To 2018

Year	Indian nationals' departures from India	% change
2010	12988001	17.4
2011	13994002	7.7
2012	14924755	6.7
2013	16626316	11.4
2014	18332319	10.3
2015	20376307	11.1
2016	21871995	7.3
2017	23942957	9.5
2018	26296484	9.8

Source: India Tourism Statistics 2018, Ministry of Tourism



Port-Wise Departures of Indian Nationals' Departures from India, 2011 – 2018

s. no.	Port/ Land check post	Year								% share in 2018
		2011	2012	2013	2014	2015	2016	2017	2018	
1	Delhi (Airport)	3009762	3226344	3517589	3794923	4092035	4475300	5119669	5801451	22.06
2	Mumbai (Airport)	3264653	3501739	3734176	4146539	4474820	4692109	5097038	5457293	20.75
3	Chennai (Airport)	1540106	1620314	1730503	1803368	1900570	1999412	2078070	2361244	8.98
4	Cochin (Airport)	1098333	1205315	1390833	1610742	1960220	2190681	2215214	2142700	8.15
5	Bengaluru (Airport)	746051	810108	852591	953558	1143585	1240313	1353255	1658292	6.31

6	Hyderabad (Airport)	777540	810903	925401	1068658	1274431	1313670	1395090	1601374	6.09
7	Calicut (Airport)	970961	986463	1112297	1178769	1106353	1110940	1353560	1405048	5.34
8	Trivandrum (Airport)	677998	739698	854564	924216	1013203	1037257	1095913	1174470	4.47
9	Kolkata (Airport)	453682	502802	562907	591621	712522	752497	832156	899897	3.42
10	Ahmedaba (Airport)	275981	286707	366102	396930	464927	494394	504689	605404	2.30
11	Others	1178935	1234362	1579353	1862995	2233641	2565422	2898303	3189311	12.13
	Total	13994002	14924755	16626316	18332319	20376307	21871995	23942957	26296484	100.00
	% Share of Top 3	55.84	55.94	54.02	53.16	51.37	51.06	51.35	51.79	
	% Share of Top 10	91.58	91.73	90.50	89.84	89.04	88.27	87.89	87.87	

Source: India Tourism Statistics 2018, Ministry of Tourism

The port-wise number of Indian national's departures from India for 2011 to 2018, are given in the above Table. During 2018, top 3 airports for departures of Indian nationals from India were Delhi, Mumbai, and Chennai. Delhi airport registered the highest share (22.06%) followed by Mumbai airport (20.75%) and Chennai airport (8.98%). These 3 top airports accounted for 51.79% of the total departures in 2018. During 2017, Delhi, Mumbai, and Cochin airports had a percentage share of 21.38%, 21.29% and 9.25%, respectively.

The share of Top 10 ports in overall departures of Indian nationals from India during 2011-2018 has also gradually decreased from 91.38% in 2011 to 87.87% in 2018. This decline may be due to various reasons including introduction of international flights at other airports.

Growth Drivers

- 2019 observed countless accumulation of direct flights allowing direct connectivity of global airports with Indian cities. The main ones were – Georgia (Tbilisi), Jaffna and Batticaloa in Sri Lanka, Hanoi and Ho Chi Minh in Vietnam and Dushanbe in Tajikistan. Also, high-class direct flights to New York from Mumbai, Japanese Airlines opening Tokyo to Bengaluru and Lufthansa making way for Bengaluru-Munich flights.
- Air India started flights to Kenya which allowed a good quantity of tourist outflow to Africa.

Challenges

• The Departure of Jet Airways from the Indian Aviation Industry

The departure of Jet Airways from the Indian aviation industry led to chaos on the Indian outbound travel. It condensed the number of direct flights to Paris and also summer bookings.

• Offline Visa

The experiments of receiving an offline visa printed would also have disheartened Indians to visit countries like US, UK or Schengen ones. Indians mostly favour online visa or eVisa because of its quicker support and accessibility.

• Rupee Depreciation

The rupee depreciation also became a huge hurdle for the Indian outbound market. United States, Canada, London, France, Italy and Switzerland kept seeing a dip in bookings because of the rupee depreciation.

• Food Preferences Of Indian Travellers

Food preferences of Indian travellers can be added to the list of challenges. Not all countries have an authentic vegetarian cuisine availability throughout the stay which could discourage Indians to travel outside their home country.

• Pandemic

With Covid emerging as a big surprise disruptor to travel & mobility, any pandemic in the future has an immense potential to negatively impact outbound tourism

• Geo-Political Factors

The ongoing Russia-Ukraine conflict and the Sri-Lankan political & economic crisis are reminders of how geo-politics can be a big threat to outbound tourism.

CONCLUSION

With more than 1.3 billion inhabitants and GDP increasing by more than seven percent every year, India offers enormous potential for future growth in outbound travel. Technology is playing a big role in information dissemination and to drive bookings. Whether it is to meet a relative settled abroad, a shopping trip, a global sport event or just for leisure, Indians are increasingly travelling abroad. The major drive for outbound tourism

is the advent of the country's tourism offices in India which enables better connectivity for planning travel and getting a visa. The eVisa program by many countries and visa on arrival policy has enabled a huge growth in Indians travelling abroad. The middle-class family who wouldn't mind travelling every year or at least every 2 years followed by those packs of adventurous millennials who are inclined to spend on travelling their heart out rather than save will drive the growth in tourism. In fact, India's middle-class approximately numbers to more than 350 million people. An average Indian traveller spends \$1,200 per visit as compared with Americans who spend about \$700, and British who spend \$500. So, such trends can show a bright future for Indian outbound travel, in the post-pandemic period. The two major threats to travel in general and outbound tourism in particular are future pandemics (if any) & geo-political factors.

REFERENCES

1. Kirti Singh Dahiya , Dr. D.K Batra(2016),” Travel industry selecting between online and offline mode” International Journal of Scientific and Research Publications, Volume 6, Issue 9, September 2016 694 ISSN 2250-3153 www.ijsrp.org
2. Puckett, K. (2015). Marketing Ideas for your Travel Agency Business. Retrieved from Travel tech <https://traveltechstrategies.com/2015/01/marketing-ideas-travel-agency-business/>
3. Smaranda Cosma, Carman Nastase, Marius Bota, Mihaela Tutunea (2014), Comparison between online and offline tourism using association techniques, JEL classification: L83
4. Bethapudi Anand (2013), The role of ICT in tourism industry, Journal of applied economics and business, VOL.1, ISSUE 4 – PP. 67-79
5. Begum Zafreen (2014), E-retailing- A case study of online Travel industry of India, International Journal of Research in Science and Technology Volume 1, Issue 1: October - December 2014 pp.50-54
6. Cyriac, P.C. (2018). India Tourism Statistics 2018. 19-35.
7. Cyriac, P.C. (2020). India Tourism Statistics 2020. 6-21.
8. Online travel bookings to see \$24 billion more spending’—Times of India. (n.d.). Retrieved April 19, 2021, from https://timesofindia.indiatimes.com/trend-tracking/online-travel-bookings-to-see-24-billion-more-spending/articleshow/68914966.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
9. From Jet Airways closure to Air India crisis: How India's aviation sector stalled in 2019. (n.d.). The New Indian Express. Retrieved April 19, 2021, from <https://www.newindianexpress.com/specials/2019/dec/25/from-jet-airways-closure-to-air-india-crisis-how-indian-aviation-sector-got-stalled-in-2019-2080409.html>

A Comparative Analysis between Traditional and Online Shopping and Its Impact on Consumer Buying Behaviour

Puja Ahuja Gupta and Rambhavan Yadav

Shri L.R. Tiwari Degree College of Arts, Commerce and Science, Mira Road, Thane, Maharashtra, India

ABSTRACT

In today's market scenario customers are considered to be the king of the market. In earlier time there was monopoly of the marketer, hence marketer use to increase the price and reduce the service. But now customers are having many options. Hence customers are key to business success. In today's world marketer has to identify the customers need and desire and produce accordingly. Marketer need to study consumer's buying behavior for the effective sell of products and services. Consumer buying behavior also helps to understand the likes and dislikes of the customers. Cloths are the basic need of the human beings. As the world is becoming trendy peoples are preferring fashionable and trendy cloths. In this growing world peoples focus has been shifted from non-branded clothes to branded clothes. If the marketer want to increase the sale of branded apparel and want to sustain in the market then he should focus on consumers buying behavior. The main purpose of this study is to understand the consumers buying behavior towards traditional shopping and online shopping of branded apparel. The study also observes preference of customer regarding branded apparel. To meet the objective primary data is collected with the help of questionnaire and secondary data is collected through online platform.

Keywords: Consumer Behaviour, Online Shopping, Traditional Shopping

INTRODUCTION

Consumers Buying Behavior

A buyer, often known as a consumer, is a person who buys products and services for his or her own personal use. In other world Consumers are those who buy goods and services for immediate use or consumption. The study of when, why, how, and where consumers buy or don't buy a product is known as consumer buying behaviour. Consumer purchasing behaviour is largely influenced by consumer psychology. It investigates individual consumers' demographics and behavioural characteristics in order to comprehend their desires. It investigates individual consumers' demographics and behavioural characteristics in order to comprehend their desires. Consumer buying behaviour refers to the actions performed by customers before purchasing goods or services (both online and offline).

OBJECTIVE

- 1) To study consumers buying behavior towards traditional shopping of branded apparel.
- 2) To study consumers buying behavior towards online shopping of branded apparel.
- 3) To study preference of consumers regarding branded apparel. [online and traditional shopping]

RESEARCH METHODOLOGY

I] Data Sources:

The research is done with the help of questionnaire through online.

II] Sampling Design:

The sample size selected for the study is 100 and it was selected through simple random sampling.

Importance/ Need of Study of Consumers Behavior



Major factors Influencing Consumer Behavior

- 1) Psychological Factors
- 2) Social Factors
- 3) Cultural factors
- 4) Personal Factors
- 5) Economic Factors

Online Shopping

Online shopping, often known as e-shopping, is a type of electronic commerce that allows customers to buy goods or services directly from vendors over the internet via a web browser or a mobile app.

Traditional Shopping

Traditional shopping is a type of shopping in which customers go to a store and buy the products and brands they want. In other words, end-consumers can walk into a shopping centre and decide whether to buy in cash or on credit after seeing and choosing a product.

Branded Apparel:

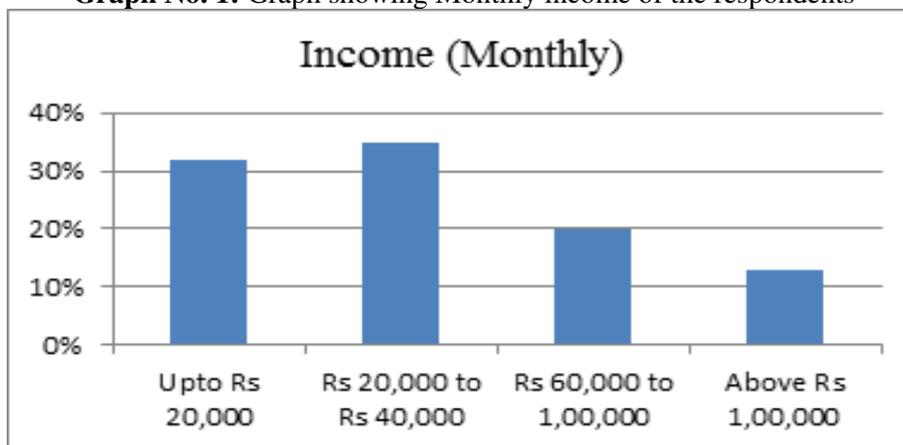
Rather than being sold under a store's name or the garment's own name, branded apparel bears the company's brand name. Those apparel which hold company's brand name those apparel are known as branded apparel.

Data Analysis and Interpretation

Table No. 1: Showing Monthly Income of Respondents

Monthly Income	Percentages (%)
Upto Rs 20,000	32%
Rs 20,000 to Rs 40,000	35%
Rs 60,000 to Rs 1,00,000	20%
Above 1,00,000	13%
Total	100%

Graph No. 1: Graph showing Monthly income of the respondents

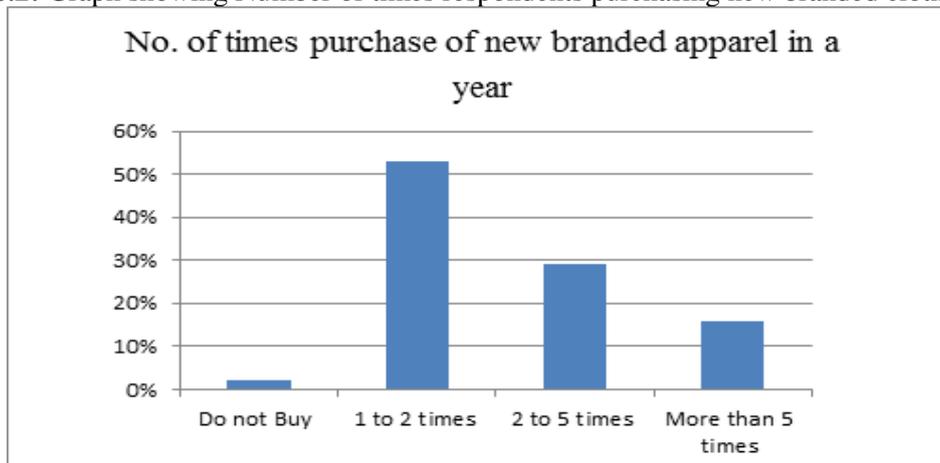


Above Table and Graph reveals that 35% respondents has monthly income of Rs 20,000 to Rs 40,000, 32% respondents has monthly income upto Rs 20,000, 20% respondents monthly income is Rs 60,000 to 1,00,000 and 13% respondents monthly income is above 1,00,000.

Table No.2: Table Showing Number of times respondents purchasing new branded clothes in a year

Opinion	Percentages (%)
Do not Buy	2%
1 to 2 times	53%
2 to 5 times	29%
More than 5 times	16%
Total	100%

Graph No.2: Graph showing Number of times respondents purchasing new branded clothes in a year

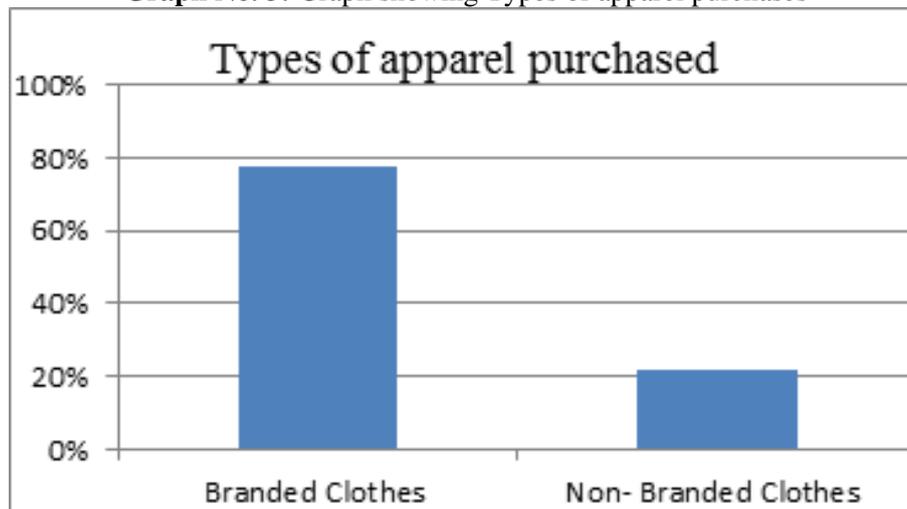


Above Table and Graph highlights that maximum 53% of the respondents purchase new branded apparel 1 to 2 times a year, 29% respondents purchase new branded apparel 2 to 5 times a year, 16% respondents purchase new branded apparel more than 5 times a year and 2% respondents do not buy new branded apparel.

Table No.3: Table showing Types of apparel purchases

Types	Percentages (%)
Branded Clothes	78%
Non-branded Clothes	22%
Total	100%

Graph No. 3: Graph showing Types of apparel purchases

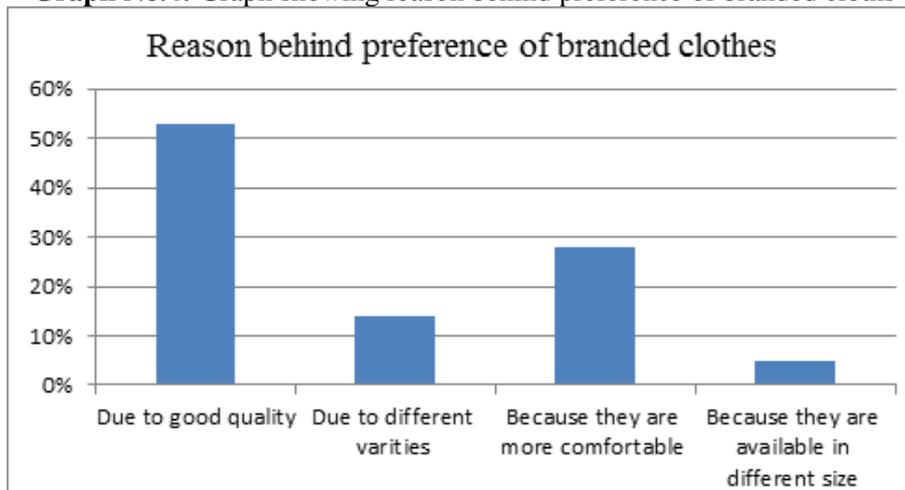


Above Table and graph shows that maximum respondents i.e 78% purchases branded apparel and 22% respondents purchases non- branded apparel.

Table No. 4: Table showing reason behind preference of branded cloths

Opinion	Percentages (%)
Due to good Quality	53%
Due to different varieties	14%
Because they are more comfortable	28%
Because they are available in different size	5%
Total	100%

Graph No.4: Graph showing reason behind preference of branded cloths

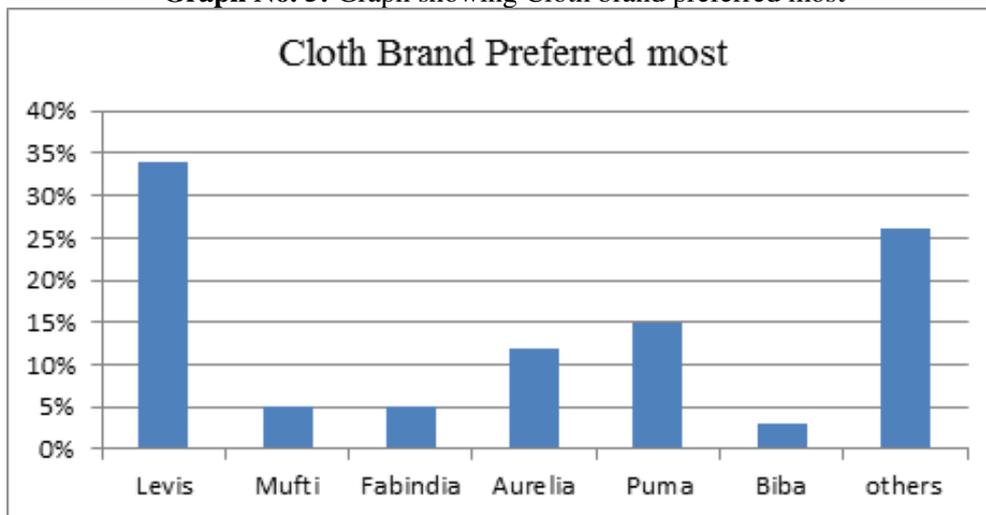


Above Table and Graph highlights that maximum 53% respondents prefer to buy branded clothes due to good quality, 28% respondents prefer to buy branded clothes because they are more comfortable, 14% respondents prefer to buy branded clothes due to different varieties and 5% respondents prefer to buy branded clothes because they are available in different size.

Table No.5: Table showing Cloth brand preferred most

Cloth Brands	Percentages (%)
Levis	34%
Mufti	5%
Fabindia	5%
Aurelia	12%
Puma	15%
Biba	3%
Others	26%
Total	100%

Graph No. 5: Graph showing Cloth brand preferred most



Above Table and Graph indicates that maximum 34% respondents prefer levis, 26% respondents prefer other brands , 15% respondents prefer puma, 12 % respondents prefer Aurelia , 5% respondents prefer Mufti , 5% respondents prefer Fabindia and 3% respondents prefer Biba.

Table No. 6: Table showing Mode preferred frequently to buy branded clothes

Mode	Percentages (%)
Online shopping	41%
Traditional Shopping(Retail Shop)	59%
Total	100%

Graph No.6: Graph showing Mode preferred frequently to buy branded clothes



Above Table and graph reveals that maximum 59% respondents prefer traditional shopping mode for frequent purchase of branded clothes and 41% respondents prefer online shopping mode for frequent purchase of branded clothes.

Table No. 7: Table showing purchase of branded clothes in different physical retail

Different Physical retail	Percentages (%)
Store	37%
Branded Showroom	33%
Shopping mall	29%
Exhibition	1%
Total	100%

Graph No.7: Graph showing purchase of branded clothes in different physical retail



Above Table and Graph indicates that maximum 37% respondents purchase branded clothes form store, 33% respondents purchase branded clothes form branded showroom, 29% respondents purchase branded clothes form shopping malls and 1% of respondents purchase branded clothes form exhibition.

Table No. 8: Table showing does the respondents prefer to buy branded clothes online

Opinion	Percentages (%)
Yes	36%
No	33%
May be	31%
Total	100%

Graph No. 8: Graph showing does the respondents prefer to buy branded clothes online



Above Table and Graph shows that maximum respondents i.e 36% prefer to buy the branded clothes online, 33 % respondents do not prefer to buy branded clothes online and 31% respondents they may buy branded clothes online.

Table No.9: Table showing faced quality issue when branded clothes are purchases online

Opinion	Percentages (%)
Always	7%
Most of the time	27%
Rarely	52%
Never	14%
Total	100%

Graph No.9: Graph showing faced quality issue when branded clothes are purchases online



Above table and Graph reveals that maximum 52% respondents rarely face quality issue when branded clothes are purchased online, 27% respondents face quality issue most of the time when they purchase branded clothes online, 14% respondents has never faced quality issue when they purchase branded clothes online and 7% respondents always face quality issue when they purchase branded clothes online.

Table No. 10: Table showing Are Branded clothes are expensive then non-branded clothes

Opinion	Percentages (%)
Highly expensive	19%
Expensive to some extends	63%
Less Expensive	13%
Not at all expensive	5%
Total	100%

Graph No.10: Graph showing Are Branded clothes are expensive then non-branded clothes

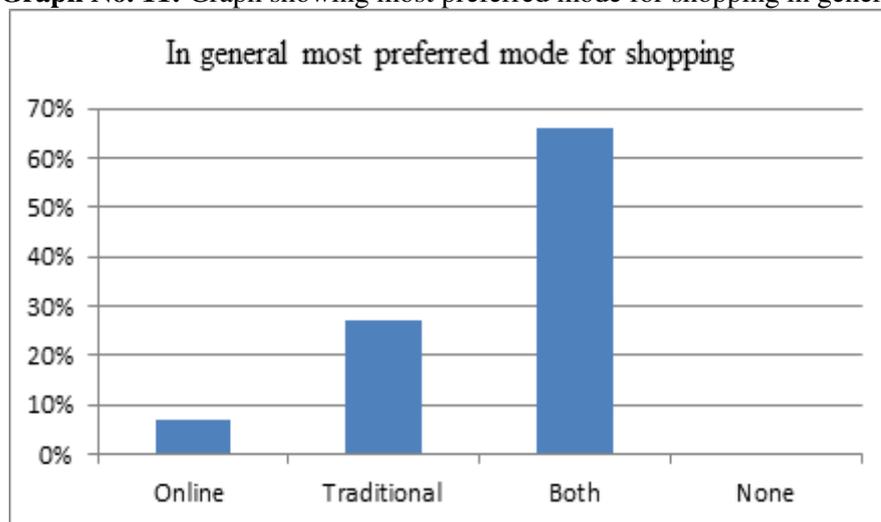


Above Table and Graph highlights that maximum 63% respondents feels that branded clothes are expensive to some extends, 19% respondents feels branded clothes are highly expensive, 13% respondents feels branded clothes are less expensive and 5% respondents feel branded clothes are not at all expensive.

Table No. 11: Table showing most preferred mode for shopping in general

Types	Percentages (%)
Online	7%
Traditional	27%
Both	66%
None	0%
Total	100%

Graph No. 11: Graph showing most preferred mode for shopping in general



Above Table and Graph indicates that maximum 66% respondents prefer both online and traditional mode for shopping, 27% respondents prefer traditional shopping and 7% respondents prefer online shopping.

Table No. 12: Table showing which mode satisfies more while shopping

Types	Percentages (%)
Online	6%
Traditional	37%
Both	57%
None	0%
Total	100%

Graph No.12: Graph showing which mode satisfies more while shopping



Above Table and Graph reveals that maximum 57% respondents are satisfied which both online and traditional shopping, 37% respondents are satisfied by traditional shopping and 6% respondents are satisfied by online shopping.

FINDINGS

1. 35% respondents have monthly income Rs 20,000 to Rs 40,000.
2. 53% respondents purchase new branded apparel 1 to 2 times a year.
3. 78% respondents purchase branded apparel.
4. 53% respondents prefer to buy branded clothes due to good quality.
5. 34% respondents prefer levis.
6. 59% respondents prefer traditional shopping mode for frequent purchase of branded clothes.
7. 37% respondents purchase branded clothes form store.
8. 36% respondents buy the branded clothes online.
9. 52% respondents rarely face quality issue when branded clothes are purchased online.
10. 63% respondents feels that branded clothes are expensive to some extends.
11. 66% respondents prefer both online and traditional mode for shopping.
12. 57% respondents are satisfied which both online and traditional shopping.

DISCUSSION AND CONCLUSION

Through above research, it is summarized that peoples prefer branded apparel then non- branded apparel. Due to increase in purchasing power of peoples they prefer branded apparel and people think branded apparel are not too expensive they are expensive to some extend and they can afford it. The reason behind more preference of branded apparel is its good quality and its comfort level. People give more preference to the quality then price. Hence, they prefer branded apparel. Most famous and preferred brand among people is levis. As the technology has upgraded just by one click customer can get products at their home due to this for general shopping people prefer both online and traditional shopping. But for the purchase of branded apparel people prefer traditional mode because when they purchase online branded apparel rarely, they face quality issue. People gets fitting problem, color problem and size problem. Hence, they prefer more traditional shopping mode for the purchase of branded apparel.

REFERENCES

1. <http://indianresearchjournals.com/pdf/IJMFSMR/2012/August/2.pdf>
2. https://www.researchgate.net/publication/267684595_Consumers'_Attitude_towards_Branded_Apparels_Gender_Perspective
3. https://www.researchgate.net/publication/308916782_Consumer_Attitude_and_Purchase_Decision_towards_Textiles_and_Apparel_Products

4. https://www.researchgate.net/publication/323143317_A_Study_on_Branded_Apparels_Customers_Purchase_Behavior_with_Reference_to_India
5. <https://www.ijedr.org/papers/IJEDR1803012.pdf>
6. <https://ijrcs.org/wp-content/uploads/IJRC202002021.pdf>
7. <http://www.gjar.org/publishpaper/vol4issue10/ce169.pdf>
8. https://www.ijirts.org/master/publishedpaper/IJRT143365_PAPER.pdf

An Analysis of the Changing Consumer Behaviour towards Different Brands with Special Reference to Telecommunication Industry

Puja Ahuja Gupta and Deepti Sadvelkar

Shri L.R. Tiwari Degree College of Arts, Commerce and Science, Mira Road, Thane, Maharashtra, India

ABSTRACT

India has a huge number of telecommunication users compared to other nations. The telecom industry is facing severe competition which has led to just three major players in this sector. This turbulent competition began after JIO started offering free services which compelled the others to either shut their services or merge. In this paper, the researcher has tried to find the major factors that caused switching from a previous provider to a new provider in this Industry. The paper intends to study the factors responsible for brand switching behavior. This study will help understand the drivers of brand switching in this sector

Keywords: brand switching, price, network, promotion

INTRODUCTION

Telecommunication services is an integral part of our daily lives. Whether work or entertainment, data and network plays a very important role in lives of people. The era has come where a mobile handset is almost owned by everybody and for most people it's impossible to survive without network and connection of mobile services from the young kids to the older generation. This is one sector where switching is not as easy as switching a shampoo or an FMCG product. However still people switch for better facilities and one such big wave of switching happened after JIO entered the market with free services in India.

This caused major prominent long time players to merge or shut as they couldn't face the intense competition from the new entrant that came with a very low price strategy and captured almost the entire market.

Brand switching is basically when the consumers switch from one product to the other or one provider to the other in case of services. Apart from switching it's also important to retain consumers as it is rightly said that one consumer retained is one consumer gained. It's important to make consumers loyal to a brand which is possible only if the services given delight the consumers and give them way beyond what they expect.

Hence the Objectives for the Study Are –

1. To find the factors that have driven the consumer to switch their telecommunication brand.
2. To find is there is any relation between gender of a consumer and his reason to switch.

SCOPE OF THE STUDY

1. This study intends to understand the reasons why a consumer has switched his telecommunication brand.
2. It also tries to find if there is any relation between gender and the reason for switching.
3. The study is conducted in Mumbai Region
4. The study can be of use to telecom industries to devise strategies to retain consumers or poach consumers from the competitors.

Limitations of the Study

1. The study is restricted to Mumbai Region.
2. The findings are based on the sample under study
3. The study is limited to the behavior post entry of Reliance JIO

LITERATURE REVIEW

David Mazursky & Hebrew University Priscilla LaBarbera New York University, 1987 "When consumers switch brands" indicated a considerable difference among experienced consumers' cognitive processes with respect to whether switching behavior is attributed to extrinsic motives (price, discount, coupon). It also speaks about intrinsic incentives which is a desire to try a new brand. In case of extrinsic incentives, the consumers are excited to switch even though they have higher level of satisfaction with the earlier brand, as compared to switching caused by intrinsic motives.

Kamat, Dinesh 2013 “” critical evaluation of customer satisfaction Pune” observed the reason for choosing a service provider differs across the demographic segment. The results from this study clearly explained some interesting and important consumer behavior and attitude of respondents. It was seen that majority of respondents preferred their current service provider because of high-quality ‘network coverage’. The analysis supported the claim of different aspects influences in selecting service provider. This research showed that consumers always prefer a service provider having good network coverage, economical and quality of service followed by value- added services.

Ching-chow Yang (2003) “Establishment and applications of integrated model of service quality measurement, stated that customer satisfaction measurement in this study explains the strength and the area of improvement in the quality of product. Continuous improvement is one of the key secrets for a firm to practice to ensure best quality for its products. Through the constant improvement in performance, the enterprise can enhance customer satisfaction and upraise profits.

M. Satish, K.J Naveen, V. Jeevananthan, (2011), A Study on Consumer Switching Behavior in Cellular Service Provider: A Study with reference to Chennai recognized the factors that influence the consumers to switch the service providers. It is stated that is a relation between switching the service provider and the factors like customer service, frequent network trouble, soaring high call rates of the providers.

RESEARCH METHODOLOGY

The sampling technique used in this research is convenience sampling. There were 300 responses taken out of which the study was conducted only on those who switched their providers.162 respondents said that they had switched the provider.

The Data analysis done was of **descriptive and inferential type**. The researcher constructed the entire tool for the study which questions on what drove the consumer to switch his provider for which exploratory factor analysis was applied on the data of 162 responses to extract the major drivers that caused switching tendency.

Descriptive Analysis

The description of the sample is as follows –

Table 1: Scheme of Telecom Service

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	BOTH PREPAID AND POSTPAID IN TWO DIFFERENT NUMBERS	1	.6	.6	.6
	Post Paid	36	22.2	22.2	22.8
	Prepaid	124	76.5	76.5	99.4
	WIFI CALLING	1	.6	.6	100.0
	Total	162	100.0	100.0	

Table 2: Switching pattern

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	More than Thrice	9	5.6	5.6	5.6
	Once	99	61.1	61.1	66.7
	Thrice	10	6.2	6.2	72.8
	Twice	44	27.2	27.2	100.0
	Total	162	100.0	100.0	

Table -3 Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Government employee	7	4.3	4.3	4.3
	housewife	10	6.2	6.2	10.5
	Private employee	43	26.5	26.5	37.0
	Retired	1	.6	.6	37.7
	Self employed	22	13.6	13.6	51.2
	student	79	48.8	48.8	100.0
	Total	162	100.0	100.0	

Table 4: Marital Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	married	40	24.7	24.7	24.7
	Unmarried	122	75.3	75.3	100.0
	Total	162	100.0	100.0	

Table 5: Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.0	95	58.6	58.6	58.6
	2.0	67	41.4	41.4	100.0
	Total	162	100.0	100.0	

Inferential Analysis

Factor analysis was applied on all the variables that were likely to have caused switching of the provider with the intention to extract the major factors that caused switching.

H1- The correlation matrix is identity matrix

H0- The correlation matrix is not identity matrix

Table 6

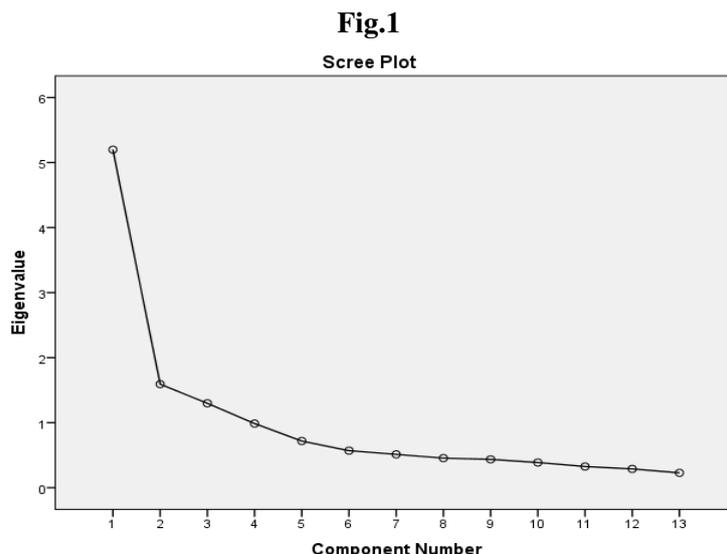
KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.857
Bartlett's Test of Sphericity	Approx. Chi-Square	872.674
	df	78
	Sig.	.000

The KMO Bartlett's indicates that the sample size is adequate and the model is fit

Mean values of all the variables

Table 7

Descriptive Statistics			
	Mean	Std. Deviation	Analysis N
price	4.123	1.0140	162
free data	4.123	1.1077	162
problem of calldrop	3.957	1.0476	162
faster internet speed	4.617	.8124	162
better offers	4.191	1.0663	162
value added services	3.685	1.2334	162
better customer support	3.975	1.1526	162
better callconnection	4.389	.9859	162
more roaming service	3.981	1.1873	162
peer pressure	3.031	1.3441	162
brand image	3.519	1.2719	162
previous provider shut	2.698	1.5883	162
network	4.259	1.3493	162



The above scree Plot indicates three factors extracted where the Eigen values are >1

Extraction Method: Principal Component Analysis.

Table 8

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.198	39.987	39.987	5.198	39.987	39.987	3.461	26.626	26.626
2	1.593	12.253	52.240	1.593	12.253	52.240	2.471	19.009	45.636
3	1.298	9.984	62.224	1.298	9.984	62.224	2.156	16.588	62.224
4	.987	7.589	69.813						
5	.718	5.524	75.337						
6	.570	4.387	79.724						
7	.513	3.944	83.668						
8	.455	3.501	87.169						
9	.436	3.357	90.526						
10	.388	2.982	93.508						
11	.326	2.508	96.016						
12	.289	2.223	98.239						
13	.229	1.761	100.000						

Extraction Method: Principal Component Analysis.

All the factors explain up to 62 % of the variance and as you can see in the table 3 factors were extracted which had Eigen Value more than 1.

Table 9

Component Matrix^a

	Component		
	1	2	3
value added services	.774		
more roaming service	.774	-.315	
better customer support	.762		
brand image	.728		-.391
better offers	.689		.305
faster internet speed	.671		
free data	.646	.426	.303
better callconnection	.616	-.610	

peer pressure	.590	.443	-.386
problem of calldrop	.572	-.407	
price	.546	.541	.392
previous provider shut	.436		-.582
network			.463
Extraction Method: Principal Component Analysis.			
a. 3 components extracted.			

Table 10

Rotated Component Matrix ^a			
	Component		
	1	2	3
better callconnection	.865		
more roaming service	.770		
better customer support	.717		.308
problem of calldrop	.699		
faster internet speed	.692	.360	
value added services	.540	.405	.381
price		.848	
free data		.777	
better offers	.342	.697	
network		.343	-.318
previous provider shut			.764
peer pressure		.344	.752
brand image	.413		.692
Extraction Method: Principal Component Analysis.			
Rotation Method: Varimax with Kaiser Normalization.			
a. Rotation converged in 4 iterations.			

Three factors were extracted which were as follows –

1. Quality of Service

2. Value for Money

3. Brand Image and word of mouth

H2- There is a significant difference between gender of a consumer and switching due to factor X where X is

a.1. (Price),a.2.(faster internet)a.3. (speed) a.4.(better offer)a.5.(value added service) a.6.(better customer support) a.7(better call connection) a.8(peer pressure), a.9.(more roaming service) a.10 problem of call drop, a.11.(free data)a.12. (network)

H0- There is no significant difference between gender of a consumer and switching due to factor X where X is

a.1. (Price),a.2.(faster internet)a.3. (speed) a.4.(better offer)a.5.(value added service) a.6.(better customer support) a.7(better call connection) a.8(peer pressure), a.9.(more roaming service) a.10 problem of call drop, a.11.(free data)a.12. (network)

Table11

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
price	Equal variances assumed	1.048	.308	.043	160	.966	.0069	.1623	-.3136	.3274

	Equal variances not assumed			.041	127.812	.967	.0069	.1667	-.3229	.3368
faster internet speed	Equal variances assumed	3.211	.075	-1.109	160	.269	-.1436	.1295	-.3994	.1122
	Equal variances not assumed			-1.122	148.002	.264	-.1436	.1280	-.3965	.1093
better offers	Equal variances assumed	.916	.340	-1.075	160	.284	-.1827	.1700	-.5185	.1531
	Equal variances not assumed			-1.099	152.268	.274	-.1827	.1663	-.5113	.1459
value added services	Equal variances assumed	5.292	.023	-1.703	160	.090	-.3332	.1956	-.7196	.0531
	Equal variances not assumed			-1.752	154.385	.082	-.3332	.1902	-.7090	.0426
better customer support	Equal variances assumed	8.379	.004	-1.480	160	.141	-.2712	.1832	-.6330	.0907
	Equal variances not assumed			-1.531	156.254	.128	-.2712	.1771	-.6210	.0787
better callconnection	Equal variances assumed	4.619	.033	-2.117	160	.036	-.3295	.1556	-.6368	-.0221
	Equal variances not assumed			-2.193	156.684	.030	-.3295	.1502	-.6261	-.0328
peer pressure	Equal variances assumed	2.226	.138	.957	160	.340	.2053	.2145	-.2182	.6289
	Equal variances not assumed			.974	150.401	.331	.2053	.2108	-.2111	.6218
more roaming service	Equal variances assumed	5.843	.017	-2.776	160	.006	-.5152	.1856	-.8817	-.1486
	Equal variances not assumed			-2.892	158.025	.004	-.5152	.1781	-.8670	-.1633
brand image	Equal variances assumed	.137	.712	.218	160	.828	.0443	.2035	-.3576	.4462
	Equal variances not assumed			.216	137.023	.830	.0443	.2056	-.3622	.4508
problem of calldrop	Equal variances assumed	.093	.761	.320	160	.750	.0536	.1676	-.2774	.3846

	Equal variances not assumed			.317	138.290	.752	.0536	.1689	-.2804	.3875
free data	Equal variances assumed	.493	.483	.039	160	.969	.0069	.1773	-.3432	.3570
	Equal variances not assumed			.039	144.459	.969	.0069	.1765	-.3419	.3557
network	Equal variances assumed	8.039	.005	-1.379	160	.170	-.2960	.2147	-.7199	.1279
	Equal variances not assumed			-1.443	158.879	.151	-.2960	.2051	-.7011	.1091

Table 12

Group Statistics					
	@2Gender	N	Mean	Std. Deviation	Std. Error Mean
price	1	95	4.126	.9480	.0973
	2	67	4.119	1.1081	.1354
faster internet speed	1	95	4.558	.8343	.0856
	2	67	4.701	.7788	.0951
better offers	1	95	4.116	1.1191	.1148
	2	67	4.299	.9850	.1203
value added services	1	95	3.547	1.3028	.1337
	2	67	3.881	1.1081	.1354
better customer support	1	95	3.863	1.2344	.1266
	2	67	4.134	1.0135	.1238
better callconnection	1	95	4.253	1.0515	.1079
	2	67	4.582	.8555	.1045
peer pressure	1	95	3.116	1.3980	.1434
	2	67	2.910	1.2641	.1544
more roaming service	1	95	3.768	1.2670	.1300
	2	67	4.284	.9971	.1218
brand image	1	95	3.537	1.2447	.1277
	2	67	3.493	1.3186	.1611
problem of calldrop	1	95	3.979	1.0312	.1058
	2	67	3.925	1.0775	.1316
free data	1	95	4.126	1.1227	.1152
	2	67	4.119	1.0944	.1337
network	1	95	4.137	1.4776	.1516
	2	67	4.433	1.1312	.1382

The above test results state alternate hypothesis is accepted for value added services, better call connection, better customer support and more roaming services and network as the P value is ≤ 0.05 where its seen with this sample that females have switched due to the above factors compared to male.

FINDINGS AND MANAGERIAL IMPLICATIONS –

One customer retained is one customer gained. In this era of competition where consumer enjoys ultimate benefit out of the competition, it's important to implement adequate strategies to avoid brand switching and retain the consumer and ultimately make the consumer loyal to the brand. On this study the Exploratory factor analysis gave results stating that three factors are most important which drove the consumers to change their provider –Value for money, Brand image and word of mouth, Quality of service. The providers must ensure that they delight the consumers with their service on aspects like calling, service, customer care which will in turn develop a good brand image that will cause a favorable word of mouth promoting the brand and inducing the customers to switch. Also as in the telecommunication sector switching is not as easy as switching an FMCG

product extreme value for money strategies can induce the customers to switch as customers are constantly looking out for value. Hence whether a telecommunication provider wants to retain consumers or is looking at poaching consumers of the competitor it's important to give value for money, amazing services and create a distinct and positive brand image by either providing free services or positioning very well in the minds of consumers.

Also the retention strategies should be more female centric as it's clearly seen that females have switched more due to service parameters. Hence the companies can look at strategies to retain female consumers by special offers during specific days like mother's day, woman's day related to female such that they could build brand loyalty among the female consumers.

BIBLIOGRAPHY AND REFERENCES

1. Bill Chiaravalle and Barbara Findlay Schenck, *Branding For Dummies*
2. BGR India-02-Feb-2017, Reliance Jio controls 94% mobile data traffic share in India: Report
3. B. Svendsen, G., & K. Prebensen, N. (2013). The effect of brand on churn in the telecommunications sector. *European Journal of Marketing*, 47(8), 1177-1189.
4. Business Today - Feb 23, 2017, Airtel-Telenor deal: Reliance Jio triggers consolidation in telecom sector
5. Customer Resistance to Churn in the Mobile Telecommunication Sector: The Relationship between Trust, Commitment, and Perceived Risk
6. David Mazursky & Hebrew University Priscilla La Barbera "when consumers switch brands, New York University, 1987
7. Deighton, J., Henderson, C. M., & Neslin, S. A. (1994). The effects of advertising on brand switching and repeat purchasing. *Journal of marketing research*, 28-43.
8. Dick, A. S., & Basu, K. (1994). Customer loyalty: toward an integrated conceptual framework. *Journal of the academy of marketing science*, 22(2), 99-113
9. Economic Times - Feb 23, 2017, Telenor hangs up on India, to sell business to Airtel
10. Economic Times - Feb 23, 2017, Telenor hangs up on India, to sell business to Airtel
11. Economic Times - Feb 23, 2017, Telenor hangs up on India, to sell business to Airtel
12. Economic Times - Feb 23, 2017, Telenor hangs up on India, to sell business to Airtel
13. Economic Times - Feb 23, 2017, Telenor hangs up on India, to sell business to Airtel
14. Economic Times - Feb 23, 2017, Telenor hangs up on India, to sell business to Airtel
15. Feng Jr, Yuanyuan, and Xuan Zhang Jr. "The impact of customer relationship marketing tactics on customer loyalty within Swedish mobile telecommunication industry." (2009).
16. Feng, Y. J., & Zhang, X. J. (2009). The Impact of Customer Relationship Marketing Tactics On Customer Loyalty Within Swedish Mobile Telecommunication Industry
17. Hindu Business Line - Feb 22, 2017, RJio effect: Bharti Airtel to acquire Telenor India
18. Joe A. Dodson, Alice M. Tybout, Brian Sternthal, *Journal of Marketing Research*, Vol. 15 No, Impact of Deals and Deal Retraction on Brand Switching
19. John U. Farley, *Journal of Marketing Research*, Vol. 1, No. 4 (Nov., 1964), pp. 9-14, Why Does "Brand Loyalty" Vary over Products?
20. John, J. (2011). An analysis on the customer loyalty in telecom sector: Special reference to Bharath Sanchar Nigam limited, India. *African Journal of Marketing Management*, 3(1), 1-5.
21. Kamath, Dinesh. "A critical evaluation of customer satisfaction of cellular phone services in Pune." (2011). Wang, Y., Lo, HP. & Yang, Y. *Information Systems Frontiers* (2004) 6: 325.

A Study on Sustainable Agriculture: Perception and Procedures to be Followed for Limitation of the Loss

Sayed Amjad Kadri¹ and Devika Suryavanshi²

¹AIAIMS- Mumbai, Maharashtra, India & JJT University, Rajasthan, India

²BMS, Siddharth College of Commerce and Economics, Maharashtra, India & JJT University, Rajasthan, India
{Under guidance of Dr. Rinkesh Chheda }

ABSTRACT

The paper presents the results of a scientific project focused on limiting nutrient losses from farms by introducing measures to apply fertilizers in a more sustainable way. It is a case study of selected aspects of farm management, focussing on the issue of sustainable agriculture and their tools. The main aim of the study was to analyse and evaluate farmers' knowledge of the fertilizing process and its aspects, as well as applying sustainable agricultural activities on farms. The study emphasised the importance of nutrient management, as very important for sustainable farming. Also, the links between farmers' opinions and their activities were analysed. The important issue concerned measures for sustainable farm management introduced on the farms, as well as measures to limit nutrient leaching into groundwater. Twenty-eight farmers from two regions in Poland were interviewed about their perceptions for the case study. In general, the farmers considered their farm activities to be more sustainable than in the past. They demonstrated an understanding of the general idea of sustainable agriculture. However, many farmers still demonstrated a poor grasp of nutrient flows and nutrient balances on farms. Their knowledge and perception was based on general, rather than specific knowledge gleaned from an academic/vocational course. The farmers demonstrated a realization that there were some new, or low-cost measures that could be introduced to make management more sustainable and pro-environmental, but there was still a need for wider adoption of sustainable agricultural practices.

Keywords: sustainable agriculture, pro-environmental

INTRODUCTION

Agriculture impacts on the national economy, the environment, as well as contributing to climate change. Farming and animal husbandry is essential to food production, and in Poland the ongoing specialisation in agriculture influences the structure and economy of the entire society [KRASOWICZ 2008; PRUS 2008]. Over time, competition and the wish to increase one's income have been accompanied by the enlargement of farm units and higher livestock densities [STANISZEWSKA 2008; ZEGAR 2005]. But farms with intensive animal production have the highest nutrient losses. The Helsinki Convention [Convention... 1992], as well as the Directive 2000/60/EC and the Council Directive 91/676/EEC, all emphasize the need to reduce nutrient losses and improve nutrient management to ensure agricultural sustainability and meeting climate change [QUERNER, MULDER 2007]. Agriculture was once understood to cater to a narrow, local market but it has now taken on an international role. On the one hand, Polish farmers are subject to international competition arising from mechanization and other issues related to increasing efficiency. But they must also deal with the resource management and the environment, which requires an improved system of training in farm management. For example, nutrient leaching from agriculture causes eutrophication, and animals emitting greenhouse gases to the atmosphere contribute to global warming [RUDZIANSKAITE, MISNEVICIENE 2005]. The Food and Agriculture Organization defined sustainable agriculture as "production which fulfils food security, environmental protection, and economic and social needs in rural areas" [FAO 2016]. This task is complex, because it involves not only human activities such as a farm management and agricultural policies but also many independent factors, for example climate conditions, terrain, soil type, gas emissions from animals, etc. [CYMERMAN 1994; KIELBA-SA et. al. 2016]. The purpose of sustainable agriculture is to protect and save natural resources. Some of these may become depleted, e.g. soil nutrients, or seriously damaged or contaminated (groundwater or water courses). Some natural resources such as phosphorus are expected to run out later this century. Therefore, more sustainable agricultural practices are emerging to conserve and protect resources [CORDELL, WHITE 2011]. As a result of market and social needs, farm managers are expected to ensure good quality of food while protecting the environment, including water and air quality, soil properties, and ecosystems services [SOBCZYK 2014]. Thus, farmers face the challenge of balancing social and economic goals without sacrifice the environment or natural ecosystems. This is particularly difficult when the economic outcome is dependent on the use of natural goods. Achieving a balance in this area is particularly difficult [PRUS 2010]. Various research projects have investigated means and processes to implement the idea of sustainable agricultural development. One such initiative in Poland and Sweden was the pilot project "Self-

evaluation and risk analysis by farmers concerning losses of nutrients and low cost remedial measures conducted in 2013–2016”. Farmers’ perceptions of the impact of their practices on the environment, and their readiness to adopt various methods to improve the degree of sustainability have been analysed in this paper. Specifically the aim was to analyse the development of more sustainable usage of nutrients on farms. Some results of the case study were drawn from the initial investigation made of the group of 28 subjects (case study). The paper make use of the reports developed under the pilot project, including detailed research results, i.e.: “Self-evaluation of the risk of enhanced nutrient leaching by Polish farmers: nutrient balances, soil maps, farm walks and other tools” [RAMNERÖ 2015], “Analysis of advisors’ collaboration with farmers. Report 1: Final report of questionnaire study” [DRANGERT, KIEŁBASA 2015] and “Self-evaluation and risk analysis by farmers concerning losses of nutrient and low cost remedial measures. Report 2: Post-project interview study” [DRANGERT, KIEŁBASA 2016].

MATERIALS AND METHODS

The empirical studies were drawn from the pilot project which was conducted by Stockholm University, Swedish University of Agricultural Sciences, Vatema AB and Institute of Technology and Life Sciences (Pol. Instytut Technologiczno Przyrodniczy) in Falenty, focussing on two Polish provinces: Ma-zowieckie and Pomorskie, in the 2013–2016 period. The farmers were introduced to the farm-gate nutrient balance concept, a method for assessing how the risk for nitrogen leaching from individual fields is dependent on farming practices, and farm walks together with agricultural advisors (from the public advisory offices), and they were provided with soil surveys and subsidized lime and catch-crop seeds. Twenty-eight farmers were selected for interview before (2013) and after (2015) in order to identify changes in farm activities and farmers’ perceptions of the impact of their land use activities. The subjects were selected initially as representing farmers of all type of farms (ranging from 13 ha to 150 ha of arable land), and representing crop, husbandry and mixed farms. All the subjects cooperated with agricultural advisors, either public (via public agricultural advisory centres) or private (private consultancies). The farmers were drawn from different age groups and educational backgrounds. They were grouped into two classes depending on the criteria: owners (or renters) of 13–45 ha or 45–150 ha areas; 20–45 or 45–67 age groups, and those with no or basic agricultural education or those with some agricultural (above basic level) (Tab. 1). According to the most recently published Agricultural Census, most farmers in Poland have a basic vocational education, while 40% of farm managers have a secondary or higher education. Although the overall level of farmers’ educational exposure is improving, 56% of farmers still lack and agricultural education [ŁĄCZYŃSKI (ed.) 2014]. In our study group, 68% of farmers run large farms, which exceed 45 hectares of agricultural land (Tab. 1). Most of the farmers (60%) had not attended agricultural college or university. The rest had gained vocational or formal academic agricultural education, or had completed agricultural training of at least one year. The study group was dominated by farmers with lengthy experience in farm management, the average age of the farmer being 45 years.

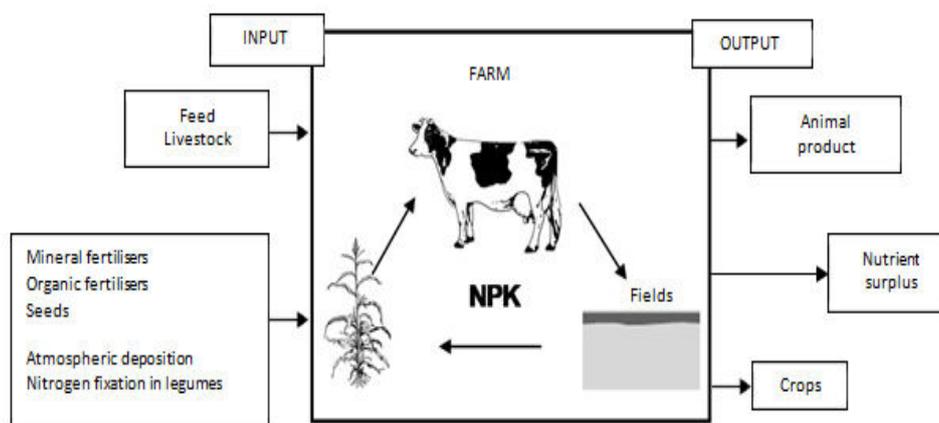
Table 1: Characteristics of selected farmers taking into account age, education and farm size (in 2015)

Province	Farmer's age	Education	Farm size, ha
Mazovia	24	Basic	35
	64	Basic	20
	28	basic plus	32
	29	Basic	40
	46	Basic	34
	39	basic plus	70
	43	Basic	45
	47	basic plus	18
	66	basic	20
	47	basic plus	100
	63	basic	51
	52	basic	20
	31	basic plus	22
	52	basic	112
Pomerania	24	basic plus	69
	43	basic	30
	47	basic plus	13
	63	basic	38
	51	basic plus	80
	27	basic plus	16
	64	basic	40
	63	basic	55
	50	basic	153
	58	basic	15
	49	basic	42
	23	basic plus	41
	36	basic plus	52
	38	basic	20

Most of the interviewees had extended their farms since Poland had joined EU and they had also introduced mechanised to a large extent. They had invest-ed in new buildings and manure handling equipment to facilitate work. They may have alternated crops and the types of animals, but only a few had ventured into complementary activities such as machinery repair workshop services or producing bird feed for sale.

Tools for Sustainable Nutrient Management on Farms

At a farm level, the global resource challenges and environmental hazards are less pronounced. Here, nutrient management is an essential part of sustainable agriculture as it affects not only farm results but also soil and water conditions [PIETRZAK 2013]. Achieving a balanced and sustainable management of organic and mineral fertilizers on farms poses a significant challenge, and affects production results as well as the state of the environment [BEEGLE et al. 2000]. A number of tools have been developed to support farm managers to improve their nutrient management, as well as to prevent nutrient losses. These are often based on an analysis of nutrient flow on a farm. Nutrient flow analyses on farms indicate if there is a need to focus on achieving improved efficiency of some nutrients. The balance is typically calculated for N, P and K, and includes the most common input routes, stores of nutrients (in animals, manure or goods) on the farm, and amounts of output leaving farms (Fig. 1). The practical value of an FGB depends on the ac-curacy of the data entered. Nutrient surpluses or deficits may be used as qualitative indicators of the environmental impact generated by a farm [HENDRIX et al. 2008; ULÉN et al. 2012]. On the basis of a nutrient flow analysis, the farm-gate balance may be developed, as one tool towards sustainable agriculture. Another important tool for sustainable nutrient management is a fertilization plan without which it is difficult to achieve sustainable nutrient management [ULÉN et al. 2013]. The plan specifies the optimal dosages of mineral fertilizer and manure for each crop, taking into account its nutritional requirements and soil fertility, i.e. content of available macro-nutrients [GOULDING et al. 2008]. Complementary to a fertilization plan is the calculation model developed to assess how the risk of nitrogen leaching from individual fields is related to farming practices, including crop rotation, ploughing timescales, previous year yields and fertilization activities. A particular challenge regarding fertilization is the need for updated knowledge about the nutrient content of manure; data that is largely absent in Po-land [OENEMA, PIETRZAK 2002]. As practical results indicate, and many research studies show, detailed knowledge about this aspect of farm management is required if the process of counter-acting nutrient flows from agricultural activities is to be addressed [DE-UMLICH et al. 1999]



RESULTS

FARMERS' ATTITUDES TOWARDS SUSTAINABLE NUTRIENT MANAGEMENT ON A FARM

At the start of the study, farmers were asked about their fertilizer practices and their knowledge particularly concerning:

- constraints of the Nitrates Directive,
- differences in nutrient content between cow and pig manure (the two most commonly used organic fertilizers), and
- Nitrogen and phosphorus behaviour in soil.

The aim of the examination was to evaluate farmer's knowledge and awareness of some essential issues on the fertilization process. All farmers stated that they had responded to the requirements of the EU Nitrate Directive in terms of maximum admissible nitrogen dosages. Farmers acknowledged that nitrogen dosages per hectare

must not exceed 170 kg per year. They confirmed that those dosages had not been exceeded at the selected farms. It is worth noting that the farmers complained about the shortage of fertilizers, rather than excess availability. As regards to their knowledge and understanding of nutrient content in different types of manure, fifteen farmers (53%) were of the opinion that there were significant differences in nutrient composition between manure from cows and pigs. Thirteen (46%) farmers considered cow manure to be better than pig slurry because it was richer in phosphorus and potassium, and furthermore that nitrogen was more concentrated in cow manure than in pig manure. In contrast, two farmers advanced the view that pig slurry was better than cow manure because it contained more nutrients, and was absorbed more easily than cow manure. Two farmers (7%) suggested that it was difficult to judge if there was any difference or not, while four (14%) farmers considered pig and cow manure to have very similar in nitrogen content. Generally, most respondents advanced the view that pig manure acidified the soil to a greater extent than cow manure. The farmers were also invited to comment on nitrogen (N), phosphorus (P) mobility in the soil, and the significance of mobility in the process of balanced fertilization. Almost all of the subjects (86%) claimed that nitrogen (N) was more mobile in soil and that phosphorus (P) was less mobile. In contrast, P was said to remain in the soil and accumulate, and according to those respondents P could therefore be applied at any time. However, three (10%) farmers considered that everything depended on the natural condition of the soil, as well as the prevailing environmental conditions. Most of the farmers (68%) responded that N should be applied in precise dosages, because if more was applied than needed, the nutrients would be lost to the atmosphere or would percolate into water courses. These responses demonstrate the farmers were aware that they should not apply excess nitrogen than required. Nine (32%) farmers were of the view that the type of soil played a role, whereby N became more mobile in sandy soil and was at risk of leaching. These subjects stated that these losses could be reduced through the use of catch crops. A third of respondents advocated the growing of catch crops such as lupine, phacelia and mustard to ensure N was retained in the catch crop during the winter months. Next, the farmers were invited to evaluate some tools that may be deployed for sustainable fertilization. These tools were measures and methods either applied or designed during the term of the project. Some were new, and others had either been known or had been applied previously by the selected farmers. The tools were tested by the subjects together with their respective agricultural advisers. Each were working together to conduct the tests and study the results on the farms. These tools may be described as sustainable nutrient management tools because they help to manage a farm in a more balanced and environmentally-friendly way. During the project, the following tools or methods were used:

- soil survey,
- identifying hotspots for potential nitrogen leaching,
- the farm-gate balance,
- Fertilization plan.

Table 2 shows the results of the inquiries into each farmer's experiences regarding about the use of sustainable nutrient management tools.

Table 2: The numbers given indicate the farm sizes, farmer's ages and educational backgrounds, where farmers gave a positive response¹⁾ to the use of tools for sustainable nutrient management and improved water quality

Ranking number	Specification	Farm size, ha			Farmers age, yr	Education	
		13-45	46-150	20-45	46-67	Basic	Basic plus
1	soil survey	19	9	12	16	12	16
2	fertilization plan (balance)	6	10	11	5	2	14
3	identifying hotspots for leaching (i.e. farm-walk)	7	7	8	6	3	11
4	farm-gate nutrient balance (FGB)	1	5	3	3	1	5

Either the farmer had already used the tool or had changed agricultural management activities after the advisor's visit. Source: own study.

The soil survey emerged as most important factor for farmers, as well as wide availability and low-cost measures used in sustainable agriculture (Tab. 2). All farmers (28) interviewed attested to the usefulness of the soil surveys, which they considered to be necessary and important in order to optimize fertilizer dos-ages. Economic benefits were anticipated, but only a few interviewees cited financial benefits in terms of environmental protection measures and more sustain-able production methods. Only four (14%) farmers stated that they had conducted such soil surveys for the first time in response to this project. As for the fertilization plan (balance), all respondents indicated that they had a basic idea of what such a plan entailed, but not all of them stated that they knew about the details well enough to apply it in practice. These farmers stated that the instructions were either too complicated or unfathomable, and revealed that they had often outsourced the task of developing a plan to the agricultural advisors. Only 16 of the farmers (57%) reported that they had developed and applied a fertilization plan by themselves. The rest of the study group (43%) admitted that they had encountered difficulties in understanding the task or had encountered the concept for the first time as part of the project. One way of conducting a comprehensive analysis of all farm activities is what is known as the farm-walk, where the farmer walks through his/her farm together with the agricultural advisor. The objective is to identify hotspots for potential leaching of nutrients and to propose and agree remedial measures. Half of the farmers (14) pointed out that the farm walk conducted jointly with the advisor had elicited new and interesting information, which could be used to limit nutrient leaching on the farm and as a guide to using nutrients in a more sustainable way. The farmers stated that they regarded the input of agricultural advisors as applicable and useful to the job of running the farm. It is noteworthy that nearly 40% of the farmers reported that the farm-walk did not generate any new information. They stated that they were al-ready sufficiently familiar with issues on their proper-ty and had all the necessary knowledge to manage the farm effectively. The farm-gate nutrient balance (FGB) was a new tool for all farmers interviewed at the beginning of the project (2013). They had never calculated a nutrient balance for their farm prior to the project. The second round of interviews (2015) revealed that more than 80% of the farmers were able to recall details of the FGB to a lesser or greater extent. Their answers demonstrated that their knowledge on how to use the FGB was still not well established and required wider dissemination within the agricultural sector. However, six farmers (21%) revealed that they changed their farm management practices as a result of the farm-gate balance recommendations: they applied non-tillage systems and reduced applications of mineral fertilizers of NPK or just N. Another nine (32%) farmers stated that the calculation showed that their farms had a good nutrient balance and, accordingly, that they had managed their farm in a more sustainable way with respect to nutrients. The number of farmers who responded positively to these tools used for sustainable production and im-proved water quality are depicted in Table 1. In general, they are ranked in terms of:

- 1) Soil surveys;
- 2) Fertilization plans;
- 3) Hot spot identifications, and;
- 4) farm-gate balances;

reflecting the farmer`s attitudes and willingness to use the tools. As would be expected, younger, educated farmers with more than a basic agricultural education were generally more positive in their appraisal of the project results. They were able to identify the value of the tools better than more poorly educated or older generation farmers, who tended to be less enthusiastic about the project. It is also noteworthy that farmers who ran larger farms were more interested in the tools, most likely because the farms were the main sources of revenues and income. It follows that farmers in this position prefer not to operate blindly. They place an added value on scientific research and attach more im-portance to such studies. However, not all tools were understood and re-called in detail by the farmers involved in the project. The farm-gate balance, as well as the identification of leaching sites, proved to be particularly difficult for some. The identification of hot spots frequently proved to be too time-consuming and too intricate and detailed, according to the responses received. As for the farm-gate nutrient balance, the farmers stated that details has been presented in an overly-academic way, and also that their advisors had not appeared to have been as well prepared to collaborate with them on this issue as the farmers had expected. In general, the farmers' responses indicated that some had a problem explaining how the nutrient flow affected the balance of fertilizer components. The farm-gate balances prepared during the project were frequently misinterpret-ed by the farmers. To determine the factors influencing

the farm-gate nutrient balance and the identification of nutrient spots on their farms, the farmers often fell back on their own intuitive skills and what would be best described as their ‘common sense’.

Famer’s Perspectives on Sustainable Practices in Agriculture

As noted above, the farmers offered similar views on several issues, but differed widely on other issues. Government policies and EU regulations influence mainstream farmer’s knowledge of the practical. At the same time, farmers exchange experiences and ide-as to improve the outcomes of their efforts, particularly in smaller communities where social relationships play an important role. Here, the process of individual’s knowledge development becomes complex and challenging. The farmers surveyed were asked to identify the impact their practices and tools used might have on other farmers in the local community (neighbourhood, village) along the lines of: Did other farmers emu-late their activities? Were they interested in pro-environment practices and the idea of sustainable agriculture? The results are shown in Figure 2.

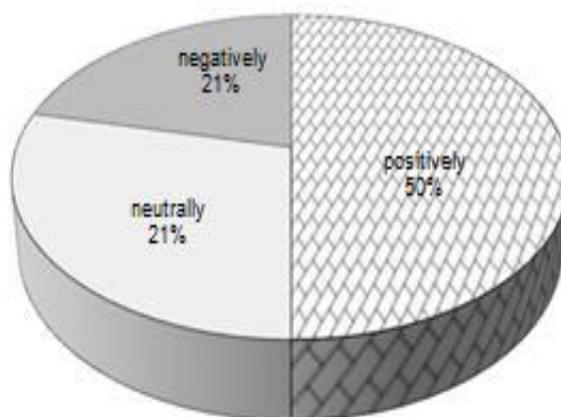


Fig. 2: The structure of respondents` answers to the question: “How pro-environmental practices are being perceived by other farmers in the neighbourhood?”; source: own study

Fourteen (50%) farmers responded that their neighbours perceived their activities positively, and replicated their management practices because they saw that something new worked well (Fig. 2). Some claimed that they had earned from each other, and had adopted the same procedures. Nine also added that farmers had mirrored other’s methods of avoiding nutrient losses and preventing pollution of the environment, especially watercourses and ponds. This emulation practice also concerned the wider use of fertilization plans and nutrient balances, which were largely unknown but had since become more prevalent. A trend towards cost-effective precise fertilization could be discerned. This resulted not only in eco-nomic savings, but also in enhanced protection of the environment through minimizing nutrient losses, water eutrophication, and soil degradation. Eight farmers (29%) said that most of their neighbours ran their farms in traditional ways and had adopted a non-committal attitude towards innovation in as much as they did not conduct soil surveys or test new fertilization techniques. This does not necessarily mean that these farms were managed in non-sustainable ways. On the contrary, these businesses are capable of being managed in harmony with nature. New tools or innovations were often implemented by younger famers and some farmers adopted more environmentally-friendly measures when they foresaw financial benefits (e.g. they had engaged in the EU’s CAP programmes). Six farmers out of 28 stated that they had formed the view that other farmers were not interested in environmental protection and sustainable practices. One respondent considered that some of his neighbours had adopted a “wasteful” approach – having extracted benefits from the fields until these resources had been exhausted.

DISCUSSION

Farmers levels of knowledge and awareness of environmental issues have an unquestionable impact on the natural world. However, farmers interviewed during this project were usually unable to volunteer accurate formulas or give authoritative explanations related to nutrient cycles on farms or nutrients behaviour in soils. In many cases (57%), the farmers inter-viewed took an intuitive approach to the problem of sustainable nutrient management. Older farmers (under 50-years old, 32%) predominantly drew on their long experience of farming and tacit knowledge gathered through informal channels. They had exchanged views and ideas with other farmers and agricultural advisors. In addition to the measurable benefits (in-come, revenue, yields), more experienced farmers perceived the environment and natural resources as important and inseparable elements of their everyday activities. On the other hand, younger farmers were mainly oriented towards short term profits,

but were willing to introduce changes and implement innovations if they expected positive outcomes. They primarily gained from knowledge attained at agricultural schools or universities, and complemented this with information from the Internet or various training activities. They tended to have less experience of farming techniques but had received a more formal agricultural education than the older farmers examined in the survey group. On the basis of this research, it should be borne in mind that farmers generally understood the importance of sustainable agriculture in terms of keeping down the use of chemical fertilisers. The main drivers for this approach tended to be high prices and a need to fulfil EU regulations in order to benefit economically. However, in our study, farmer's comments often betrayed generalised and somewhat vague notions of nutrient cycling and their responses demonstrated that their knowledge was not so developed and sophisticated when it came to furnishing the details. Their practices were very often based upon their own experiences, as not all of them had received the benefit of an academic, agricultural education. However, their own observations and experiences were usually 'in simpatico' with the concept of sustainable agriculture. All the farmers were aware of the requirements resulting from EU regulations and directives. These regulations tightened measures and rules to ensure that agricultural production were compliant with the needs of nature. These rules contain many provisions concerning water, air and soil protection. All farmers in the EU are obliged to fulfil the cross-compliance requirements if they wish to receive full direct payments. Therefore, it should be stressed that it is not economic pressure that is the most important factor behind farmers changing perceptions and practices towards more environmental-orientated activities. There is also external pressure resulting from the law (at national and EU levels). However, legal pressure is closely linked to financial pressure, for example receiving full direct payment or subsidies from the "Agro-environmental programme" is dependent on satisfying the regulations. This study demonstrates that farmers have changed their perceptions as a result of external pressures in many cases: they have built manure pads or slurry tanks, invested in modern machinery, or have taken care of ditches. They have demonstrated an eagerness to seize the opportunity of obtaining financial support from EU programmes to make such environmentally-friendly investments. All these factors have led them to adopt more efficient farm management practices which are, in many cases, more sustainable (reducing leakage into the ground and surface water, less reliance on chemical fertilizers and greater precision in the application of such substances). One of the benefits of this project is that the farmers have acknowledged that there are tools or measures that can be adopted to contribute to more sustainable farm management, especially in the case of the fertilization process and the improvement of nutrient management on farms. They have recognised that the implementation of these tools does not require a large financial outlay. The benefits of the FGB sheets, soil surveys and fertilization plans have been demonstrated, through the project. Farmers have identified the point that less mineral fertilizers are needed and may be applied with improved precision. There-by, farmers may achieve similar production results but with a reduced environmental impact on soils and rivers. Applying the tools requires knowledge and awareness, as well as time to calculate dosages and conducting soil tests. Some farmers noted that their knowledge base was not sufficient to introduce new pro-environmental measures.

CONCLUSIONS

Farmers manage and control many aspects of their business, while the weather, market changes, and the law are outside their control. They face increasing EU and national-wide regulations of their activities that may be helpful or restricting. The challenge of environmental sustainability adds existing aspects to be taken into consideration in terms of planning and day-to-day activities. There are a number of external factors, e.g. availability of donor funds, agricultural policies, agricultural entities, and environmental requirements that affect the implementation of pro-environmental practices and significantly impact on a businessman's thinking processes. Such factors affect the implementation of sustainable development and determine to what degree sustainable agriculture objectives can be achieved. Based on the studies conducted and analyses undertaken, the following conclusions are drawn.

1. Project intervention using tools to calculate farm nutrient balances and risks for nitrogen leaching on individual fields were well received, although more training is needed for a full and comprehensive assessment of the systems being applied. In addition, some of the required input data may not be readily available to farmers or among agricultural advisory agencies. This means that the full effect of such tools will be a long-term process involving both training and more studies on manure nutrient content, soil nutrient storage and the impact of farm practices on the movement of nutrients in different Polish soils in the prevailing climate conditions
2. The advisors need to be focused not only on the short-term (operational) goals of their clients, but also on longer time perspectives including but not restricted to sustainable development goals. They should be

encouraged to offer activities and events in different ways and to different timescales, so that farmers may choose what they need. The concept of sustainable agriculture needs to be particularly emphasised in such activities. Agricultural advisory institutions should be sensitive to all aspects of sustainable agriculture and offer guidance and support in all activities (training, individual visits, group communications, etc.).

3. It is extremely important to emphasize to farmers that their management activities not only impact on soils on the farm and around nearby ditches, but also affect groundwater and surface water on a larger scale. It needs to be stressed that sustainable agriculture requires a broader view and a system-wide thinking approach, not only on the farmers' side but also on the part of advisory institutions and other entities cooperating in the rural economy and agri-business. There is a requirement for targets to be set on a coherent and common level among agencies and farmers to reduce losses, improve effectiveness and promote the recycling of nutrients alike. Farmers may be primarily guided by concrete benefits in terms of higher yields and increased subsidies while agencies also need to be sensitive to, not least, the applicable regulations.

REFERENCES

1. BEEGLE D.B., CARTON O.T., BAILY J.B. 2000. Nutrient management planning: justification, theory, practice. *Journal of Environmental Quality*. No 29 p. 72–79. Convention on the Protection of the Marine Environment of the Baltic Sea Area 1992. Helsinki Commission Baltic Marine Environment Protection Commission, HEL-COM, Finland pp. 43.
2. CORDELL D., WHITE S. 2011. Peak phosphorus: Clarifying the key issues of a vigorous debate about long-term phosphorus security. *Sustainability*. No 3(10) p. 2027–2049. Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources. CYMERMAN R. 1994. Gospodarka zrównoważona (eko-rozwoj) na obszarach wiejskich. W: Doradztwo weko-rozwoju obszarów wiejskich [Balanced economy (sustainable development) in rural areas. In: Advisory in sustainable development of rural areas]. Szczecin. Wydaw. Druk p. 11–36.
3. DEUMLICH D., MIODUSZEWSKI W., KOĆMIT A. 1999. Analysis of nutrients entering rivers with surface flow in the Odra catchment. *Journal of Water and Land Development*. No 3 p. 33–45. Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy.
4. DRANGERT J.-O., KIEŁBASA B. 2015. Analysis of advisors' collaboration with farmers. Report 1. Final report of questionnaire study. Pilot Project Baltic Sea 2020 pp.10.
5. DRANGERT J.-O., KIEŁBASA B. 2016. Self-evaluation and risk analysis by farmers concerning losses of nutrient and low cost remedial measures. Report 2. Post-project interview study. Pilot Project Baltic Sea 2020 pp. 49. FAO 2016. Sustainability assessment of food and agriculture systems (SAFA) [online]. [Access 07.11.2016]. Rome. Food and Agriculture Organization of the United Nations. Available at: [*Special Issue on Current Trend on Research in Applied Science, Management and Technology*](http://www.fao.org/nr/sustainability/sustainability-assessments-safe/en/GOULDING K., JARVIS S., WHITMORE A. 2008. Optimizing nutrient management for farm systems. Philosophical Transactions of The Royal Society – Biological Sciences. No 363(1491) p. 667–680. HENDRIX P.F., COLEMAN D.C., CROSSELEY D.A. Jr. 2008. Using knowledge of soil nutrient cycling processes to design sustainable agriculture. In: Agroecology and sustainable food systems. Taylor & Francis Group p. 63–82. KIEŁBASA B., DRANGERT J.O., ULÉN B., TONDESKI 2016. Drivers and constraints for Polish farmer's implementation of measures to remediate nutrient leaching to waters. <i>International Scientific Journal Mechanization in Agriculture and Conserving of the Resources. Scientific Technical Union of Mechanical Engineering –Bulgarian Associate of Mechanization in Agriculture</i>. Year 62. Iss. 4 p. 22–26. KRASOWICZ S. 2008. Relacje człowiek–środowisko przyrodnicze w aspekcie zrównoważonego rozwoju [Relationships man–natural environment in the context of sustainable development]. <i>Problemy Inżynierii Rolniczej</i>. No 1 p. 21–27. ŁĄCZYŃSKI A. (ed.) 2014. Charakterystyka gospodarstw rolnych w 2013 roku [Characteristics of agricultural holdings in 2013]. Warszawa. GUS pp. 450. OENEMA O., PIETRZAK S. 2002. Nutrient management in food production: Achieving agronomic and environmental targets. <i>AMBIO: A Journal of the Human Environment</i>. No 31(2) p. 159–168. PIETRZAK S. 2003. Obieg składników nawozowych w gospodarstwie rolnym – rys historyczny i współczesne podejście [The calculation of nutrients on the farm – historical and contemporary approach]. <i>Woda–Środowisko- Obszary Wiejskie</i>. T. 3. Z. 1(7) p. 9–24. PIETRZAK S. 2013. Sporządzanie bilansów składników nawozowych metodą u bramy gospodarstwa”. W: Samoocena gospodarstw w zakresie zarządzania składnikami nawozowymi i oceny warunków środowiskowych [Making balance of fertilizers by using „the-farm gate” method. In: Self-assessment of farms in the management of fertilizers and environmental conditions]. Eds. B. Ulén, S. Pietrzak, K.</div><div data-bbox=)

- Tonderski. Falenty. Wydaw. IMUZ p. 7–33. PRUS P. 2008. Sustainable development of individual farms based on chosen groups of farmers [online]. [Access 12.12.2016]. Electronic Journal of Polish Agricultural Universities (EJPAU). No 11(3) #06. Available at: <http://www.ejpau.media.pl/volume11/issue3/art-06.html>) PRUS P. 2010. Funkcjonowanie indywidualnych gospodarstw rolniczych według zasad zrównoważonego rozwoju [The functioning of individual farms according to the principles of sustainable development]. Bydgoszcz. Wydaw. Uczelniane UTP pp. 185.
- RAMNERÖ B. 2015. Self-evaluation of the risk of enhanced nutrient leaching by Polish farmers: nutrient balances, soil maps, farm walks and other tools. Department of Soil and Environment, Swedish University of Agricultural Sciences, Uppsala pp. 79.
6. QUERNER E.P., MULDER H.M. 2007. Hydrological analysis for meeting climate change effects and European Water Framework Directive targets. *Journal of Water and Land Development*. No 11 p. 59–69.
 7. RUDZIANSKAITE A., MISNEVICIENE S. 2005. Nitrate nitrogen leaching in different agroecosystems (in karst zone and Middle Lithuania). *Journal of Water and Land Development*. No 9 p. 123–133.
 8. SOBCZYK W. 2014. Sustainable development of rural areas. *Problemy Ekorozwoju – Problems of Sustainable Development*. Vol. 9. No 1 p. 119–126.
 9. STANISZEWSKA M. 2008. Rolnictwo zrównoważone a rozwój polskiego rolnictwa i wsi. W: *Koncepcja badań nad rolnictwem społecznie zrównoważonym* [Sustainable development and the development of Polish agriculture and rural areas. In: *The concept of the research on the socially sustainable farming*]. Ed. J. Zegar. Warszawa. Wydaw. IERiGŻ p. 87–105.
 10. ULÉN B., DJODJIC F., BUČIENE A., MAŠAUSKIENE A. 2012. Phosphorus load from agricultural land to the Baltic Sea. In: *Ecosystem Health and Sustainable Agriculture 1: Sustainable Agriculture*. Ed. Ch. Jakobsson. The Baltic University Programme. Sweden. Uppsala. Uppsala Univ. p. 82–102.
 11. ULÉN B., PIETRZAK S., TONDERSKI K. (eds.) 2013. Self-evaluation of farms for improved nutrient management and minimised environmental impact. *Baltic Sea 2020*. Falenty. Wydaw. ITP. ISBN 978-83-62416-67-7 pp. 92.
 12. ZEGAR J. 2005. *Koncepcja badań nad rolnictwem społecznie zrównoważonym*. W: *Koncepcja badań nad rolnictwem społecznie zrównoważonym* [The concept of the re-search on the socially sustainable farming. In: *The concept of the research on the socially sustainable farming*]. Ed. J. Zegar. Warszawa. Wydaw. IERiGŻ p. 9–23.

Chemical Characteristics of Carbonaceous Aerosol during Winter Season in Noida, India

Aparna Rai and Rahasya Mani Mishra*

School of Environmental Biology, Awadhesh Pratap Singh University, Rewa- 486003 (M.P.) India

ABSTRACT

Growing anthropogenic activities especially due to increasing in consumer mindset and rapid population growth in metropolitan cities is leading to high emission of carbonaceous aerosol. The poor air thus resulted has negative impact on climate and to health of residents. The ambient air of cities around Delhi is less studied. Further, The detail chemical analysis particulate matter is highly demanding. In this work the samples of particulate matter collected from Noida were investigated in detail. The organic and elemental components together with their sub-fractions were estimated and analyzed. The PM value during the study period were consistently high indicating higher anthropogenic activities in this duration. The PM10 value were in the range of 110 ± 83.3 to 294 ± 112.1 $\mu\text{g}/\text{m}^3$. OC, EC sub-fractions and OC/EC ratio were utilized for detail analysis of particulate matter.

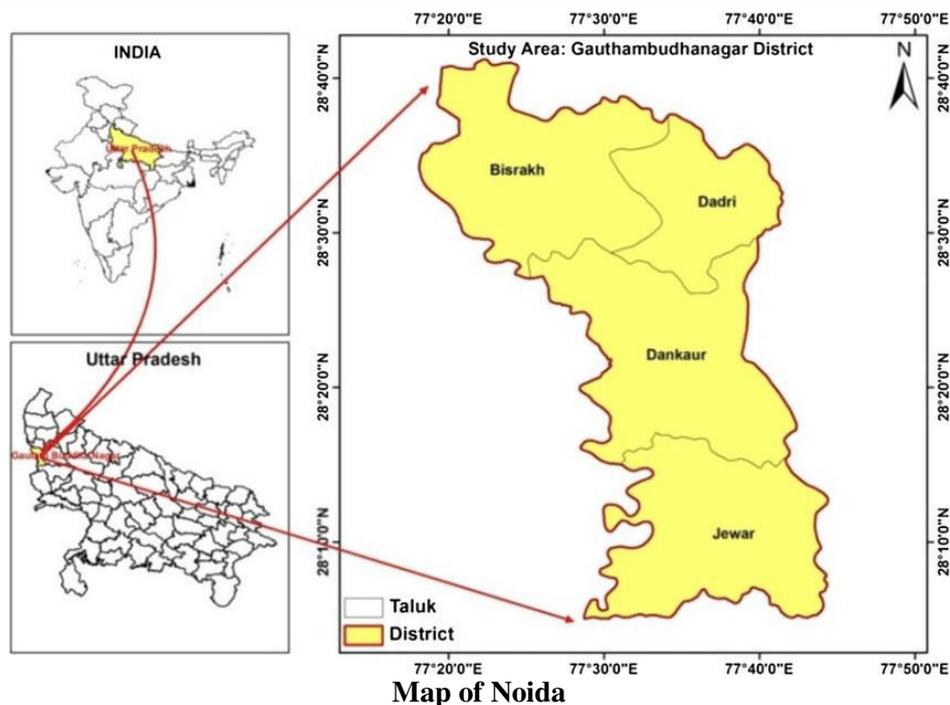
INTRODUCTION

Increasing air pollution with growing urbanization and industrialization is major concern for Delhi-National Capital Region. Particularly, during winter season there is significant increase in the concentration of particulate matter due to metrological and geographical conditions. This accumulation of particulate matter is not limited to Delhi but can be experienced around NCR and northern plain. The atmospheric particulate matter may originate from natural or anthropogenic sources and possess varying degree of organic and inorganic components. Several research findings have shown secondary aerosols, vehicular emissions, biomass burning, and soil dust as major sources and carbon as major component of aerosol. (DOI:10.1007/s11356-020-10645-y) However, with the seasonal variation the source contribution and aerosol composition may vary drastically. Emission from biomass burning contributes most during winter and post monsoon seasons. (DOI:10.1016/j.envpol.2020.114337) (DOI: 10.1007/s42452-020-03854-0). Similarly, the higher contribution of elemental carbon to total PM is observed during summer. (DOI:10.1016/j.atmosenv.2021.118598). In recent years, significant increase of carbonaceous aerosol is observed in total aerosol composition. (10.1016/j.aeaoa.2019.100039). Carbonaceous aerosol basically contains organic carbon and elemental carbon. The organic carbon emitted either directly from the source or formed because of secondary processes in the atmosphere. It mainly contains aliphatic aromatic substrates and organic acids etc. The elemental carbon; formed because of incomplete combustion of fuel or biomass composed of carbon in elemental form. Studies indicate that the elemental carbon is emitted from primary anthropogenic sources, while organic carbon is contributed by primary sources and atmospheric chemical reactions as well. The primary sources of organic carbon are fossil fuel combustion, biomass burning which contributes for the formation of fine particles. While parts of plants, decomposition of vegetable debris and soil organic matter contributes for coarse particles. The organic carbon from primary sources undergoes atmospheric chemical reactions through low vapor pressure, optimum temperature and solar radiation to produce secondary organic carbon. (<https://doi.org/10.4209/aaqr.2009.12.0080>; <https://doi.org/10.5094/APR.2013.006>) OC and EC have exclusive effects on climate. OC is known to cause both warming and cooling effects while, EC is the second most important cause of global warming after carbon dioxide. OC and EC show adverse health effect due to presence of carcinogenic and mutagenic compounds. (<https://doi.org/10.1016/j.envpol.2018.03.111>). The detail investigation of both organic and elemental content is usually carried out by estimating eight organic sub-fractions namely OC1 to OC4, OP and EC1 to EC3. These have proven to be very useful information in identifying the source of the particulate matter.

2. METHODOLOGY

2.1 Study Area and Sampling Location

Noida (New Okhla Industrial Development Authority) is one of the well planned cities of Delhi-NCR region located east to Delhi in Gautam Buddha Nagar District. The atmosphere of Noida is subtropical which is characterized by a semiarid climate in summer (April-June), moderate rainfall (July-September), post-monsoon (October-November), and winter (December- February). The atmospheric temperature of Noida typically varies from 8 to 40 °C. The wind is most often from the *east* during *July* to *August*, while during November to June from the west. For one and half months during August to September it also flow from north.



Map of Noida

For the present study, ambient air sampling was done at new Holland Road, Ecotech III, Greater Noida, which is a commercial-residential area with moderate to heavy traffic on roads. There are high rise residential buildings around the location.

Collection of Samples

The collection of PM₁₀ samples was done by **APM 541 samplers (Envirotech Pvt. Ltd., India)** for 3-4 times in a week on Micro fiber quartz filter papers on 24 hourly basis. The sampler was run with the fixed flow rate of 1.2 m³/minute. Following the standard protocol for the removal of organic impurities the filter papers were preheated in a muffle furnace at 550 °C for 6 h. Before and after sampling the filter papers were kept in desiccator for 24 h. Total 24 samples of PM₁₀ were collected and the net mass was calculated by subtracting the weight of empty filter paper from post sampling weights. The concentrations of PM₁₀ (in µg m⁻³) were measured gravimetrically.

Organic Carbon and Elemental Carbon Determination

Carbon Analyser (Atmoslytic Inc., USA) was used to perform organic carbon and elemental carbon analysis using IMPROVE thermal optical reflectance protocol (Chow et al. 2001; Fung et al. 2002). The Principal behind the separation of organic carbon and elemental carbon fractions is the preferential oxidation at different temperature. During the analysis the samples were first pyrolyzed and then organic carbon compounds charred into elemental carbon. This way different organic carbon fractions (OC1, OC2, OC3 and OC4 at 140, 280, 480 and 580 °C), pyrolyzed carbon fraction (OP) and elemental carbon fractions (EC1, EC2 and EC3 at 580, 740 and 840 °C) were analyzed, respectively. The organic carbon and elemental carbon were calculated by IMPROVE protocol program as OC1+OC2+OC3+OC4+OP and EC1+EC2+EC3-OP, respectively. The total carbonaceous aerosol can be estimated by the sum of organic matter (OM = 1.6×OC) and elemental carbon (Cao et al. 2005). The EC Shoot is the sum of EC2 and EC3 while EC char is calculated by subtracting OP from EC1. (<https://doi.org/10.1016/j.atmosenv.2009.08.018>)

RESULT AND DISCUSSION

Detail Analysis of Organic Fractions of particulate matter samples collected during October to December 2020 was performed. The highest concentration of PM₁₀, was 294.3 ±112.1, with OC and EC values 31.0 ±0.1, 2.1±0.6, respectively during the third week of October 2020. The lowest concentration of PM₁₀ was observed during first week of November 2020 with the concentration 110.0 µg/m³. Respective OC and EC values were 22.1 and 2.8 µg/m³. Figure 1 shows the variation of PM₁₀ concentration during study period.

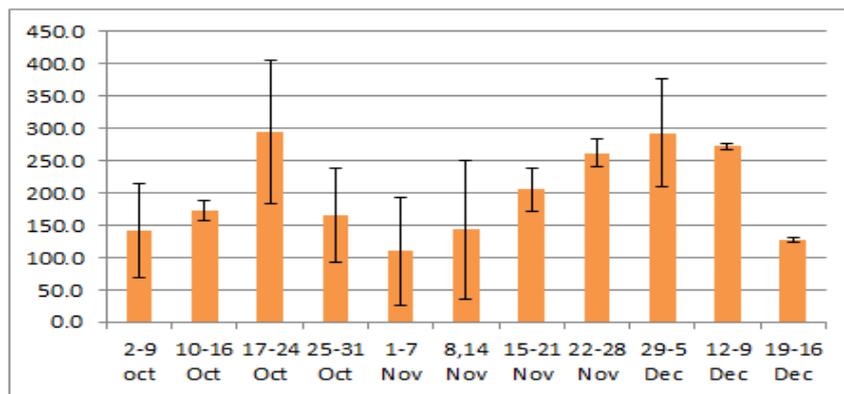


Figure 1: Variation of PM10 concentration ($\mu\text{g}/\text{m}^3$).

Date	PM conc. ($\mu\text{g}/\text{m}^3$)	OC	EC	Total Carbon	Total Organic Matter	WSOC	Total Carbanaceous aerosol
2-9 oct	141.6	20.3	2.9	23.2	32.4	3.9	35.3
10-16 Oct	172.2	28.2	2.4	30.6	45.1	7.2	47.5
27-24 Oct	294.3	31.0	2.2	33.2	49.7	7.5	51.8
25-31 Oct	165.9	28.1	2.3	30.4	45.0	9.8	47.3
1-7 Nov	110.0	22.1	2.8	24.9	35.3	4.5	38.1
8-14 Nov	142.9	20.4	2.8	23.2	32.6	4.0	35.5
15-21 Nov	205.1	22.7	4.8	25.1	36.4	3.2	41.2
22-28 Nov	262.0	25.9	2.3	28.3	41.5	5.0	43.8
29-5 Dec	292.8	30.7	3.0	33.8	49.2	7.1	52.2
12-9 Dec	272.1	32.1	4.9	37.0	51.3	9.1	56.2
19-16 Dec	127.4	30.6	5.0	35.6	48.9	10.0	53.9

Table 1: Weekly average of different TSP components ($\mu\text{g}/\text{m}^3$)

The OC and EC concentrations were random but show rising trend from October to December. A similar high value of PM10 is a common phenomenon of Delhi, mainly due to synergic effect of increase in emission and metrological conditions. It is reported that the major contribution to suspended matter in this duration is from subtle burning in western region. The particulate matter and gases transported from western part further get accumulated due to stability of atmosphere, slow dispersion and low-average mixing height in Delhi NCR region. The average concentrations of PM10, organic carbon and elemental carbon were found to be 198.8 ± 69 , 26.6 ± 4.5 and 3.2 ± 1.1 , respectively during the study period. The values are alarmingly high than the prescribed limit. **Table 1** contains the statistical summary of different Particulate matter components like, OC, EC, WSOC and Total Carbonaceous Aerosols.

The amount of OM is calculated by the multiplication of observed OC concentrations with a factor of 1.6. The total Carbanaceous aerosol is calculated by summation of OM and EC. The value conversion factor may vary for different data depending on SOA values. For aerosol with lower SOA fraction lower values of the conversion factors (1.2–1.4) are used while for the organic aerosol having lower SOA fraction; higher values are considered. Average concentrations of different carbon fractions are shown in Figure 2.

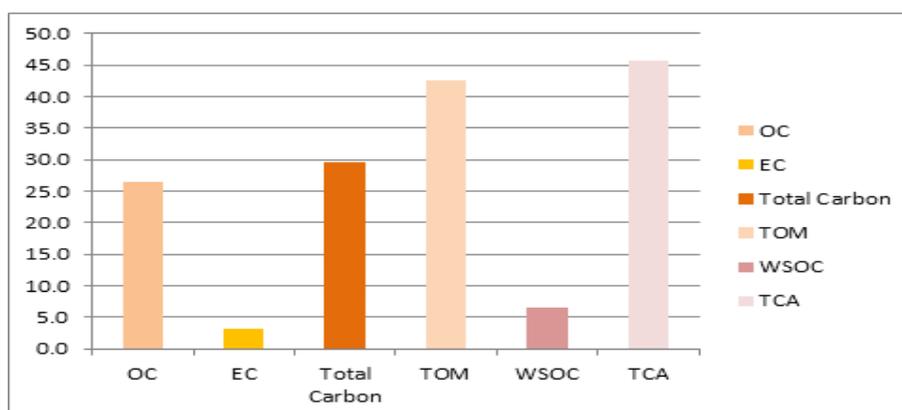


Figure 2: Average concentrations ($\mu\text{g}/\text{m}^3$) of different carbon fractions

An average $25.1 \pm 7.9\%$ percentage contribution of total carbonaceous aerosols in PM₁₀ was observed. Recently, S K Sharma et al. have analyzed ten year ambient air data and reported seasonal variation of different components of aerosol. The average PM₁₀ concentrations were 304 ± 92 and 271 ± 95 $\mu\text{g}/\text{m}^3$ during post monsoon and winter season, respectively. The TCA concentrations were 62.0 ± 27.8 and 80.6 ± 31.1 $\mu\text{g}/\text{m}^3$ during respective period. During post monsoon to winter there was a decrease in percentage TCA from 0.27 ± 0.13 to 0.23 ± 0.12 .

Interpretation of Different Carbon Fractions

Different studies have established that OC1 and EC1 sub-fractions indicate the particulate matter that comes from biomass burning, Similarly, It is suggested that OC2 and OC3 fractions indicates SOC and biomass burning sources. . The high concentrations of EC2 and EC3 represent diesel vehicle exhaust as it contains lots of high temperature component of elemental carbon particles (Watson et al. 1994). The values of OC4, EC2 and EC3 infer coal combustions and vehicular emissions. (<https://doi.org/10.1007/s11869-015-0322-y>).

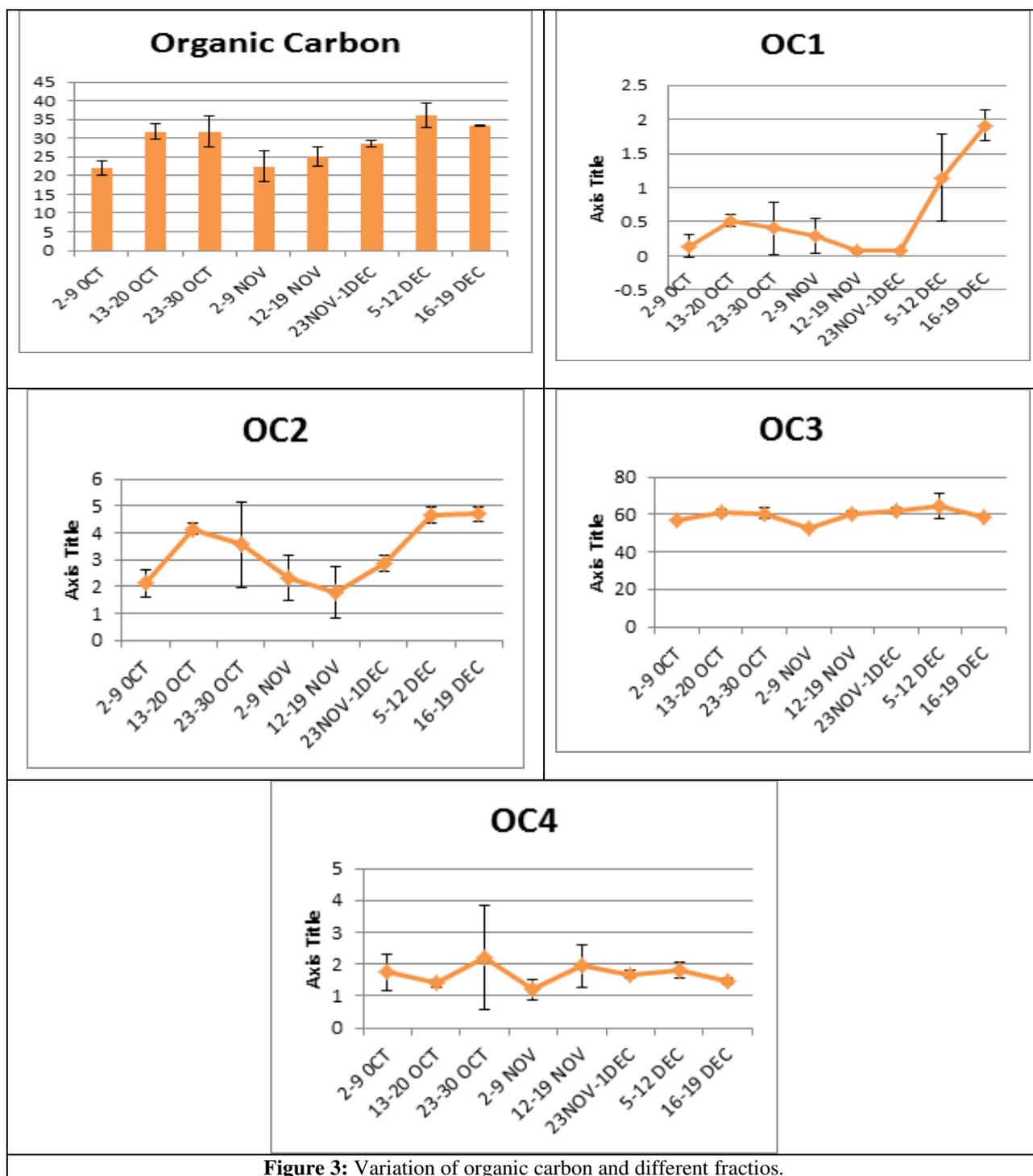


Figure 3: Variation of organic carbon and different fractios.

Zhang et al. (2012) also explained that higher concentrations of OC3 and OC4 reflect road dust as pollution source. (<https://doi.org/10.4209/aaqr.2011.07.0110>). Table 2 contains percentage contribution of OC, EC, and TCA. Throughout the study period OC 3 values were higher followed by OC2, OC4 and OC1. Out of different EC fractions the EC1 values were dominant. As shown in figure 3 and Figure 4 the OC3 and EC1 concentrations are consistently high during post monsoon season. It infers that biomass burning and road dust may be major source of pollution along with vehicular emissions.

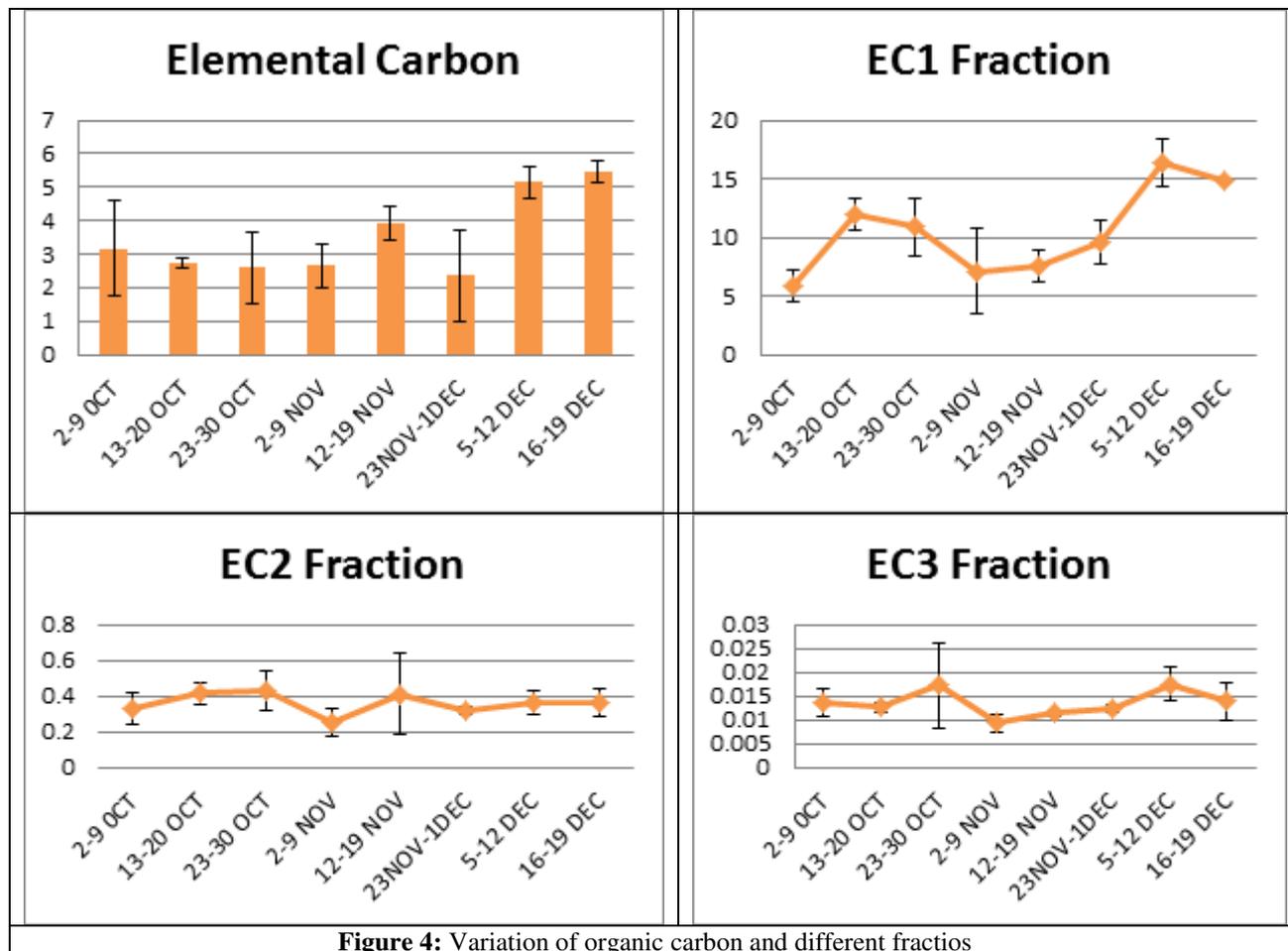


Figure 4: Variation of organic carbon and different fractions

CONCLUSION

Post monsoon season is the time of high particulate matter concentrations in ambient air around Delhi NCR. During the study the average concentrations of PM₁₀, organic carbon and elemental carbon were found to be 198.8 ± 69 , 26.6 ± 4.5 and 3.2 ± 1.1 , respectively. The percentage contribution of TCA, OC and EC to PM₁₀ is found to be 25.1, 14.5, 1.8, respectively. Slight variation in OC and EC values were observed during study period however OC3 and EC1 concentrations are consistently high. Different carbon fractions and OC/EC ratio primarily indicates the Fossil fuel, biomass burning, road dust as major source of pollutant. A detail investigation and source apportionment analysis is required for more accurate conclusions.

ACKNOWLEDGEMENT

The authors are thankful to the Dr. S. K. Sharma and Dr. T. K. Mandal for their valuable guidance and support during OC EC analysis.

REFERENCES

1. Arhami, M.; Shahne, M. Z.; Hosseini, V.; Roufigar Haghightat, N.; Lai, A. M.; Schauer, J. J. Seasonal trends in the composition and sources of PM_{2.5} and carbonaceous aerosol in Tehran, Iran. *Environmental pollution (Barking, Essex: 1987)* **2018**, 239, 69–81. DOI: 10.1016/j.envpol.2018.03.111.
2. Blanchard, C. L.; Shaw, S. L.; Edgerton, E. S.; Schwab, J. J. Emission influences on air pollutant concentrations in New York state: II. PM_{2.5} organic and elemental carbon constituents. *Atmospheric Environment: X* **2019**, 3, 100039. DOI: 10.1016/j.aeaoa.2019.100039.

3. Cao, J. J.; Wu, F.; Chow, J. C.; Lee, S. C.; Li, Y.; Chen, S. W.; An, Z. S.; Fung, K. K.; Watson, J. G.; Zhu, C. S.; Liu, S. X. Characterization and source apportionment of atmospheric organic and elemental carbon during fall and winter of 2003 in Xi'an, China. *Atmos. Chem. Phys.* **2005**, 5 (11), 3127–3137. DOI: 10.5194/acp-5-3127-2005.
4. Chow, J. C.; Watson, J. G.; Crow, D.; Lowenthal, D. H.; Merrifield, T. Comparison of IMPROVE and NIOSH Carbon Measurements. *Aerosol Science and Technology* **2001**, 34 (1), 23–34. DOI: 10.1080/02786820119073.
5. Fung, K.; Chow, J. C.; Watson, J. G. Evaluation of OC/EC speciation by thermal manganese dioxide oxidation and the IMPROVE method. *Journal of the Air & Waste Management Association (1995)* **2002**, 52 (11), 1333–1341. DOI: 10.1080/10473289.2002.10470867.
6. Gu, J.; Bai, Z.; Liu, A.; Wu, L.; Xie, Y.; Li, W.; Dong, H.; Zhang, X. Characterization of Atmospheric Organic Carbon and Elemental Carbon of PM_{2.5} and PM₁₀ at Tianjin, China. *Aerosol Air Qual. Res.* **2010**, 10 (2), 167–176. DOI: 10.4209/aaqr.2009.12.0080.
7. Guo, Y. Size distribution characteristics of carbonaceous aerosol in a rural location in northwestern China. *Air Qual Atmos Health* **2016**, 9 (2), 193–200. DOI: 10.1007/s11869-015-0322-y.
8. Han, Y. M.; Lee, S. C.; Cao, J. J.; Ho, K. F.; An, Z. S. Spatial distribution and seasonal variation of char-EC and soot-EC in the atmosphere over China. *Atmospheric Environment* **2009**, 43 (38), 6066–6073. DOI: 10.1016/j.atmosenv.2009.08.018.
9. Jain, S.; Sharma, S. K.; Vijayan, N.; Mandal, T. K. Seasonal characteristics of aerosols (PM_{2.5} and PM₁₀) and their source apportionment using PMF: A four year study over Delhi, India. *Environmental pollution (Barking, Essex: 1987)* **2020**, 262, 114337. DOI: 10.1016/j.envpol.2020.114337. (10) Jain, S.; Sharma, S. K.; Vijayan, N.; Mandal, T. K. Investigating the seasonal variability in source contribution to PM_{2.5} and PM₁₀ using different receptor models during 2013-2016 in Delhi, India. *Environmental science and pollution research international* **2021**, 28 (4), 4660–4675. DOI: 10.1007/s11356-020-10645-y.
10. Mandal, P.; Saud, T.; Sarkar, R.; Mandal, A.; Sharma, S. K.; Mandal, T. K.; Bassin, J. K. High seasonal variation of atmospheric C and particle concentrations in Delhi, India. *Environ Chem Lett* **2014**, 12 (1), 225–230. DOI: 10.1007/s10311-013-0438-y.
11. Murillo, J. H.; Rojas Marin, J. F.; Roman, S. R.; Beita Guerrero, V. H.; Arias, D. S.; Ramos, A. C.; Gonzalez, B. C.; Baumgardner, D. G. Temporal and spatial variations in organic and elemental carbon concentrations in PM₁₀/PM_{2.5} in the metropolitan area of Costa Rica, Central America. *Atmospheric Pollution Research* **2013**, 4 (1), 53–63. DOI: 10.5094/APR.2013.006.
12. Shukla, A. K.; Lalchandani, V.; Bhattu, D.; Dave, J. S.; Rai, P.; Thamban, N. M.; Mishra, S.; Gaddamidi, S.; Tripathi, N.; Vats, P.; Rastogi, N.; Sahu, L.; Ganguly, D.; Kumar, M.; Singh, V.; Gargava, P.; Tripathi, S. N. Real-time quantification and source apportionment of fine particulate matter including organics and elements in Delhi during summertime. *Atmospheric Environment* **2021**, 261, 118598. DOI: 10.1016/j.atmosenv.2021.118598.
13. Singh, A. K.; Srivastava, A. Seasonal variation of carbonaceous species in PM₁ measured over residential area of Delhi, India. *SN Appl. Sci.* **2020**, 2 (12). DOI: 10.1007/s42452-020-03854-0.
14. Zhang, R.; Tao, J.; Ho, K. F.; Shen, Z.; Wang, G.; Cao, J.; Liu, S.; Zhang, L.; Lee, S. C. Characterization of Atmospheric Organic and Elemental Carbon of PM_{2.5} in a Typical Semi-Arid Area of Northeastern China. *Aerosol Air Qual. Res.* **2012**, 12 (5), 792–802. DOI: 10.4209/aaqr.2011.07.0110.

Right to Information: An Instrument for Good Governance

Bhavna Singh¹ and Rupali Bhouradia²

¹Faculty of Law, Banasthali Vidyapith, India

²Department of Political Science & Public Administration, Banasthali Vidyapith, India

ABSTRACT

“If liberty and equality are chiefly to be found in democracy, they will be best attained when all persons alike share in government to the utmost.”

ARISTOTLE

The actual democracy ought to be found with the approach of informed citizens who are adequately encouraged to participate actively and uprightly in the administration of any country. And for a democratic society the free flow of the information is essential as it aids the society to grow and to keep an uninterrupted discussion between the people. In respect of this, the access to information is important machinery for the changes in the society. Transparency, accountability and people's participation are the directions for preserving good governance and operating the public establishment. The Right to information Act, 2005 aids to accomplish these. Apart from assuring better accountability and transparency, it also acts as an obstacle against the misuse of power. So Right to Information Act undoubtedly strengthens administration.

Right to information Act is an important instrument that can bring many social benefits. The essence of Right to Information act is to construct information dispensation government where the individual can access information in an easy way. Besides just providing information, the Act in several parts of the world acted as an effective protector in making the system works as per the rules and regulations. In India, existing Right to Information Act, 2005 is going through a definitive point and needed to bring much awareness among people to make it much more effective and to facilitate to its development. This article explains the importance and need of good governance for Government and society. It commences through explaining the importance and need of Right to information for good governance. Present paper is an effort to debate the major significance of the good governance, eradication of the corruption in India through Right to Information act and the role of Right to Information Act in good governance. The paper even attempts to determine the application of the Right to Information Act in India. The role of Right to Information Act, 2005 is highlighted in respect of good governance. This article includes the impact of Right to Information Act, 2005 and the contribution done by the instrumental approach about the recognition of Right to information.

Keywords: Good governance, Right to information, Human rights, Accountability etc.

INTRODUCTION

The process of the Government of making decisions and the procedure by which these decisions are implemented or not implemented is Governance. The report entitled “Governance and Development”, of the World Bank in 1992 defines Good Governance. That report defined Good Governance as “**the manner in which power is exercised in the management of a country's economic and social resources for development**”.¹

As per the report, good governance has 8 major features which are-

- participatory
- consensus-oriented
- accountable
- transparent
- responsive
- effective and efficient
- equitable and inclusive
- follows the rule of law

Accountability, Transparency, Participation and Responsibility are basically the four elements which are important for good governance. These elements or principles mention to the accessibility of the information to the public and this accessibility gives clearness about the working of the Government or Government institutions. And this Right to information Act, 2005 supports in satisfying these purposes.²

The Right to information and good governance are complimentary to each other. If there is no transparency, accountability cannot be rigid. There must be maximum disclosure with minimum secrecy. Good governance is measured with this accountability, transparency, availability of information, effectiveness, efficiency and cooperation between the Government and the society.

In standard and usual democracy, the Government must be accountable and answerable to individuals about their work and functioning. Therefore, Government releases and delivers the information of documents, files etc. required by the individuals on request. Thus, we can say that the Right to information is an expected outcome of good governance. The Right to Information indicates the participation of the people in the procedure of administration and governance which becomes unavoidable.

Necessity of RTI for Good Governance

In India, in the history of public administration the enactment of the Right to Information Act, 2005 was a breakthrough. Especially, in the rural areas this legislature brought answerability, responsibility, accountability and sensitivity to the development process and it also helps in monitoring corruption and suspensions in the application of Government supported programs and in the working of public authorities. The accountability and answerability of the public authorities was almost nominal before the implementation of the Right to information act. The people who elected the government and participated in the formation of democratically elected Governments and contributed in finance public activities by paying taxes had no legal rights to know before RTI's implementation about the process which has been followed in policy framing which are affecting them, how the policies have been applied? And even had no right to know about the officials related with the process of decision making and implementation of the schemes. In the name of the secrecy, the governments were keeping the information from the public; from the colonial rule till the first six decades of independence which drove wide-ranging corruption. Because of this keeping secrecy, directness and accountability were lacking in the functioning of the Government which brings incompetence. And the Right to information Act helps in satisfying and accomplishing the main objectives of good governance-Accountability, Transparency, Responsibility and Participation.

The Act played a significant part in bringing public revolution in the country to achieve good governance. It is the major weapon to fight against the arbitrariness and corruption. Today in India there is a high rate of corruption in all the stages. Accountability cannot be rigid if there is no transparency. There should be minimal secrecy and maximum disclosure. The main burden of Right to information act is to study the principles of the confidentiality and remoteness that has deeply occupied India's rigid and miserable government. There have been many affirmative revisions and changes in the level of accountability and transparency, after the implementation of Right to Information Act, 2005.

To Promote Transparency and Good Governance

Right to information enables individuals to see how government bodies are working. Every individual should openly come to know what has happened and what is to happen. Transparency is the key of good governance. The public has the right to know about the plans and programs of the government. All communication of the state must be opened to all individuals. Approach to the information is a major empower of transparency, and it refer to the accessibility of the information to the public and certainty about working of government and government institutions.³ Right to Information Act is designed to encourage transparency and answerability of government by making the procedure of the government policymaking wider.

However, in RTI some divisions are exempted of the Union government, the people get the desired information if it is in respect of the violation of human rights, people can also get the information from the private jurisdiction but that can be pursued only by the commanding authority, and it will send the note to the institution under section 11 of the Right to information act, 2005. Many of the countries have executed it through understanding that greater access to the individuals to information increases the directness of government to society needs. In return, it provides immediate remedied of public grievances and thus advances feeling of goodwill towards the state government. Democratic countries have a greater degree of openness vis-a-vis rigid establishment; nowhere in the world government institutions works completely open.

To Promote Accountability-

Accountability is another key ingredient of good governance. Without this, the root of any advancement failure cannot be found. Not only the state bodies, but the private sector bodies also are accountable to the individuals. Information is powerful and the Right to information Act brings transparency and accountability to the administration. This involves the continuation of a mechanism, which assures that both officials and political are answerable for their behavior, use of public resources and performance. If they breakdown to maintain

accountability, their authority and power are finished. The RTI Act allowed the people to explore definite and officials of their works or short of it. Hence, accountability always led to the sense of responsibility and effectiveness among government heads. The RTI Act is satisfactorily strong in its current form to even fight the roots of corruption.⁴ There will repeatedly be corruption at the roots as long as its seeds are sown at the top level. RTI Act can be used to showcase these seeds of corruption which in return can regulate corruption at the basic level.

To Promote Participation-

In good governance the participation of the community is anticipated. And as community the participation of both men and women is the base of good governance because an ideal democracy should take in concentration the interest of all sections especially the weaker sections of the community; democracy doesn't mean the rule of selecting little. Participation has a big range of descriptions. As per one side the meaning of the participation is to mean engaging of the people in any specific movement or act, but as per other opinion we can define participation as the activity of the people by which individuals can control, effect and participate in development activities. This idea of participation has been fulfilled by the RTI Act, as this act creates a relation between government and people. But without the participation of the individuals, the RTI will remain a failure. This is the need for the good governance that in the formation of advance methods the society has the chance to participate and those societies which are directly affected and the individuals would be able to be the part of the plan and application of projects and various programs. Those individuals who understands what government is doing and understands about public proceedings, they can raise their voice about the problems they are facing and can give ideas in respect to resolve them, in that way they can participate in the affairs of the government. Even where plans have a trivial effect on particular places or population clusters, there should be a discussion that takes their aspects into consideration. RTI facilities individuals in making economic choices and political and thus strengthens democracy.

Right to Information Act encouraged and facilitated people's participation in the governance. Prior citizens had the will, but they did not have the chance to take part in the so-called official proceedings. But RTI acts the way for much participation of the common individuals in governance sensibly.

Accessibility of Information Becomes Easy With RTI-

Access to information from central and state government institutions and departments, records, services, finances, documents and projects to all segments of society was made easy by right to information. The citizens indulge in the matter of government bodies concerning, development and progress. The Right to Information Act provides contributing entry to information and thus helps in building nations process and decreases the gap between administration and citizens. By the accessibility of information individuals becomes aware about the activities of the government bodies and departments. When individuals have the approach to information about service transmission and other state functions, they know what they are designated to, and they know where and how to demand their right to those activities and other uses. In pre- RTI era individuals' role was only restricted to the election of their heads, individuals didn't have the legal right to know about the affairs of government activities. But the RTI act gave the people the more-needed right to seek information concerning the works of their government authorities should co-operate the people. The RTI act was given the status of the fundamental right, and it is proof of the fact that how needed it is for the proper functioning of the government bodies.

Empowerment of the Citizens through RTI-

To assure development in the local sectors, people's participation must be decentralized. It is also called empowerment of citizens. Before the enforcement of Right to Information Act, 2005 involvement of the citizens in various acts of the government like political and financial processes, and being a democratic country the capacity to make choices has been to India. As a result of this, citizens remain unaware of various schemes, development and processes, they even can't fight for their legal rights when these rights become perception. At the same moment, people remain empty in terms of the means and ways by which they can get their entitled rights from the respective departments in a legal way.⁵

So, in this era of the technology-driven information revolution, empowerment defined as an access to information. The first thing any dictatorial government body does is to restrict the individuals' access to the sources of knowledge and monopolize it while the rule of good governance demands easy flow of knowledge. Concentration of information confidently leads to centralization of power. Now with the enforcement of Right to Information Act, 2005 individuals can take part in decision making process and this act empowers the individuals to know about the pronouncements of the government. The Right to Information Act, 2005 has been permitting individuals by giving them the right to access to information and also restricting the keeping of the

information related to the decision-making process by the government and the government institutions in the name of secrecy.

Some Other Characteristics-

Some other aspects are like-Fairness and inclusiveness; these are some other important characteristics of good governance. This indicates that every individual, every citizen is a part of the governance, and it is important in good governance that individuals don't feel like that they are not from the main division or part of the society. Every individual should have the same status in the government decisions. There is one other characteristic of the Right to Information Act is that it doesn't make any discrimination between poor and rich, and it covers all the individuals. This always plays a major role to fight against injustice, inequality and inhuman activities.

Development of Culture of the Right to Information:

For the development of the culture of right to information, an effective access to information law is important which works on both in practice as well as on paper. After more than a decade of implementation of RTI and to accomplish the purpose of developing the philosophy of right to information, this stills a challenge for society to promote the right to information and organize campaigning to promote it. By promoting such a transparency, culture has aspects to it: the acceptance of public heads to give information and willingness to file requests by the public. The absence of awareness among public to the access to information laws and of the right to seek information from various public bodies is a major problem.⁶ That's why legal awareness and campaigns in respect of freedom of information want to be commenced to increase consciousness among the people and inspire filing of the requests related to seeking information.

To Improve the Efficiency of the Government Withadequate Information Management-

An access to information is like an instrument to expose and control corruption in administration, by highlighting the poor administration in various areas like- information regarding the public funds that how these public funds will be disbursed? This era of access to information is also helping in improving the internal efficacy of the government institutions and information management in administration; in fact, after the implementation of the act on certain levels internally institutions are accountable for their actions and to keep and provide information whenever asked. But it is necessary to improve the administrative infrastructure to keep the information and records, and for this we need a proper and adequate information management system by which we can maintain information and records safe.

Role of Supreme Court of India in the Development of Right to Information Act

The Right to Information has been recognized under Article 19(1) (a) and Article 21 of the Constitution as an integral part of right to freedom of speech and expression and the right to life and personal liberty by the Supreme Court of India through various verdicts.

The Supreme Court of India in 1975 observed in **State of Uttar Pradesh Vs. Raj Narain**⁷ that freedom of speech and expression covers citizens' right to know about all public acts, anything which has been done by the public officials in public way and decided that in a responsible government, wherever all the representatives of the public must be accountable for their work, there can be secrets but only few.

In 1982, the Supreme Court of India in the case of **S.P. Gupta vs. Union of India**⁸ held that the right to know is implied in the right of freedom of speech and expression. It must be obligatory to disclose information related to the working of the government.

The Supreme Court in 1995 in the case of **Secretary, Ministry of Information and Broadcasting, Government of India v. Cricket Association of Bengal**⁹, hardly extended its view related to Article 19(1) (a) towards the right to information and decided that the right to receive and communicate information is comprised in the right to freedom of speech and expression. The right to be informed or right to know is the basis of democracy and is resultant of the entire provision of Article 19(1) (a) of the Constitution of India.

In the case of **Peoples Union for Civil Liberties vs. Union of India**¹⁰ the Supreme Court held that except the citizens have a right to participate in the affairs related to policy of the country, true democracy never exists. For this participation in the matters of the country is worthless except the citizens are well-versed about all the matters regarding which they are called upon to express their views. This is the basic requirement that the citizens have a right to know about the actions of the government. When the government is an open government about their functions and people have access to information then only, citizens can perform a significant role in a democracy.

The Supreme Court in the case of **S. Rangarajan vs. P. Jagjivan Ram**¹¹, held that the disapproval of the policies of the government was not prohibited however there must be an appropriate balance among social

interests and freedom of expression, but courts can't merely balance both the interests as if their weightage are equal. The commitment of the court to freedom of expression demands that it can't be repressed if the circumstances formed by permitting the freedom are demanding or critical and the public interest will be threatened.

The Supreme Court in the case of **Union of India vs. Association of Democratic Reforms**¹² delivered the directions to Election Commission of India that the electorates have the right to know about the backgrounds of the contenders of the election. Amongst these periods, a number of subtle verdicts followed the Supreme Court's apprehension on the right to know.

As per the decisions mentioned till the Right to Information Act was introduced, access to information was not that easy, information's were like the assets of those people who were having authority in respect of that information and they could refuse it in the name of maintaining secrecy.

CONCLUSION

Hence, we have seen through various judgements given by the Supreme Court, report of the world bank etc. who have identified right to access of information as an important and fundamental right for citizens and that this right to access to information is must for good governance. And in this, the Right to Information Act, 2005 has certainly accompanied the transparency in governance and it is also affecting entire sections of the administration. If all the provisions of this act are honestly implemented then the openness of government will definitely convert into reality, and this will enable good governance through averting corruption in government institutions and their deals. In fact, through RTI not only Judiciary but also the Information Commissions and the society are encouraging and imposing democratic accountability.¹³All efforts regarding the enactment and implementation of RTI are actually focused to guarantee that accountability will aimal administration, misuse of discretionary power, corruption and other administrative misconducts.

Access to information is empowering all sections of the society to claim their well-being and by that they truly carry the plentiful useful arrangements of the government, which generally persist on paper because of lack of the intention of administration for the accomplishment of these schemes. Therefore, to promote people central governance and to support participatory democratic government the Right to Information has been perceived as the key.

REFERENCES

1. "World Bank. 1992. World Development Report 1992: Development and the Environment. New York: Oxford University Press. © World Bank. <https://openknowledge.worldbank.org/handle/10986/5975> License: CC BY 3.0 IGO."
2. Rattan Jyoti and Rattan Vijay, 2022, Eradicating Administrative Corruption through Transparency in Public Governance: Global Scenario and the Right to Information Act, 2005, in India, Sage Journals, New Delhi. <https://journals.sagepub.com/doi/full/10.1177/00195561221080447>
3. Dhaka Rajvir, 2017, Right to Information and Good Governance: Operational Problems and Road Ahead, Sage Journals, New Delhi. <https://journals.sagepub.com/doi/abs/10.1177/0019556120090315>
4. Acharya N.K., 2012, Commentary on The Right to Information Act, 2005, Asia Law House, Hyderabad.
5. Daruwala, M. and Nayak, V. (eds), 2007, 'Our Rights, Our Information: Empowering People to Demand Rights through Knowledge', Commonwealth Human Rights Initiative, New Delhi.
6. Darbishire, H., 2010, 'Proactive Transparency: The Future of the Right to Information? A Review of Standards, Challenges, and Opportunities', Communication for Governance and Accountability Program, World Bank, Washington DC.
7. State of Uttar Pradesh Vs. Raj Narain , 1975 AIR 865, 1975 SCR (3) 333
8. S.P. Gupta vs. Union of India, AIR 1982 SC 149
9. Secretary, Ministry of Information and Broadcasting, Government of India v. Cricket Association of Bengal, 1995 AIR 1236; 1995 SCC (2) 161
10. Peoples Union for Civil Liberties vs. Union of India, AIR 1997 SC 568
11. S. Rangarajan vs. P. Jagjivan Ram, 1989 SCR (2) 204
12. Union of India vs. Association of Democratic Reforms , (2002) 5 SCC 294
13. Bhat Sairam, 2016, Right to Information and Good Governance, National Law School of India University, Bengaluru.

Analysis of Agriculture Soil Quality around Lalmatia Coalfield, Jharkhand, India by Various Physico-Chemical Parameters

Shashi Kant Kumar and Niranjan Kumar Mandal*

*Department of Chemistry, S. K. M. University Dumka, Jharkhand, India- 814101

ABSTRACT

The study was performed on the Lalmatia coalfield project in the eastern coalfields of India to evaluate the coal mining impacts on the surrounding environment, specifically on soil. Coal contributes partially to the economic development of a country but deteriorates the environment through coal mining. Besides this, it also impacts the land of agriculture surrounding that crop's production limits. The analysis of soil samples from agricultural lands around the Lalmatia coalfield was carried out using standard reported methods. The agricultural land soil samples analysis indicated that the agricultural lands around the coalfield soils were found slightly acidic and nitrogen, phosphorus, calcium, magnesium, sulfur content, heavy metals, available nutrients, exchangeable cations, organic carbon, water holding capacity, organic matter, specific gravity, and moisture content were found in satisfactory concentration. However, coal mining to no extent changes the surrounding environment and agricultural lands of the Lalmatia Coalfield.

Keywords: Lalmatia Coalfield, Soil pollution, Heavy metals and Agriculture land.

I. INTRODUCTION

Coal is the most abundant fossil fuel on the planet, accounting for approximately 75% of total fuel¹⁻². For the production of electricity, coal contributes more than 39% (1/3) all over the world³ as well as its use to generate heat by burning or produce gas by liquefying and diesel fuel. However, coal mining's effects on the ecosystem cannot be overlooked, though it greatly contributes to any country's economic development⁴⁻⁵ causes of soil, air and water pollution, loss of forest and landscape damage that leads to more deterioration of biological communities⁶⁻⁹.

There are 352 coal mines in India, of which 174 are open-cut, 158 are underground, and mixed mines number 20. There are nine major coal mines in Jharkhand, India. Lalmatia is one of the major open-cut coal mining areas in the Godda district, Jharkhand state. This coalfield was discovered by the Indian Geological Survey team¹⁰ in 1973. This coal mine was taken over by the government of India and came under the Eastern Coalfield Ltd (ECL), a subsidiary of Coal India Ltd. This coal mine produces around 100 tons of coal every day. Lalmatia coalfield is located 34 km north of Godda district. The coal quality meets the international environmental standards, i.e., low sulfur and low ash^{11,12}.

However, the area of coal mining in the Lalmatia coalfield is facing different environmental problems due to soil, water, and air pollution, and also contamination of heavy metals in the soil¹³. According to the Eastern Coalfield Ltd., practices of coal mining in the Lalmatia Coalfield are the most dangerous processes in the world, which cause a significant threat to the regional ecology. The strategy of coal mining collapsing leads to land subsidence, destruction of local water resources, erosion of soil, air pollution and biodiversity decreases^{14 15}. Heavy metal contamination of the soil, drainages, and streams of coal mining, as well as various mining processes, is now threatening the economy of the local agricultural activity¹⁶⁻¹⁷. In view of this, the present research paper, was aimed, finding out the environmental impact of coal mining around Lalmatia coal field nearby villages, Godda a district, Jharkhand state, India.

II. MATERIALS AND METHODS

The Lalmatia coalfields are one of the higher Gondwana coalfields of India, covering an area of about 400 ha. Eastern Coalfield Ltd is one of the most important coalfields in India, located in Lalmatia, Godda District, between latitude 24°54' N and longitude 87°17' E. The Eastern coalfield is about 130 acres in length and approximately 14 km in width. It stretches from west to east and finally turns southward, covering an area of about 450 sq. km. India's only source of high-quality coking coal is the Lalmana coalfield in Jharkhand. The coalfield has been a centre of activity for coal mining for more than a century. The maximum average temperature during January is about 24°C, and the minimum average temperature is about 26°C during December. A total of six sites were selected in the Lalmatia coalfields, i.e., Neema, Bagjori, Janakpur, Kendua, Hijukita, and Jatakothi village's agricultural lands. The locations of sampling briefs in the Lalmatia coalfield are illustrated in **Table-1**.

Table-1: Geographical location of different sampling sites as recorded by GPS

Sr. No.	Name of the Village	Longitude	Latitude
1	Neema	87°20'40.6"E	25°09'31.0"N
2	Bagjori	87°33'29.3"E	25°05'21.6"N
3	Janakpur	86°65'68.0"E	24°46'83.6"N
4	Kendua	87°05'83.1"E	24°54'24.9"N
5	Hijukita	87°35'86.2"E	25°04'30.3"N
6	Jatakothi	87°33'17.9"E	25°04'93.6"N

1. Sample Collection

Collected soil samples were from agricultural lands around the Lalmatia coal field study area. Soil samples were taken from the agricultural lands of six different villages, such as Neema, Jatakathi, Janakpur, Kendua, Hijukitha, and Bagjori villages, around the Lalmatia coalfield. The soil samples were grounded for air drying in the laboratory and in airtight polythene bags. Then the soil samples were passed through an individual grinder and, subsequently, a 2 mm stainless steel sieve.

2. Laboratory Analysis

All the collected agricultural soil samples were tested for their chemical and physical properties, according to standard protocols. The laboratory investigations were done in the Laboratory of the Chemistry Department, SKM University, Dumka and the Department of Chemistry, B. K. Birla College, Kalyan-Maharashtra.

The physical properties, i.e., odor, temperature, and color, were tested during the collection time of the soil sample. Determined, each sample's pH using a pHmeter (EQ-650) and measured electrical conductivity with an ELICO-CM-180 conductivity meter. The organic carbon percentage is titrimetrically determined by Walkley and Black. The potassium content was determined by the ammonium acetate method using a flame photometer¹⁹ and the emitted radiation wavelength was 766-770nm. Zinc, copper, lead, cadmium, manganese, magnesium, calcium chromium, nickel, mercury, and vanadium were determined by the soil extraction method using a Shimadzu Atomic Absorption spectrometer. Phosphorus content was calorimetrically estimated by Olsen's method²⁰.

III. RESULTS AND DISCUSSION

Table-2 depicts the physicochemical data of the agricultural soil surrounding the Lalmatia coalfield. In the soil, the amount of water is investigated by moisture content analysis, and it can be expressed in percentage. In the soil, the amount of water stored is not constant with time, but may vary from time to time. The selected soil samples' moisture content was found to range from 2.31% to 17.72%. The agricultural soil moisture content was found to be lower at Jatakothi (2.31%) due to the presence of sandy mass materials and vice-versa. In the agricultural soil samples, the percentages were found higher at Bagjori (16.9%), Janakpur (17.72%), and Kendua (16.1%) villages, indicating well for plants' normal growth. This data gives an idea of the normal growth of plants in a coal mining area.

Table-2: The physical-chemical-instrumental results of the agricultural land soil samples from the around Lalmatia coalfield villages

Test	Units	Neema	Bagjori	Janakpur	Kendua	Hijukita	Jathakothi
Na	Kg/hp	0.09	0.22	0.31	0.26	0.37	0.19
K	Kg/hp	0.45	0.38	0.56	0.37	0.29	0.22
Ca	ppm	0.08	1.20	2.77	3.88	8.2	6.5
V	ppm	ND	ND	ND	ND	ND	ND
Cr	ppm	0.1568	0.11	0.08	0.0978	0.135	0.046
Co	ppm	ND	ND	ND	ND	ND	ND
Ni	ppm	ND	ND	ND	ND	ND	ND
Fe	ppm	0.13	0.04	0.21	0.25	0.16	0.12
Zn	ppm	ND	ND	ND	ND	ND	ND
Cu	ppm	ND	ND	ND	ND	ND	ND
Hg	ppm	ND	ND	ND	ND	ND	ND
Pb	ppm	ND	ND	ND	ND	ND	ND
P	Kg/hp	0.08	0.56	0.45	0.37	0.33	0.45
As	ppm	ND	ND	ND	ND	ND	ND
Cd	ppm	ND	ND	ND	ND	ND	ND

Org. C	%	0.36	0.34	2.33	2.31	1.19	4.67
pH	-	6.04	6.01	6.44	6.67	6.26	6.76
EC	mΩ/cm	0.38	0.38	0.36	0.36	0.36	0.35
M/C	g/cm ³	8.24	16.9	17.72	8.59	16.07	2.31
Bulk Den	%	0.91	0.9	0.9	0.83	0.91	0.92
Spe Gravity	%	2.68	2.7	1.48	1.44	2.25	1.23
Org Matter	%	4.19	3.33	10.21	7.74	2.31	9.3
Alkalinity	ppm	ND	ND	ND	ND	ND	ND

Calculate the bulk density of the soil weight per unit volume, which is typically given on a dry basis in an oven. The soil sample bulk density is quite variable from site to site. Soil bulk density is also affected by soil structure, texture, and organic matter status. The agriculture soil sample bulk density was found to be between 0.83 and 0.92%, suggesting that, in the studied agriculture soil sample the presence of high organic matter is evident.

The pH method, which uses a 0–14 pH scale, is used in agriculture soil to measure the basis or acidic properties, important factor of soil solution is pH. Because carrier soil solution contains nutrients such as phosphorus, potassium, and nitrogen that plants need in specific amounts to thrive and fight off diseases. The availability of maximum primary nutrients like potassium, phosphorus, and nitrogen, as well as secondary nutrients like magnesium, calcium, and sulfur, are found in the 6.5-7.5 pH range. In the present study, agricultural soil samples were found to be lower at Bagjori village (6.01) and higher at Jatakothi (6.76.) village. Low pH at Neema (6:04), Bagjori (6:01), and Hijikuta (6.26) villages indicated that lower pH could be causing normal plant growth problems.

Soil salinity is most commonly measured by electrical conductivity and its ability to carry an electric current. Its conductivity established that 0.2-0.8dS/m is the optimal range for plant growth. During the agriculture soil sample study period, electrical conductivity was found to range from 0.35-0.38 dS/m in the agriculture lands of different villages around the Lalmatia coal field. This is because the agricultural lands of the studied villages may require the amount of nutrients present in the soil.

For the soil, chemical and physical properties, an important parameter is organic carbon, which has a series of benefits on the soil quality of agriculture lands. Organic carbon also enhances aeration of soil structure. Water penetration and water-holding capacity increase, and nutrients are supplied for plant growth. Soil with more than 0.8% organic carbon is rated as good quality. It also depends on vegetation, climate, soil texture, and current and historical land management and use. In the present agricultural land studies, the content of organic carbon in soil samples varied from 0.38-4.67% in the selected sampling sites of the Lalmatia Coal Field. The organic carbon in Neema (0.38%) village was found to have low humification, a lack of several microbes, and a rate, in the sampling site, whereas organic carbon was higher in the remaining sites due to higher. There is a presence of humic substances present in the soil samples due to garbage waste decomposition dumped on the soil. Level of organic carbon, most of the agricultural soil samples have been found rich in this range.

In the soil, nitrogen (N) is the most important element for the development of plants. Existing soil nitrogen is in three general forms: compounds of organic nitrogen, nitrate ions, and ammonium ions. In our atmosphere, plants are surrounded by nitrogen. In the present study, nitrogen content was found to be.

An essential element of phosphorus, it is classified as a macronutrient because of the large amounts of relatively required phosphorus. Phosphorus is one of three nutrients that are commonly added to soil fertilizers; for plants, the availability of phosphorus in sufficient quantities stimulates early plant growth and accelerates maturity. So, phosphorus is essential for coal mining area plant growth, and soil phosphorus mismanagement can pose a threat to soil and water quality directly or indirectly. In the present study, phosphorus content was found in the range of 0.08–0.56 kg/ha. The availability of phosphorus in the agricultural soil samples was recorded in low amounts due to the soil nature being acidic, which restricted the resulting mineralization process to the agricultural soil samples.

An essential nutrient is potassium (K) for plant growth. Three forms of potassium (exchangeable or readily available, unavailable, fixed or slowly available soil solution potassium) exist in soils. Potassium exchangeable in potassium is readily available and easily absorbed by plants. This fraction held potassium on the clay particles' surface and in the soil organic matter. It is found in equilibrium with the soil solution and is released easily when potassium is absorbed by plants from the soil solution, measured exchangeable potassium in most

soil testing. In the present study, potassium content varied from 0.22 to 0.56 kg/ha. This might be due to the mineralization process being very poor in the agricultural soil samples.

In the agricultural lands around Lalmatia coalfield villages, soil samples' heavy metal concentration is given in **Table-1**. The concentration of Cr was found in Neema (0.11 ppm), Janakpur (0.098 ppm), Kendu (0.13 ppm) and Jatakothi (0.104 ppm) villages' agriculture lands, which is higher than permissible limits²². Other heavy metals such as V, Co, Ni, Fe, Zn, Cu, Hg, Pb, As, and Cd are not detectable and found to be below permissible limits.

IV. CONCLUSION

The coalfield of Lalmatia produces better quality coal, but the process of mining deteriorates the environment, including soil, air and water, especially in agricultural fields. The acidic pH may limit the plant's growth or even cause death. The pH of the agriculture lands of Neema, Bagiori, and Hijukita villages, which are slightly acidic in nature, may be poor in micronutrients. Bulk density, moisture content, electrical conductivity, nitrogen, calcium magnesium, potassium phosphorus, organic carbon, and organic matter have been found in a moderate range for sampling sites for plant growth around Lalmatia Coalfield. The Cr content of the agriculture lands around the Lalmatia coal field was found to be higher than the permissible limits. Other heavy metals are below permissible levels. From the above discussion, it can be concluded that the evaluated soil samples in this study were found environmentally safe for agricultural, plantation, and vegetation purposes.

REFERENCES

1. Ramani RV (2013) Coal mining. Retrieved 10 January, from <http://www.britannica.com/EBchecked/topic/122975/coal-mining>.
2. Elliott MA (1981) Chemistry of coal utilization: Second supplementary volume. New York, United States: John Wiley and Sons.
3. Brown CE (2002) World energy resources. Berlin, Heidelberg, New York: Springer Verlag.
4. Chowdhury R, Maiti A and Kumar S (2017) Ecological risk assessment of mercury and other heavy metals in soils of coal mining area: A case study from Eastern part of Jharia coal field, India. Human and Ecological Risk Assessment. An International Journal, 1-19.
5. Moeng K (2019) Community perceptions on the health risks of acid mine drainage: the environmental justice struggles of communities near mining fields. Environment, Development and Sustainability, 21(6): 2619-2640.
6. Zhu D, Chen T, Zhen N and Niu R (2020) Monitoring the effects of open-pit mining on the eco-environment using a moving window-based remote sensing ecological index. Environmental Science and Pollution Research, 27(13):15716-15728.
7. Tavakoli M, Hojjati SM and Kooch Y (2019) Reduction of Plants Biodiversity in Hyrcanian Forest by Coal Mining Activities. International Journal of Environmental and Ecological Engineering, 13(4): 212-216.
8. Sadhu K, Adhikari K and Gangopadhyay A (2012) Effect of mine spoil on native soil of Lower Gondwana coal fields: Raniganj coal mines areas, India. International Journal of Environmental Sciences, 2(3): 1675-1687.
9. Zazouli M, Dehbandi R, Mohammadyan M, Aarabi M, Dominguez AO, Kelly FJ, Khodabakhshloo N, Rahman MM and Naidu R (2021) Physico-chemical properties and reactive oxygen species generation by respirable coal dust: Implication for human health risk assessment. Journal of Hazardous Materials, 5(405): 124185.
10. Wikipedia: https://en.wikipedia.org/wiki/Lalmatia_Colliery.
11. Harun-Or-Rashid HM, Urbi Z and Islam M (2014) Environmental impact of coal mining: a case study on the Barapukuria coal mining industry, Dinajpur, Bangladesh. Middle-East Journal of Scientific Research, 21(1): 268-274.
12. Sajjad M and Rasul M (2015) Prospect of underground coal gasification in Bangladesh. Procedia Engineering, 1(105): 537-548.
13. Hossen MA, Chowdhury AI, Mullick MR and Hoque A (2021) Heavy metal pollution status and health risk assessment vicinity to Barapukuria coal mine area of Bangladesh. Environmental Nanotechnology, Monitoring & Management, 1(16): 100469.

14. Mason TJ, Krogh M, Popovic GC, Glamore W and Keith DA (2021) Persistent effects of underground longwall coal mining on freshwater wetland hydrology. *Science of the Total Environment*, 10(772): 144772.
15. Li J, Liang J, Wu Y, Yin S, Yang Z and Hu Z (2021) Quantitative evaluation of ecological cumulative effect in mining area using a pixel-based time series model of ecosystem service value. *Ecological Indicators*, 1(120): 106873.
16. Dragović S, Mihailović N and Gajić B (2008) Heavy metals in soils: distribution, relationship with soil characteristics and radionuclides and multivariate assessment of contamination sources. *Chemosphere*, 72(3): 491-495.
17. Egorova N, Egorova I, Maltseva E and Sukhikh A (2019) Quality Numerical Indicators of Raw Materials of *Sanguisorba Officinalis* L. Growing on Overburden Dumps of Kuzbass Coal Surface Mines. In *E3S Web of Conferences*, (Vol. 105, p. 02004). EDP Sciences.
18. Wan M, Hu W, Qu M, Li W, Zhang C, Kang J, Hong Y, Chen Y and Huang B (2020) Rapid estimation of soil cation exchange capacity through sensor data fusion of portable XRF spectrometry and Vis-NIR spectroscopy, *Geoderma*, 1(363): 114163.
19. Sparks D, Page A, Helmke P and Loepfert R (2020) *Methods of soil analysis, part 3: Chemical methods*. John Wiley & Sons.
20. Fink J, Inda A, Bavaresco J, Barrón V, Torrent J and Bayer C (2016) Adsorption and desorption of phosphorus in subtropical soils as affected by management system and mineralogy. *Soil and Tillage Research*, 1(155): 62-68.
21. Estefan G, Sommer R and Ryan J (2013) *Methods of soil, plant, and water analysis; A manual for the West Asia and North Africa region*, 3:65-119.
22. BIS IS; Bureau of Indian Standards; New Delhi. 2012, Jul 6:2-3.

An Ayurvedic Approach In Female Pattern Hair Loss (~Khalitya) A Case Study

Vijay Singh Yadav

Vikritivigya Department, Faculty of Ayurveda, IMS BHU, India

ABSTRACT

Female pattern hair loss (FPHL) is that the most ordinary kind of alopecia in women. Affected women may have psychological distress and impaired social functioning. Early diagnosis and initiation of treatment are desirable because treatments are simpler to avoid the progression of hair loss than stimulating regrowth. In Ayurvedic texts, the gradual loss of hairs is termed as Khalitya (~Hair Loss). This condition comes under the heading of Kshudra roga (~the minor disease) or Shiroroga (~diseases of head & scalp). Within the present case, a 31 years old female presented with problem of hair loss. Also, she complained of mild dandruff and dryness in skull. She was having hair loss on vertex of skull. On basis of symptoms, she was diagnosed as case of Khalitya which is caused by Dushti of Four Dosha i.e., elevated Pitta together with Vata Dosha and Rakta, Kapha Dushti. During this case study Neelibhryangyadi oil and Sweta Gunja Beeja and Kalihari Moola Svarasa is employed for local application and Bhringraj and Triphala Yavakuta is given for hair wash, Rasayan Choorna, Saptaamrita Lauh and Kumari Asava as oral medication. Evaluation of improvement relies on relief in sign and symptoms.

Keywords: Female pattern hair loss (FPHL), Khalitya, Neelibhryangadi Oil, Rasayan choorna, Shiroroga.

INTRODUCTION

Female pattern hair loss (FPHL) has emerged because the preferred term for androgenic alopecia (AGA) in women because of the uncertain relationship between androgens and this entity.^[1] FPHL is that the commonest hair loss disorder in women. Initial symptoms may develop during the teenage years and result in progressive hair loss with a characteristic pattern distribution.^[2] FPHL is characterized as a non-scarring diffuse alopecia that evolves from the progressive miniaturization of hair follicles and subsequent reduction within the number of hairs, especially within the central, frontal, and parietal scalp regions.^[3] Problem of falling of hair is progressively increasing in society affecting the standard of life. Ayurveda Khalitya means hair fall and it resembles with baldness or alopecia in modern science. In Ayurvedic texts Khalitya is considered as a Kshudra Roga.^[4] Because of irregular life style and changes in environment like excessive pollution, use of synthetic chemicals and improper diet have increased no. of patients with diseases like Khalitya.^[5] Pitta present at rootstock of the hair, getting increased in association with Vata cause falling of hair. Then Kapha and Rakta together block the follicles of the hair not allowing fresh ones to grow. This condition is understood as Indralupta, Khalitya, and Ruhya.^[6] Now a days Alopecia may be a quite common ailment related to several comorbidities, including depression, anxiety, and a number of other autoimmune diseases (thyroid disease, lupus, vitiligo, psoriasis, autoimmune disorder, inflammatory bowel disease).^[7] So its effective and safe treatment is required which is given in Ayurvedic texts. During this case study by the assistance of Ayurveda symptoms of patient's disease reduced.

Patient Information

A 31 years old female patient with registration no.2431869 visited the o.p.d of Vikriti Vigyan with chief complaints of hairfall (~Khalitya), dandruff (~Darunaka) and dryness (~Rukshata). According to patient, she was asymptomatic 6 years back then she suffered from hair fall, which was remote in the starting, then it increases day by day gradually. Hair loss was more prominent on the vertex and parietal region, including the scalp. On temporal region, the hair loss was minimal. She has no any family history of hair fall. No any other active disease was present in the patient. She has some mental stress and some bad habits which are supposed to increase hair fall, like avoiding oiling of scalp.

Clinical Findings

On examination it was found that hair loss on vertex and right parietal region is much more and very less on left parietal and occipital region. Mild dandruff and dryness of scalp was also present. No any discharge was found on scalp. No any history of DM/HTN/Thyroid was present. Hair loss was assessed with the help of Severity Of Alopecia Tool Scale (SALT). On physical examination it was found that BP (124/80 mm of Hg) and pulse (76/Min.) of pt. was normal. History of Irregular menstruation was found in patient. Pt. was Kapha Pradhan Pitta Prakriti. Personal history of patient is shown in table-1

Table-1 Personal History of patient

Diet	Vegetarian
Appetite	Decrease
Micturition	4-5time/day
Sleep	Sound sleep for 7 hours
Bowel Habits	Regular
Addiction	No Any

Timeline

The medicines were prescribed to patient as per the treatment protocol shown in Table no-2.

Table No-2 Given Treatment

Duration	Drug	Dose, mode of administration and Anupana
Jan- 5,2022- Feb 7,2022	1. Rasayan choorna+ Saptamrita lauha 2. Sweta gunja+Tankana+ Gudahal Pushpa Choorna 3. Kumari Asava 4. Amalaki choorna+ madhuyasti choorna + triphala yavakuta	1. 3gm twice with water 500mg twice with water 2. 2gm Each for local application with Malatyadi Taila 3. 15 ml mix with water take after food twice 4. 3 gm each soaked in water at night and use this water for hair wash once a week
Feb-7,2022- April 1,2022 April 1,2022- April 26, 2022 April 26,2022- May23, 2022	1. Rasayan choorna+ Saptamrita lauha 2. Kalihari+ Sweta Gunja 3. Kumari Asava 4. Bhringaraja+ Triphala Yavakuta 5. Nilibhrayngyadi Taila	1. 3gm twice with water 500mg twice with water 2. 3gm+2gm for local application daily 3. 15 ml mix with water take after food twice 4. 3 gm each soaked in water at night and use this water for hair wash once a week 5. For local application daily once

Diagnostic Assessment

Based on the clinical pattern the condition was diagnosed as Female pattern hair loss (FPHL)(~khalitya) and advised for shaman chikitsa(~Treatment) through a multichannel approach. Hair loss in women is polygenic and multifactorial with the additional influence of environmental factors. FPHL is the most common hair loss disorder in women. Initial symptoms may develop during the teenage years and lead to progressive hair loss with a characteristic pattern distribution. FPHL is characterized as a nonscarring diffuse alopecia that evolves from the progressive miniaturization of hair follicles and subsequent reduction in the number of hairs, especially in the central, frontal, and parietal scalp regions.^[8]

Therapeutic Interventions

For first one month Rasayan Choorna, Saptamrita Lauha and Kumari Asava were given as internal medicine, and Sweta Gunja Beeja Choorna, Tankana, Gudahal Pushpa Choorna were given for local application daily once with Malatyadi Tail. Amalaki Choorna, Madhuyasti Choorna and Triphala Choorna were given for hair wash once a week.

For next four months Rasayan Choorna, Saptamrita Lauha and Kumari Asava were given as internal medicine, and Sweta Gunja Beeja Choorna, Kalihaari Mool Choorna were given for local application daily once with Malatyadi Tail. Bhringaraja and Triphala Choorna were given for hair wash after soaked in water once a week and Neelibhrangyadi Tail were giver for local application daily.

Patient Follow Up and Outcome

The patient was followed up every month till five consecutive months. After a month, patient get thirty percent relief from hair fall. The dandruff and dryness were also reduced significantly. In consecutive follow up patient start regaining hairs. The dandruff and dryness were completely eliminate. Result was assessed by SALT score.

The SALT score is calculated by measuring the percentage of hair loss in each of 4 areas of the scalp—vertex (40%), right Scalp (18%), left Scalp (18%), and posterior (24%)—and adding the total to achieve a combined score.^[9] Before and after treatment change in SALT Score shown in table no-3 and Graph-1. The photographs of patient before and after treatment are in figure respectively-

Table No-3 SALT Score before and after treatment

Area	Before Treatment	After Treatment
Rt. Scalp	13%	9%
Lt. Scalp	13%	10%
Post. Scalp	20%	18%
Vertex	28%	20%
Total	74%	57%

Graph-1 Change in SALT score Before and After Treatment-

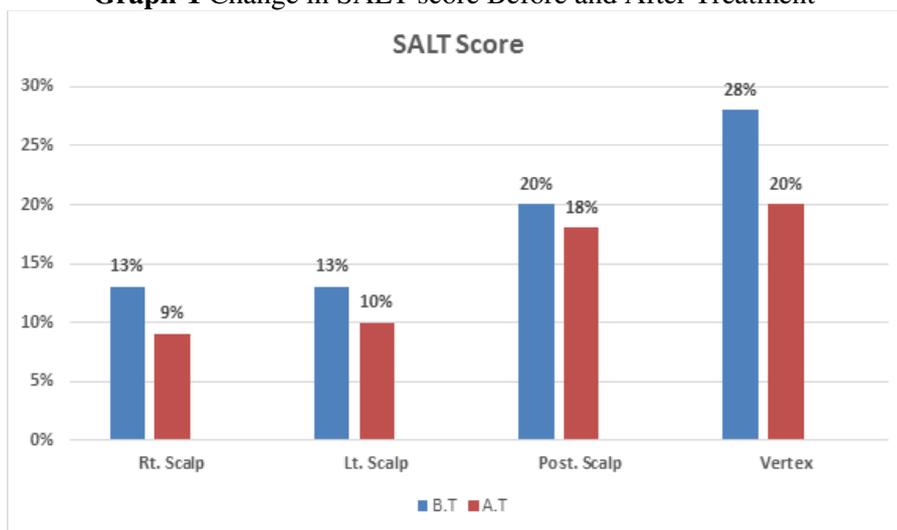


Figure-1 Before Treatment



Figure-2 After Treatment

DISCUSSION

According to Acharya Shusruta, in Khalitya, 4 Dosha i.e., Vata, Pitta, Kapha and Rakta are involved.^[10] Acharya Shusruta mentions that the Tejas with the help of the Vatadi Doshas scorches the scalp rapidly so as to cause Khalitya to a person. In Khalitya, Bhrajaka Pitta sites in skin and Roma Kupa (opening of hair follicle) get vitiated and enter in skin through Roma Kupa with vitiated Vata Dosha due to which hair fall occurs, after that vitiated Rakta and Kapha Dosha blocks the opening of hair follicle due to which production of new hair stops. Overall in Khalitya, hair fall occurs and new hair does not appear that leads to baldness. Khalitya is pitta pradhana tridoshaja vyadhi.^[11]

Rasayan Choorna and Saptamrita Lauha-As per Ayurveda, Khalitya is a sign of ageing process and Rasayan therapy plays an important role as antiaging.^[12] Rasayana Choorna has been administered as it calms Vata, Pitta, Kapha Doshas. Rasayana choorna owing to its immune-modulatory and rejuvenation properties helps in regeneration of new hair and also in continuous nourishment of hair. Saptamritalooha is the formulation containing loha, it acts as Rasayana to enhance the qualities of the Rasa and Rakta Dhatu. It is also useful for kesharanjan.^[13]

Kumari Asava- Kumari is deepana (~appetiser), pacana (~digests metabolic toxins), balya (~strengthening the tissues), bhedana (~cathartic), and arthavajanaka (~induces menstruation). Kumari is often used to manage irregular periods and excessive pain during menstruation.^[14] Kumaryasava supports the good health of liver and maintains the healthy liver functions. It increases the digestive fire. Due to which the food is digested properly and all the Dhatus get proper nutrition.

Gunja Beeja and Kalihari Mool Choorna Lepa -Sweta Gunja has Laghu and Ruksha and Tikshana Guna and Tikta, kashya rasa and katu vipaka. As per the trendy concept of regeneration and growth of hair with relevance to this disease, one in all the modes of local treatment suggests the requirement of activation of the hair follicles through induction of mild irritant dermatitis. With its inherent properties, Gunja Beeja and kalihari mool choorna lepa irritates the lesions with Tikshana Guna and Ushna Veerya and Tikta rasa. Combine these properties act to irritate and activate the hair follicles by that promoting hair growth of the affected part.^[15] It should be administered in appropriate quantity and with due caution; best avoided on delicate skin (like over face).

Bhringraj and Triphala Yavakuta for Hair Wash- Kashaya Rasa is present predominantly in Triphala. Which helps in external cleansing of the skin of scalp that eliminates dead cells and dandruff. Both drugs has Keshranjana property also. Bhringaraj has properties. Bhringaraja has Katu Rasa, Tiikshana, Ushana, Ruksha guna, Kaphavatahara and hair growth promoting (Keshya) properties.^[16]

Neelibhryangadi Taila- Application of hair oil prevents premature hair fall, early greying of hairs and it also leads to long black and firm rooted hairs.^[17] External application of Sneha in the form of oil or Ghrita (clarified butter) in various diseases helps in pacifying the disease due to its Sukshma Guna (i.e. higher permeability in cells) and the properties of the drugs used in its preparation get more potentiated and acts specifically in diseased condition by the principles of Samanya Visheshha Siddhanta. Main ingredients of Nilibhryngadi oil are Nili, Bhringaraja, Aja Ksheera, Narikel Ksheera. Contents of Neelibhryangadi oil has Keshya and Kesharanjan properties by which it is helpful in Khalitya.

CONCLUSION

Used Ayurvedic medicines as well as therapy has full of Rasayan, and Keshya properties so they shows excellent results on Khalitya. In this case study patient get relief in symptoms of Khalitya. Although improvement present in SALT score.

Declaration of Patient Consent:

Patient consent was taken.

Financial Support and Sponsorship:

Nil

Conflicts of Interest

There are no any conflicts of interest.

REFERENCES

1. Olsen EA. The midline part: an important physical clue to the clinical diagnosis of androgenetic alopecia in women. *J Am Acad Dermatol.* 1999 Jan;40(1):106-9. doi: 10.1016/s0190-9622(99)70539-6. PMID: 9922024.
2. Vujovic, A. and Del Marmol, V. (2014) The Female Pattern Hair Loss: Review of Etiopathogenesis and Diagnosis. *BioMed Research International*, 2014, Article ID: 767628. <https://doi.org/10.1155/2014/767628>
3. Olsen EA. The midline part: an important physical clue to the clinical diagnosis of androgenetic alopecia in women. *J Am Acad Dermatol.* 1999 Jan;40(1):106-9. doi: 10.1016/s0190-9622(99)70539-6. PMID: 9922024.
4. Shusruta Samhita, Nidan Sthana, Kshudra Roga Nidan 13/33-34. Available from: <http://niimh.nic.in/ebooks/eshusruta>.
5. Management of KHALITYA(hairfall) with natural remedies"-case study", *International Journal of Emerging Technologies and Innovative Research* (www.jetir.org | UGC and issn Approved), ISSN:2349-5162, Vol.8, Issue 2, page no. pp2196-2201, February-2021, Available at : <http://www.jetir.org/papers/JETIR2102269.pdf>
6. Vangsen Samhita kshudrarogaadhikaar 32/134-135, Edited by Hari Prasad Tripathi, Chaukhambha Sanskrit series office Varanasi, 2009.
7. Pratt CH, King LE Jr, Messenger AG, Christiano AM, Sundberg JP. Alopecia areata. *Nat Rev Dis Primers.* 2017 Mar 16;3:17011. doi: 10.1038/nrdp.2017.11. PMID: 28300084; PMCID: PMC5573125.
8. Olsen EA. The midline part: an important physical clue to the clinical diagnosis of androgenetic alopecia in women. *J Am Acad Dermatol.* 1999 Jan;40(1):106-9. doi: 10.1016/s0190-9622(99)70539-6. PMID: 9922024.
9. Strober BE, Menon K, McMichael A, Hordinsky M, Krueger G, Panko J, Siu K, Lustgarten JL, Ross EK, Shapiro J. Alefacept for severe alopecia areata: a randomized, double-blind, placebo-controlled study. *Arch Dermatol.* 2009 Nov;145(11):1262-6. doi: 10.1001/archdermatol.2009.264. PMID: 19917955.
10. Shusruta Samhita, Nidan Sthana, Kshudra Roga Nidan 13/33-34. Available from: <http://niimh.nic.in/ebooks/eshusruta>.

11. Shusruta Samhita, Nidan Sthana, Kshudra Roga Nidan 13/33-34. Available from: <http://niimh.nic.in/ebooks/eshusruta>.
12. Charaka Samhita, Chikitsa Sthana, Rasayan Adyaya-Abhayaamalakraayaapaada1/1-7-8. Available from: <http://niimh.nic.in/ebooks/eCharaka>.
13. Bhaisajya Ratnavali Netraroga Chikitsa 64/232-236, Edited by Kaviraj shree Ambikadatta Shastri Ayurvedacharya, Chaukhambha Sanskrit Sansthan Varanasi, 2009.
14. V. S, Nimmy & Sheba, M. (2021). Exploring The Pharmacological Therapeutic Efficacy Of Kumari (Aloe Vera L.) On The Reproductive System. World Journal of Pharmaceutical Research. 10. 1593. 10.20959/wjpr20214-20189.
15. Sachin, Patil & Sagar, Narode & Kavita, Patil. (2016). A Clinical Study To Evaluate The Efficacy Of Gunja Seeds As A Local Application In The Management Of Indralupta. International Journal of Ayurveda and Pharma Research. 10.47070/ijapr.v4i1.70.
16. Bhaav Prakasha Nighantu Purva Khanda Gudchyadivarga-Bhringraj-206-207. Available from: <http://niimh.nic.in/ebooks/enighantu>.
17. Charaka Samhita, Sutra Sthana, Matrashitiyoadhyaaya 5/81-82. Available from: <http://niimh.nic.in/ebooks/echaraka>.

A Study of Isolation of Marine Bacteria and Its Antimicrobial

Ivo Romauld S and Satish Mohabe

Department of Bio-Techonology, Faculty of University of Teaching Department, Madhyanchal Professional University, Ratibad, Bhopal- 462044, India

ABSTRACT

The misuse and overuse of antibiotics have led to the emergence of multidrug-resistant microorganisms, which decreases the chance of treating those infected with existing antibiotics. This resistance calls for the search of new antimicrobials from prolific producers of novel natural products including marine sponges. Many of the novel active compounds reported from sponges have originated from their microbial symbionts. Therefore, this study aims to screen for bioactive metabolites from bacteria isolated from sponges. Twelve sponge samples were collected from South Australian marine environments and grown on seven isolation media under four incubation conditions; a total of 1234 bacterial isolates were obtained. Of these, 169 bacteria were tested in media optimized for production of antimicrobial metabolites and screened against eleven human pathogens. Seventy bacteria were found to be active against at least one test bacterial or fungal pathogen, while 37% of the tested bacteria showed activity against *Staphylococcus aureus* including methicillin-resistant strains and antifungal activity was produced by 21% the isolates. A potential novel active compound was purified possessing inhibitory activity against *S. aureus*. Using 16S rRNA, the strain was identified as *Streptomyces* sp. Our study highlights that the marine sponges are a rich source of abundant and diverse bacteria producing metabolites with antimicrobial activities against human pathogenic bacteria and fungi.

Keywords: marine sponges; Actinobacteria; antimicrobial; dermatophytes

INTRODUCTION

Excessive and misuse of antimicrobial agents has been attributed to the emergence of multidrug-resistant (MDR) microorganisms, which increases the mortality rate associated with infectious diseases [1,2]. This multidrug resistance and associated mortality demand a redoubling of efforts to find new effective antimicrobials from alternative sources. In the last decade this has included the development of novel antimicrobials from different nanocompounds [3,4]. However, as approximately 50% of the new drugs in the antibiotic pipeline have originated from natural products, it was decided to survey marine microorganisms [5]. The marine environment is an abundant source of active natural compounds with biological and pharmaceutical properties [6,7]. Each year, the amount of metabolically active compounds from the marine environment increases and sponges contribute a large share with about 200 new active compounds identified annually where the nature of active compounds varies depending on the sponges species [8–10]. Due to the nature of marine environments compared with their terrestrial counterparts, marine sponges may be exposed to different challenges which stimulate production of biologically-active molecules as defense mechanisms [10]. These active metabolites from marine sponges isolated from various geographical locations can be nucleoside derivatives, terpenoids, polyethers, alkaloids, macrolides, or peptides with various biological activities including anti-inflammatory, anti-cancer and antimicrobial properties [10–15]. Marine sponges (phylum Porifera) are one of the earliest life forms that exist in the world (~630 million years). They are the second largest benthic community compared to coral reefs, and the diversity of sponge species outnumbers the combined species diversity of other organisms in the community. The mesohyl of many sponges is heavily populated by microbial symbionts, including bacteria, fungi, viruses, and archaea, which account for up to 50% of sponge biomass in the case of high microbially abundant sponges. Microbes surviving in these extremely nutrient-poor and antagonistic environments, such as marine sponges, frequently produce a variety of secondary metabolites to overcome the negative effect of the surrounding environment. Due to the requirement for large amounts of sponge biomass for the production of any bioactive and mass cultivation of marine sponges being difficult, the utilization of sponges as a source of antibiotics is hindered. The observed structural similarities among active compounds from marine sponges and terrestrial microorganisms indicated that sponge associated bacteria could be the main sources of some of these active compounds. Moreover, numerous studies have identified a wide range of antimicrobial activities from sponge-associated microbes, which makes these microbial populations an important source for novel antimicrobials.

The phylum Actinobacteria contributes to the major share of active metabolites from sponges. A comprehensive study revealed the presence of various Actinobacteria with a range of antimicrobial activities and others have also reviewed metabolites with different biological activities from sponge-associated culturable and

unculturable microbial population. Clinically-significant bioactive compounds from marine sponge-associated microbes have been reported from different geographical areas including the Great Barrier Reef of Australia, South China Sea, Mediterranean Sea, Indonesia, Papua New Guinea, and the Indo-Pacific region, to name a few. Antimicrobials, such as pyrrolo[1,2-a] pyrazine-1,4-dione, hexahydro, naphthacene glycoside, kocurin, and saadamycin, were among the many compounds obtained from marine sponge-associated bacteria. Cultivation of sponges at an industrial scale for mass production of active compounds has not yet been achieved though there have been recent attempts to use resin to capture sponge metabolites from sponge kept alive in an aquarium. On the other hand, if compounds are produced by sponge-associated microbes, the scale-up is relatively easy to achieve.

ISOLATION OF BACTERIA

One piece of dried and surface sterilized sponge (approximately 1 cm³) was cut from the inner mesohyl and ground in 10 volumes of sterile seawater using a clean, sterile pestle and mortar. A 10-fold dilution series (10⁻¹ to 10⁻⁶) was prepared and 100 µL of the three highest dilutions were inoculated onto different primary isolation media, which are selected from previous studies, in six replicates. Seven different media SYP, asparagine peptone agar, natural seawater agar (NS), humic acid vitamin agar, marine agar, nutrient agar and tryptone soya agar were used for bacterial isolations. Plates were incubated at 15 °C and 27 °C at aerobic, microaerophilic, and anaerobic conditions over 16 weeks to ensure for the isolation of less abundant bacteria as they require longer period to form colonies. Once a week, colonies were picked out from primary isolation media and sub-cultured onto SYP, ISP2 and NA plates to get single pure colonies. Pure cultures were stored on plates and agar slants for short periods, and colonies were also placed in 30% glycerol and stored at -80 °C for future use.

MORPHOLOGICAL IDENTIFICATION OF BACTERIA

All bacterial isolates were sub-cultured onto three identification media (SYP, ISP2 and NA) and categorized based on the similarity of their colony morphology; namely colony colour and nature of the spores. Microscopic observation of stained (Gram staining) and unstained (wet mount) bacteria was further applied for identification. Bacteria identification was done with two skilled personnel to reduce the observer bias.

GENOTYPIC IDENTIFICATION OF BACTERIA

Genomic DNA of all bacterial isolates was extracted using a CTAB method as described previously. Two sets of primers (27F (5' -GAG-AGT-TTG-ATC-CTG-GCT-CAG3'), 765R (5' -CTG-TTT-GCT-CCC-CAC-GCT-TTC-3')) and (704F (5' -GTA-GCG-GTG-AAATGC-GTA-GA-3'), 1492R (5' -CAC-GGA-TCC-TAC-GGG-TAC-CTT-GTT-ACG-ACT-T-3')) were used for amplification of the bacterial 16S rRNA gene. Amplified products were digested with HhaI and PstI restriction enzymes for RFLP-based categorization of the isolates. Representative PCR products from each RFLP pattern were sequenced and the NCBI database was used for BLASTN analysis. Sequences were initially aligned using the multiple alignment program CLUSTAL W version 2.0. Phylogenetic trees were reconstructed using the neighbor-joining method (based on 1000 bootstrap iterations) with the MEGA version 7 software program.

AGAR PLUGS ANTIMICROBIAL SCREENING

One hundred and sixty-nine bacterial isolates were selected to represent proportionally different sources, morphology and genotypic patterns, and were sub-cultured in duplicate onto ISP2 medium, for Actinobacterial strains (111 in number) and brain heart infusion agar for other bacterial strains for antimicrobial production. Plates were incubated for either 15 (Actinobacterial) or 5 days (for other bacterial strains) at 27 °C in an aerobic environment for optimum antimicrobial production. After incubation, 6-mm plugs from each bacterium were cut out and screened for activities. The other plate was used to obtain an extract. Here, the full plate containing the culture and the agar medium was chopped and placed into a tube containing 40 mL methanol. The tube was shaken for 6 h and the contents centrifuged at 3000 rpm for 10 min. The supernatant was collected and screened for the antimicrobial activity to confirm those strains which showed activities in agar plug assay.

1. ANTIBACTERIAL AND ANTICANDIDA SCREENING

An agar-based disk diffusion method was used for antibacterial screening. Here ready-made antibiotic assay medium (AAM: Oxoid) was used for the antibacterial activity assay. Test organisms were grown in tryptone soy broth (TSB: Oxoid) at 37 °C by shaking at 150 rpm overnight. Growth was assessed by measuring optical density (OD) at 600 nm and an OD of 0.25 of test organisms were added to the AAM at the ratio of 1 mL per 25 mL of the medium, which was then poured into a 9 cm Petri plate. After drying, a 6 mm plug of 14 (Actinobacteria) or 5-day old (other bacteria) culture was placed onto the test strain (10 plugs per plate). To confirm the activity shown by the cultures on the plug assay, the methanol extract from the agar cultures was

also tested in duplicate by being placed into a 6 mm diameter well. Methanol was used as a negative control, with vancomycin (200 µg/mL) and ciprofloxacin (200 µg/mL) as positive controls for Gram-positive and Gram-negative bacteria, respectively. The culture was incubated overnight at 37 °C and the diameter of the inhibition zone was measured in mm. A similar approach was followed for the screening of anti-Candida activities with Sabouraud broth and Sabouraud agar (Oxoid) used for seed medium and antibiotic assays, respectively. Amphotericin B (100 U) was used as positive control and methanol as a negative control. All tests were carried out in duplicate.

2. ANTIFUNGAL SCREENING

Four pathogenic dermatophytic fungal species—*T. rubrum*, *T. interdigitalis*, *Saccharophthora* sp., and *M. gypsum* were grown on potato dextrose agar (Oxoid) at pH 6 for seven days. At the same time, a heavy inoculum of bacteria was streaked on one side of the plate (maximum of three bacteria per plate) and incubated until good growth was observed. A 6 mm plug of test fungi (one per plate) was cut out and placed in the center of the plate (perpendicular to each bacterium streak) and incubated for two weeks. Similarly, a plug of fungus was placed onto the medium without bacteria as a negative control. Results were recorded as follows: very strong inhibition (+4), when the growth of the fungi away from the streaking was >20 mm; strong inhibition (+3), when the growth of the fungi away from the streaking was 15–20 mm; moderate inhibition (+2), at 10–14 mm or less; weak (+1); 10 mm or less; and negative (-), no difference compared to negative control.

EVALUATION OF DIFFERENT MEDIA FOR ANTIMICROBIAL PRODUCTION

Small scale experiment was designed to evaluate primary screening media for initial screening of antimicrobials. Here, we selected eight highly active bacterial strains from the above experiment and their antimicrobial production was evaluated on five common growth/production media: YEA, potato dextrose agar, SYP, mannitol soybean agar (MS) and ISP2. Each strain was inoculated in the same manner using the method mentioned in Section 2.6 and 50 µL of the methanol extracts were screened for antibiotic activities against *S. aureus* and MRSA and the mean zone of inhibition was recorded.

LIQUID STATE ANTIMICROBIAL PRODUCTION, SCREENING AND LARGE SCALE PRODUCTION

Once the active strains were identified by the agar-plugs screening method, they were screened using different liquid media for mass production of antimicrobials. For this, three highly active bacterial strains (RB27, RB53 and RB154) were selected and processed as follows: two loopfuls of each strain were inoculated into 50 mL of IM22 seed medium (g/L: glucose-15, soyatone-15, pharmedia-5, CaCO₃-2 and NaCl- 5) in 250 mL baffled Erlenmeyer flasks and incubated at 27 °C 150 rpm for three days. This initial step helps to standardize the amount of inoculum for the subsequent antimicrobial production. The wellgrown seed medium (2.5 mL) was inoculated into 50 mL of four types of liquid production media: (1) sucrose medium (SM (per l; sucrose 20 g, CaCO₃ 2.5 g, KNO₃ 1 g, MgSO₄·7H₂O 0.5 g, NaCl 0.5 g); (2) ISP2 (malt extract 10 g, yeast extract 4 g, glucose 4 g); (3) glucose medium (GM; (glucose 20 g, soybean flour 10 g, CaCO₃ 4 g, COCl₂·6H₂O 1 mg), and (4) MS (mannitol 20 g, soybean flour 20 g) in 250 mL baffled Erlenmeyer flasks and incubated at 27 °C in shaker of 150 rpm for 7 days. Every day, 1 mL of the culture was collected, centrifuged at 3000 rpm for 10 min and the supernatant screened for antimicrobial activities by disk diffusion method.

BIOAUTOGRAM OF EXTRACT FROM RB27

Fifty microliters of extract dissolved in water was spotted onto a silica gel 60 F254 TLC plates (Merck) and placed in a TLC tank containing different eluting solvent systems, including butanol, chloroform:methanol:water (7:7:3); chloroform: methanol (7:7); and pyridine:6M HCl:RO water: methanol (10:4:26:80), and run until the solvent reached 1 cm from the top of the TLC plates. After drying, the plates were observed at 254 and 365 nm and the position of the different compounds marked with a pencil. The TLC plates were left on the agar medium for 1 h to allow the compound to diffuse into the plate and then removed from the medium. Finally, the plates were incubated overnight at 37 °C and the medium was investigated for the zone of inhibition.

PURIFICATION OF EXTRACT FROM RB27

Data from the preliminary investigation and bioautogram indicated the active compound from strain RB27 is very polar and would not dissolve in methanol. This water-soluble antibiotic was purified with sequential extraction using ethylacetate and water saturated butanol. Then, once the residual solvent evaporated off, the water-soluble portion was passed through an amberlite XAD-4 column and only the spent was active. The spent was freeze-dried to remove all liquid and then washed with methanol to remove any solvent-soluble material. In the final step, an off-white powder was dissolved in water and passed through a thin long LH20 (Sephadex),

molecular sieve, which separate sample components. Water was used as eluent to remove components from LH20 and the fractions were collected with multiple tubes with 1 mL volume, and each fraction was tested for activity against *S. aureus*. Finally, the active fractions were pooled, freeze-dried and stored at $-20\text{ }^{\circ}\text{C}$ until further experimentation.

NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY AND ACCURATE MASS ANALYSIS OF EXTRACT FROM RB27

Forty milligrams of purified extract from strain RB27 were submitted to Flinders University Analytical Centre and Chemistry laboratory (Flinders University) for ^1H NMR analysis and accurate mass determination. For NMR analysis 20 mg of the extract were dissolved in 500 μL of Deuterated water (D_2O). NMR analyses were performed using a Bruker 600 MHz spectrometer, equipped with 5 mm inverse multinuclear probe, 5 mm triple resonance probe, variable temperature, z-gradients and autosampler which is optimized for ^1H and ^{13}C detection. ^1H NMR spectra were acquired at 400 MHz. Standard Bruker software was used to execute recording of 1 and 2 dimensional. All resonance bands were referenced to a tetramethylsilane internal standard. For accurate mass analysis, about 1 mg of the extract was dissolved in 15 mL of acetonitrile and subjected to mass analysis with high-definition mass spectrometer (HDMS).

CONCLUSION

The number and the morphological diversity of bacterial isolates from the study area varies depending on the source of the sponges. Dominance of actinobacterial genera was observed. Quite a remarkable percentage of the selected isolates displayed antimicrobial activities against *S. aureus*, *C. albicans*, *T. rubrum*, *T. interdigitalis*, *M. gypsum*, and *Saccharophagus* sp. Bacteria under the phylum Actinobacteria, particularly genus *Streptomyces*, showed marked antimicrobial activities compared to other isolates in the tested experimental conditions. Antimicrobial production greatly depended on the genus type, medium ingredients, and time of incubation. One new antibiotic compound was purified. Marine sponges of South Australia contain uncommon bacterial genera possessing antimicrobial activities, encouraging future explorations to identify novel antimicrobials. In this study, only representative isolates were screened for activities and not all the strains were isolated due to capacity limitations. Therefore, future studies should screen more strains and focus on the characterization of potential novel antimicrobials, including testing them for cell toxicity.

REFERENCES

1. Singer, R.S.; Finch, R.; Wegener, H.C.; Bywater, R.; Walters, J.; Lipsitch, M. Antibiotic resistance—The interplay between antibiotic use in animals and human beings. *Lancet Infect. Dis.* 2003, 3, 47–51.
2. Magiorakos, A.-P.; Srinivasan, A.; Carey, R.B.; Carmeli, Y.; Falagas, M.E.; Giske, C.G.; Harbarth, S.; Hindler, J.F.; Kahlmeter, G.; Olsson-Liljequist, B.; et al. Multidrug-resistant, extensively drug-resistant and pandrug-resistant bacteria: An international expert proposal for interim standard definitions for acquired resistance. *Clin. Microbiol. Infect.* 2012, 18, 268–281.
3. Wang, C.; Makvandi, P.; Zare, E.N.; Tay, F.R.; Niu, L. Advances in Antimicrobial Organic and Inorganic Nanocompounds in Biomedicine. *Adv. Ther.* 2020, 3, 2000024.
4. Makvandi, P.; Wang, C.; Zare, E.N.; Borzacchiello, A.; Niu, L.; Tay, F.R. Metal-Based Nanomaterials in Biomedical Applications: Antimicrobial Activity and Cytotoxicity Aspects. *Adv. Funct. Mater.* 2020, 30, 1910021.
5. Webster, N.S.; Taylor, M.W. Marine sponges and their microbial symbionts: Love and other relationships. *Environ. Microbiol.* 2012, 14, 335–346.
6. Marques, D.N.; De Almeida, A.S.; Sousa, A.R.D.O.; Pereira, R.; Andrade, A.L.; Chaves, R.P.; Carneiro, R.F.; Vasconcelos, M.A.; Neto, L.G.D.N.; Pinheiro, U.; et al. Antibacterial activity of a new lectin isolated from the marine sponge *Chondrilla caribensis*. *Int. J. Biol. Macromol.* 2018, 109, 1292–1301.
7. Beesoo, R.; Bhagooli, R.; Neergheen, V.S.; Li, W.-W.; Kagansky, A.; Bahorun, T. Antibacterial and antibiotic potentiating activities of tropical marine sponge extracts. *Comp. Biochem. Physiol. Part C Toxicol. Pharmacol.* 2017, 196, 81–90.
8. Blunt, J.W.; Copp, B.R.; Hu, W.-P.; Munro, M.H.G.; Northcote, P.T.; Prinsep, M.R. Marine natural products. *Nat. Prod. Rep.* 2007, 24, 31–86.
9. Mehbub, M.F.; Lei, J.; Franco, C.M.M.; Zhang, W. Marine Sponge Derived Natural Products between 2001 and 2010: Trends and Opportunities for Discovery of Bioactives. *Mar. Drugs* 2014, 12, 4539–4577.

10. Gogineni, V.; Hamann, M.T. Marine natural product peptides with therapeutic potential: Chemistry, biosynthesis, and pharmacology. *Biochim.Biophys.Acta (BBA) Gen. Subj.* 2018, 1862, 81–196.
11. Newman, D.J. Natural Products as Leads to Potential Drugs: An Old Process or the New Hope for Drug Discovery? *J. Med. Chem.* 2008, 51, 2589–2599.
12. Meesala, S.; Singh, R.; Watve, M.G.; Naik, D.G. A new antibacterial imidazole from the marine sponge *Irciniafusca*. *Indian J. Nat.Prod.Resour.* 2018, 9, 75–78.
13. Raslan, A.E.; Radwan, M.M.; Ahmed, S.A.; Nafady, A.M.; Zaki, M.A.; Wanas, A.S.; Abou-Karam, M.; Shier, T.W.; Hassanean, H.A.; ElSohly, M.A. Monanchoramides A–D, ceramides from the marine sponge *Monanchoraclathrata* with cytotoxic activity. *Phytochem.Lett.* 2018, 23, 83–89.
14. Liu, H.-B.; Lauro, G.; O'Connor, R.D.; Lohith, K.; Kelly, M.; Colin, P.; Bifulco, G.; Bewley, C.A. Tulongicin, an Antibacterial Tri-Indole Alkaloid from a Deep-Water *Topsentia* sp. *Sponge. J. Nat. Prod.* 2017, 80, 2556–2560.
15. Visamsetti, A.; Ramachandran, S.S.; Kandasamy, D. *Penicilliumchrysogenum* DSOA associated with marine sponge (*Tedaniaanhelans*) exhibit antimycobacterial activity. *Microbiol. Res.* 2016, 185, 55–60
16. Maloof, A.C.; Rose, C.V.; Beach, R.; Samuels, B.M.; Calmet, C.C.; Erwin, U.H.; Poirier, G.R.; Yao, N.; Simons, F.J. Possible animal-body fossils in pre-Marinoan limestones from South Australia. *Nat. Geosci.* 2010, 3, 653–659.
17. Van Soest, R.; Boury-Esnault, N.; Hooper, J.; Rützler, K.; de Voogd, N.; de Glasby, B.A.; Hajdu, E.; Pisera, A.; Manconi, R.; Schoenberg, C.; et al. *World Porifera Database*. 2011. Available online: <http://www.marinespecies.org/> (accessed on 16 December 2012).
18. Webster, N.S.; Wilson, K.J.; Blackall, L.L.; Hill, R.T.; Toledo-Arana, A.; Valle, J.; Solano, C.; Arrizubieta, M.J.; Cucarella, C.; Lamata, M.; et al. Phylogenetic Diversity of Bacteria Associated with the Marine Sponge *Rhopaloeidesodorabile*. *Appl. Environ. Microbiol.* 2001, 67, 4538–4545.

An Empirical Approach to Develop A Punjabi Dialect Tool for Hearing Impairment Students through Indian Sign Language (ISL)

Manpreet Singh and Rajesh Sharma

Computer Science and Engineering, GNA University Phagwara, FEDA-E, Kapurthala, Punjab, India

ABSTRACT

A sign is used everywhere such as for conveying the message, for talking, etc. Sign Language is the Language consumed by hearing impairment folks. This research based on the Punjabi Language Sentence to Indian Sign Language (ISL) conversion system's purpose for better communication and education for hearing impaired folks. The developed system takes Punjabi sentences as input and gives output in 3D animation. Basically every country has own sign language so there is no universal or written form of sign language is available, so generating synthetic sign animation is a good idea. In the future, it can be implemented as a guide or as a tutor to promote sign language to the common people of Punjab.

Keywords: Animation, Hamnosys, Punjabi Sentence, Sign Language.

INTRODUCTION

NLP (Natural Language Processing) is a term for converting any language to human-understandable language. In this research, the most frequently used Punjabi sentence converted into Indian Sign Language with the help of NLP however, there is a tool name ESIGN (E-Sign Editor) with the help of HamNoSys Notation to convert sentences to sign language. Sign language is a medium to convey the message to hearing Impairment folks using their hand gesture, expressions, etc. HamNoSys Notations used to build the sign because deaf and dumb people only understand the sign language. Sign language is not a universal language, it changes from one region to another. Every country has its sign language which varies from other countries in terms of syntax and grammar. 250 English words into sign language form used in daily life like names of birds and Animals, Colors, and also common words used in school in basic behaviors' norms[1]. In this research 100, Punjabi language sentences were converted into Indian Sign Language. There is no Punjabi dictionary available for sign language only an English Language dictionary available so in that case 100 common sentences in the English language were converted into the Punjabi language after that we converted it into sign language. There are the 3 Edition of Sign languages available, on February 17, 2021, the ministry of social justice and empowerment released the third edition of Indian Sign Language, and the third edition included Medical, Legal, Academic, Technical, and many more terms, Using Synthetic animation dictionary for Indian Sign Language and the sign editor tool to generate hamnosys and converted to the sigmal file.

LITERATURE SURVEY

This article covers the implementation of a Punjabi text of Indian Sign Language (ISL) conversion system designed to enhance hearing-impaired people's communication and education. The proposed method carries Punjabi text as input and produces 3D animation as output. More than 100 often used Punjabi terms are included in the existing corpus, which is divided into several categories. This approach has been tested on all the terms that have been prepared. Because sign language varies so there is no universal or written form of sign language, the best approach is to create synthetic sign animation. It can be used as a teaching method to enhance sign language education among Punjab's ordinary people shortly. An automatic method for translating Punjabi words to Indian Sign Language using artificial animations was developed since more than 4 million people in India have hearing impairments. This notation can provide a written version of sign languages, such as English, Punjabi, or other written languages. This notation is mostly used in gestures. This study shows initial research on a system developed for generating ISL signs using Punjabi input words. This is user-friendly approach may be used to learn sign language by anyone, especially those who understand Punjabi[1].

Sign language recognition research is developing significantly. In this field, several approaches were created. Sign Language is mostly used for the communication of deaf and dumb people. This article demonstrates the sign language of 28 of them, including gestures in American Sign Language with backspace and whitespace hand. The system proposed has five modules: model setting, caching bottlenecks, adding FC towards the model, model training, and printing on skilled graphs and labels. Any user can get the application and sit just before the camera. He/she can make sign-language symbols (ASL). The system shows the relevant English text at the same time. This system tried to create numerous principles of picture processing and essential image characteristics effectively by using gesture recognition[2].

The use of sign language and gestures of communication among language recognition systems is discussed here. Deaf people Indian sign language is used for communication System Overview purposes by deaf or vocally impaired persons in India. This study focuses on the numerous studies that have been conducted on sign approaches used for the recognition of Indian Sign language recognition systems for various languages. A review of hand gesture recognition applications, with varied recognition stages but techniques for sign language recognition that all agree on the fundamental structure of the topic with different tools and algorithms recognition system. These steps are shown on a representation of an Indian sign language recognition system, along with hurdles and areas for future research. The major focus of this research is to analyze various techniques used in the classifications of static techniques for the detection of sign language and gestures including some of the alphabets of ISL. Provide a comprehensive evaluation. The network could detect static movements with an accuracy of up to 80%. Graze computing time without losing Forward Back Propagation Network (BPN) inaccuracy are two widely utilized feature extraction techniques to decrease the employed networks of the supervised learning class[3].

A sign is a medium to deliver a message to other, deaf and dumb people are used sign language for talking to each other. This research focuses on a critical review of recognizing signs in the text. This paper explains the different types of techniques like ANN, SVM, HMM used in a feature extraction during the sign conversion process. At the school level, the goal was to effectively identify the two-handed dynamic gesture used by deaf and dumb children to communicate in Indian Sign Language. Children have a lot of difficulty making whole phrases, thus this automated recognizer tool is employing a vision-based approach that is suggested in the system. The technology functions by capturing an image of a youngster making a gesture, translating it into a sign that appears on a display, and then turning it into speech. Lab View software is used for all data analysis. The topic of the paper is currently employed categorization techniques, including some dynamic ones like hand gestures. The primary goal of this study is to identify dynamic gestures used by deaf students in the classroom. The suggested technique works well for both static and dynamic motions and may be used in real-time with any backdrop color. The deaf youngsters can form sentences and interact with the instructor and other learners without difficulty.[4].

The aim of this project is to create a system that can accurately translate Indian sign language in the area of numbers so that those who are less fortunate can communicate with others without the assistance of an interpreter in public settings like banks and train stations, etc. The system outlines for an automatic recognition of Indian sign language of numeric signs that are in the form of isolated images, in which only a regular camera was used to a system. We initially built a database of numeric signs with 5000 signs and 500 photos per numeric sign in order to apply the project in a practical context. From sign photos, desirable characteristics are extracted using direct pixel value and hierarchical cluster approaches. KNN and neural network classification approaches were utilized to categories the indicators after features from the photos were extracted. Up to 97.10 percent accuracy is attained in the tests' results[5].

METHODOLOGY USED

Learning sign language is difficult because there are two phases to it. Depending on the direction of translation, a part of translation and recognition of sign language or a gesture. Using the same language but in two different formats, such as speech and text or speech to text, the synthesis or recognition can be done. As we translate a language into another language, such as Hindi, links between two languages are necessary. Both are used the natural language processing (NLP) and the synthesis or recognition component are part of the sign language in machine translation. In our experimental work, the gesture uses a 3D avatar to translate a sentence to Sign Language generates animation based on text input. Our translation system receives an input sentence from the sign corpus and sends it to the SIGMAL-formatted HamNoSys sign notation converter module.[6].

INPUT MODULE

Previously developed machine translation systems for Sign Language is neither are automatic nor platform-independent. In earlier developed systems mostly used for different operations like E-SIGN is used for generating hamnosys notations as well as Sigmal URL app to display the format of the animation. Both tools required JRE (Java Runtime Environment) for a single user on MAC, Windows, or Linux OS. So that to build the translation ISL system platform independently was our aim of the research. Our ISL core contains information on hand shapes, orientation, position, and movement of the gesture. In this our proposed work is a collection of daily use of Punjabi Sentences after Hamnosys notation and last convert hamnosys to Sigmal format.

OUTPUT

Our purposed researches provide output in the format of synthetic animation of the 3D avatar. For Example, Punjabi Sentence “mYN SrimMdw hW” is made up of a collection of hamnosys (□,;PV, \ !8H). In this example, eleven icons are used to write the sign notation. There is 2 sign notation is used and the 1 sign notation is: The first icon represents a hand shape as a closed hand with an open index finger. The second and Third icons show the hand orientation, in which a down arrow is used towards the body and the ellipse represents the palm orientation parameter. The fourth icon represents the chest for placing the finger and the last one indicates contact parameter and 2 sign notation is the first icon is used for two-handed symmetrical sign, such signs are, and the hand positions mirror one another. The second icon's thumb extended and the Third and Fourth icons show the hand orientation, in which an arrow is used away from the body and ellipse represents the palm orientation parameter. The last icons represent Ear location for placing extended thumb from hand. The following is the translation into SiGML format of these notation sign parameters. These XML tag standards are used in SiGML format to create "sigmal" files. In addition, the system converts into two distinct tags when it is translated into SiGML. In the final step, this SiGML file is being used as input and animation as per SiGML tags by a 3D avatar (ViSiCAST).

IMPLEMENTATION DETAILS

According to the research's implementation details, a system created in Hamnosys Sign Language notation is utilized to convert Punjabi sentences into ISL. Virtual Humans Research for Sign Language developed the animation representation 3D avatar, which is utilized and can be found at vh.cmp.uea.ac.uk. SiGML translation is necessary to convert the HamNoSys notation system to SiGML format since a few additional avatars, including "Anna, Saggi, and Max," can translate the SiGML xml format.

Figure.1 (a) HamNoSys and SiGML code of sentence “One, Two, And Four”

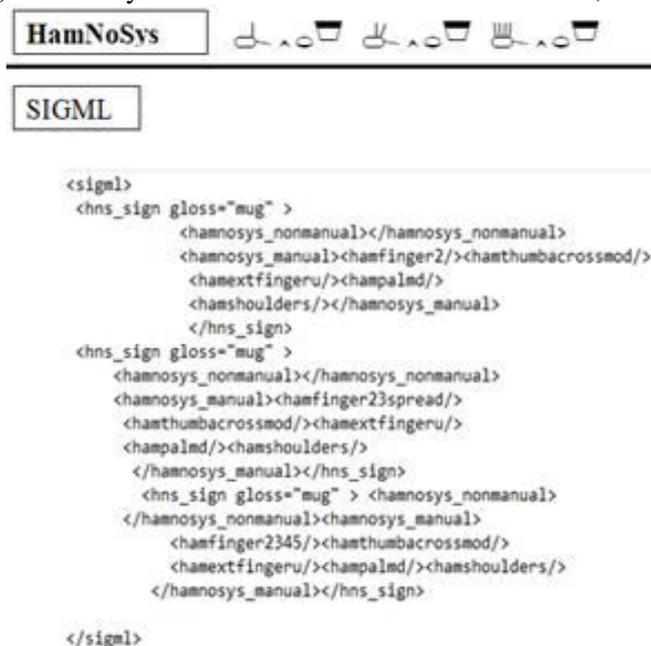


Figure.1 (b) 3D animation depict gesture of sentence “One, Two, Four”



EXPERIMENTAL RESULTS

The experiment analyses the work of the time taken process of Punjabi Sentences to Indian Sign Language translation. In given below two different experiments:

In first experiment collection of Punjabi sentences and making the sign language cross ponding the Punjabi sentences. The tool in this to making the sign is E- Sign Editor and SiGML tool provide the output in the 3d animation. The table shows the outcomes of an experiment that involved translating selected sentences from Punjabi into English. The output of the supplied phrase is displayed in the next column as a synthetic 3D animation. The description column explains how the animation functions. Each sentence's output is compared to both a recorded ISL video and an ISL dictionary book.

Sr.No	Input Punjabi	Output	Description
1	quhwf (Your)		A pointed index finger, end the hand and finger pointing at chest level.
2	kMm (Work)		Both hands facing each other hands, "one" hand cut the small finger of the vertical left "one" hand and both placed at the chest level
3	pRBwivq (Impress)		Both hands towards same, in this word "impress" output in collage form, in first formation the both hand touch the cheek, moreover second formation both hands are opposite in side and placed at the chest level in last formation also same hands placed at chest level and same in side. The combination of three formations makes the word "pRBwivq (Impress)".

Table1. Punjabi Sentence, Indian Sign Language and their report

In this table the Punjabi language sentence is "quhwf kMm buhq pRBwivq hY[" in this sentence formation is used word by word is used. On the other hand scan a QR code for getting more knowledge how avatar is performing a Sign. In this the sentences is "kI qusI ibmwr ho[" display by the avatar.



Figure.2 in QR code “kI qusI ibmwr ho [”display by the avatar

The second experiment to confirmation accuracy and quality of Sign generated, firstly developing a website <https://punjabilang.com/> where user can take help for communication moreover once the website is fully load on the any web browser it also work in offline mode and the website Response time is approx ~300 to ~2000 millisecond and for evaluation purpose is manual evaluation of sentences by the performs in front of hearing impairment students played randomly selected sentences, this help to acknowledge that the students can understand the sign and it's also learn an easier way with the help of a computer generated character (avatar). The average estimate the accuracy is 85%.

CONCLUSION AND FUTURE SCOPE

This experiment depicts how Indian Punjabi Language Sentence converts into Indian Sign Language. This research proposed a system the aim is to teach the Punjabi language at deaf and dumb schools because everyone teaches in the English Language only. So in this try to make a common Punjabi sentence into Indian Sign Language so that a lay human being can understand the sign language as well as try to learn and also for hearing impairment's folks. The Sign Language work is most pending in future might the technology is most advanced like we developed an application help to a lay human being who cannot understand the sign language in this we can a used our smartphone camera a signer convey the message in the formation of sign and if sign stored in the database automatically sentence is display in the smart phone and also hearing impairment people also used this.

REFERENCES

1. Sugandhi, P. Kumar, and S. Kaur, “Indian Sign Language Generation System,” *Computer (Long. Beach. Calif.)*, vol. 54, no. 3, pp. 37–46, 2021, doi: 10.1109/MC.2020.2992237.
2. R. Singh, S. Shekhar, S. Shaurya, S. Kumar, and K. S. Rekha, “Sign Language to Text,” vol. 10, no. 6, pp. 6–8, 2020.
3. D. M. Viswanathan and S. M. Idicula, “Recent Developments in Indian Sign Language Recognition : An Analysis,” *Int. J. Comput. Sci. Inf. Technol.*, vol. 6, no. 1, pp. 289–293, 2015.
4. A. P. Phatale and V. B. Malode, “Indian Sign Language : Study of Existing Approaches,” pp. 956–963.
5. R. P. and A. K. S. Madhuri Sharma, “Indian Sign Language Recognition Using Neural Networks And Knn Classifiers,” *ARNP J. Eng. Appl. Sci.*, vol. 2222, no. 8, pp. 1255–1259, 2020, doi: 10.1063/5.0005665.
6. A. Dhanjal and W. Singh, “An Automatic Conversion of Punjabi Text to Indian Sign Language,” *ICST Trans. Scalable Inf. Syst.*, no. January, p. 165279, 2018, doi: 10.4108/eai.13-7-2018.165279.

Food Colors: Types, Effects on the Human Health and Their Applications

Ginni Rani and Amita Singh

DPG Degree College, Sector-34, Gurugram- 122001, India

ABSTRACT

For improving appearance, high color intensity and more color stability synthetic food colors have been used commonly. By food manufacturers, synthetic food colors are widely used over the natural food colors due to low cost and high stability. Many non-permitted synthetic colors may be present in food items available in the markets. Mutations, cancers, reduced hemoglobin concentrations, allergic reactions, neurocognitive effects and toxicological effects may lead by highly used in synthetic food color. Quinoline yellow, lake foods colors, carmoisine red and tartrazine are synthetic colorants which are toxic in nature. Betalains, chlorophyll, carotenoids and anthocyanins are plant natural colors. By the food industry, there is replacement of synthetic food colors by natural plant colorants on consumer demand which enhance the awareness of synthetic food colorants toxicity.

Keywords: Colorants, toxicity, carcinogenic effects

1. INTRODUCTION

Color plays a vital role for increasing the satisfaction of consumers about food items. For ripeness, freshness, attractive look and safety food colors are used [1]. In markets, there are various shades of color are available. It is scientifically proved that some synthetic food colors are harmful, toxic and carcinogenic in nature [2]. For customers demand many new technologies are developing now [3]. Synthetic food colorants are safe if they are used in a limited range [4]. Some colorants are banned due to neurocognitive effects and toxic effects [5]. All-around dyes are Azo dyes with azo group (-N=N-) used in food items extremely [6]. Azo dyes excreted through urine only after metabolized in liver and kidney [7]. Azo dyes are exposure to oxygen and light and more stable at high pH [8]. For high color stability, better appearance, high color intensity, several synthetic food colorants have been used as additives in many food items to preserve, flavour, attractive appearance and freshness [9]. This review aims to overview the classification, application and effects of food colorants on human health by considering the above points.

2. TYPES OF FOOD COLORS

Food colors are classified into two types, natural food colors and synthetic food colors.

2.1. Natural Food Colors

Natural food colors are obtained from plants. Basically, there are two type of food colorants are given by nature one is the water soluble such as betalains, anthocyanins and another is the oil soluble such as chlorophylls and carotenoids [10]. Food processing industries have great demand for the natural food colorants which are safe as well as healthier for the consumers [11].

2.1.1. Betalains: These are water-soluble natural food colorants obtained from those plants which contain nitrogen. From flowers, stem, leaves and bracts of plants, these food colorants are also obtained not only in plants edible parts. In both UV and visible regions, betalains are absorbed due to betalamic acid which shows phenolic nature [12]. Betalains are more stable at low pH (i.e. from 3 to 6 pH range) [13]. Main two groups of betalains are yellow betaxanthins and violet betacyanins.

2.1.2. Chlorophylls: These are oil soluble. It is a green pigment which is responsible for the green color of plants [14]. Chlorophylls are of two types colors, chlorophyll a appears blue-green color which contains methyl group (-CH₃ group) and chlorophyll b appears yellow-green color which contain aldehyde group (-CHO group) [15]. In alkaline, chlorophylls are stable in pH from 7 to 9 range. In contact with heat, light, enzymes, acids and oxygen, chlorophylls are highly sensitive and reactive in low pH range results changing of green color of chlorophyll to olive brown [16].

2.1.3. Carotenoids: These are lipid soluble natural food colorants. It is a molecule which contains 40 atoms of carbon and extracted from tomato peels. Carotenes (contain H and C) and xanthophylls (contain C, H and O) are the two classes of carotenoids [17]. In many plants and animals, pigments of yellow, orange and red colors are obtained due to the presence of carotenoids. At pH range from 4 to 6, carotenoids are more stable and decomposition of carotenoids take place at pH less than 3 [18]. It acts as a pro-vitamin A and antioxidant which help in body metabolism.

2.1.4. Anthocyanins: These are water-soluble natural food colorants. Blue, purple, orange and red colors of fruits and vegetables obtained due to the presence of anthocyanins [19]. Factors such as light, pH, temperature, oxygen and sugars are responsible for the stability of anthocyanins food colorants. Both color intensity and flavylum cation (red) concentration get decreased when pH range is increased [20]. Some plants contain anthocyanins such as apple, peach, strawberry, raspberry, blueberry, red cabbage and so on.

2.2 Synthetic Food Colors

Different forms of synthetic colors are available in powder, granular and lake colors (water soluble).

2.2.1. Quinoline yellow: It is a primary synthetic food color. It is of green shade with a bright yellow color. The chemical composition of quinoline yellow is $C_{18}H_{11}NO_2$ [21].

2.2.2. Carmoisine: It is also a primary synthetic food color. Carmoisine color shade is red to maroon. It is mainly used in ice-cream. The chemical composition of carmoisine is $C_2OH_{12}N_2Na_2O_7S_2$ [22].

2.2.3. Tartrazine: It is widely used synthetic food color which is available in lemon yellow azo-dye. In candies, soft drinks, ice-creams, desserts, custards, pop-corns, domestic cooking, cereals, chips, etc. tartrazine gives attractive look and make food items tasty. It is also known as Yellow No. 5. The chemical composition of tartrazine is $C_{16}H_9N_4Na_3O_9S_2$ [23].

2.2.4. Erythrosine: It is made up from coal tar. Erythrosine color shade is pink to reddish pink (cherry pink). It is used in food manufacturing of candies, capsules and cakes. The chemical composition of erythrosine is $C_{20}H_{14}Na_2O_5$ [24-25].

3. EFFECTS OF FOOD COLORS ON HUMAN HEALTH

In Acceptable Daily Intake (ADI) of any food color is not harmful for human body [26]. Intake of non-permitted textile colors show toxic, harmful and carcinogenic effects if these food colors are consumed in high quantity [27-28]. Hyperactivity is to be noticed in many children by adding of some food colors in their daily diet [29]. Numerous of side effects are observed after the consumption of food colorants such as Blue 1, Red 40, Yellow 5 and Yellow 6 contain toxic substances which are responsible for cancers and allergic reactions in human body such as hives and asthma, mutation, reduced hemoglobin concentration, neurocognitive and toxicological effects [30]. Lower size of food colorants molecule has more absorption rate than the higher size of food colorants molecule. During the absorption of small size food colorant, there are high chances of toxicity because small size food colorants molecules can pass through mucosal wall easily [31].

4. APPLICATION OF FOOD COLORS

Some application of food colors are given below:

- In cookies, biscuits, cake icing (decoration) many synthetic food colors are used by bakers in their bakery for enhancing the occurrence of natural color [32].
- Products such as jellies, cream/paste, chewing gum, etc. a wide variety of color is used to make product more attractive [33].
- Addition of food colors in juice and cold drinks which results change in taste and color [34].
- In dairy products such as ice-cream, proceed cheese, milkshakes and water ices, etc. various food colors are used to make the product delicious for the satisfaction of consumers [35-36].

5. CONCLUSION

From ancient time, we are using a wide variety of colors in our cultures and societies as traditions. Natural as well as synthetic food colors are helpful to preserve food from harmful bacteria and fungus. Natural colors are safer than synthetic food colorants for human health. The main problem is to overcome the stability of natural colorants. There are risks of several health issues after the consumption of colorants in food such as mutagenicity, allergic reactions, hyperactivity, carcinogenicity and toxicological effects.

REFERENCES

1. Duangmal, K., Saicheua, B., Sueeprasan, S. Role of anthocyanins as a natural food colorant and improvement of its color stability. AIC Color and Paints, Interim Meeting of the International Color Association. 2004; 155-158.
2. Ozkan, G., Bilek, SE. Microencapsulation of natural food colorants. International Journal of Nutrition and Food Science. 2014; 3(3): 145- 156.

3. Meena Devi, V.N., Ariharan V.N., Nagendra PP. Annato: Ecofriendly and potential source for natural dye. *International Research Journal of Pharmacy*. 2013; 4(6):106-108.
4. International Food Information Council Foundation Exclusive Journalist Webcast. What you need to know about food colors and hyperactivity: 2011. Available: <http://www.foodinsight.org/Content/3840/Master%20SI>
5. Arvanitoyannis IS, S Choreftaki, Tserkezou P. An update of EU legislation (Directives and Regulations) on food related issues (Safety, Hygiene, Packaging, Technology, GMOs, Additives, Radiation and Labelling): presentation and comments. *Int J Food Sci Technol* 2005;40:1021-1112.
6. Stolz A. Basic and applied aspects in the microbial degradation of azo dyes. *Appl Microbiol Biotechnol* 2001;56: 69- 80. <http://dx.doi.org/10.1007/s002530100686> PMID:11499949
7. Chequer FMD, Dorta DJ, de Oliveira DP. Azo dyes and their metabolites: does the discharge of the azo dye into water bodies represent human and ecological risks? In: Hauser P, Editor. *Advances in Treating Textile Effluent*. InTech; 2011. pp. 27-48. <http://dx.doi.org/10.5772/19872>
8. Tull D. Colorful dyes with southwestern plants. In: *Edible and Useful Plants of the Southwest: Texas, New Mexico, and Arizona*. University of Texas Press; 2013. Gautam, *STCJ* 2015;2(1):69-75 75 © 2015.STCJ.All Right Reserved pp 335-362.
9. Xing, Y., M. Meng., Xue, H., Zhang, T., Yin, Y., & Xi, R. (2012). Development of a polyclonal antibody-based enzyme-linked immune sorbent assay (elisa) for detection of sunset yellow fcf in food samples. *Talanta*, 99, 125–131. doi:10.1016/j.talanta.2012.05.029.
10. Reshmi, SK., Arvindhan, KM. The effect of Light, Temperature, p H on stability of on the Pharmaceutical Resonance 2020 Vol. 2 - Issue 2 © Published by DYPIPSR, Pimpri, Pune - 411 018 (MH) INDIA 19 stability of Betacyanin pigments in Basella Al ba fruits. *Asian Journal of Pharmaceutical and Clinical Research*. 2012; 5(4): 107-110.
11. Agrawal A. Scope of Betalains as a food color ants. *International journal of advanced scientific and technical research*. 2013; 3(3): 22-36.
12. Gand-Herrero, F., Jimenez-Atienzar, M., Cabanes, J., Garc-Carmona, F., Escribano J. Stabilization of the bioactive pigment of Opun Tia fruits through maltodextrin encapsulation. *J. Agric. Food. Chem.* 2010; 58:10646–10652.
13. Henriette, M.C., Azeredo. Betalains: properties, sources, applications, and stability – a review. *International Journal of Food Science and Technology*. 2009; 44: 2365–2376.
14. Levent İnanc, A. Chlorophyll: Structural Properties, Health Benefits and Its Occurrence in Virgin Olive Oils. *Academic Food Journal*. 2011; 9(2): 26-32.
15. Steet, JA., Tong, CH. Degradation kinetics of green color and chlorophylls in peas by color imetry and HPLC. *J Food Sci*. 1996; 61: 924- 928.
16. Ozkan, G., Bilek, SE. Enzyme-assisted extraction of stabilized chlorophyll from spinach. *Food Chem*. 2015; 176: 152–157.
17. Provesi, JG., Amante, ER. Changes in carotenoids during processing and storage of pump kin puree. *Food Chemistry*. 2011; 128: 195– 202.
18. Qian, C. Decker, E.A., Xiao, H., McClement, DJ. Physical and chemical stability of β - carotene-enriched nanoemulsions: Influence of pH, ionic strength, temperature, and emulsifier type. *Food Chem*. 2012; 132: 1221–1229.
19. Mazza GJ. Anthocyanins and heart health. *Ann. Ist. Super. Sanita*. 2007; 43: 369-374.
20. Miguel MG. Anthocyanins: Antioxidant and/or anti-inflammatory Activities. *Journal of Applied Pharmaceutical Science*. 2011; 1 (6); 7- 15.
21. Soheila, K., & Sahar, H. Z. (2011). Thermodynamic study on the binding of tartrazine food additive to calf thymus DNA. *Clinical Biochemistry*, 44, S233. doi:10.1016/j.clinbiochem.2011.08.566.

22. Sahraei, R., Farmany, A., & Mortazavi, S. S. (2013). A nanosilver-based spectrophotometry method for sensitive determination of tartrazine in food samples. *Food Chemistry*, 138, 1239–1242. doi:10.1016/j.foodchem.2012.11.029.
23. Perera, M. N., Abuladze, T., Li, M. R., Woolston, J., & Sulakvelidze, A. (2015). Bacteriophage cocktail significantly reduces or eliminates *Listeria monocytogenes* contamination on lettuce, apples, cheese, smoked salmon and frozen foods. *Food Microbiology*, 52, 42–48. doi:10.1016/j.fm.2013.08.018.
24. Mohamed, M. H., Attia, H. A., Mahmoud, S. A., Somaia, A. N., Samar, M. M., & Gihan, F. A. (2011). Toxicological impact of amaranth, sunset yellow and curcumin as food coloring agents in albino rats. *Journal of Pakistan Medical Student*, 1(2), 1–9. doi:10.1016/j.fct.2010.03.028.
25. Preston-Martin, S., Pogoda, J. M., Mueller, B. A., Holly, E. A., Ljinsky, W., & Davis, R. C. (1996). Maternal consumption of cured meats and vitamins in relation to pediatric brain tumors. *Cancer Epidemiology, Biomarkers & Prevention*, 5(8), 599–605. doi:10.1207/S15327914NC340115.
26. Beatriz M, Gloria A. Synthetic colorants. In: Hui YH, editor. *Handbook of food science, technology, and Engineering 4 volume*. CRC press; 2005. pp 86.1–14. <http://dx.doi.org/10.1201/b15995-95>
27. Kroger, M., Meister, K., & Kava, R. (2006). Low-calorie sweeteners and other sugar substitutes: A review of the safety issues. *Comprehensive Reviews in Food Science and Food Safety*, 5, 35–47. doi:10.2359/0372-024x-51.9.2084.
28. Lhotta, K., Hofle, G., Gasser, R., & Finkenstedt, G. (1998). Hypokalemia, hyperreninemia and osteoporosis in a patient ingesting large amount of cider vinegar. *Nephron*, 80(2), 242–243. doi:10.1159/000045180.
29. Ghoreishi, S. M., Behpour, M., & Golestaneh, M. (2012). Simultaneous determination of sunset yellow and tartrazine in soft drinks using gold nanoparticles carbon paste electrode. *Food Chemistry*, 132, 637–641. doi:10.1016/j.foodchem.2011.10.103.
30. Bigwood, T., Hudson, J. A., Billington, C., Carey-Smith, G. V., & Heinemann, J. A. (2008). Phage inactivation of foodborne pathogens on cooked and raw meat. *Food Microbiology*, 25, 400–406. doi:10.1016/j.fm.2007.11.003.
31. Dawson DJ, Rudinger J. Food containing non-toxic food coloring compositions and process therefor. US patents US3920855A 1975.

Effect of Solvent Polarity on Viscosity of 2-Hydroxy Substituted 1, 3- Dipropanone

Dongapure A. C¹, Bodkhe P. S² and Choudhari P. P^{3*}

¹Department of Chemistry, Shankarlal Agarwal Science College Salekasa, Gondia, Maharashtra, India

²Government Vidarbha Institute of Science and Humanities, Amravati, Maharashtra- 444604, India

³Department of Chemistry, G.S Tompe College, Amravati, Maharashtra- 444704, India

ABSTRACT

We are going to report the observed measurements of the viscosity and density of two binary mixtures comprising various molar concentrations of 1-(5-Bromo-2-hydroxyphenyl)-3-p-tolylpropane-1,3-dione with Dimethyl sulfoxide (DMSO) and water at three different percentage (60%, 70%, and 80%). The measurements were conducted at various molar concentration C as follows: C = (0.01, 0.005, 0.0025, 0.00125, and 0.000625). The viscosity and density measurements were carried out using Ostwald's viscometer and pycnometer. The results were correlated using the graph of $(\eta_r - 1)/\sqrt{C}$ versus \sqrt{C} relations that express density and viscosity as functions of the Falkenhagen coefficient and Jones-Dole coefficient, which explain the solvent - solvent, and solute - solvent interaction. To study the viscosity of the binary mixtures as a function of density, and composition, we have applied several polarities mixing DMSO in water.

Keywords: Viscosity, density, relative viscosity, 2-hydroxy Substituted 1,3- Dipropanone containing phenol, Ligand, DMSO

INTRODUCTION

1-(5-Bromo-2-hydroxyphenyl)-3-p-tolylpropane-1,3-dione is a β -diketone more important because it is a key intermediates synthesis of Carbon-Carbon bonds in a vast quantity of biologically and pharmaceutically products (1). The compounds having a 1,2 diketone functional group with phenyl ring have been reported to possess various biological activities such as anti-inflammatory, antimicrobial (2), antioxidant (3) (4), anti-malarials (5), anti-tuberculosis (6), anti-HIV and antitumor (7). Viscometric studies have found a wide range of applications in various fields. Density and viscosity are significant factors employed for equipment design, solution theory, process simulation, and molecular dynamics (8) (9). Viscosity is a play important role in physical property for calculations related to fluid flow. Thermophysical parameters have been explain intermolecular interactions in liquids over the past several years (10) (11). Several researchers reported the thermoacoustical parameters in polymers, liquefied gases, organic liquids, and binary liquid mixtures (12) (13). Viscosity measurement is helpful to understand the type of molecular interactions and this helps to examine the solvent-solvent interaction and solute-solvent interaction occurring in solutions (14). The literature reveals that work on acoustical properties of solutions of organic compounds was carried out by using viscometric techniques (15).

The DMSO was chosen as a solvent because of its broad applicability in chemical, and biological processes (16) (17), pharmacy, and medicine (18). The essential pharmacological use of DMSO in drugs idoxuridine is to upturn the dispersion of the drug into the skin (19). The structure of DMSO contains hydrophobic methyl groups bonded to a greatly polar sulfoxide group. DMSO molecules show association due to the dipole-dipole interactions among the sulfur and oxygen (20). DMSO contains hydrogen acceptor oxygen atom; hence it can form Hydrogen-bonds with hydroxyl (OH) groups (21).

Because of the above-mentioned consequence of DMSO and β -diketone in medicinal and pharmaceutical chemistry, we aim to synthesize β -diketone (22) and to study the effect of the concentration of this β -diketone on the different percentage of solvent mixtures. Water and DMSO (60%, 70%, and 80%) were used as a solvent. The density ρ , viscosity η , the Falkenhagen coefficient A and Jones-Dole coefficient B of solutions of these compounds were experimentally observed at different molar concentrations of 1-(5-Bromo-2-hydroxyphenyl)-3-p-tolylpropane-1,3-dione. These experimentally calculated results help to study molecular interactions.

EXPERIMENTAL

In this present investigation, the attempt is made to understand the behaviour of β -diketone ligands namely 1-(5-Bromo-2-hydroxyphenyl)-3-p-tolylpropane-1,3-dione have been carried out in organic solvents Dimethyl sulfoxide (DMSO). The ligand 1-(5-Bromo-2-hydroxyphenyl)-3-p-tolylpropane-1,3-dione was already prepared by using a very common synthetic method (23). Then the viscosity and density measurements of a diverse molar solution of ligand at room temperature were calculated. All chemicals used to synthesise substituted β -

diketone ligand were of A.R. grade. DMSO was purified by described method (24). The reaction scheme for the synthesis of 1-(5-Bromo-2-hydroxyphenyl)-3-p-tolylpropane-1,3-dione from 4-Bromophenol is shown below

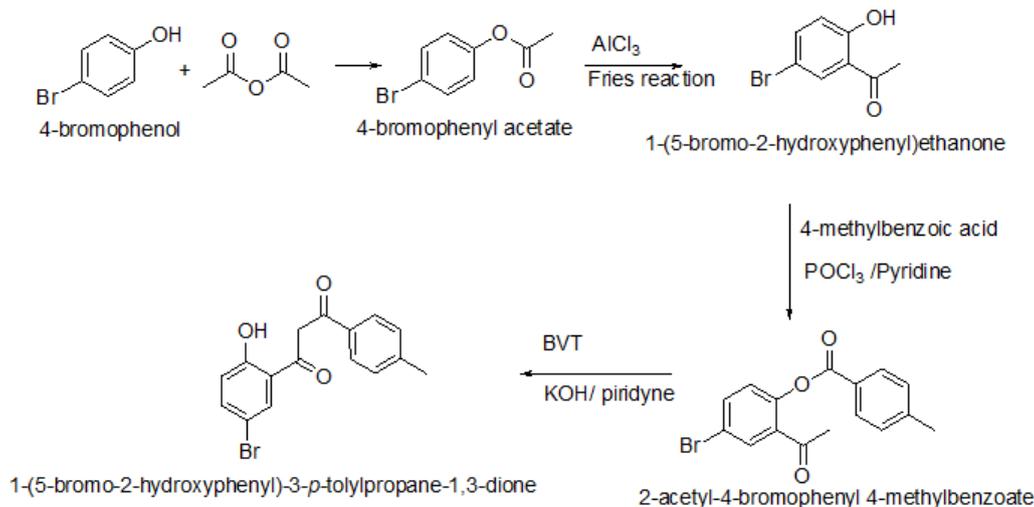


Figure 1: Reaction scheme for the synthesis of Ligand

Solutions of 1-(5-Bromo-2-hydroxyphenyl)-3-p-tolylpropane-1,3-dione as a function of molality 0.01 mol kg⁻¹ were prepared in pure DMSO and varied concentration 0.005, 0.0025, 0.00125, and 0.00062 was prepared by using 0.01 mol kg⁻¹ solution. The weighing of 1-(5-Bromo-2-hydroxyphenyl)-3-p-tolylpropane-1,3-dione was done on an electronic single pan five digit Balance with a precision of ± 0.0001 mg. Before every measurement, calibrated and standardized at 25°C with triply distilled water and dry air at normal atmospheric pressure. Using Ostwald's viscometer method viscosity was measured with a common relative uncertainty of ± 1 × 10⁻⁶ Pa s. The stopwatch was used to observe the efflux time of solutions with an precision of ± 0.01 s. The mean of at least three readings was taken as the final efflux time for every sample for the calculation of the viscosity of the solution.

RESULTS AND DISCUSSION

The relative viscosity and density of these compounds increase with an increase in concentration. The increase in viscosity with an increase in concentration is credited to the increase in the solute-solvent interactions due to the intermolecular hydrogen bonding between -S=O group of DMSO and -OH group of 2-Hydroxy substituted 1,3-Dipropenone containing phenol group. The experimentally determined values of density ρ , viscosity η , relative viscosity η_r , specific viscosity η_{sp} , Falkenhagen coefficient-A and Jones-Dole coefficient-B, in DMSO water mixture at room temperatures, are listed in tables no.1 to 3.

The relation between viscosity (η_{sp}/\sqrt{C}) and concentration of the solution (\sqrt{C}) is represented by plotting the graph (Fig. no.2 to 4). The graph for each system shows a linear straight line recognizing the validity of the Jones-Dole equation. The value of the Jones-Dole coefficients-B is the slope of the graph (η_{sp}/\sqrt{C}) versus (\sqrt{C}), while the value of Falkenhagen coefficient-A is the intercept of the graph of (η_{sp}/\sqrt{C}) versus (\sqrt{C}).

From table 4, the B-coefficient is found to be negative values for all the systems, and is a measure of disorder introduced by the solute into the solvent in all the systems. The Falkenhagen coefficient-A is a positive value in all the systems, and this coefficient reflects strong solute-solute interaction.

Table 1

Temp: (305 ± 0.1) K

Medium: 60% DMSO-Water

Conc. (C) (mol/lit)	\sqrt{C} (mol ^{1/2} lit ^{-1/2})	Density (gm/cc)	Time Flow (s)	Relative Viscosity $\eta_r = \eta / \eta_0$	Specific Viscosity $\eta_{sp} = \eta_r - 1$	η_{sp}/\sqrt{C}
0.01	0.1000	1.1263	22.123	1.1944	0.19442	12.2826
0.005	0.0707	1.1253	22.098	1.1920	0.1920	15.1137
0.0025	0.0500	1.1243	21.123	1.1384	0.1384	22.7918
0.00125	0.0354	1.1232	20.478	1.1025	0.1025	27.9003
0.000625	0.0250	1.1220	19.854	1.0678	0.0678	33.4475

Table 2

Temp: (305 ± 0.1) K

Medium: 70% DMSO-Water

Conc. (C) (mol/lit)	\sqrt{C} (mol ^{1/2} lit ^{-1/2})	Density (gm/cc)	Time Flow (s)	Relative Viscosity $\eta_r = \eta / \eta_0$	Specific Viscosity $\eta_{sp} = \eta_r - 1$	η_{sp}/\sqrt{C}
0.01	0.1000	1.1258	24.509	1.88439	0.88439	8.8439
0.005	0.0707	1.1236	23.675	1.88059	0.88059	12.4534
0.0025	0.0500	1.1220	22.864	1.7395	0.7395	14.79
0.00125	0.0354	1.1208	21.156	1.79603	0.79603	22.5151
0.000625	0.0250	1.1198	20.987	1.68473	0.68473	27.3892

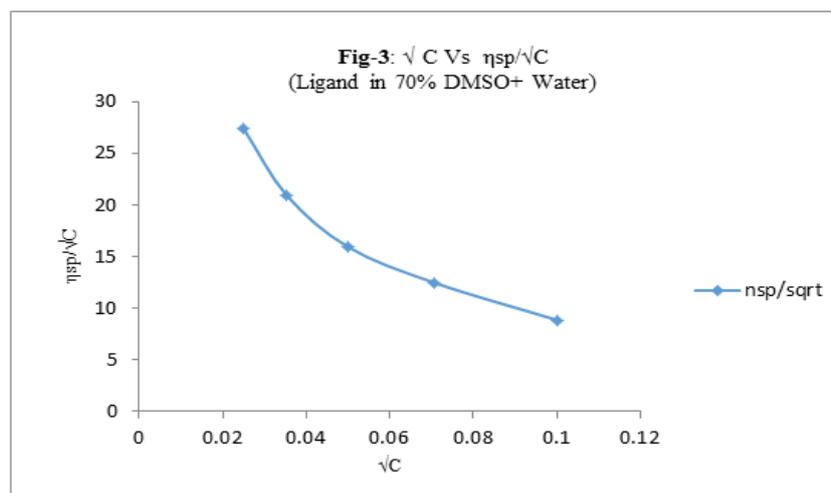
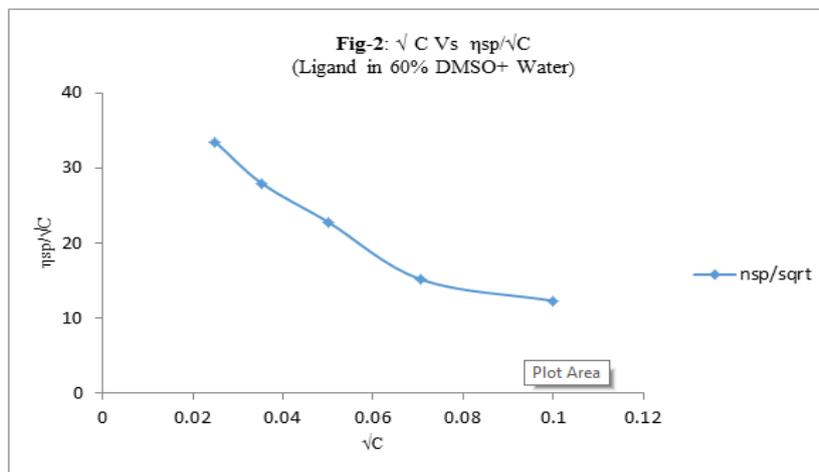
Table 3

Temp: (305 ± 0.1) K

Medium: 80% DMSO-Water

Conc. (C) (mol/lit)	\sqrt{C} (mol ^{1/2} lit ^{-1/2})	Density (gm/cc)	Time Flow (s)	Relative Viscosity $\eta_r = \eta / \eta_0$	Specific Viscosity $\eta_{sp} = \eta_r - 1$	η_{sp}/\sqrt{C}
0.01	0.1000	1.0756	30	1.99721	0.99721	9.9721
0.005	0.0707	1.0700	28	1.92538	0.92538	13.0868
0.0025	0.0500	1.0685	29	1.85674	0.85674	17.1348
0.00125	0.0354	1.0655	27	1.71624	0.71624	20.2583
0.000625	0.0250	1.0637	25	1.70102	0.70102	28.0408

The drop in viscosity concerning an increase in the concentration of ligand may be credited to the decline in solute-solvent interactions. From the graph of $(\eta_r - 1) / \sqrt{C}$ versus \sqrt{C} . 'A' which shows the solute-solute interactions and 'B' which then shows solute-solvent interactions have been calculated. The large and small values of 'A' show the stronger and weaker solute-solute interactions.



For 60% DMSO, 70% DMSO, and 80% DMSO in water, at various molar concentrations of 1-(5-Bromo-2-hydroxyphenyl)-3-p-tolylpropane-1,3-dione, the value of relative viscosity, specific Viscosity, η_{sp}/\sqrt{C} increases. This increase is due to strong solute-solvent interactions due to the increasing strength of the bond between the (-OH) group of water and the (-C=O) group of the ligand as well as the interactions between the (-OH) group of ligand and (-C=O) group DMSO.

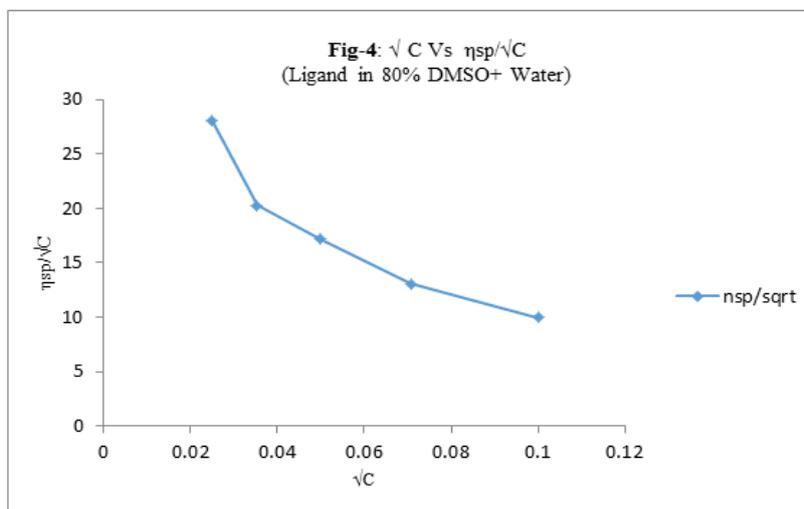


Table 4: A and B Coefficient values

	A	B
Ligand in 60% DMSO+ Water	38.191	-282.6
Ligand in 70% DMSO+ Water	30.541	-237.35
Ligand in 80% DMSO+ Water	29.929	-217.57

CONCLUSIONS

In this article, Density ρ , viscosity η , relative viscosity η_r , specific viscosity η_{sp} , Falkenhagen coefficient-A, and Jones-Dole coefficient-B explained the solvent-solvent, solute-solvent and molecular interactions for different concentrations of 1-(5-Bromo-2-hydroxyphenyl)-3-p-tolylpropane-1,3-dione in various solvent mixtures.

ACKNOWLEDGEMENT

The authors are thankful to Principal, G.S Tompe College, Amravati for the necessary facilities.

REFERENCES

1. Kharat, Pandharinath S. Nikam and Sanjeevan J. s.l. : J. Pharm. Pharmacol. 46 (1994) pp. 1291–1295.
2. Tahereh Sedaghat, Marjan Monajjemzadeh and Hossein Motamedi. s.l.: Coord Chem Rev., 64, 18 (2011), pp. 3169-3179.
3. Galano, Annia. s.l. : Chemical Physics 363 (2009) pp. 13-23.
4. N. Sreejayan, K.I. Priyadarsini, T.P.A. Devasagayam, M.N.A. Rao., s.l. : Int. J.Pharmacol. 151 (1997) pp. 127-130.
5. Jakob Kljun, Iztok Turel. s.l. : Org. Biomol. Chem., 12, (2014) pp. 1655–1666.
6. A.J. Ruby, G. Kuttan, K.D. Babu., s.l. : Cancer Lett. 94 (1995) pp. 79-83.
7. Abbas, H. s.l. : DRUG DELIVERY 29,1, (2022) pp. 714-727.
8. D. Venkatesan, Joshua Amarnath D, T. Srinivasa Krishna, P. Biswas, R. Dey. s.l. : J.Mol. Liq. 299 (2020) pp. 112221.
9. J.V. Srinivasu, T.S. Krishna, K. Narendra, G. SrinivasaRao, B. SubbaRao. s.l. : J. Mol. Liq. 236 (2017) pp. 27-37
10. TA. Saini, A. Harshavardhan, R. Dey, Indian Journal of Chemistry Section a 56(1), pp. 21-35.
11. S. K. Lomesh, D. Kumar., Journal of Molecular Liquids, 241, pp. 764-771.
12. K. Narendra, Ch. Kavitha, T. S. Krishna., International Journal of Ambient Energy, 43 (1), pp. 1113-1119.

13. J. Jugan, M. Abdulkhadar., *Journal of Molecular Liquids*, 100 (3), pp. 217-227.
14. Sain, Akanksha., *Journal of Molecular Liquids*, 323, pp. 114593.
15. Abbas Mehrdad, Mohsen Hajikarimi. s.l. : *The Journal of Chemical Thermodynamics*, 139 (2019), pp. 105880.
16. Raj Chakrabarti, Clarence E.Schutt. *Gene*, 274 (1–2) (2001), pp. 293-298.
17. Masaji Sawai, Kozo Takase, Hirobumi Teraoka, Kinji Tsukada. *Experimental Cell Research*, 187(1), (1990), pp. 4-10.
18. Capriotti K, Capriotti J., *International Medical Case Reports Journal*, 8, (2015) pp. 231—233.
19. L.Spotswood. s.l. : *J. Chem. Eng. Data* 50 (2005) 1161 (2), pp. 191–197.
20. J. Catalan, C. Diaz, F. Garcia-Blanco. s.l. : *J. Org. Chem.* 66 (2001) pp. 5846–5852.
21. Kristina Noack, Johannes Kiefer, Alfred Leipert. s.l. : *J. Chem. Eng. Data* 48 (2003) pp. 630-637.
22. Dongapure A.C, Choudhari P.P. s.l. : *Der Pharma Chemica*, 14 (2022) pp. 24-27.
23. S Bodkhe, Pathade R. M.and. s.l. : *IJCESR*, 6 (2019), pp. 84-87.
24. Furniss B.S., Hannaford A.J. A.R. *Vogel’s Text Book of Practical Organic Chemistry*. s.l. : Fifth Edition, 2007.
25. M.J.W. Povey, S.A. Hindle, J.D.Kennedy, Z. Stec.,. s.l. : *Chem.Phys.* 5 (2003) pp. 73-78.
26. C.D. Eads. s.l. : *J. Phys. Chem. B* 104 (2000) pp. 6653–6661.
27. J.N. Nayak, M.I. Aralaguppi, T.M. Aminabhavi. s.l. : *J. Chem. Eng. Data* 48 (2003) 628.
28. Dongapure A.C, Choudhari P.P. s.l. : *Der Pharma Chemica*, 2022, 14(5): 24-27.
29. S, Pathade R. M.and Bodkhe P. s.l. : *IJCESRE*, 6, (2019), pp. 84-87,.

Internet Dependency and Emotional Maturity: Theoretical Perspective

Gyan Prakash Pandey, Haldhar and Anil Kumar Dixit
Maharishi University of Information Technology, Lucknow, India

ABSTRACT

The internet has become a potent tool for global communication and information exchange in the digital age. The internet has an impact on students' lives as well as on the social, political, and economic spheres in both positive and negative ways. Internet addiction has been brought on by the internet's sharp rise in popularity in recent years. The degree of addiction caused by internet use has a negative effect on students' lives. For internet users, it is crucial to genuinely grow and emotionally mature in order to control and manage their own emotions and consistently deal under any conditions. Everybody's life is greatly impacted by their emotions. The balancing of internal growth with external reality is one definition of emotional maturity. It is the ability to handle situations without needlessly exaggerating them. They attempt to resolve the problem themselves rather than seeking to blame others for their problems or behaviour. A person who is emotionally mature is capable of adjusting to any situation. In light of this, the current research aims to investigate the theoretical perspective of internet dependence and emotional development.

INTRODUCTION

Social media is a key factor in how individuals are changing their lifestyles. Social media comprises blogging and social networking services that enable quick connections between users. Through social networking, users can connect with friends, family, and acquaintances online. Despite the fact that this may occasionally happen, social networking platforms are not always about meeting new people online. Instead, they focus mostly on engaging with real-life friends, family, and acquaintances. These websites let you schedule events, speak about them, download music, and even play online games like Scrabble and Chess. Your friends, family, and acquaintances are frequently friends with a number of other people. People are connected to one another through a network of links, much like in real life.

Emotional maturity is the state of being able to comprehend various types of things. Your emotional maturity will enable you live the lifestyle you desire. There are many indicators of emotional maturity. Some of these include adaptability, accountability, vision, personal growth strategies, alternate viewpoints, resilience, and so on. The emotional development of students is significantly impacted by the internet. The greatest ways to gauge how the internet affects students' emotional development are to look at their levels of self-awareness, self-control, motivation, self-regulation, social skills, and empathy. Internet users must be emotionally mature in order to control and monitor their own emotions, gauge others' emotional states, and respond to events consciously and appropriately. It has been noted rather frequently that adolescent internet users become emotionally immersed in this virtual world and behave in that emotional flow, which occasionally causes an emotional trauma that leaves a long-lasting effect. The emotional development of the person has an impact on their actions. Students' emotional maturity is crucial since they are the foundation of future generations. The goal of the current study is to assess pupils' emotional development. The emotional development of a person influences their actions. Students' emotional development is crucial because they will support future generations. Everybody's life is greatly impacted by their emotions. The balancing of internal growth with external reality is one definition of emotional maturity. It is the ability to handle situations without needlessly exaggerating them. They attempt to resolve the problem themselves rather than seeking to blame others for their problems or behaviour. A person who is emotionally mature is capable of adjusting to any situation.

India has the second-highest global internet user population and has seen rapid growth in recent years. Social media networks are typically coupled with internet access. There were 143 million social media users in India as of April 2015, with 118 million of them living in urban regions and 25 million of them coming from rural areas. According to a 2017 survey by IMRB, there are currently 481 million internet users in India, and that figure is expected to increase to 500 million by the end of June 2018. Social media is fast gaining popularity among the young people and youth in the age of globalization. Students that are enrolled in colleges and universities are the main consumers of social media. Social networking sites are web-based tools that let users create semi-public or public profiles in constrained systems and list other users with whom they can interact and exchange ideas. The nature, form, and type of these relationships, however, may vary from site to site. Because social networking sites are unique, users can discuss and publicly display their social networks in addition to meeting strangers. This leads to relationships between people that would not otherwise be feasible through any

other currently in use media. Most frequently, users of social networking sites engage with others who are already their friends or acquaintances there and who have similar mindsets, interests, and viewpoints.

Social networking sites are well-known for giving users a forum for conversing, sharing links, movies, photos, and other content, but they are also used to address social issues. The phenomena of social networking has grown during the last ten to fifteen years. Since then, social networking sites have developed from a specialised online activity to a popular one that is used by tens of millions of internet users both for leisure and for work. On the socioeconomic effects of these locations in the Indian setting, however, there hasn't been much study. Social networking websites have had both beneficial and harmful effects on Indian youth. Social networking has been a thing since the dawn of civilization. With more people using and comprehending email, being able to shop online, searching the web for recipes, or finding a long-lost instruction manual for a piece of equipment in the garage, etc., the internet medium is evolving. Today, the internet is more about Facebook, Myspace, Orkut, blogs, and podcasts. These are some of the devices and technological advancements related to the widespread contemporary phenomena known as social networking.

Social media sites have become the most efficient instrument for learning, knowledge sharing, and education, and young people use them for more than just personal communication. Traditional approaches to ICT have been superseded with Covid-19-based teaching and learning strategies in educational institutions from the primary level to higher education. The use of social networking sites, IT platforms, and other ICT technologies is expanding for efficient knowledge exchange, information distribution, learning, and teaching. Even institutions of higher learning and training are hosting online classes, webinars, and other academic events. This has increased the reach of global networking, extensive collaboration, wider engagement, and knowledge sharing. Therefore, the government has encouraged the use of ICT in educational institutions and has provided the fundamental framework for online teaching and learning. The popularity of social networking sites demonstrates a substantial shift in Internet users' social and private conduct. Among young adults, social networking sites have emerged as a vital form of entertainment and communication. Social networking sites will continue to be popular even though they have begun to interfere with everyday activities of regular people. Everything in this world has a potential for both good and negative use. As social networking sites have grown in popularity, people are now connected in new ways and are able to engage with one another virtually. Additionally, the expansion of social networking websites in Indian society demonstrates a substantial shift in the social and private lives of adolescents. Although these websites assist young people in disclosing personal information, they also encourage them to exaggerate about many areas of their lives. These favourable elements do, however, come with concerns like identity theft and cyber-blackmail. Addiction, concentration problems in school, and mood fluctuations are further harmful consequences on teenagers. Additionally, these websites give teenagers a place to participate in some immoral behaviour. On social networking sites, users can experiment with emotions and conceal their true identities. On these social networking sites, they put their best foot forward, giving the impression of perfection. Internet crime has also increased as a result of social networking sites. Through the use of social networking sites, crime has become simple, anonymous, and efficient. Researchers and thinkers around the world are becoming concerned about the rise of cybercrime in network culture. Analysis of numerous studies and works done in this field is crucial.

CONCEPTUAL FRAMEWORK

The dissemination of information, images, and videos is greatly aided by this online social networking. Internet usage has increased significantly in the past ten years; most young individuals now use it everyday, if not more frequently (Lenhart & Madden, 2007; Lenhart, Madden, & Hitlin, 2005; Sun et al., 2005). Generation Y, often known as the Millennial generation, or today's college students, are exposed to a variety of technologies in many areas of their lives (Browning, Gerlich, & Westermann, 2011). On a daily basis, they actively participate in social networking, text messaging, blogging, content sharing, online learning, and many other activities using desktop computers, laptops, E-readers, tablets, and cell phones (Cassidy, Griffin, Manolovitz, Shen, & Turney, 2011). Online social networks (OSNs) are now a common form of communication across all Internet user generations, but especially among students. Thus, to engage with present and potential students and to disseminate educational material, academic institutions and professors are increasingly turning to social networking platforms like Facebook and LinkedIn. (2012) Paul, Baker, and Cochran Additionally, a lot of studies have stated that the Internet's allure can encourage excessive use. This tendency has been labelled as Internet addiction in previous study (Griffiths, 2000; Soule et al., 2003; Widyanto and Griffiths, 2006). However, Young (1998) stated that while highly engaging programmes like online chatting can be addictive, the Internet itself is not addictive. Additionally, Balakrishnan and Shamim (2013) published a piece titled Malaysian Facebookers: Motives and Addictive Behaviors Unraveled that discussed how the internet has

evolved into a sophisticated platform for compulsive sexual behaviour, sex trafficking, and sex crimes as well as a highly effective and lucrative way to distribute sexually explicit material (Galbreath and Berlin, 2002).

Almost every element of contemporary life has been impacted by the digital era's progress. The internet becomes a necessary tool for people and has a big impact on our social, political, economic, and even emotional lives every day. People use the internet for a variety of purposes including communication, business, shopping, online bill payment, entertainment, and more at work, school, home, and in public spaces. Smartphones, laptops, tablets, computers, and smart televisions can all access the internet. Although the internet has significantly improved our daily lives, excessive internet use can cause addiction, which has a detrimental effect on our quality of life. Internet addiction is defined as the inability to control one's want to use the internet, which finally results in challenges in one's life on the social, psychological, educational, and/or professional fronts (Chov and Hsiao, 2000; Spada, 2014). According to a study done in Malaysia by Dr. Norharlina Bahar, a child and adolescent psychiatrist, men under 24 have the greatest levels of internet addiction (The Syar 2016). Students, especially undergraduates, are thought to be more prone to internet addiction while they are between the ages of 19 and 24. (Lee 2010; That Cher & Goolam 2005). The majority of those who use the internet excessively engage in social media and online gaming.

Anxiety, despair, health issues, playing, weariness, unemployment, lower productivity at work, and social isolation were some of the adverse consequences of the excessiveness. The internet addiction may also contribute to melancholy, boredom, low self-esteem, and attention deficit hyperactivity disorder (Norharlina 2016). College students today rely heavily on the internet for a variety of activities, including informational searches, social networking, entertainment, online shopping, and online gaming. Online education is being improved by colleges all around the world using the internet. Students who use the internet sensibly and for the correct purposes, such as researching, learning, developing their soft skills, exchanging knowledge and experience with overseas students, and other activities, benefit. While the internet offers numerous benefits and increases productivity, if kids develop an addiction to it, it could be hazardous to their academic performance. Low academic performance and mental instability may result from it (Oskenby et al. 2015). (Yeap et al 2016).

The larger body of literature on sex offender typologies in general informs the research on typologies of offenders who sexually entice adolescents online. For instance, Lanning (2010) described a continuum of sex offenders, contrasting "preferential" offenders with "situational" offenders who are more indiscriminate toward their victims (specifically fantasising and seeking out specific types of victims such as children). Elliott and Beech (2009) and Krone (2004) concentrated on Internet sexual offenders for whom pornography is a part of the offence. Again mentioning the relevance of pornography for some, Alexy, Burgess, and Baker (2005) concentrated primarily on Internet sexual offenders while also expanding the focus to include offenders who do not use pornography in their offence. According to a 2008 study by Wolak, Finkelhor, Mitchell, and Ybarra, adult men who approach youngsters in online chat rooms for sexual contact are frequently not hiding their age or sexual intentions. A meta-analysis was carried out by Babchishin, Hanson, and Hermann (2011) to determine whether online offenders were an unique group of criminals or simply regular sex offenders who had adopted a new form of crime commission.

Internet addiction has been brought on by the internet's sharp rise in popularity in recent years. The degree of addiction caused by internet use has a negative effect on students' lives. For internet users, it is crucial to genuinely grow and emotionally mature in order to control and manage their own emotions and consistently deal under any conditions. The Internet offers recommendations for the improvement of children and young people's physical, psychological, social, and behavioural (Finkelhor, Mitchell, and Wolak, 2000; Finkelhor, Mitchell, and Wolak, 2003; Greenfield, 2004; Katz and Rice, 2002; Kraut et al., 1998; Subrahmanyam et al., 2001; Thornburgh and Lin, 2002 and Yan, 2006). It has frequently been observed that adolescent internet users become truly involved in this virtual world and act in that impassioned stream, which occasionally causes an emotional hurt that leaves a long-lasting impact. The emotional maturity, emotional instability, emotional regression, social maladjustment, and personality disintegration levels among web-addicted students are rising.

Emotions play a crucial role in everyone's existence, just as important as life itself. The term "emotions" refers to feelings, along with their specific thinking, biological and psychological states, and a variety of acting propensities (Goleman, 1995). Emotional maturity is an internal growth that balances the mind and intellect with the external reality. Mature emotional behaviour at any level is that which represents the outcome of emotional development. A person has integrity and behaves with it if they are truly emotionally mature. A person's attitudes and behaviours are emotionally mature if they have integrity. A decent response to a circumstance by distancing oneself from the pulls and pushes of both positive and negative emotions is what is meant by

emotional maturity. An emotionally mature individual is one whose emotional life is well under control, according to Chamberlain (1960). Everyone who wants to have the appropriate understanding needs it. A correct knowledge helps someone mature. A person who has emotional maturity sees things clearly and without distortion. It involves comprehending the facts. An emotionally mature individual can always find a way out of any situation. A child that is emotionally stable can adjust to himself, family members, and peers in a productive way (Smithson 1974). Gurmit Singh (2014) investigated how adolescents' mental health related to their emotional development and parent-child relationships. The study's findings indicated a favourable and significant relationship between mental health and emotional development as well as between mental health and parent-child relationships.

Emotional maturity, in the words of Walter D. Smithson (1974), is the process through which the personality constantly aspires to a higher feeling of emotional health, both internally and interpersonally. When explaining the traits of an emotionally mature individual, Kaplan and Baron note that one of them is the ability to tolerate delays in demand fulfilment. He can take a little bit of frustration, but not much. He believes in long-term planning and is able to defer or modify his expectations in response to circumstances. A youngster that is emotionally mature has the ability to successfully adjust to oneself, family members, and classmates in the classroom, community, and culture. However, being mature also implies being able to completely embrace such attitudes and behaviours, not only having the capacity to do so. While effectiveness is a reflection of emotional intelligence, emotional maturity predicts the capacity to control and monitor one's own emotions as well as the capacity to judge others' emotional states and shape their perspectives. The ability to handle problems appropriately and consciously, and to maintain emotional stability and control even under the most trying circumstances, is the most notable indicator of emotional maturity. People who are emotionally mature typically feel more at ease around themselves and find that activities that involve other people are more pleasurable and orderly than activities that do not involve other people. According to Ellison (2013), internet usage in our society and in colleges has increased recently. The younger generation, who has grown up with these modern technology, is better able to use them than the older generation. The use of the internet by young people is very popular. Internet use and other digital technologies are employed for a variety of reasons, but communication remains the main one. Social networking sites and web 2.0 tools have changed the way people interact with one another and with the world at large. Internet use has both positive and negative impacts, just like everything else. On occasion, it can be used to relieve tension, but excessive internet use can lead to a number of health problems. According to research by Newness et al. (2012), those who exhibit high levels of emotional intelligence and honesty/integrity reveal less improper social network information. Honest and emotionally astute people appear to be aware of the drawbacks of divulging unsuitable social network stuff.

CONCLUSION

It may be concluded that young internet users lack emotional maturity. The findings of this study can encourage parents and instructors to limit their students' online usage. Young people and youngsters are currently dealing with a lot of challenges in life. Numerous psycho-somatic issues, such as worry, stress, irritation, and emotional problems in daily life, are being caused by these difficulties. Thus, spiritual science has developed in addition to the perceived need for Raj Yoga and meditation among college-bound youngsters. Yoga and meditation have enduring effects on character development, optimistic thinking, and healthy physical and mental growth. Finding long-lasting methods to control emotions became important because, without them, a distorted mind, driven by a chaotic thought pattern, would only result in volatile words and acts, causing great disruption to oneself, one's family, and the entire community. The term "emotional intelligence" refers to a broad range of personal aptitudes and temperaments, which are typically referred to as "soft skills," "life skills," or "intra-personal and interpersonal skills," as opposed to the more traditional definition of "general intelligence," which also includes "general technical and professional aptitudes.

REFERENCES

1. Alexy, E. M., Burgess, A.W., & Baker, T. (2005). Internet offenders traders, travelers and combination trader-travelers. *Journal of Interpersonal Violence*, 20(7), 804–12.
2. Babchishin, K. M., Hanson, R. K., & Herrmann, C. A. (2010). The characteristics of online sex offenders: A metaanalysis. *Sexual Abuse: A Journal of Research and Treatment*, 23, 92123. doi: 10.1177/1079063210370708
3. Babchishin, K., Hanson, R., & Hermann, C. (2011). The characteristics of online sex offenders: A meta-analysis. *Sexual Abuse: A Journal of Research and Treatment*, 23(1), 92–123

4. Balakrishnan, V., & Raj, R. (2012). Exploring the relationship between urbanized Malaysian youth and their mobile phones: A quantitative approach. *Telematics And Informatics*, 29(3), 263-272.
5. Balakrishnan, V. and Shamim, A. (2013) "Malaysian Facebookers: Motives and addictive behaviours unraveled," *Computers in Human Behavior*, (29:4), pp.1342-1349.
6. Browning, L., Gerlich, R., & Westermann, L. (2011). The new HD classroom: A "Hyper Diverse" approach to engaging with students. *Journal Of Instructional Pedagogies*,, 1-10. Retrieved from <http://www.aabri.com/manuscripts/10701.pdf>
7. Browning, L., Gerlich, R., & Westermann, L. (2011). The new HD classroom: A "Hyper Diverse" approach to engaging with students. *Journal Of Instructional Pedagogies*,, 1-10. Retrieved from <http://www.aabri.com/manuscripts/10701.pdf> ,
8. Cassidy, E., Britsch, J., Griffin, G., Manolovitz, T., Shen, L., & Turney, L. (2011). Higher education and emerging technologies: Student usage, preferences, and lessons for library services. *Reference & User Services Quarterly*, 50(4), 380-391.
9. Chamberlain, V. C. (1960). *Adolescence to Maturity*. London: The Badley Head
10. Chou, C, & H Siao, M., (2000), Internet addiction, usage, gratifications, and pleasure experience; The Taiwan College student's case. *Computer, Edu.*35, 65-80.
11. Elliott, I., & Beech, A. (2009). Understanding online child pornography use: Applying sexual offense theory to internet offenders. *Aggression and Violent Behavior*, 14, 180–193.
12. Eysenck, H.J. and Nais, D.K. (1978). *Sex, violence and the media*. New York: Saint Martin's Press.
13. Finkelhor, D., Mitchell, J. M., & Wolak, J. (2003). Escaping or connecting? Characteristics of youth who form close online relationships. *Journal of Adolescence*, 26, 105–119
14. Finkelhor, D., Mitchell, K. J., & Wolak, J. (2000). *Online Victimization: A report on the nation's youth*. (NCMEC 6-00-020). Alexandria, VA: National Center for Missing & Exploited Children.
15. Galbreath, N., & Berlin, F. (2002). Paraphilias and the Internet. In A. Cooper (Ed.), *Sex and the Internet: A guidebook for clinicians* (pp. 187-205). New York: Brunner Routledge.
16. Goleman, D. (1995). *Emotional Intelligence*. New York: Bantam Books
17. Greenfield, P. (2004). Developmental considerations for determining appropriate internet use guidelines for children and adolescents. *Journal of Applied Developmental Psychology*, 25(6), 751-762.
18. Griffiths, M. (2010). Internet abuse and internet addiction in the workplace. *The Journal Of Workplace Learning*, 22(7), 463-472.
19. Katz, J. E., & Rice, R. E. (2002). *Social consequences of Internet use: Access, involvement and interaction*. Cambridge, MA: MIT Press.
20. Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukophadhyay, T., & Scherlis, W. (1998). Internet paradox: A social technology that reduces social involvement and psychological well-being? *American Psychologist*, 53 (9), 1017–1031
21. Krone, T. (2004). A typology of online child pornography offending. *Trends & Issues in Crime and Criminal Justice*, 279, 1–6.
22. Lanning, K. (2010). *Child molesters: A behavioral analysis for professionals investigating the sexual exploitation of children*. Alexandria, VA: National Center for Missing & Exploited Children.
23. Lee, S. (2010), Analysis of college student's online lifestyle and their psychological profiles in South Korea, *Cyber Psychology, Behaviour & Social Networking*, 13(6), 701-704.
24. Lenhart, A., Madden, M., & Hitlin, P. (2005). *Teens and technology: Youth are leading the transition to a fully wired and mobile nation*. Pew Internet And American Life Project.
25. Lenhart, A., Purcell, K., Smith, A., & Zickuhr, K. (2010). *Social media & mobile internet use among teens and young adults*. Pew Internet & American Life Project, 1-37.

26. Newness, K., Steinert, J., & Viswesvaran, C. (2012). Effects of Personality on Social Network Disclosure: Do Emotionally Intelligent Individuals Post Inappropriate Content? *Psychological Topics* 21 (2012), 3, 473-486
27. Noharlina, B. (2016). Panel discussion ; Challenges for prevention and control of health problems associated with excessive use of internet and related products in children and adolescents. Paper presented at seminar on public health issues of excessive use Internet, computers, smartphones and similar electronic devices. Regal Kowloon Hotel.
28. OS Kenbay, A. Elmira, K., Aliya, T., Maiva, K. Saya, B. & Salima N (2015). Addictive behavior among adolescents. *Procedia-social and behavioural sciences*. 171, 406-411.
29. Paul, J., Baker, H., & Cochran, J. (2012). Effect of online social networking on student academic performance. *Elsevier*, 1, 2118-2119:2123. Retrieved from <http://www.elsevier.com/locate/comphumb>
30. Singh, Gurmit (2014). "Mental Health Of Adolescents In Relation To Emotional Maturity And Parent Child Relationship," Working papers 2014-09-02, Voice of Research.
31. Smitson, W. S. (1974). The meaning of emotional maturity, *Mental Health*, 58, 9-11.
32. Spada M (2014). An overview of problematic Internet use. *Addictive Behaviors* 39, 1, 3-6
33. Subrahmanyam, K., Kraut, R., Greenfield, P. M., & Gross, E. F. (2001). New forms of electronic media: The impact of interactive games and the Internet on cognition, socialization and behavior. In D. L. Singer, & J. L. Singer (Eds.), *Handbook of Children and the Media* (pp. 73-99). Thousand Oaks, CA: Sage
34. Sun, P.-C., Tsai, R. J., Finger, G., Chen, Y.-Y., & Yeh, D. (2008). What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. *Computers & Education*, 50(4), 1183-1202.
35. Thatcher, a., & Goolam, S. (2005). Defining the South African Internet addict: Prevalence and biographical profiling of problematic internet users in South Africa. *South Africal Journal of Psychology*, 35(4), 766-792.
36. Thornburgh, D., & Lin, H. S. (Eds.). (2002). *Youth, pornography and the Internet*. Washington, DC: National Academic Press
37. Widyanto, L., & Griffiths, M. (2006). "Internet addiction": A critical review. *International Journal of Mental Health and Addiction*, 4, 31-51.
38. Wolak, J., Finkelhor, D., Mitchell, K. J., & Ybarra, M. L. (2008). Online "predators" and their victims: Myths, realities, and implications for prevention and treatment. *American Psychologist*, 63(2), 111-28.
39. Wolak, J., Mitchell, K., & Finkelhor, D. (2006). *Online victimization of youth: Five years later*. Alexandria, VA: National Center for Missing and Exploited Children.
40. Yan, Z. (2006). What influences children's and adolescents' understanding of the complexity of the Internet? *Developmental Psychology*, 42(3), 1-11.
41. Yeap, J.A., L. Ramayah, T. Halim, H.A. Ahmad, N.H. & Kurnia S. (2016). Exploring the impact of internet addiction on academic engagement; A Preliminary study on undergraduates. *Indian Journal of Management Science*, 6(1), 1-9.
42. Young, & Kimberly, S. (1998). Internet addiction: The emergence of a new clinical disorder. *Cyber Psychology & Behavior Journal*, 1(3), 237-244.

Psychosocial Development of Primary School Students: A Study of Parishadiya Schools of Lucknow District in Uttar Pradesh

Niharika Srivastva, Sita Devi and Anil Kumar Dixit
Maharishi University of Information Technology, Lucknow, U.P, India

ABSTRACT

Education is a lifelong development process. Education has an important place in the natural and progressive development of the child's innate powers. In today's era, in the field of education, the child is not only considered as a passive resource. It is the duty of the teacher in the teaching process to make the child active and ensure his physical and mental powers, abilities, interests and tendencies and provide education according to his abilities. The nature of early education was merely to provide information for the development of the psychological attitude of children. As a result of this trend, an attempt was made to make education child-centred and to solve educational problems; educationists emphasized the use of psychological principles in the field of education. The present study has been presented in the context of psycho-social development of students in parishadiya primary schools of selected development blocks of Lucknow district of Uttar Pradesh.

INTRODUCTION

Education is one of the basic needs of man that is why the government has made education compulsory and free for children up to 6-14 years. If we want to see the society as developed then we have to realize the imagination of educated society. Keeping this view in mind, it is very important to have universalization of education. We all Indians have the right to get education. There is no discrimination of any kind in this that is why it has been said that education is for all. Education is an important medium of social change and development, and it gives a decisive direction to the progress of any individual, society or country. The desired speed and direction can be given to the development of the country only by the promotion of quality education. Therefore, it is necessary that the education system should be such that it can meet the diverse needs of the ever-changing society. Everyone's cooperation is needed in raising and upgrading different levels of education, in which the role of parents, relatives, society and teachers is most important.

The credit of bringing revolution in the field of education goes to psychology. The nature of early education was merely to provide information for the development of the psychological attitude of children. As a result of this trend, an attempt was made to make education child-centred and to solve educational problems; educationists emphasized the use of psychological principles in the field of education. Today education is not understood to mean merely providing information to the child. The teacher should have complete knowledge of the psychology of the student; otherwise he will not get success in whatever he tries to teach. Keeping this view in mind, the educationist John Adams said that "there are two actions in the activities of teaching, one of the person and the other of the object." . The development of the child takes place according to his innate characteristics, tendencies and interests. Therefore, only after getting the knowledge of these things, efforts can be made for its all round development. For this, the teacher should have a detailed knowledge of the basic bases, nature, mental level, interests, intellectual abilities, personality and needs of the learner etc. By studying the close relationship between education and psychology, it has become clear that the main relation of education-psychology is with teaching-learning and its related situation and result. All parts of psychology affect the parts of education. In fact, the study of education-psychology, created by the mutual integration of studies, research and work of education and psychology, the solution of many problems related to education, is based on the study of psychology. One of the main objectives of education is the social development of the individual. That is why education is said to be a deliberate and purposeful process, through which changes and refinements take place in the behavior of the person. Therefore, we can say that socialization or social development of the child can be done only through education. For this, the parents and other members at home and the teacher in the school help in the development of social and mental feelings of the child through his studies and other extra-curricular activities of the school.

Realizing these basic objectives of primary education, our Constitution makers, made primary education compulsory and free to all citizens in Directive Principles of State Policy, in Article-45 of the Constitution Under this, the states were directed to make the education of children in the age group of 6 to 14 compulsory and free. In 2000 The 86th Constitutional Amendment passed by our Parliament, it has been declared a fundamental right by the government to get free and compulsory primary education from the age of 6 to 14 years. In order to enhance the quality of primary and upper primary schools, Sarva Shiksha Abhiyan was

launched as a mission to achieve universal primary education. This mission was initially undertaken in collaboration with the State Governments to provide proper education to children in the age group of 6-14 years by 2010.

The government has emphasized the importance of parents/guardians making important decisions in the educational process. Therefore, it is essential that parents/guardians are provided with a clear delineation of the roles and functions of child education. The attitude of parents with reference to the importance of education in relation to students, educational motivation and achievements is a complex matter. The positive attitude of parents towards the child's education is important in determining the child's school attendance and the child's academic achievement. The favorable attitude towards schooling and education enhances the participation of parents in the present and future education of the children. Sensitive attitude towards the education of their children is adversely affected by low socio-economic status and since the education of tribal disadvantaged children is affected by many factors in school, society and family especially for tribal children. For school participation, it is important that all three factors must be positive or that at least one or two factors must be strongly favorable. In developed and developing countries, children from families with socio-economic resources are enrolled in school more often. For wealthy families, the direct costs associated with education, such as fees, books and uniforms are less likely to be a deterrent. The opportunity cost of children not being able to earn additional income at home, on the family farm or through child labor, is also less important for them. Parental attitude is a measure or index of parental involvement. A child, who is brought up with affection and care in the least restrictive environment, will be able to cope better with the visible world. Hence, the family shapes the social integration of the child as compared to a formal school.

REVIEW OF LITERATURE

Before starting any research work, there is a need to review the literature related to the research problem. In order to confirm this information well, in practical knowledge, in the initial stage of each research model, its theoretical and previous research work has to be reviewed in the literature. On the basis of the results obtained in the study of Mehndi, S. (1979), it was concluded that proper facilities of library and laboratory were found in the schools run by private institutions. Teaching learning materials were used by the teachers at the time of teaching in the school, whereas most of the primary schools run by the local governments lacked these facilities and the educational achievement of the students was below the academic achievement of the students of the schools run by private institutions. It was also found that the educational achievement of the students of the schools run by private institutions was higher than the schools run by the Municipal Corporation studied the status and reason of enrollment, absence and drop outs from schools. After this study, it was concluded that enrollment was higher in rural areas but less than enrollment in urban areas. The school facilities and the number of teachers had no relation with the status of enrollment. The condition of primary education is commendable. There was a significant increase in the number of primary schools and students in Gujarat in the last three decades after independence. The study was carried out with the aim of knowing the ability in Mathematics and Gujarati and concluded that the mean difference of all the variables except academic motivation was found to be statistically inconsistent among the students of different age groups. To study the quality of education facilities, the main objective of this research was to evaluate the level of facilities provided in primary school and the local environment and to measure the level of achievement and learner (primary classes) of school education outcomes. In the conclusion obtained from this research study, it was concluded that the infrastructure available by the school and the achievement of the learners affected the quality level of the school.

Pushpa, Rashmi (1997) studied the academic achievement of students in Hindi language and mathematics with reference to the educational qualifications of parents of class V students of primary level, short research in M.Ed course in Lucknow University. The educational achievement of the students was studied with reference to the educational qualifications of their parents. For this study, the researcher took a sample of 200 primary level students of Lucknow city, in which both students studied. Bora, Sunita Rani (2000) selected 4-4 primary schools of Lucknow city and rural area for research and selected the students of these schools from class 1 to class 3 for study. Based on the results of the study, it was concluded that teaching-learning material attracts children very much and develops listening and speaking ability in children. Shikha (2002) conducted a comparative study of academic achievement and educational resources of primary students of Lucknow. For his study, the researcher selected class five students of government and private primary schools of Lucknow city for study and used observation method to get the results and conclusions. Katiyar, Preeti (2005) in a study of Lucknow University highlighted that "studying Hindi and English language reading skills, writing skills and mathematical skills in Mathematics subject keeping in mind the primary level students". In his findings, the

researcher found that most of the students of government primary schools have lower reading skills in Hindi language and lower in English than Hindi. Vocabulary is also low in these students. The students of these schools have low level of writing skills in both the languages. Similarly the skill is of general level and knowledge of concepts of mathematics is low.

RESEARCH METHODOLOGY

Parishadiya schools of Lucknow district have been selected for the survey work of the present research. In the study, 250 students were selected by random method. Present research research is based on primary data, but the secondary data has also been taken for insight stimulation on the topic of research. From the district, five development blocks namely Mal, Malihabad, Chinhath, Bakshi ka Talab and Sarojini Nagar were selected. In each selected development block, 2 primary schools were targeted for selection. In each selected school, 25 students are targeted to be selected in the study sample. The students have been selected for the field survey by random method. Two questionnaires have been constructed to collect the data in the presented research. The information collected from the field has been processed and tabulated with the help of SPSS. The data has been interpreted and analysed critically.

PSYCHO-SOCIAL DEVELOPMENT OF STUDENTS

The psycho-social development of students is influenced by family and school environment, social and cultural values, educational quality, inclusive educational infrastructure and behavior of teachers etc. Relatively backward and lower social class students are relatively more enrolled in council primary schools. Therefore, social and cultural environment, school environment, facilities related to school, teaching etc. are important. Similarly, the attitude of teachers towards education and social values influences the psycho-social development and inclusive education of the students. The psycho-social development of students and attitude of teachers towards education and social values have been analyzed.

The mental intelligence level of about three-fourth students was found to be good and excellent, whereas in the Bakshi ka Talab block, the mental intelligence level of about 62 percent of the students was found to be satisfactory and somewhat satisfactory. The value of chi square was found to be 93.78 which shows the importance of mental intelligence level of the students. More than half of the students were found to have good mental intelligence level in maths subject. This ratio was found relatively higher in Sarojini Nagar and Malihabad development block. The mental intelligence level of about two thirds of the students of Bakshi Ka Talab development Block was recorded as satisfactory in the subject of Mathematics. The value of chi square was recorded as 66.51, which shows the importance of the subject. In Hindi subject, the mental intelligence level of about 58 percent students was found to be good, while the mental intelligence level of about 40 percent students in Hindi subject was satisfactory. The value of chi square was found to be 68.68, which shows the importance of the subject. More than half of the students had good mental intelligence level in English subject while about 42 percent of the students were found to have satisfactory mental intelligence level in English subject. The chi square value was recorded as 88, which shows the importance of the subject. The mental intelligence level of about 39 percent of the students was found to be good in the general knowledge subject while the mental intelligence level of about 58 percent of the students in the general knowledge subject was found to be satisfactory. The value of the class was recorded as 57.67, which shows the importance of the subject. Most of the students were satisfied with regular attendance of teachers in school, behavior of teachers, method of teaching, teaching and management, discipline, hot, nutritious and cooked regular food whereas about half the students were found completely satisfied with the drinking water facility and school building in the schools. A large proportion of the students were found dissatisfied with the cleanliness, medical check-up, furniture and seating arrangement.

CONCLUSION

It is clear from the above analysis that the mental intelligence level of the students is relatively good and excellent, whereas the mental intelligence level of the students was found to be comparatively satisfactory and good in Mathematics, Hindi, English and General Knowledge. The condition of mid-day meal in schools was relatively better and most of the students got free textbooks, school uniforms and bags. A large number of students were also found satisfied and partially satisfied with respect to the facilities available in the school. They are provided moral education and physical education. Most of the students do their homework on time, they help the parents with household chores, however students get less opportunities to participate in non-academic activities.

REFERENCES

1. Bora, Sunita Rani (2000): "Identifying Teaching and Learning Materials in Developing Reading Habits in Primary School Children", Thesis, Lucknow University, Lucknow.
2. Gupta, S.P. (1980): "Status and Reasons for Enrollment, Dropouts of Absenteeism in Primary Schools" Dissertation, University of Meerut, Meerut.
3. Kapadia, K.P. (1984): "Study of the Development of Elementary Education in the State of Gujarat after Independence (From 1947 To 1980)" Dissertation, Gujarat University, Ahmedabad.
4. Katiyar, Preeti (2005): "Study of Hindi and English Language Reading Skills, Writing Skills and Mathematical Skills in Mathematics Subject to the Primary Level Students", Lucknow University, Lucknow.
5. Mehndi, S. (1979): "Study of Educational and Teaching Facilities Available in the Primary Schools Run by the Municipal Corporation of Baroda and the Primary Schools Run By Private Agencies" in Baroda city, University of Baroda, Baroda.
6. Pushpa, Rashmi (1997): "Study of the Educational Achievement of Primary Level Students with Reference to the Educational Qualifications of their Parents", Lucknow University, Lucknow
7. Shikha (2002): "Educational Achievement of Students of Primary Schools of Lucknow", Small Dissertation, M.Ed. Course, Lucknow University, Lucknow.

Scaffolded Vee Diagram as an Instructional Strategy for Enhancing Scientific Inquiry among Learners

Ismail Thamarasseri and Shejeena K. A

School of Pedagogical Sciences, Mahatma Gandhi University, Kottayam, Kerala, India- 686560

ABSTRACT

Education is the most empowering force in the world. It creates knowledge, builds confidence, and breaks down barriers to opportunity. Science education cultivates students' curiosity about the world and enhances scientific thinking. Through the inquiry process, students will recognise the nature of science and develop scientific knowledge and science process skills to help them evaluate the impacts of scientific and technological development. Most of the science learners engage in a process of knowledge integration where they make sense of diverse information including their own experiences, classroom instruction, and related ideas. Inquiry-based approaches to science teaching enable students to independently elaborate on scientific topics and acquire scientific knowledge through self-directed learning. When the learners confronted with a new situation, they able to self-regulate and control their own learning there by metacognition occurs. In order to metacognition occur, one must have strategies for guiding their understanding of a given topic. An instructional strategy that can aid students in developing metacognitive awareness is the Vee diagram (Gowin, 1981; Novak & Gowin), 1984. In the present study the researcher evaluates the effectiveness of scaffolded vee diagram as an instructional strategy for enhancing scientific inquiry among learners.

Keywords: Scaffolded vee diagram, Scientific Inquiry, Scaffolding, Meta cognitive tool

INTRODUCTION

Teaching is a series of events through which a teacher attempts to bring desired behavioural changes in students. Through teaching, the manner of thinking, feeling and acting of students is changed. Teaching widens the adaptability of students to complex environments. It is true that teaching is a process by which teacher and students create a shared environment including set of values and beliefs, which in turn colour their view of reality. In modern world science is regarded as a way of life or philosophy of living because the whole of the universe is being dominated by the application of science. The Kothari Commission (1964-1966) emphasis "science education at the secondary stage will have to be strengthened and science should be taught as a discipline of the mind and a preparation of higher education." The understanding of the stages of intellectual development suggested by Piaget in 1982 can help us to design the science curriculum and teaching accordingly. The developmental stage, age, range and the characteristics of formal operation are summarized by Piaget. Science has now established to be one of the compulsory subjects in the school curriculum because of the various types of values. They are (1) Intellectual values (2) Utilitarian values (3) Vocational values (4) Cultural values (5) Moral values (6) Aesthetic values (7) Training in the scientific method (8) Inclusion of scientific attitudes and (9) Psychological values.

Science teaching is especially relevant in the Indian context as our scientific and technological destiny is now being shaped in the millions of our science classroom. In a developing country like India, the attempt is to achieve better students' development through science education. The development of science has enormously influenced the practical life of man and changed his mode of living and thinking. The aims and objective of teaching science have been changing continuously in the last few decades. The explosion of knowledge and the consequent changes in curriculum and methods of teaching necessitated setting up of new goals for science teaching.

TEACHING STRATEGIES

Singh and associates reviewed studies on teaching strategies. They have observed that majority of studies in this area are the product process type, that is simply measuring the outcome of an instructional process. It is difficult to answer the question which one of the strategies or methods of teaching is the most effective? In the past, researchers have used the observational approach, the project method, environmental approach, a combination of methods, use of science skills as well as toys, motion pictures etc. Ghosh in 1989 showed that "scientific aptitude was related to scientific attitude, there were no such significance in respect of sex, socio-economic status and place of work among the various groups". Kumar in 1991 showed that "the development of scientific attitudes depends upon their perception of science teaching and nature of learning experiences. The National Policy on Education in 1968 stresses that "science education must be strengthened so as to develop in the child some well-defined abilities and values like spirit of inquiry, creativity, objectivity, courage to question and

aesthetic sensitivity.” Due to the lack of understanding of the subject, our young future scientists who reach the secondary classes have ensure the content but not ‘digested’ it, consequently the passive learning continues.

Assessment is used to evaluate the strengths and needs of learners, guide instruction, and measure progress and achievement. When using laboratory activities in extension programming or in formal courses, developing an appropriate assessment can appear challenging. Myres in 2005 said that “laboratory settings are any location where the learner is able to interact with materials and or models to better observe and understand the topic at hand”. Using traditional forms of assessment such as quizzes and tests can make it much easier to quantify learners’ performance, but these approaches often do not adequately assess actual learner achievement. Donaldson and Odom in 2001 stated, “traditional laboratory assessments indicate students’ ability to follow lab instructions rather than showing that they have the thought processes that are necessary for them to question, design, conduct and analyze an experiment”. Concept maps, Vee maps and portfolios are alternate forms of assessment that can replace traditional quizzes and tests and can be used to more effectively assess student learning in a laboratory setting.

Vee Mapping

Vee mapping or Vee diagramming as an instructional tool, underpinned by Ausubel’s (1968) theory of meaningful learning. Novak and Gowin in 1984 defined “Vee map is an instructional strategy which helps students better understand the nature and purpose of laboratory activities and it also helps students to understand how new knowledge is attained in an experimental situation.” The Vee map strategy begins by focusing student’s attention on what they know before the inquiry. Students then generate research questions, design and conduct experiments and interpret the data. Through interpretation they arrive at new knowledge that must be integrated with their prior knowledge. Vee mapping is a visual means of representing concepts and their inter relationships.

Vee map has been used to guide students in their laboratory experience, to facilitate reflective thinking and learning, as they plan and conduct their own investigations. To learn meaningfully, individuals must choose tolerate new knowledge to relevant concepts and propositions they already know.

Psychological Foundations of Vee Maps

Vee diagram was developed by Bob Gowin as a way to aid in the understanding of meaningful relationships between events, processes, or objects. It is a tool that helps in seeing the interplay between what is known and what needs to be known or understand. The Vee diagram has three purposes: (1) Planning and carrying out a research project (2) analyzing a research article and (3) as a teaching tool. The V is a name derived from the shape of the diagram. A Vee diagram is a structured visual means of relating the methodological aspects of an activity to the underlying conceptual aspects. Gowin’s Vee showing epistemological elements which are involved in the construction or description of new knowledge. All elements interact with one another in the process or constructing new knowledge or value claims.

General Structure of Vee Map

A Vee diagram consists of a V-shape separating theoretical / conceptual (thinking) from the methodological (doing) elements of inquiry. Both sides actively interact with each other through the use of the focus question that directly relates to events an or objects.

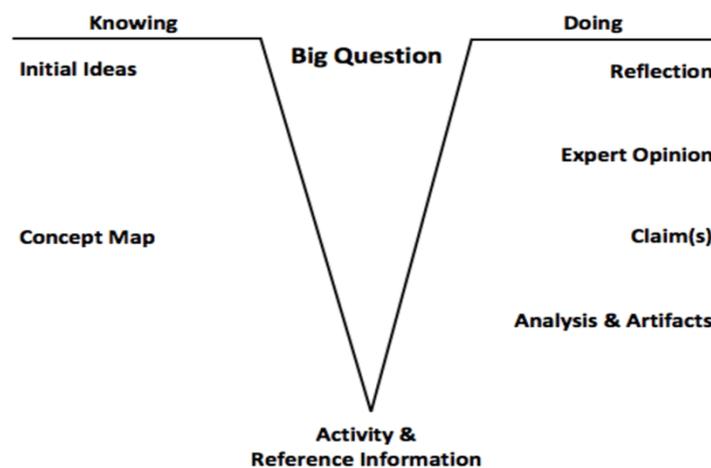


Figure 1. The Form and parts of the Vee Map, retrieved from [https://www.researchgate.net/figure/A-modified-form-of-Gowins-Vee-diagram_fig2_301808396]

The structure of the Vee diagram with its various labels and guiding questions provides a systematic guide for students to reason from the problem context (event/object) and given information (records) in identifying relevant principles, theorems, formal definitions and major rules (principles and concepts) which can guide the development of appropriate methods and procedures (transformations) to find an answer (knowledge claim) to the focus question. The arrow indicates that there is a continuous interplay between the two sides as students' reason through the various sections of the Vee.

Double Vee Diagram

Novak and Gowin in 1984 developed Vee heuristic, help students and instructors to clarify the nature and purpose of laboratory work in science. This was first introduced to college students as a useful tool for improving laboratory instruction. The modified double Vee diagram is an adapted organizational structure that serves as an overall guide to process of scientific inquiry, the extended Vee graph effectively scaffolds student learning.

Virtual Vee Map

Coffman and Riggs proved that Virtual Vee map is successful in promoting student learning in the areas of inquiry and data analysis using resources and data available on the internet. The virtual Vee map encompasses the concepts of rigor and relevant while establishing essential use of technology in the classroom. Virtual Vee maps allow for laboratory preparation and lessen the grading time while allowing students to construct laboratory reports via a computer-based template promotion of higher-level thinking skills no longer necessitate completion of lengthy lab reports, which take the instructor hours to grade. Virtual Vee maps supply the students with a template and lead them in the direction of the scientific method. So Virtual Vee map is an interactive tool that promotes higher-level thinking skills for the student, greater freedom for the instructor to interact with the students and less evaluation time for the instructor.

Steps in Developing Vee Maps

The general structure of Vee map includes six areas – focus question, word list, concept map, events, data and analysis and conclusions. The focus question is the center of the Vee map and guides the laboratory experience. A focus question must be clearly stated followed by the collection of data. Students are encouraged to work together to identify words. From the student's word lists, a teacher can quickly assess their level of understanding of the topic. Below the word list students construct a concept map using the mentioned terms. As students proceed with their laboratory experience, and as they began to understand the concept addressed through the laboratory. At the bottom of the Vee map is the events area. In this area students write the procedure or draw the laboratory set up that will be used to answer the focus question. In the data and analysis area, students record their collected data and appropriate analysis. In the upper right side of the Vee map, students report their conclusions based on the laboratory experience.

Why Vee Map Work

First, Vee map provide a format for students to construct their knowledge about a science concept. Students can see how scientific knowledge is developed through the process of reflecting on what they know and the investigation they undertake. Constructivist learning theory (Driver et al, 1997; Fosnot, 1996) and the National Science Education standards states that students should learn about the nature of science. These documents reinforce the need for active learning environments in which students are cognitively engaged with science ideas and the manner in which science develops. Second Vee maps can reveal the process by which a student construct knowledge. Teachers can identify the prior knowledge of a student through the word list. The data and analysis area can show teachers how students support their claims or hypothesis, while the conclusion section demonstrates the level of students understanding. As a student progresses through each of these areas, the teacher can modify instruction and curriculum to meet each student's need. Traditional laboratory reports typically do not provide this much information. Third, Vee maps can be graphical formats that foster communication. As the Vee map is constructed, students working in groups take with one another to develop each area. They need to agree on selected words and events and decide how to analyze data. The teacher can then move among the groups and effectively assist each group in developing their knowledge. Here the investigator using Vee diagram as a scaffold.

Scaffolding

The concept of scaffolding is grounded in Vygotsky's Social Constructivist view of learning. Scaffolding is the giving support to students while they are engaging in the problem-solving activities. Jerome S Bruner and Lev S Vygotsky connect the term scaffolding. Scaffolding can support students to activate schema. Scaffolding is the instructional techniques used by the teachers to provide support to students as they learn and develop a new

concept or skill. Simons & Klein, 2007 states that “Scaffolding appears in different forms, including tools, strategies, guidelines, questions, prompts, and feedback.” Teachers provide scaffolding based on the learners need and abilities. Puntambekar and Hubscher in 2005 states that “scaffolding can help students to resolve complex problems provide a structure for organizing scientific arguments and explanations or further highlight the process of science”. Scaffolds are created by teachers to guide students and continue working through the parts of the diagram. The Vee diagram is most effective instructional tool for the evolution of knowledge. Students getting an opportunity to express their emotions, feelings and thoughts. They can frame their own research questions working with each other and with the teacher. Scaffolding in education allow students to experience student centered learning than teacher-centered learning. The supportive strategies gradually removed and the learners able to get the capacity for acquiring independent learning. This method helps promote the development and advancement of cognitive and psychomotor learning skills. Students gather information from all the resources develop claims, and evidence-based arguments against each other and also with the help of experts. Through Vee diagram is used by all these steps.

Scientific Inquiry

Inquiry means to ask for information or investigate something to find out more. Scientific inquiry using evidence from observations and investigations to create logical explanations and answer questions. Scientific inquiry is for people who want to be challenged and use creative and critical thinking to answer questions related to science. Teaching scientific inquiry means finding ways for engaging students in investigative activity and also teaching appropriate ways of thinking and doing. Reiser et al.2001 states that “addressing scientific problems through inquiry requires that students link a scientific purpose with scientific procedures that lead to a conclusion supported by reasoned argument. Below is a sample flow chart for Scientific Inquiry. It is oriented as a circle because Scientific Inquiry often occurs as a cycle, with one answer leading to a new question.

Scientific Inquiry refers to the diverse ways in which scientist study the natural world and propose explanations based on the evidence derived from their work. Scientific Inquiry includes the traditional science processes, but also refers to the combining of these processes with scientific knowledge, critical thinking and scientific reasoning to develop scientific knowledge. National Research Council (NRC) makes several suggestions for how laboratory activities can be changed to improve student’s skills and understanding of science: First, laboratory activities need to be more inquiry-based so students can develop more practical skills and an understanding of the complexity associated with the practical work. Second, students need opportunities to read, write, and engage in discussions as they work. Below is a sample flow chart for scientific inquiry.

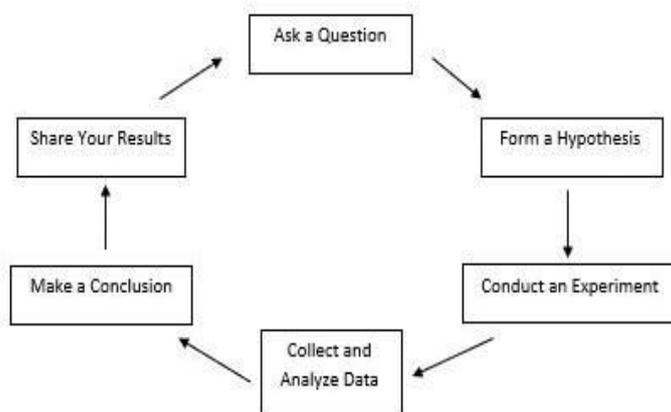


Figure 2. Scientific Inquiry Flow Chart

Retrieved from [<https://study.com/academy/lesson/scientific-inquiry-lesson-for-kids-process-definition.html>]

The seven steps of Scientific Inquiry are;

Step 1 – Question- The thing that you want to know or the question you want to answer.

Step 2 – Research- Conduct research

Step 3 – Hypothesis

Step 4 – Experiment, test the hypothesis

Step 5 – Observations, data you collect during the experiment.

Step 6 – Result / Conclusion

Features of Scientific Inquiry

Scientific Inquiry has two primary functions. First it provides a brief description about how Scientific Inquiry conducted in practice. Secondly the successful completion of scientific inquiry at the end of the process. The teachers encouraged students to engage in self-explanation by asking them questions about their inquiries and by asking peers to respond to the answers. Scientific Inquiry is the combination of traditional process with scientific knowledge, critical thinking and scientific reasoning. The essential features of Scientific Inquiry are

- Learner engages in scientifically oriented questions.
- Learner gives priority to evidence in responding to questions.
- Learner formulates explanations from evidence.
- Learner connects explanations to scientific knowledge.
- Learner communicates and justifies explanations.

Vee Map Evaluation

Vee map has been used to guide students in their laboratory experience. The Vee map guides students in their quest for new knowledge and helps them to interpret what they discover. Vee maps helps students how new knowledge is attained in an experimental situation. Through interpretation, they arrive at new knowledge that must be integrated with their prior knowledge. The details of the value points for the evaluation of Vee map is given in table

Vee Map	Value Points	Points Earned
Vee Map	10	
Title/ Name / Partner / Date	5	
Purpose	10	
Apparatus List	5	
Procedure	5	
Data	15	
Results	20	
Conclusions	15	
References	5	
Yellow Note book copies	10	
Total Points	100	

CONCLUSION

Vee diagramming has been found to be beneficial to the teaching learning process. Vee diagramming helped learners do better in tests requiring problem solving skill. Learners will be more confident of themselves as they go through the learning process. The Vee map is designed to increase higher level thinking skills for students, increase technology use, and develop independent reading strategies. The Scaffolded Vee diagram is a relevant tool for enhancing inquiry-based science learning.

REFERENCES

1. Bybee, R.W., 2000, Teaching science as inquiry. In Minstrell, J. and van Zee, E.H., Inquiring into inquiry learning and teaching in science (pp. 21-46). American Association for the Advancement of Science: Washington, DC
2. Crawford, B.A., 2000, Embracing the essence of inquiry: new roles for science teachers. Journal of Research in Science Teaching, 37(9), 916-937 [https://doi.org/10.1002/1098-2736\(200011\)37:9](https://doi.org/10.1002/1098-2736(200011)37:9)
3. Calals, G.J. (2009). The Vee Diagram As a Problem Solving Strategy: Content Area Reading / Writing Implications. National Forum Teacher Education Journal, 19 (3), 15-23 International Journal, 43(1), 93-103. Education Journal, 19 (3), 15-23.
4. Ebrahim, A. (2012). The Effect of Cooperative Learning Strategies on Elementary Students' Science Research Journal, 3(3), 184-189.
5. Hsu, Y.S., Lai, T.L. & Hsu, W.H. (2014). A Design Model of Distributed Scaffolding Inquiry Based Learning. Res Sci Educ. 1 (2), 23-30

6. Alvarez, M. C., & Risko, V. J. (2007). The Use of Vee Diagrams With Third Graders As A Metacognitive Tool For Learning Science Concepts. Teaching and Learning Presentations. Paper 5. Retrieved 4/25, 2011, from <http://e-research.tnstate.edu/pres/5>
7. Coffman, C., & Riggs, L. (2006). The virtual vee map: A template for Internet inquiry. *Journal of College Science Teaching*, 36(1), 32-39.
8. EPA (2011). Health Risks Retrieved 4/25, 2011, from <http://www.epa.gov/radon/healthrisks.html>
9. Kern, C., & Crippen, K. J. (2008). Mapping for Conceptual Change. *The Science Teacher*, 75(September), 32-38.
10. Knaggs, C. M., & Schneider, R. M. (2011). Thinking Like a Scientist: Using Vee-Maps to Understand Process and Concepts in Science. *Research in Science Education*.
11. Novak, J. D. (1990). Concept maps and Vee diagrams: two metacognitive tools to facilitate meaningful learning. *Instructional Science*, 19(1), 29-52.
12. NRC (2000). *Inquiry and the national science education standards: A guide for teaching and learning*. Washington, DC: National Academy Press.
13. Passmore, G. G. (1998). Using Vee Diagrams to facilitate meaningful learning and misconception remediation in radiologic technologies laboratory education. *Radiologic Science & Education*, 4(1), 11-28.
14. Roehrig, G., Luft, J. A., & Edwards, M. (2001). The versatile vee map. *The Science Teacher*, 33(1), 28-31.

Extent of Precautionary Safety Measures Adopted by the Residents of Vadodara City While Travelling for Leisure during Pandemic Covid-19

Vashima Veerkumar, Neerja Jaiswal and Kesha Solanki

Department of Family and Community Resource Management, Faculty of Family and Community Sciences,
The Maharaja Sayajirao University of Baroda, Vadodara, India

ABSTRACT

The present study aimed to identify the Precautionary Safety Measures adopted by the tourists while travelling for leisure during the Pandemic (COVID-19). The research design was descriptive. The data were collected via survey method with the aid of a questionnaire comprising of two sections. The first section included background information and the second section comprised of problems experienced by the respondents in context of 6 As of Tourism. The sample of the study were 140 tourists of Vadodara city who had travelled at least one day.

The findings of the research revealed that mean age of the respondents was 25.07 years. Majority of the respondents were Males. It was also revealed that more than two-third of the respondents adopted precautionary safety measures "To High Extent" while leisure travel during Pandemic COVID-19. The findings of the study will aid the tourism industry in understanding the needs of the travellers so as to enhance their experiences during Pandemic COVID-19.

Keywords: Precautionary Safety Measures, tourists, leisure travelling

INTRODUCTION

This pandemic had an impact on not only human health and life, but also on daily activity participation and travel perspective. Work from home, e-learning, and a reduction in public activities and events all contributed to a large reduction in travel demand (De Vos, 2020). However, there had been a noticeable increase in internet shopping, eliminating human interaction during and travel (Khaddar & Fatmi, 2020). COVID-19 has made an impact on both urban and rural life in India. The COVID-19 transmission was the first to be tamed, and a social distancing measure was implemented. In India, 1.3 billion people had been in lockdown since March 24th 2020 to 17th May 2020 (Ghosh et al., 2020).

To deal with Pandemic COVID-19, India imposed a 68-day four-phased lockdown that began on March 24th to 31st May 2020. India was hit with second wave, resulting to curfew restrictions. In the year 2021, India had imposed night curfew all over the country along with travel and movement restrictions.

Leisure travelling is a part of life for families across the globe. People travel for necessity or recreation. But with the onset of coronavirus, this part of normal life has become increasingly risky. Travel has been linked to stress reduction and can alleviate symptoms of anxiety and depression. Similar studies were found through review of literature focusing on related areas to identify the problems faced by the tourists while leisure travelling during Pandemic COVID-19 was less explored research area. Hence, the present study has been conceptualized.

Objective of the study

- To identify the extent of Precautionary Safety Measures adopted by the respondents while travelling for leisure during Pandemic COVID-19

Hypothesis of the study

- The extent of precautionary safety measures adopted by the respondents while travelling for leisure during Pandemic COVID-19 varies with their Personal Variables [Age (in year), Gender, Educational qualification, Employment status, Marital status, Monthly personal income (in ₹)], Family Variables [Type of family, Size of family] and Situational variables (Number of days for leisure travel, Preference regarding mode of conveyance and Preference regarding companion for leisure travel).

Delimitations of the study

- The present study was limited to the residents of Vadodara city who travelled for leisure for more than one day (24 Hours) to any National or International Destination.
- The present study was limited to the time period of August 2020 to December 2021.

REVIEW OF LITERATURE

The researches conducted outside of India focused on tourist's consumption and travel behaviour, global change on tourism industry due to Pandemic COVID-19. The studies also focused on impacts and implications for advancing and resetting tourism industry at the time of Pandemic COVID-19 and impact on the willingness to pay of user's public transport and shared mobility services. The perceptions of tourists on Pandemic COVID-19 risk, effects of COVID-19 on marketing practices, tourist's behaviour and consumption in the tourism industry, changes caused by COVID-19 Pandemic on tourist's behaviour were also explored by researchers. The studies conducted abroad also explored satisfaction with travelling during Pandemic COVID-19, factors affecting travel decision making and mode of travel preferences of tourists during Pandemic COVID-19.

The related researches conducted within India focused on effects and impact of the Pandemic COVID-19 on tourism industry. The psychological impacts on the tourists and travel mode choice behaviour of tourists during Pandemic COVID-19 were also explored. The related researches on Precautionary safety measures adopted by the tourists while travelling in India were not much explored. Therefore, the researcher was interested in carrying out an investigation on the topic undertaken.

METHODOLOGY

The research design for the present investigation was descriptive in nature. The samples of the study were the tourists who were resident of Vadodara City and travelled for leisure during Pandemic COVID-19 from August 2020 to December 2021 to any National or International destination selected through purposive sampling. The consent was taken from the respondents and was asked to co-operate in giving the needed information for the present study. The data collection tool for the present study was questionnaire prepared and data was unruffled online via google form. Apart from background information, questionnaire comprised of one section viz. This scale was developed by the researcher. "Precautionary Safety Measures adopted by the respondents while travelling for leisure during Pandemic COVID-19" It includes 26 statements regarding precautionary safety measures adopted by the tourists while travelling during pandemic COVID-19 period. It had a 3-point continuum for the responses "Always", "Sometimes", "Never" which was scored 3 through 1 respectively. This scale was developed by the researcher. The Cronbach Alpha reThe content validity of the scales was established by giving to the experts form Department of Family and Community Resource Management, The Maharaja Sayajirao University of Baroda, Vadodara. The corrections were done by the researcher as suggested by the experts in the tool. The data were gathered by the researcher in the month of November 2021 to December 2021

FINDINGS AND DISCUSSIONS

Background Information: The findings related to personal, family and travel related information are reported here.

Personal Information: It was found that Majority (87.14%) of the respondents belonged to the age group of 20 to 29 years. More than one - half (54.29%) of the respondents were Males and less than one - half (45.71%) of the respondents were Females. Less than two third (63.58%) respondents were Graduates. More than one-half (53.57%) of the total respondents were not employed. Majority (85%) of the respondents were Unmarried. More than one-half (53.57%) of the total respondents were not earning at the time of data collection. The data revealed that less than one-fourth of the respondents (23.57%) were earning less than equal to 25000 rupees. The mean of personal monthly income of the respondents was ₹15,725 (fig1).

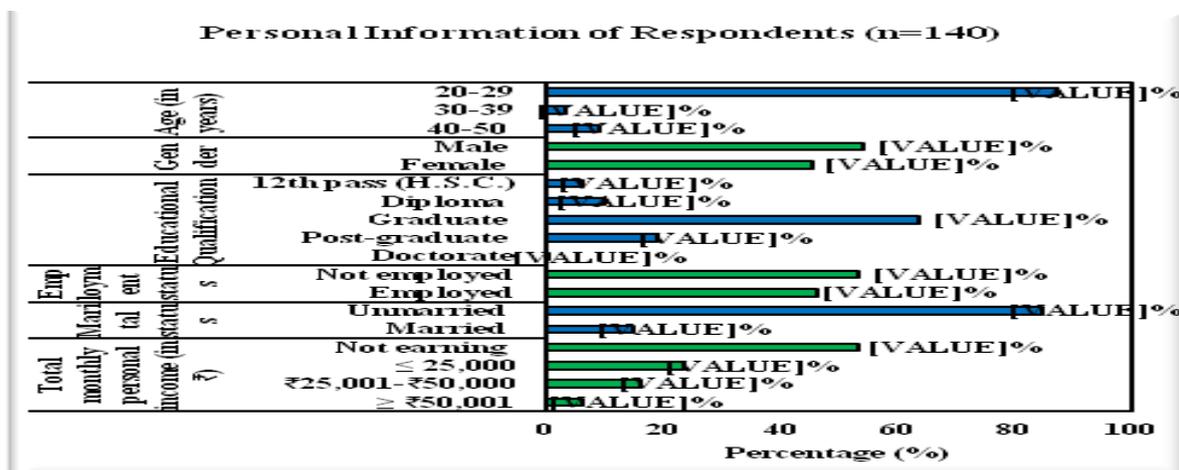


Figure 1: Distribution of the respondents according to their personal Information

Family Information: A less than two-third (65%) of the respondents belonged to nuclear family followed by 35 per cent respondents belonged to joint family. Slightly more than three-fourth (76.4%) respondents had a small size family comprising 2-4 members (fig 2).

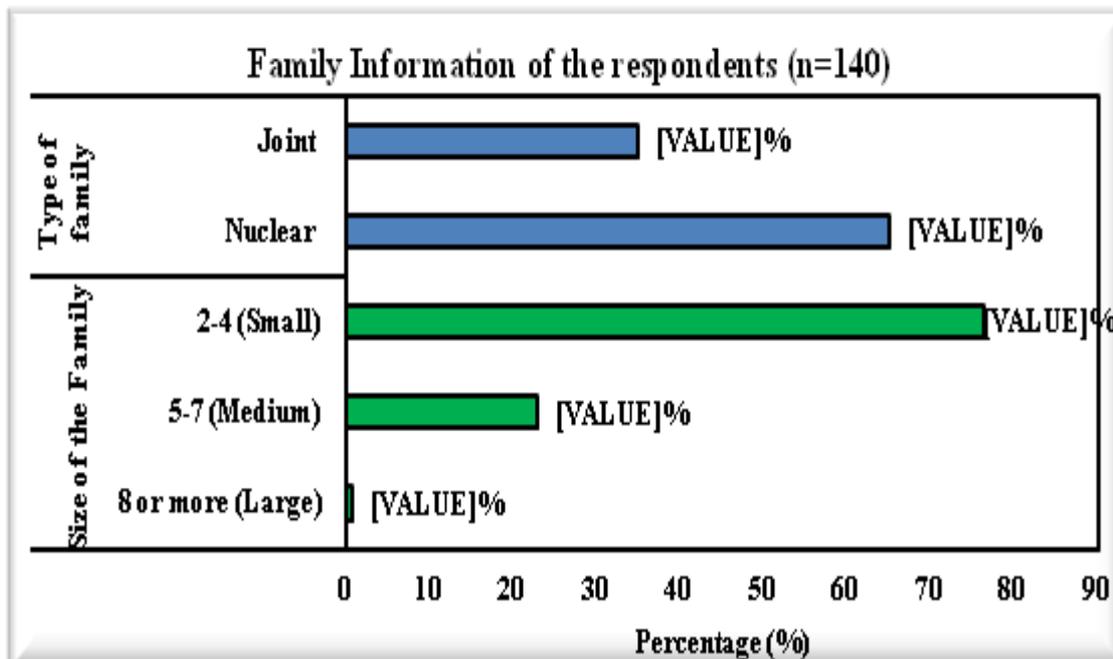


Figure 2: Distribution of the respondents according to their Family Information

Travel related Information: It was found that more than one-third (36.4%) of the total respondents travelled for leisure for two days during Pandemic COVID-19. Preferences of mode of conveyance while travelling for leisure during Pandemic COVID-19 revealed that less than three-fourth (70.71%) of the total respondents preferred private transport. Slightly more than two-third (66.43%) of the respondents preferred to travel with a companion.

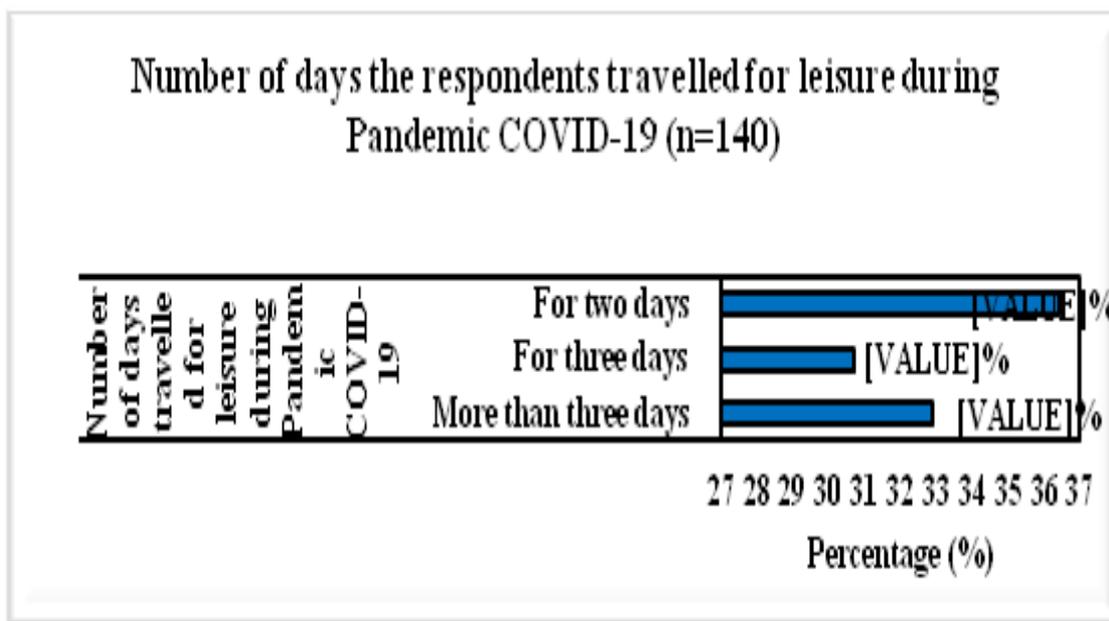


Figure 3: Distribution of the respondents according to the number of days they travelled for leisure during Pandemic COVID-19

Number of Days the Respondents Travelled for Leisure during Pandemic COVID-19: More than one-third (36.4%) of the total respondents travelled for leisure for two days during Pandemic COVID-19. A little less than one-third (30.7%) of respondents travelled for leisure for three days during Pandemic COVID-19. The data in table 4 & figure 4 also revealed that 32.9 per cent of the respondents travelled for leisure for more than 3 days during Pandemic COVID-19 (fig 3).

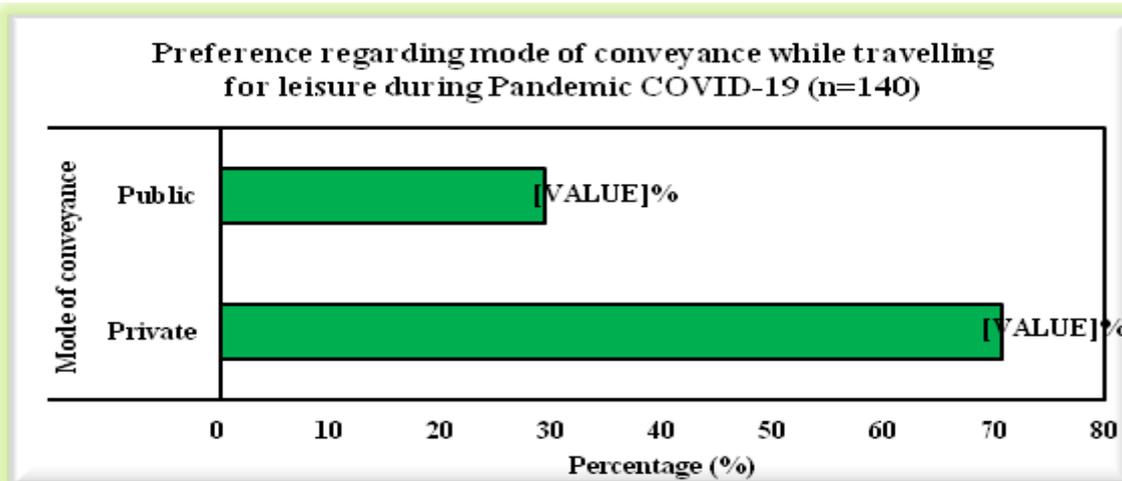


Figure 4: Distribution of the respondents according to their preference regarding conveyance while travelling for leisure during Pandemic COVID-19

Mode of Conveyance: The data revealed that preferences of mode of conveyance while travelling for leisure during Pandemic COVID-19 revealed that less than three-fourth (70.71%) of the total respondents preferred private mode of conveyance followed by slightly more than one-fourth (29.29%) of the respondents who preferred public mode of conveyance for while travelling for leisure during Pandemic COVID-19 (fig 4).

Extent of precautionary safety measures adopted by the respondents for travelling for leisure during Pandemic COVID-19

It referred to the extent of precautionary safety measures adopted by the respondents while travelling for leisure during Pandemic COVID-19.

Table 1: Distribution of the respondents according to their Precautionary safety measures adopted by them while travelling for leisure during Pandemic COVID-19

Sr No.	Precautionary safety measures adopted by the respondents while travelling for leisure during Pandemic COVID-19	Respondents (n = 140)						Wt. Mean Score (3-1)
		Responses according to the Precautionary safety measures adopted by them while travelling for leisure during Pandemic COVID-19						
		Always		Sometimes		Never		
		f	%	f	%	f	%	
1	Following the COVID-19 guidelines even after receiving a vaccine	95	67.86	41	29.29	4	2.85	2.65
2	Sanitizing hands regularly	94	67.14	41	29.29	5	3.57	2.63
3	Packing hand sanitizer, extra face masks and disinfectant wipes in an easily accessible spot	93	66.44	43	30.71	4	2.85	2.63
4	Covering the mouth and face with a tissue or the inside of the elbow when coughing or sneezing	92	65.72	43	30.71	5	3.57	2.62
5	Disposing of waste safely	91	65.00	46	32.86	3	2.14	2.62
6	Making sure of not travelling with someone who is at increased risk for severe illness	92	65.72	44	31.43	4	2.85	2.62
7	Keeping proof of vaccination or a negative COVID-19 test with you	90	64.29	46	32.86	4	2.85	2.61
8	Keeping photocopy of important documents such as Aadhar card	91	65.00	44	31.43	5	3.57	2.61
9	Taking care of not falling ill and infected	92	65.72	41	29.28	7	5.00	2.60

10	Taking sanitizer and essential medicines during travel	90	64.29	43	30.71	7	5.00	2.59
11	Washing of hands for at least 20 seconds after finishing the journey	85	60.71	52	37.15	3	2.14	2.58
12	Avoiding contact with anyone who is sick	85	60.71	50	35.72	5	3.57	2.57
13	Booking tickets online to avoid exposure to virus	85	60.71	51	36.44	4	2.85	2.57
14	Taking food and water from home while travelling	83	59.29	54	38.57	3	2.14	2.57
Sr No.	Precautionary safety measures adopted by the respondents while travelling for leisure during Pandemic COVID-19	Respondents (n = 140)						
		Responses according to the Precautionary safety measures adopted by them while travel for leisure during Pandemic COVID-19.						Wt. Mean Score (3-1)
		Always		Sometimes		Never		
		f	%	f	%	f	%	
15	Following quarantine rule of each city as mentioned	90	64.28	41	29.29	9	6.43	2.57
16	Limiting contacting with frequently touched surfaces	86	61.43	47	33.57	7	5.00	2.56
17	Avoiding touching the face	82	58.57	51	36.43	7	5.00	2.53
18	Complying with the government guidelines for each city or state travelling to	81	57.85	52	37.15	7	5.00	2.52
19	Doing contactless payments	80	57.14	53	37.86	7	5.00	2.52
20	Planning the journey and checking the route timely	77	55.00	55	39.29	8	5.71	2.49
21	Using disinfectant wipes on handles or surfaces	76	54.29	57	40.71	7	5.00	2.49
22	Keeping windows open for ventilation wherever possible	71	50.71	62	44.29	7	5.00	2.45
23	Making less random stops as much as possible while travelling	71	50.71	61	43.58	8	5.71	2.45
24	Refraining from eating or drinking on public transportation	66	47.14	66	47.15	8	5.71	2.41
25	Maintaining a distance of 6 feet between you and others	63	45.00	69	49.29	8	5.71	2.39
26	Opting for restaurants that offers drive thru	57	40.71	69	49.29	14	10.0	2.30
Total								2.54

Precautionary Safety Measures Adopted by the Respondents While Travelling for Leisure: The data in table 1 revealed that more than two-third (67.86%) of the respondents “Always” followed the COVID-19 guidelines even after receiving vaccine. The findings of the study also revealed that 67.14 per cent of the respondents “Always” sanitized their hands while travelling for leisure during Pandemic COVID-19 followed by slightly more than two-third (66.44%) of the respondents always packed hand sanitizer, extra face masks and disinfectant wipes in easily accessible spot while travelling during Pandemic COVID-19. The findings also revealed that 65.72 per cent of the respondents “Always” took care of not falling ill and not getting infected and made sure that they were not travelling for leisure with someone who is at an increased risk of severe illness while travel for leisure during Pandemic COVID-19. The findings also revealed that slightly less than one-half (49.29%) of the respondents “Sometimes” by opted for restaurants that offered drive thru followed by 43.58 per cent of the respondents “Sometimes” made few random stops as much as possible while travelling during Pandemic COVID-19.

The weighted mean scores regarding extent of precautionary safety measures adopted while travelling for leisure during Pandemic COVID-19 revealed that highest for “Following the COVID-19 guidelines even after receiving a vaccine” (2.65) followed by “Sanitizing hands regularly” (2.63) and “Packing hand sanitizer, extra face masks and disinfectant wipes in an easily accessible spot” (2.63).

Extent of Precautionary Safety Measure Adopted by the Respondents While Travelling for Leisure During Pandemic COVID-19: A total of 26 statements were framed, reflecting extent of Precautionary safety

measures adopted for travelling for leisure during Pandemic COVID-19 from August 2020 to December 2021. The respondents were asked to respond on a 3-point scale in terms of the responses “Always”, “Sometimes” and “Never” which were scored 3 through 1. The minimum score was 26 and maximum was 78. Minimum and maximum possible score were divided into three categories on the basis of equal interval which were High extent, Somewhat extent and Low extent of safety measures. It was determined for the entire scale. High score reflected high extent of precautionary safety measures adopted by the respondents while travelling for leisure during Pandemic COVID-19

The data in figure 5 it can be observed that more than two-third 69.29% of the respondents adopted precautionary safety measures “To high extent” while travelling for leisure during Pandemic COVID-19. More than one-fourth (29.29%) of the respondents adopted precautionary safety measurement “To moderate extent” while travelling for leisure during pandemic. Remaining (1.42%) of respondents adopted low extent of precautionary safety measurement while travelling for leisure during Pandemic COVID-19.

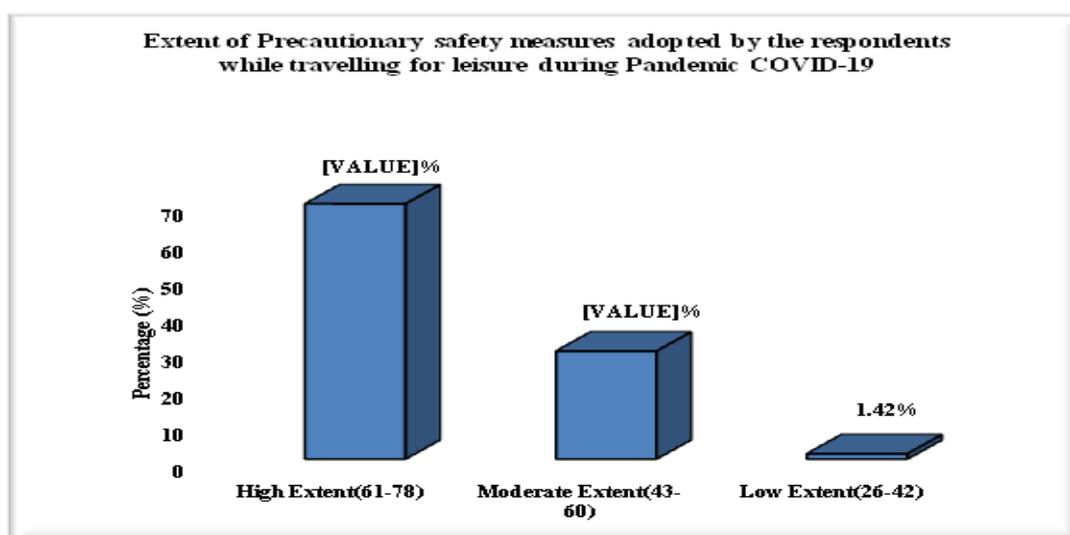


Figure 5: Distribution of the respondents according to the extent of Precautionary safety measures adopted by the respondents while travelling for leisure during Pandemic COVID-19

Testing of Hypothesis

Analysis of Variance (ANOVA) was computed to test the variation of the extent of problems faced by the respondents while leisure travelling during Pandemic COVID-19 with their age (in years), educational qualification, employment status, total monthly personal income (in ₹), size of the family, number of days for leisure travel of the respondents during Pandemic COVID-19.

The F-value was not found significant in the extent of precautionary safety measures adopted by the respondents during Pandemic COVID-19 for age (in years), education qualification, employment status, Total Monthly Personal Income (in ₹), Size of Family, Number of Days for Leisure Travel of the respondents. Hence, the null hypothesis was accepted.

The computation of t-value exhibited on significant difference in the extent of precautionary safety measures adopted by the respondents while travelling for leisure during Pandemic COVID-19 with their gender, marital status, type of family, preference regarding mode of conveyance while travelling for leisure and preference regarding companion while travelling for leisure. Thus, the null hypothesis was accepted.

CONCLUSION AND IMPLICATIONS

The findings of the study will be helpful for the students of Hospitality Management specialization. The findings of the study can aid the authorities for utilizing the information for restructuring and developing policies which are tourists friendly. The findings can aid the stakeholders in identifying the expectations of the tourists and thus update the services accordingly. The findings of the present research would be a ready reference for documentation on the related subject.

REFERENCE

1. De Vos, J., 2020. The effect of COVID-19 and subsequent social distancing on travel behavior. *Transp. Res. Interdiscip. Perspect.* 5. <https://doi.org/10.1016/j.trip.2020.100121>.

2. Ghosh, A., Arora, B., Gupta, R., Anoop, S., & Misra, A. (2020). Effects of nationwide lockdown during COVID-19 epidemic on lifestyle and other medical issues of patients with type 2 diabetes in north India. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 14(5), 917–920. <https://doi.org/10.1016/j.dsx.2020.05.044>
3. Khaddar, S., & Fatmi, M. R. (2021). COVID-19: Are you satisfied with traveling during the pandemic? *Transportation Research Interdisciplinary Perspectives*, 9, 100292. <https://doi.org/10.1016/j.trip.2020.100292>

Experimental Study of Non-Damaging Drilling Fluid Using Biodegradable Reagents for Shale Stability

Sidharth Murali* and Deepjyoti Mech

Department of Petroleum Engineering, Presidency University, Bengaluru- 560064, Karnataka, India

ABSTRACT

For hydrocarbon production drilling a borehole is a very important process in the petroleum industry. Drilling fluid is used for an effective drilling operation to produce the crude oil. Bentonite and Barite is used in a conventional drilling fluid which is a disadvantage as they react with shale and cause formation damage. This can lead to reduce in productivity and the economic value. Therefore, to prevent it, a non-damaging drilling fluid (NDDF) is synthesized using biodegradable reagents to avoid the formation damage. A NDDF fluid of psyllium husk and turmeric is prepared to counter the problems faced by conventional drilling fluid. A rheological property as well as the shale stability test has been investigated for the prepared unconventional fluid/ NDDF. It was observed that the selected NDDF fluid prepared using psyllium husk and turmeric showed good enhancement in rheology. Due to the presence of psyllium husk, the filtrate loss is observed to be reduced from the shale stability test. The shale samples have been obtained from Assam-Arakan basin. This work is mainly focused on using minimal number of biodegradable reagents such as turmeric and psyllium husk. Therefore, it can be used in unconsolidated formations to prevent it from the formation damage and have a potential to be used in an economical way due to the less cost and easily available of the above-mentioned reagents.

Keywords: Non-damaging drilling fluid (NDDF); Psyllium husk; Rheological properties; Shale stability; Turmeric.

1. INTRODUCTION

The drilling fluid or the drilling fluid is a well-made/ prepared single component that's is kept in contact with wellbore until and after the drilling operation. Some amount of specially prepared fluid is pumper using some fluid pumps from the surface and exists at the bit and it come back through the annulus to the surface for drill cutting removal. Some basic functions of the drilling fluid are a) the drill cutting is removed by bring it to the surface b) to balance the formation pressure c) it supports the well bore until casing is done d) helps in lubrication the drill string [1-4]. The types of drilling fluids are a) freshwater drilling system b) saltwater based drilling system c) oil or synthetic based drilling fluid. Drilling in offshore and onshore more than 70% are shale formation and 90% of the times wellbore instability take place [5-9]. These shale formations contains more amount of organic matter similar to source rocks and developed fracture networks unlike conventional formations. According to research mostly OBM performed much better when drilled using WBM but its not the solution for the problems occurring while drilling. The main reason for well bore instability is that the conventional drilling (bentonite and barite) react with the shale formation therefore more swelling and spalling take place. Mechanism for formation damage due to drilling fluid are a) formation plugging due to bentonite and barite b) hydration of clay envelop around the pay zone c) chemical reaction between formation fluid and fluid. Therefore to over this issue Non damaging drilling fluid is used. It is seen that NDDF has reduced the formation damage and react comparatively less with shale. NDDF is mainly used for the increment of production by reducing formation damage. It is said that when the formation damage is reduced there is more productivity [11-14].

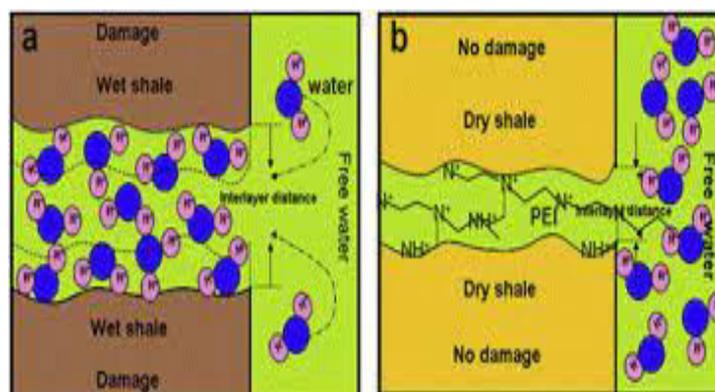


Fig1: Reaction of water based drilling fluid in shale ([16])

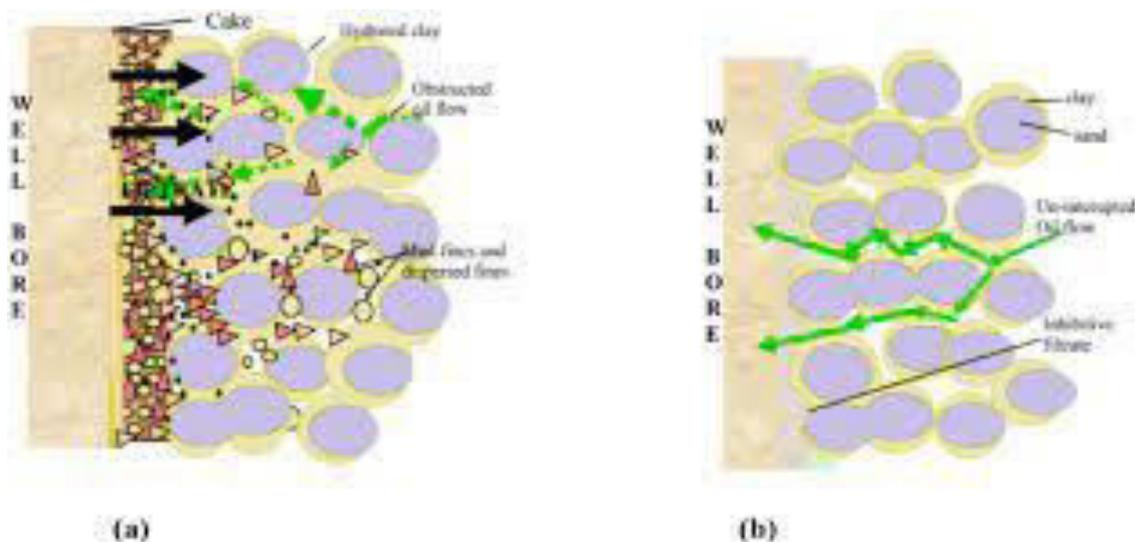


Fig2 (a): Reaction of conventional fluid in shale **(b):** Reaction of NDDF in shale [20]

The NDDF fluid was firstly introduced in the Mehsana asset of ONGC, in North Cambay basin India [10]. In NDDF components like bentonite and barite are not used, minimal drilled fine solids, filtrate does not react with formation to form any precipitate. Fine solid in conventional drilling fluid enter the formation and blocks the oil to come out, but NDDF has no such fine particles. The fluid filtrate swells the clay envelopes thereby obstructing the oil flow. [15]

In this work we are mainly focusing on the synthesis and development of NON damaging drilling fluid using less amount of biodegradable additives like turmeric, psyllium husk, CaCO_3 and CMC. The determination of the rheological properties are done and examined using various equipment's for different composition of CMC as well as different composition of psyllium husk. Different NDDF fluid have been prepared using various additives but the main goal is to reduce the number of additives used and prepare a better and less reactive NDDF fluid.

2. EXPERIMENTAL SECTION

2.1. Materials

Only four additives were used in this work and they are psyllium husk, turmeric, carboxy methyl cellulose (CMC), calcium carbonate (CaCO_3). In this work, psyllium husk is mainly used for increase of gel strength and also consider it for filtration agent. Turmeric is mainly used as they act as an anticorrosive agent as well as they act as good adsorbent and reduce the friction. The corrosion inhibition result of turmeric is attributed to the surface assimilation of phenolic resin constituents over the metal surface. CaCO_3 is mainly used because they bridge a pore throat on the formation for external filtrate cake. They are used to induce higher amount of specific gravity instead of barite. CMC is used as a viscosifier and additionally acts as a water loss preventive.

2.2. Experimental Set-Up



Fig 3: Hand crank viscometer



Fig 4: Marsh funnel



Fig 5: pH meter



Fig 6: Fluid balance



Fig 7: Remi stirrer

The fluid is prepared using the Remi stirrer as shown in the figure 7. Distilled water is used throughout the experiment for preparation of fluid. Organic turmeric, fine CaCO_3 , psyllium husk and CMC is mixed for certain period of time using Remi stirrer. The specific gravity of the prepared fluid is determined using fluid balance instrument as shown in the figure 6. The apparent viscosity, yield point, plastic viscosity is determined using the hand crank viscometer as shown in the figure 1. The marsh funnel is used to find the effective viscosity as shown in the fig 4. The pH meter as shown in the fig 5 is used to find the PH of the prepared fluid.

2.3. Experimental Procedure

A predetermined concentration of the required additives were taken. The required amount was weighed and were added or mixed to 1500ml of distilled water. This mixture was stirred to a certain period of time using the Remi stirrer [fig 7]. This process helps to smoothen the drilling fluid thereby making uniform properties throughout the fluid. Firstly, the density of the prepared fluid is measured using fluid balance [fig 6]. Certain amount of fluid is poured into the equipment and the equipment is balanced until the bubble is centralized. The density is noted in ppg, specific gravity, lb/ft^3 , psi/1000ft . The apparent viscosity, plastic viscosity, yield point and gel strength is measured using the hand crank viscometer [fig 5]. The viscometer gives us the shear stress values which are later converted. The hand crank viscometer is used to measure the shear stress at 600rpm and 300rpm. Using these shear stress the required properties are determined using below formulas eq 1, eq 2 and eq 3:

$$\text{Plastic viscosity (centipoise)} = 600\text{rpm} - 300\text{rpm} \quad (1)$$

$$\text{Apparent viscosity (cp)} = 600\text{rpm}/2 \quad (2)$$

$$\text{Yield point (lb/100ft}^2\text{)} = 300\text{rpm} - \text{plastic viscosity} \quad (3)$$

The ratio of yield point and apparent viscosity is also determined using the below formula

Eq (4): [17]

$$\text{Ratio } \text{yp/ap} = \text{yield point} / \text{apparent viscosity} \quad (4)$$

The hand crank is kept at 3rpm to determine the gel strength of the prepared drilling fluid. The gel strength is noted for 10sec at 3rpm and the fluid is kept idle for 10mins and again the same process is repeated. First observed is the initial gel strength and after 10mins the observed is the final gel strength [18]. The PH of drilling fluid with different concentration is determined using the PH meter. The PH rod is dipped into the drilling fluid

and the PH is noted. To find the effective viscosity, marsh funnel equipment is used [fig 4]. The prepared drilling fluid is filled into the marsh funnel upto the marked point. The drilling fluid is let freely to pour into a beaker upto 950ml and the timing is noted. Two trials are done and the average of both the time is taken into consideration. Using the determined time we use the below equation to find the effective viscosity of the drilling fluid eq 5 [17]:

$$\text{Effective viscosity: } \rho \cdot g \cdot t \cdot 25 \quad (5)$$

Where ρ = the density of the drilling fluid, t = time taken by the fluid to flow out of marsh funnel.

The result or the observation of all the tests is compared with each other and two best concentrations with best rheological properties are selected and the shale stability test is performed.

In shale stability test, the shale rocks are taken and crushed or powdered into fine particles using hammer. These powdered shale particles are dried in the oven at 67°C for 2 hours. After drying, the shale sample are weighed and later filled into the vial tubes of 14ml. the shale sample is filled upto 7ml and the NDDF prepared is filled from 7ml to 14ml. As two best NDDF was taken, two vial tubes the filled the same way. The vial tubes were left to rest for 24 hours and every 2 hour the reading was observed. This is done to determine the reaction with shale, whether it was absorbing fluid and expanding. Later after 24 hour the wet shale is take weighed and again it is dried in the oven for 2 hours at 67°C. The dried sample is again weighed. The spalling and swelling if determined using below eq 6 and eq 7 [20]:

$$\text{Swelling (\%)} = \frac{\text{wt of wet rock (g)} - \text{wt of dried rock after immersion (g)}}{\text{Wt of dried rock after immersion (g)}} \quad (6)$$

$$\text{Spalling (\%)} = \frac{\text{initial dry weight (g)} - \text{wt of dried rock after immersion (g)}}{\text{Wt of dried rock after immersion (g)}} \quad (7)$$

3. RESULTS AND DISCUSSION

In this work, the non damaging drilling fluid comprises of mainly just four additives which are: psyllium husk, turmeric, CaCo₃, CMC. These additives are added one by one with distilled water to formulate the NDDF. Each additive is added to improve or enhance the properties of the prepared drilling fluid. Therefore the concentration of each additive is tested the best or optimum concentration for each additive is taken.

3.1 NDDF Fluid Using Different Concentration of CMC

These additives are added one by one with distilled water to formulate the NDDF. Each additive is added to improve or enhance the properties of the prepared drilling fluid. Therefore the concentration of each additive is tested the best or optimum concentration for each additive is taken. 1500L of distilled water is taken.

Three NDDF sample is made or prepared using a) 7.5g of turmeric + 25g of psyllium husk+ 3.15g of CaCO₃ + 4.8 g of CMC.

b) 7.5g of turmeric + 25g of psyllium husk + 3.15g of CaCO₃ + 4.9 g of CMC

c) 7.5g of turmeric + 25g of psyllium husk + 3.15g of CaCO₃ + 5g of CMC

Three fluid samples were prepared using these concentrations and the rheological properties of these fluid samples are observed. For Fluid (a) it was observed that the plastic viscosity is 72cp and apparent viscosity is 93.5cp and the effective viscosity is 173cp. Fluid (b) it was observed that plastic viscosity is 45cp and apparent viscosity is 72.5cp and effective viscosity is 119cp. Fluid (c) it was observed that plastic viscosity is 31cp apparent viscosity is 54.5cp and effective viscosity is 69cp.

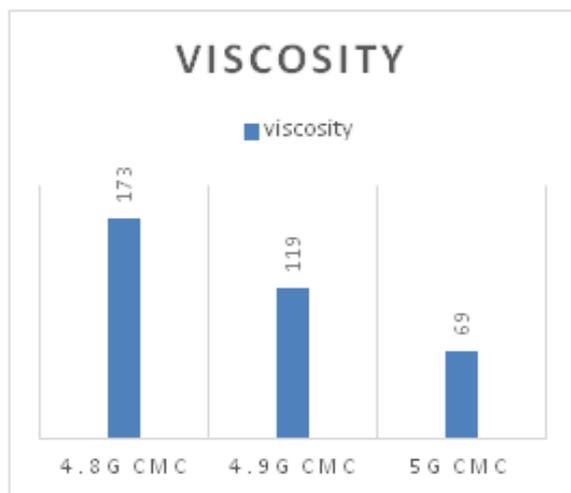


Fig 8: Viscosity for different conc of cmc

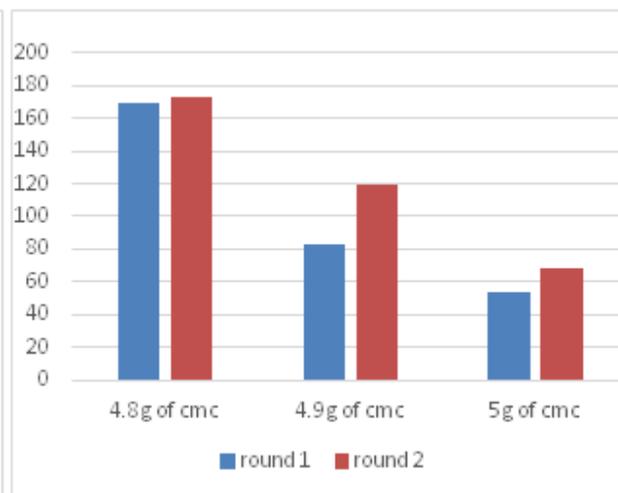


Fig 9: Two rounds for each NDDF fluids

As we can see in the figure 8, the concentration of CMC is different for three different fluid is varying. The viscosity of fluid with concentration of 5g CMC is comparatively less compared to other concentration of CMC. For each concentration of fluid two rounds is done to find the rheological properties. And the values from the second round is taken in consideration. As 5g of CMC gives us better effective viscosity it is taken into consideration

3.2. Different Concentration of Psyllium Husk

As 5g of CMC is taken into consideration now we prepare and observe the fluid for different concentration of psyllium husk. The following are the concentration used to prepared the fluid sample:

- 7.5g of turmeric + **25g** of psyllium husk + 3.15g of CaCo₃ + 5g of CMC
- 7.5g of turmeric + **15g** of psyllium husk + 3.15g of CaCo₃ + 5g of CMC
- 7.5g of turmeric + **5g** of psyllium husk + 3.15g of CaCo₃ + 5g of CMC
- 7.5g of turmeric + **1g** of psyllium husk + 3.15g of CaCo₃ + 5g of CMC

The rheological property of fluid sample of these concentration is observed and the best concentration of fluid is taken into consideration.

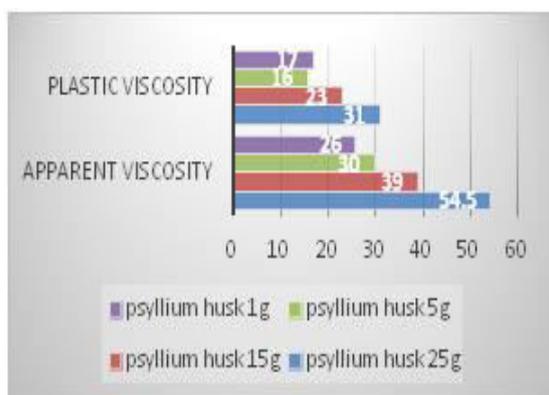


Fig 10: Viscosity of various conc of psyllium husk

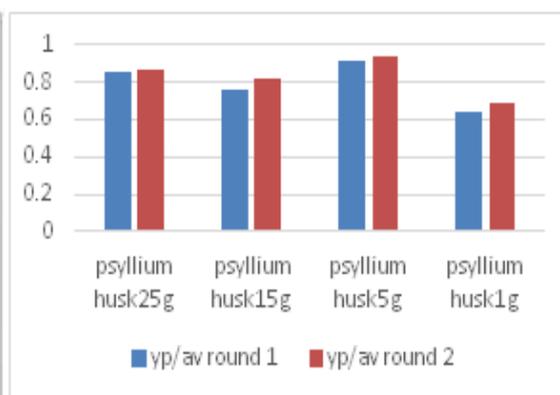


Fig 11: YP/AV ratio of diff conc. of psyllium husk

As seen in the figure 10, the plastic viscosity and apparent viscosity is determined for various concentration of psyllium husk. The values are observed for two rounds of the fluid of each concentration. It is observed that the apparent viscosity and plastic viscosity of the fluid is decreasing as the concentration of psyllium husk decreases. In fig 11, the yp/av ratio is considered every fluid prepared with different conc of psyllium husk. Higher YP/PV ratio is desirable for greater shear-thinning because it can reduce the pumping pressure in drill pipe and increase the cutting carrying capacity in the annulus region [5]. The yp/av ratio of 5g of psyllium husk is closer to 1 therefore is taken into consideration

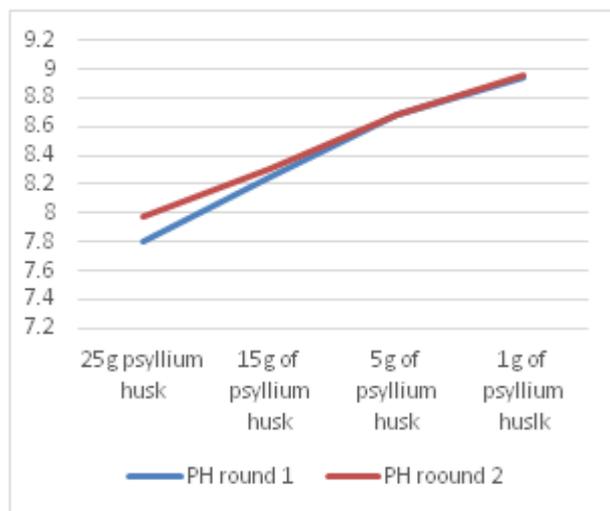


Fig 12: pH of different conc. of psyllium husk

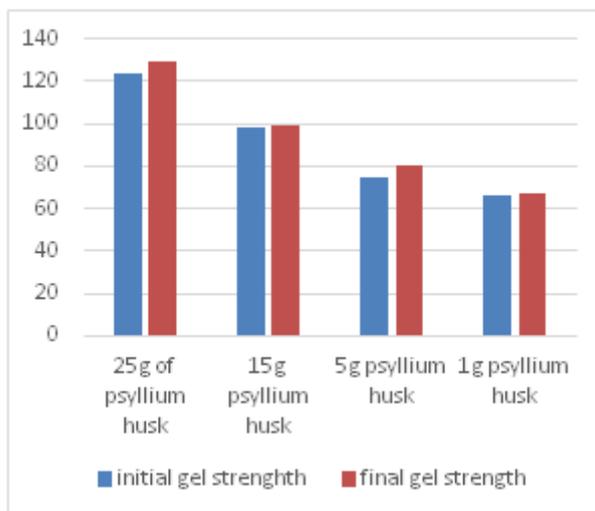


Fig 13: Initial and final gel strength of psyllium husk

Fig 12 show us the PH of fluid different concentration of psyllium husk. It is observed that as the psyllium husk concentration is decreased there is a good rise in the pH of the fluid. The PH of fluid with psyllium husk of 5g and 1g has 8.69 and 8.96 which is a good pH thereby chance of corrosion is less. Fig 13 shows us the initial and final gel strength of fluid with different concentration of psyllium husk. It is observed that as the concentration of psyllium husk is decreased there is drastic change or decrease in the gel strength of the prepared fluid. We can observed the gel strength of 25g is psyllium husk is 129 lb/100sqft, 15g of psyllium husk is 99 lb/100sqft, 5g of psyllium husk is 80 lb/100sqft and 1g of psyllium husk is 67lb/100sqft. It is observed that 1g is psyllium husk is providing a better gel strength that other composition of psyllium husk. As the pH and gel strength is optimum, fluid of 5g and 1g psyllium husk is taken into consideration for shale stability test.

3.4. Shale Stability Measurement

Shale swelling or spalling are some main issues while drilling in shale formation. Drilling fluid consisting of bentonite and barite react with the shale formation and cause formation damage, stuck pipe, collapse [19,20]. Therefore NDDF mud is being used in shale formation as they are less reactive with shale and the swelling and spalling percentage of the fluid would be comparatively less compared to conventional drilling fluid. The formulated NDDF fluid of 5g of psyllium husk and 1g of psyllium husk is prepared under 400ml of distilled water with following measurement = > fluid 1: 0.84g of CaCo3 + 1.33g of CMC + 2g of turmeric + 1.33g of psyllium husk + 400ml of distilled water.

Fluid 2: 0.84g of CaCo3 + 1.33g of CMC + 2g of turmeric + 0.2g of psyllium husk + 400ml of distilled water.

Table 1: Shale stability reading for fluid 1 and fluid 2

Hour	Shale Volume (ml)	Fluid-1	Fluid-2
		Fluid Volume Level (mL)	Fluid Volume Level (mL)
0	7	14	14
2	7	14	13.9
4	7	14	13.9
6	7	14	13.9
8	7	14	13.9
10	7	14	13.9
12	7	14	13.9
14	7	14	13.9
16	7	14	13.9
18	7	14	13.9
20	7	14	13.9
22	7	14	13.9
24	7	14	13.9

During the test measurement it is observed that fluid 1 has not absorbed any NDDF mud or we can say no NDDF has reacted with the shale formation but in fluid 2, 0.1ml of fluid has been absorption with respect to 24 hours of time as shown in the table 1. We can conclude from this that with respect to 24hour time period the

fluid 2 has reacted more than fluid 1. The swelling and spalling of both the shale sample is calculated using eq 6 and eq 7.

Table 2: Shale immersion test results

	Fluid-1	Fluid-2
Initial Dry Weight (g)	10.3	10.3
Wet Weight (g)	12	11.3
Dry Weight after Immersion (g)	10.1	10

From the Table 2 we can observe the initial weight of the shale sample, weight of shale sample after immersion (wet weight) and dry weight of shale sample after immersion. Using these data that we determine the swelling and spalling of the fluid 1 as well as fluid 2 using eq 6 and eq 7. Swelling percentage of fluid 1 is 18.80% and spalling percentage is 1.98%.

Swelling % of fluid 2 is 13% and spalling% of fluid 2 is 3%. From this we can observe that the swelling % of fluid 2 is less than that of fluid 1 and the spalling % of fluid 1 is less than that of fluid 2.

Overall it is clear that the prepared NDDF is more effective in shale formation. It gives us better swelling and spalling % than any previous NDDF mud prepared. The NDDF with 5g is considered better than 1g as we see in Table 1 there is no reduction of NDDF into shale sample. Which implies the NDDF did not react with the shale sample.

4. CONCLUSION

The NDDF prepared using psyllium husk of two different concentration was formulated and compared which was tested for 24 hr to observe the reaction of the NDDF with shale formations. As the psyllium concentration is decreased, we observed an increase in pH value. Also, the gel strength was observed to be decreasing with decrease in psyllium husk concentration. From the shale stability test and static immersion test were carried out, it was observed that 5g psyllium husk NDDF is less reactive with shale compared to 1g psyllium husk NDDF. The rheological properties were determined and showed satisfactory result. The prepared NDDF consists of psyllium husk and CMC is used in this work. The swelling% and spalling% is comparatively less in the NDDF. The shale immersion test helped us know that 5g psyllium husk NDDF was less reactive in shale formation than 1g of psyllium husk. Thereby this reduce the risk of problems in the borehole like collapse and formation collapse. Therefore, the psyllium husk based NDDF show good potential to be used in pay zone and reduces the probability of problems during production due to better wellbore stability and helps in production of unconventional crude oils.

ACKNOWLEDGEMENTS

This research wouldn't have been possible without immense support of my faculty advisor, Dr. Deepjyoti Mech. His experience and knowledge on this particular topic has helped me to do this research and gain lot of knowledge and new learning experience. I would like to acknowledge Drilling Fluids Laboratory, Department of Petroleum Engineering, Presidency University, Bengaluru – 560064, India to provide the laboratory facilities to carry out my research work successfully. I would also like to owe my heartiest gratitude to Dr. Suman Paul, Head of the Department of Petroleum Engineering, Presidency University, Bangalore for this encouragement during the entire research work. Also my sincere gratitude to all the faculty and staffs of Petroleum Engineering Department.

REFERENCES

1. G. V. Chilingarian, P. Vorabutr, Drilling and Drilling Fluids (Developments in Petroleum Science); Elsevier Science Ltd., 1983.
2. H. Rabia, Oilwell Drilling Engineering: Principles and Practice. Graham & Trotman Ltd., 1986.
3. B. Hughes, Baker Hughes- Drilling Fluids Reference Manual. Baker Hughes, 2006.
4. Alcheikh, I. M; Ghosh, B. A Comprehensive Review on the Advancement of Non-damaging Drilling Fluids. Int J Petrochem Res. 1 (2017) 61-72.
5. H.C.H. Darely, G. R. Gray, Composition and Properties of Drilling and Completion Fluids (7th ed.). Gulf Professional Publishing, 1988.
6. A.R. Ismail, A.H. Aliasc, W. R. W. Sulaimana, M. J. Zaidi, I. Ismaila, Drilling fluid waste management in drilling for oil and gas wells. Chem. Eng. Trans. 56 (2001) 1351-1355.

7. M.A. Tehrani, A. Popplestone, A. Guarneri, S. Carminati, Water-Based Drilling Fluid for HT/HP Applications. International Symposium on Oilfield Chemistry, 28 February-2 March, Houston, Texas, U.S.A. 2007, SPE-105485-MS.
8. M. Kohdja, M. Khodja-Saber, J. Canselier, N. Cohaut, F. Bergaya, Drilling Fluid Technology: Performances and Environmental Considerations. IntechOpen, (2010a).
9. M. Zakaria, M. M. Husien, Novel nanoparticle-based drilling fluid with improved characteristics. SPE International Oilfield Nanotechnology Conference and Exhibition, 12-14 June, Noordwijk, The Netherlands. 2012.
10. N. Mandal, U. Jain, B. S. A. Kumar, A. K. Gupta, Nondamaging drilling fluid enhances borehole quality and productivity in conventional wells of Mehsana Asset, North Cambay Basin. SPE/IADC Indian Drilling Technology Conference and Exhibition. SPE/IADC. 2006, SPE-102128-MS.
11. S. Cobianco, M. Bartosek, A. Guarneri, Non-damaging drilling fluids. United States Patent. 2002, US 6,495,493 B1.
12. V. Mahato, P. Shrikanth, B. V. Krishna, Development of non-damaging and inhibitive water based oil well drilling fluids. *Petrol Sci Technol.* 31 (7) (2013) 721-726.
13. P. Talukdar, S. B. Gogoi, A study on the role of pre-gelatinized starch (pgs) in the non damaging drilling fluid (NDDF) for the Tipam Sand of Geleki Oil Field of Upper Assam Basin. *Int J Appl Sci Biotechnol*, 3(2) (2015a) 291-300.
14. P. Talukdar, S. B. Gogoi, Effective role of XC-polymer in the non damaging drilling fluid (NDDF) for Tipam Sand of Geleki Oilfield of Upper Assam Basin. *Int. J. Res. Eng. And Appl. Sc.* 5(5) (2015b) 16-33.
15. P. Talukdar, S. B. Gogoi, Use of Calcium Carbonate as Bridging and Weighting Agent in the Non Damaging Drilling Fluid for Some Oilfields of Upper Assam Basin. *Int. J Current Res.*, 7(8) (2015c) 18964-18981.
16. Yuxiu, peizhi yu A Strong Inhibition of polyethyleneimine as shale inhibitor in Drilling Fluid
17. M. Kuma, B. M. Das, P. Talukdar, The effect of salts and haematite on carboxymethyl cellulose–bentonite and partially hydrolyzed polyacrylamide–bentonite muds for an effective drilling in shale formations. *J. Pet. Expl. Prod. Technology.* 10 (2019) 395–405..
18. C. Lam, S. A. Jefferis, Interpretation of viscometer test results for polymer support fluids. *Geotech Spec Publ.* (2014) 439-449.
19. M. Kuma, B. M. Das, P. Talukdar, The effect of salts and haematite on carboxymethyl cellulose–bentonite and partially hydrolyzed polyacrylamide–bentonite fluids for an effective drilling in shale formations. *J. Pet. Expl. Prod. Technology.* 10 (2019) 395–405.
20. Deepjyoti Mech, Borkha Mech Das, Akshay Sunil, Minhaj Areekkan¹, Syed Imaad¹ Formulation of a Rice Husk based Non-Damaging Drilling Fluid and its effect in Shale Formations

The Highly D_2 – Distance of Irregular Labeling Fuzzy Graphs

¹R. Suja Kumari and ²K. Chithamparathanu Pillai

¹Department of Mathematics, Scott Christian College, Nagercoil, Tamil Nadu, India

²Department of Mathematics, Lekshmipuram College, Neyyoor, Tamil Nadu, (Affiliated to Manonmaniam Sundaranar University), India

ABSTRACT

This paper states a new concept of highly D_2 –distance of irregular labeling fuzzy graphs and highly totally D_2 –distance of irregular labeling fuzzy graphs. The relation between highly D_2 –distance of irregular labeling fuzzy graphs and highly totally D_2 –distance of irregular labeling fuzzy graphs are examined. Some properties related to neighbourly totally D_2 –distance of irregular labeling fuzzy graphs, highly totally D_2 –distance of irregular labeling fuzzy graphs and product fuzzy graphs are discussed. In addition, some more properties and examples of highly D_2 –distance of irregular labeling fuzzy graphs are observed and viewed for highly totally D_2 –distance of irregular labeling fuzzy graphs.

Keywords: Highly D_2 –distance of irregular labeling fuzzy graphs, highly totally D_2 –distance of irregular labeling fuzzy graphs, neighbourly totally D_2 –distance of irregular labeling fuzzy graphs, product fuzzy graphs, neighbourly D_2 –distance of irregular labeling fuzzy graphs.

1. INTRODUCTION

Some various properties of fuzzy graphs [FGs] was introduced by Azriel Rosenfeld [2]. Ravi Narayanan, Santhi Maheswari [5] developed and discussed some properties of highly irregular and highly totally irregular fuzzy graphs. Some properties of fuzzy distance two labelling graphs was discussed by Anuj kumar, pradhan[1]. In this paper, we defines highly D_2 –distance of irregular labeling fuzzy graphs and highly totally D_2 –distance of irregular labeling fuzzy graphs. The condition that provides the connection between these two graphs and a characterization of a neighbourly D_2 –distance of irregular labeling fuzzy graphs, neighbourly totally D_2 –distance of irregular labeling fuzzy graphs and product fuzzy graphs are examined

The following terminologies fuzzy graph, irregular labelling fuzzy graph and product fuzzy graph are respectively abbreviated as FG, IRRLFG and PFG.

2. PRELIMINARIES

Let $G = (A_N, B_A)$ be a FG on $G^* = (N, A)$ for which the membership function $A_N : N \rightarrow [0,1]$ and $B_A : N \times N \rightarrow [0,1]$. Then the graph G is said to be a D_2 –distance of irregular labeling fuzzy graph if the arcs and nodes of this graph G have different assignment such that the following conditions are satisfied. (1) $B_A(x,y) < A_N(x) \wedge A_N(y)$ for all x,y in N ; (2) $B_A(x,y) \leq |A_N(x) - A_N(y)|$, if $d(x,y) = 1$ and (3) $|B_A(x,y) - B_A(y,z)| \leq A_N(y)$, if $d(x,z) = 2$, where y is a node on the path connected by the nodes x and z . The graph $F(G)^p = (A_N, B_A)$ be a PFG then $B_A(x,y) \leq A_N(x) \times A_N(y)$ for all x,y in N . The degree of a node x in G [4] is defined as $d(x) = \sum B_A(xy)$ for all $xy \in A$ and total degree of a node x in G [4] is $td(x) = d(x) + A_N(x)$, $x \in N$. If every nodes of G is adjacent to the nodes with distinct degrees, then G is said to be highly irregular fuzzy graph and if every nodes of G is adjacent to the nodes with distinct total degrees, then G is said to be highly totally irregular fuzzy graph. A graph G is called neighbourly irregular fuzzy graph [5] if every two adjacent nodes of the graph G has distinct degree and if every two adjacent nodes has distinct total degrees then the graph G [5] is said to be neighbourly totally irregular fuzzy graph.

3. The Highly D_2 –Distance of Irregular and Highly Totally D_2 –Distance of Irregular Labeling Fuzzy Graphs:

Let G be a FG on G^* . A graph G is said to be highly totally D_2 –distance of irregular labeling fuzzy graph, if every node of G is adjacent to nodes with distinct total degrees and if the nodes and arcs of this graph satisfies the following conditions :

(1) $B_A(x,y) < A_N(x) \wedge A_N(y)$ for all x, y in N ; (2) $B_A(x,y) \leq |A_N(x) - A_N(y)|$, if $d(x,y) = 1$ and (3) $|B_A(x,y) - B_A(y,z)| \leq A_N(y)$, if $d(x,z) = 2$, where y is a node on the path connected by the nodes x and z .

We are giving suitable examples for above definition.

Example: 3.1

Let us consider a PFG, G on G^* . Define $A_N(s) = 0.3$, $A_N(t) = 0.4$,

$A_N(u) = 0.5$, $A_N(v) = 0.6$, $A_N(w) = 0.7$, $B_A(s, t) = 0.06$, $B_A(t, u) = 0.02$, $B_A(u, v) = 0.01$, $B_A(v, w) = 0.03$, $B_A(w, s) = 0.04$. Here $td(s) = 0.4$, $td(t) = 0.48$, $td(u) = 0.53$, $td(v) = 0.64$, $td(w) = 0.77$ and (1) $B_A(s, t) < A_N(s) \wedge A_N(t)$ for all s, t in N ; (2) $B_A(s, t) = 0.06 \leq 0.3 = |A_N(s) - A_N(t)|$, if $d(s, t) = 1$ and $|B_A(s, t) - B_A(t, u)| = 0.04 \leq A_N(t)$ if $d(s, u) = 2$.

Similarly, the above conditions are satisfied for the remaining nodes. So the graph G is a D_2 -distance of irregular labeling fuzzy graph. Now, every node of G is adjacent to nodes with distinct total degrees. Hence the graph G is highly totally D_2 -distance of irregular labelling fuzzy graph.

4. The relation between product fuzzy graph and highly totally D_2 -distance of irregular labelling fuzzy graph

Theorem: 4.1

Let $G : (A_N, B_A)$ be a product fuzzy graph on $G^* : (N, A)$. If the membership values A_N and B_A are distinct then the graph G is a highly totally D_2 -distance of irregular labelling fuzzy graph.

Proof:

Assume that G is a product fuzzy graph if $B_A(x, y) \leq A_N(x) \times A_N(y)$ for all x, y in N , and $A_N(x), A_N(y)$ in $[0, 1]$. Now, $B_A(x, y) < A_N(x) \wedge A_N(y)$; $B_A(x, y) \leq |A_N(x) - A_N(y)|$, if $d(x, y) = 1$ and $|B_A(x, y) - B_A(y, z)| \leq A_N(y)$ if $d(x, z) = 2$ for all x, y and z in A . Clearly all the conditions of D_2 -distance of labeling fuzzy graphs are satisfied by such a PFG. So G is a D_2 -distance of labeling fuzzy graph. Also, $td(x) = d(x) + A_N(x)$ for all $x \in N$ and every node of G is adjacent to nodes with distinct total degrees. Hence the graph G is highly totally D_2 -distance of irregular labelling fuzzy graph. But the membership values A_N and B_A are distinct.

Theorem: 4.2

Let G be a product fuzzy graph on G^* . If each nodes and arcs of the graph G assigns a distinct membership values then the graph G is a highly D_2 -distance of irregular labeling fuzzy graph.

Proof:

Let G be a product fuzzy graph on G^* then $B_A(x, y) \leq A_N(x) \times A_N(y)$ for all x, y in N . If each nodes and arcs of the graph G assigns a distinct membership values then, $B_A(x, y) < A_N(x) \wedge A_N(y)$, $B_A(x, y) \leq |A_N(x) - A_N(y)|$, if $d(x, y) = 1$ and $|B_A(x, y) - B_A(y, z)| \leq A_N(y)$ if $d(x, z) = 2$. Also, $d(x) = \sum B_A(xy)$, for all x, y in A . and every node of G is adjacent to nodes with distinct degrees. Hence the graph G is a highly D_2 -distance of irregular labeling fuzzy graph.

Theorem: 4.3

Let G be a product fuzzy graph on G^* . Then the graph G is a highly totally D_2 -distance of irregular labeling fuzzy graph, if the membership value $A_N(u)$ is not constant, for all u in N .

Proof:

Let G be a product fuzzy graph on G^* then $B_A(x, y) \leq A_N(x) \times A_N(y)$ for all x, y in N . Hence, if the membership values A_N is not constant then all the condition of the D_2 -distance of labelling fuzzy graph will be satisfied by such a product fuzzy graph and every node of G is adjacent to nodes with distinct total degrees. Hence the graph G is a highly totally D_2 -distance of irregular labeling fuzzy graph.

Remark 4.4:

Let G be a PFG on G^* . If each arcs of the graph assign a distinct membership values then the graph G is highly totally irregular FG. But it is not D_2 -distance of labelling fuzzy graph.

For Example:

Let us consider a PFG, G on G^* . Define $A_N(s) = 0.3$, $A_N(t) = 0.3$, $A_N(u) = 0.3$, $A_N(v) = 0.3$, $A_N(w) = 0.3$, $A_N(x) = 0.3$, $B_A(s, t) = 0.06$, $B_A(t, u) = 0.12$, $B_A(u, v) = 0.02$, $B_A(v, w) = 0.03$, $B_A(w, x) = 0.042$, $B_A(x, s) = 0.14$. The graph G is highly totally irregular FG, since every nodes of G is adjacent to nodes with distinct total degrees. But it is not D_2 -distance of labelling fuzzy graph, since every nodes of G is not satisfied the condition, $B_A(s, t) \leq |A_N(s) - A_N(t)|$, if $d(s, t) = 1$.

Remark 4.5:

Let G be a PFG on G^* . If G is a highly totally D_2 -distance of irregular labeling fuzzy graph and the membership value $A_N(u)$ is constant, for all u in N then G may or may not be a product fuzzy graph depends only on the assignment of arcs and nodes of that graph.

5. Properties of highly totally D_2 -distance of irregular labeling fuzzy graph.

Theorem: 5.1

Let $G : (A_N, B_A)$ be a PFG on $G^* : (N, A)$. If the graph G is a highly totally D_2 – distance of irregular labeling fuzzy graph then the graph G need not be neighbourly totally D_2 – distance of irregular labeling fuzzy graph.

For Example:

Let us consider a PFG, G on G^* . Define $A_N(s) = 0.3$, $A_N(t) = 0.41$, $A_N(u) = 0.411$, $A_N(v) = 0.6$, $A_N(w) = 0.7$, $A_N(x) = 0.8$, $B_A(s, t) = 0.021$, $B_A(t, u) = 0.01$, $B_A(u, v) = 0.02$, $B_A(v, w) = 0.04$, $B_A(w, x) = 0.05$, $B_A(x, s) = 0.06$. The graph G is highly totally D_2 – distance of labelling FG, but G is not neighbourly totally D_2 – distance of irregular labeling fuzzy graph, because two adjacent nodes t and u have same total degree.

Theorem: 5.2

Let $G : (A_N, B_A)$ be a PFG on $G^* : (N, A)$. If the graph G is a neighbourly totally D_2 – distance of irregular labeling fuzzy graph then the graph G need not be highly totally D_2 – distance of irregular labeling fuzzy graph.

For Example:

Let us consider a PFG, G on G^* . Define $A_N(s) = 0.2$, $A_N(t) = 0.4$, $A_N(u) = 0.6$, $A_N(v) = 0.43$, $B_A(s, t) = 0.05$, $B_A(t, u) = 0.02$, $B_A(u, v) = 0.03$, $B_A(v, s) = 0.01$. The graph G is neighbourly totally D_2 – distance of irregular labelling FG, since every nodes of G is D_2 – distance of labelling fuzzy graph, conditions are satisfied. But G is not highly totally D_2 – distance of irregular labeling fuzzy graph, because the node s is adjacent to nodes t and v have same total degree.

Theorem: 5.3

Let $G : (A_N, B_A)$ be a PFG on $G^* : (N, A)$. If the graph G is a highly totally D_2 – distance of irregular labeling fuzzy graph then the graph G need not be highly D_2 – distance of irregular labeling fuzzy graph.

For Example:

Let us consider a PFG, G on G^* . Define $A_N(s) = 0.4$, $A_N(t) = 0.8$, $A_N(u) = 0.5$, $A_N(v) = 0.7$, $A_N(w) = 0.2$, $B_A(s, t) = 0.04$, $B_A(t, u) = 0.03$, $B_A(u, v) = 0.05$, $B_A(v, w) = 0.02$, $B_A(w, s) = 0.01$. The graph G is highly totally D_2 – distance of irregular labelling FG. But G is not highly D_2 distance of irregular labeling fuzzy graph, since the node u is adjacent to nodes t and v have same total degree.

Theorem: 5.4

Let $G : (A_N, B_A)$ be a PFG on $G^* : (N, A)$. If the graph G is a highly D_2 – distance of irregular labeling fuzzy graph then the graph G need not be highly totally D_2 – distance of irregular labeling fuzzy graph.

For Example:

Let us consider a PFG, G on G^* . Define $A_N(s) = 0.4$, $A_N(t) = 0.5$, $A_N(u) = 0.6$, $A_N(v) = 0.7$, $A_N(w) = 0.61$, $B_A(s, t) = 0.02$, $B_A(t, u) = 0.03$, $B_A(u, v) = 0.04$, $B_A(v, w) = 0.05$, $B_A(w, s) = 0.01$. The graph G is highly D_2 – distance of irregular labelling FG, since every nodes of G is D_2 – distance of labeling fuzzy graph, conditions are satisfied. But G is not highly totally D_2 distance of irregular labeling fuzzy graph, since the node v is adjacent to nodes w and u have same total degree.

Theorem: 5.5

Let $G : (A_N, B_A)$ be a PFG on $G^* : (N, A)$. If the graph G is a highly D_2 – distance of irregular labeling fuzzy graph and the membership value A_N is a constant function, then the graph G is highly totally D_2 – distance of irregular labeling fuzzy graph.

Proof:

Suppose that G is highly D_2 – distance of irregular labeling fuzzy graph then the graph G satisfies the different assignments such that (1) $B_A(x, y) < A_N(x) \wedge A_N(y)$ for all x, y in N ; (2) $B_A(x, y) \leq |A_N(x) - A_N(y)|$, if $d(x, y) = 1$ and (3) $|B_A(x, y) - B_A(y, z)| \leq A_N(y)$, if $d(x, z) = 2$, where y is a node on the path connected by the nodes x and z . And every nodes of G is adjacent to nodes with distinct degrees. Let x be the node adjacent to y and z with distinct degrees (ie) $d(y) = k_1$ and $d(z) = k_2$ (say), where $k_1 \neq k_2$. Also assume that $A_N(x)$ is constant (ie) $A_N(x) = c$, where c is any constant and $x \in N$. Then to prove that $td(y) \neq td(z)$. Suppose that $td(y) = td(z) \Rightarrow k_1 + c = k_2 + c \Rightarrow k_1 = k_2$. which is a contradiction. So the node x is adjacent to the nodes with distinct total degrees. Hence the graph G is highly totally D_2 – distance of irregular labeling fuzzy graph.

Theorem:5.6

Let G be a PFG on G^* . If the graph G is highly totally D_2 – distance of irregular labeling fuzzy graph and the membership value A_N is a constant function then the graph G is highly D_2 – distance of irregular labeling fuzzy graph.

Proof:

Suppose that G is highly totally D_2 – distance of irregular labeling fuzzy graph. That is (1) $B_A(x, y) < A_N(x) \wedge A_N(y)$ for all x, y in N ; (2) $B_A(x, y) \leq |A_N(x) - A_N(y)|$, if $d(x, y) = 1$ and (3) $|B_A(x, y) - B_A(y, z)| \leq A_N(y)$, if $d(x, z) = 2$ and any node x of G is adjacent to nodes y and z with distinct total degrees. This implies that $td(y) \neq td(z) \rightarrow (1)$, where $d(y) = k_1$ and $d(z) = k_2$ (say), where $k_1 \neq k_2$. Also, assume that $A_N(x) = c \forall x \in N$, where c is any constant. Now, (1) $\Rightarrow d(y) + A_N(y) \neq d(z) + A_N(z) \Rightarrow k_1 + c \neq k_2 + c \Rightarrow k_1 \neq k_2 \Rightarrow d(y) \neq d(z)$. Thus x is adjacent to the nodes y and z with distinct degrees and this is true for each nodes in the graph G . Hence the graph G is highly D_2 – distance of irregular labeling fuzzy graph.

Theorem: 5.7

If a PFG, G is both highly D_2 – distance of irregular labeling fuzzy graph and highly totally D_2 – distance of irregular labeling fuzzy graph, then the membership value A_N is not a constant function.

Proof:

Suppose the graph G is PFG, then $B_A(x, y) \leq A_N(x) \wedge A_N(y)$ for all x, y in N and this graph G satisfies the following different assignments (ie) (1) $B_A(x, y) < A_N(x) \wedge A_N(y)$ for all x, y in N ; (2) $B_A(x, y) \leq |A_N(x) - A_N(y)|$, if $d(x, y) = 1$ and (3) $|B_A(x, y) - B_A(y, z)| \leq A_N(y)$, if $d(x, z) = 2$. Let the graph G is k_1 -irregular and k_2 - totally D_2 – distance of irregular labeling fuzzy graph (ie) $d(x) \neq k_1$ and $td(x) \neq k_2 \forall x \in N \Rightarrow d(x) + A_N(x) \neq k_2 \Rightarrow k_1 + A_N(x) \neq k_2 \Rightarrow A_N(x) \neq k_2 - k_1 \forall x \in N$. Thus A_N is not a constant function.

Remark: 5.8

If a PFG, G is highly D_2 – distance of irregular labeling fuzzy graph then the fuzzy sub graph G need not be highly D_2 – distance of irregular labeling fuzzy graph.

CONCLUSION

In this paper, a new idea of the highly D_2 – distance of irregular labeling fuzzy graph has been introduced. The highly D_2 – distance of irregular and highly totally D_2 – distance of irregular labeling fuzzy graph are compared through some various examples. The relation between highly totally D_2 – distance of irregular labeling fuzzy graph and neighbourly totally D_2 – distance of irregular labeling fuzzy graphs are examined. Some various properties of highly D_2 – distance of irregular labeling fuzzy graphs are studied through various examples and the results are examined for highly totally D_2 – distance of irregular labeling fuzzy graphs.

REFERENCES

1. Anuj kumar, Pradhan . P, Some properties of fuzzy distance two labeling graph, International Journal of computer sciences and Engineering, Vol -7, Issue – 5, May -2019.
2. Azriel Rosenfeld . A, Fuzzy Graphs, in : Zadeh . L .A, Fu . K . S, Shimura .M (EDs), Fuzzy sets and their Applications, Academic press, New York, (1975), pp .77 – 95.
3. Nagoor Gani . A, Latha . S . R, On Irregular Fuzzy Graphs, Applied Mathematics Sciences, Vol .6, 2012, no .11, 517 – 523.
4. Nagoor Gani . A, Radha . k, On regular Fuzzy Graphs, Journal of Physical Sciences, Vol . 12, 2008, 33 – 40.
5. Ravi Narayanan .S, Santhi Maheswari . N . R, Highly Totally Irregular Fuzzy Graphs, J .Comp & Math. Sci . Vol – 4 (5), 445 – 449 (2013).
6. Sekar . C, Santhi Maheswari . N . R, On (2, K) – Regular and totally (2, K) – Regular Fuzzy Graphs, International Journal of Mathematics and Soft Computing, Vol . 4 No .2 (2014), 59 – 69.

Synthetic Study of Ni, Cu and Pd Metal Complexes with Antibacterial Analysis

Amit Kumar

P G Department of Chemistry, Magadh University Bodh Gaya, Bihar, India

ABSTRACT

A series of organic compounds along with their nickel(II) copper(II), and Palladium(II) metal complexes have been synthesized and characterized by elemental analyses, molar conductance, IR, NMR and electronic spectral data. These compounds have been screened for antibacterial activity against *Basillus Subtillus*, *Staphylococcus Aurus*, *Escherichia coli*, and *Salmonella typhi* using the agar-well diffusion method. All the synthesized compounds have shown good affinity as antibacterial and/or antifungal agents which increased in most of the cases on complexation with the metal ions.

Keywords: Complexes, synthesis, complexes, characterized, antimicrobial ligands metal

INTRODUCTION

An antibiotic is a drug or combination of substances that prevents bacterial growth.¹ *Mycobacterium tuberculae*, a bacterium that is spread from person to person through the air, is the disease that causes tuberculosis. In order to effectively treat tuberculosis (TB), medication combinations are frequently employed.^{2,3} Antibiotic-metal complexes (AMC) are becoming more and more important in the field of modern pharmacy. Finding new, more potent, and more broadly acting medications is essential in the face of an increasing number of germs that are resistant to common antibiotics.⁴ In this regard, antibiotic compounds with metal ions have excellent prospects. Only tablets, capsules, liquids, and injectables are available as antituberculosis medications, which are used to treat tuberculosis.⁵ The bacterium that causes tuberculosis, *Mycobacterium tuberculae*, spreads from person to person through the air. A molecule or substance that prevents bacterial growth is an antibiotic.⁶ Combinations of drugs are routinely used to successfully treat tuberculosis (TB).^{7,8} The only antituberculosis drugs available for treating tuberculosis are pills, capsules, liquids, and injectables. Sulfonamides have antimicrobial, insulin-releasing anti-diabetic, carbonic anhydrase inhibitory, high-roof diuretic, and antithyroid properties in their different subgroups.⁸

MATERIAL AND METHODS

The following are the various tools, procedures, glassware, solvents, reagents, and techniques utilised in the production of sulfonamide compounds:

- Bruker advance 300 MHz NMR
- Perkin Elmer 100 FT-IR spectrophotometer
- Agilent 1100 MCD trap-5C Mass spectrometer
- Digisun conductivity meter, DI 909 model
- Perkin Elmer UV-Vis spectrophotometer. U.V lamp

METHODOLOGY

Synthesis of the Complexes

4-(2-Hydroxybenzylidene) amino) benzenesulfonamide [HBABS]:

To an answer of 1.72 g (0.01 mol) of 4-aminobenzenesulfonamide (Merck) broke up in 100 ml of methanol in a 250 ml round base jar, 1.22 g (0.01 mol) of 2-hydroxy benzaldehyde (SD fine) was included and the substance were refluxed on a water shower for 2 hours. The arrangement, on cooling, gave a yellow hued compound, which was separated and recrystallized from ethanol. Yield (56%), MP: 180°C.^{10,11}

4-(Furan-2-ylmethylene) aminobenzenesulfonamide [FMABS]:

An answer of 1.72g (0.01mol) of 4-aminobenzenesulfonamide (Merck) broke down in 100 ml of methanol in a 250 ml round base cup, was included with 0.96g (0.01 mol) of furan-2-carbaldehyde (Fluka) . The arrangement was refluxed on a water shower for 3 hours. The compound isolated was separated and recrystallized from methanol to give a dark hued strong. Yield (62%), MP: 130°C.¹²

4-(Thiophene-2-ylmethylene) aminobenzenesulfonamide [TMABS]:

To an answer of 1.72g (0.01mol) of 4-aminobenzenesulfonamide (Merck) disintegrated in 100 ml of methanol in a 250 ml round base cup, 1.22 g (0.01 mol) of thiophene-2-carbaldehyde (Fluka) was included. The arrangement was refluxed on a water shower for 3 hours. The compound isolated was separated and recrystallized from methanol to give a light yellow shaded strong. Yield(82%), MP: 140°C.^{13,14}

(Thiophen-2-ylmethylidene) pyridine-4-carbohydrazide [TMPCH]:

To an answer of 1.23g (0.01m) of pyridine-4-carbohydrazide (Finar) disintegrated in 100 ml of methanol in a 250 ml round base cup, 1.22 g (0.01 mol) of thiophene - 2-carbaldehyde (Fluka) was included. The arrangement was refluxed on a water shower for 3 hours. The compound isolated was sifted and recrystallized from methanol to give a light yellow shaded strong. Yield (86%), MP: 130°C.¹⁵

(Thiophen-2-ylmethylidene) pyrazine-2-carboxamide [TMPCA]:

An answer containing 1.24g of pyrazinamide (Hi media) in 100 ml of ethanol in a 250 ml round base carafe was included with 1.12 g (0.01 mol) of thiophene-2-carbaldehyde. The substance were refluxed on a water shower for 2 hours. The compound isolated was separated and recrystallized from methanol to give a light yellow shaded solid^{9,10}. Yield (68%), MP:178-180°C.¹⁶

Arrangement of the Metal Complexes

The Ni, Cu and Pd buildings with all the ligands were readied utilized.

Ni (II) Edifices:

To an answer of the ligand in hot methanol was included gradually, with blending, Ni(OAc)₂.4H₂O (ALDRICH) arrangement in methanol and the blend was refluxed on a high temp water shower. It was concentrated constrained to two-third the first volume and cooled. The strong that isolated out was sifted, washed with water, hot methanol and ether and was vacuum dried over combined CaCl₂.

Cu (II) Edifices:

To a methanolic arrangement of copper(II)chloride (CuCl₂.2H₂O), a hot methanolic arrangement of the ligand was included gradually with blending. The blend was refluxed on a heated water shower. It was concentrated constrained to two-third the first volume and cooled. The strong that isolated out was sifted, washed with water, hot methanol and ether and was vacuum dried over intertwined CaCl₂.

Pd (II) Buildings:

PdCl₂ (SRL) (1.0g) was broken down in concentrated hydrochloric corrosive and weakened with water to 100 ml to give 0.1N arrangement regarding hydrochloric corrosive. An aliquot of this arrangement was treated with an equivalent volume of methanol and was included drop-wise, under blending, with a hot methanolic arrangement of the ligand. The blend was refluxed on a high temp water shower. It was concentrated constrained to two-third the first volume and cooled. The strong that isolated out was sifted, washed with water, hot methanol and ether and was vacuum dried over combined CaCl₂.

Antimicrobial Screening Procedure

A grouping of 5 mg/ml of each compound was set up in DMSO that had no impact on the microbial development. Bacterial species: The accompanying Gram +ve and Gram – ve culture of human pathogens were utilized to test the antibacterial movement of the mixes.

Gram + ve : *Staphylococcus aureus* and *Basillus Subtillus*

Gram –ve : *Salmonell typhi* and *Escherichia coli*

Agar Cup Plate Technique¹⁷

A normalized 1 to 2 x 10⁷ cfu/ml 0.5 MC Furland standard was presented onto the outside of a sterile agar plate and equitably circulated inoculums by utilizing a sterile glass spreader. All the while, 6 mm wells were cut from the plate utilizing a sterile plug borer. 80 □ l arrangement at a grouping of 5 mg/ml of the mixes was presented vigorously at 37 °C. After 24 hrs, the hindrance zones were estimated with a ruler and contrasted and the control well containing just DMSO and 5 mg/ml of streptomycin as the norm.

RESULTS AND DISCUSSION

In the present study, 4-aminobenzenesulfonamide has been condensed with 2-hydroxybenzaldehyde, furan-2-carbaldehyde and thiophene-2-carbaldehyde; pyridine-4-carbohydrazide with thiophene-2-carbaldehyde and pyrazine-2-carboxamide with thiophene-2-carbaldehyde and the accompanying Schiff base ligands acquired and portrayed.

4-((2-Hydroxybenzylidene) amino) benzenesulfonamide (HBABS) (Fig. 1)

4-((Furan-2-ylmethylene) amino) benzenesulfonamide (FMABS) (Fig. 2)

4-((Thiophen-2-ylmethylene) amino) benzenesulfonamide (TMABS) (Fig. 3)

N'-(Thiophen-2-yl-methylidene) - pyridine-4-carbohydrazide (TMPCH) (Fig. 4)

N-(Thiophen-2-ylmethylidene) - pyrazine-2-carboxamide (TMPCA) (Fig. 5)

Based on fundamental research, conductance, warm, attractive, infrared, electronic, and ESR ghostly data, the Ni, Cu, and Pd edifices of these Schiff base ligands have been prepared and generally described. According to the knowledge gained, pertinent conclusions on the geometry of the structures have been reached.

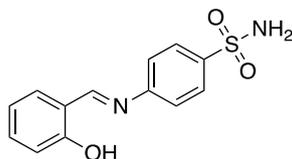


Fig. 1. 4-((2-Hydroxybenzylidene)amino)benzenesulfonamide (HBABS)

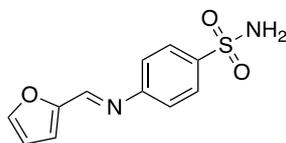


Fig. 2. 4-((Furan-2-ylmethylene)amino)benzenesulfonamide (FMABS)

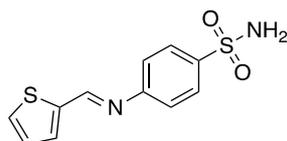


Fig. 3. 4-((Thiophen-2-ylmethylene)amino)benzenesulfonamide (TMABS)

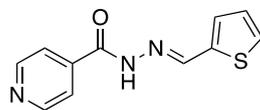


Fig. 4. N'-(Thiophen-2-yl-methylidene)-pyridine-4-carbohydrazide (TMPCH)

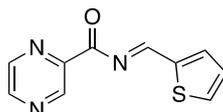


Fig. 5. N-(Thiophen-2-ylmethylidene)-pyrazine-2-carboxamide (TMPCA)

Due to the significance of this class of aggressors, the designer integrated and represented metal Schiff base structures made of sulfonamide, carbohydrazide, pyrazinamide, and other aldehydes. The ligands and a fraction of their metal structures that have been produced for organic action have been screened in preparation for the testing. In the current investigation, 4-aminobenzenesulfonamide was used to condense thiophene-2-carbaldehyde, pyridine-4-carbohydrazide, pyrazine-2-carboxamide, and the related Schiff base ligands. These responses were discovered and displayed in (figures 1-5).

Based on fundamental research, conductance, warm, attractive, and infrared data, electronic data, and ghostly ESR results, the Ni, Cu, and Pd structures of these Schiff base ligands have been constructed and essentially represented. Relevant inferences about the geometry of the structures have been made in light of the knowledge acquired. At room temperature, all of the ligands are stable and non-hygroscopic. They are truly solvent in hot methanol and dimethylformamide, insoluble in water, and moderately soluble in methanol and (CH₃)₂CO. Investigative, mass, ¹H NMR, and IR horrifying evidence has painted a picture of the ligands.

CONCLUSION

Distinct physico-substance information has been used to depict the structures of Ni, Cu, and Pd complexes with five different compounds. Complexes of mixed ligands with transition metals Ni, Cu, and Pd have been created. The complexes are subjected to several forms of characterisation employing infrared spectroscopy, electric

conductivity, melting point, and solubility. Escherichia coli, Salmonella typhi, Staphylococcus aureus, and Basillus subtilus were all targets of the complexes' antibacterial action.

REFERENCES

1. Von N. F. *Angew. Chem. Int. Ed.* 45, 31, 2006 (5072).
2. Menzies, D, Al Jahdali, H, and Al Otaibi, B. *The Indian journal of medical research* 133, 2011, (257). PMC 3103149.
3. Cornwall, J. *The Lancet*, 1997 (660).
4. Regiel F. A. , Da ȓrowski J.M., Mazuryk, O., Spiewak, K., Kyzioł, A.; Pucelik, B.; Brindell, M., Stochel, G. *Coord. Chem. Rev.* 351 , 2017, (76).
5. Harries A.D; Hargreaves N.J, Kumwenda J., Kwanjana1 J.H, Salaniponi1 F.M, *Int J Tuberc Lung Dis*, 11, 2000 (998).
6. Von N. F. *Angew. Chem. Int. Ed.* 45, 31, 2006 (5072).
7. Menzies, D, Al Jahdali, H, and Al Otaibi, B. *The Indian journal of medical research* 133, 2011, (257). PMC 3103149.
8. Cornwall, J. *The Lancet*, 1997 (660).
9. Harries A.D; Hargreaves N.J, Kumwenda J., Kwanjana1 J.H, Salaniponi1 F.M, *Int J Tuberc Lung Dis*, 11, 2000 (998).
10. Li, Y., Yang Z.S., Zhang, H., Cao, B.J. and Wang FD, *Artemisinin Derivatives Bearing Mannich Base Group: Synthesis and Antimalarial Activity.* *Bio org and Med Chem.* 11, 2003 (4363-4368).
11. Pandey, S.N., Lakshmi V.S. and Pandey, A. *Biological activity of Mannich bases.* *Indian J Pharm Sci.* 65, 2003 (213).
12. Huang, J.L., Wang H.Y., and Tian X.Y., *Polym. J., Sci. Part A: Polym.Chem*, 34, 1933 (1996).
13. Huang J.L., Chen, .S, Tan L.S., and Wang H.Y., *Science in China (Series B)*, 41, 1998 (55).
14. Chen, S., Huang Z.H., and Huang, J.L., *Eur.J. Polym.* 36, 2000 (1703).
15. Narang, K.K., and Vinod Synth, P., *React. Inorg. Met-Org. Chem.* 2, 1996 (191).
16. Brown, D.J., *The Pyrazines.* J. Wiley. Sons, Inc., New York, 2002.
17. Desta, B., *J. Ethnopharmacol.*, 100, 2005 (168).

Palladium (II) Catalysed Oxidation of Aspartic Acid by Quinolinium Dichromate (QDC) In Perchloric Acid Medium: A Kinetic and Mechanistic Approach

Priyanka Meena, Dhan Raj, Kamini Meena and Manju Bala Yadav

Department of Chemistry, Govt. College Kota, Rajasthan, India

ABSTRACT

The oxidation reaction of aspartic acid with quinolinium dichromate (QDC) has been studied spectrophotometrically in the presence of aqueous HClO₄ medium and the catalytic effect of Pd (II) on the reaction was observed. The reaction order with respect to aspartic acid, QDC, Pd (II) and H⁺ were found to be first order. The reaction was carried out at three different temperature and activation parameters have been calculated. Initial addition of the reaction product, Cr (III) does not affect the rate. A transient complex formed between (PdCl₂) and aspartic acid in 1:1 ratio disproportionate in slow and rate determining step. A suitable reaction mechanism is proposed in agreement with the obtained kinetic results.

Keywords: Acidic Medium, Aspartic Acid, Quinolinium Dichromate (QDC), Oxidation, Palladium.

I. INTRODUCTION

Amino acids are molecule containing an –NH₂ group, –COOH group with a side chain which varies in different amino acids (Singh, 2011). They can undergo many kinds of reactions, depending on whether a particular amino acid contains a polar or nonpolar substituents (Khan et al., 2011). Aspartic acid is a non essential amino acid which is found abundantly in plant proteins especially in sprouting seeds. This can be manufactured from oxalo acetic acid in the body (Sanjana et al., 2013). Physiologically, aspartic acid helps in the removal of ammonia, which is highly harmful to the central nervous system.

Oxidation of amino acids is of great importance both from a chemical view point and from its bearing on the mechanism of amino acid metabolism. Various kinetic studies are being carried out on the oxidation of amino acids using different oxidants in acid and alkaline medium. (Raj, 2021; Suzuki, 2019; Kiss & Ferenczy, 2021; Salman & Ibrahim, 2019; Du et al., 2018; Bin et al., 2017; Vaijayanthi & Mathiyalagan, 2013).

Chromium(VI) is well established carcinogen and mutagen (Klein & Cnang, 1996; Katz & Salen, 1994) and can be reduced to lower states by a wide variety of biological and chemical reductants (Barnhart, 1997). The existence of different species of Cr(VI) in acid solution, unstable oxidation states [Cr(IV) and Cr(V)] and the tendency of Cr(III) to form a variety of complexes all combine to give systems of considerable complexity (Beattie, & Haight, 1972). Now a days the development of newer Cr(VI) – reagents (Corey & Schmidt, 1997; Bhattacharjee et al., 1982; Corey, 1985; Climate et al., 1989; Sharma & Mahanti, 1999; Balasubramanian, & Prathiba, 1986) for the oxidation of organic compounds continues to be of major interest. The chromium (VI) reagent (QDC) is a versatile oxidant that deserves further investigation.

Transition metals are known to catalyze various redox reactions because they involve multiple oxidation states. Recently many kinetic studies on the oxidation of amino acids catalysed by different transition metal ions such as Ru (Afanasenko et al., 2019), Os (Gupta et al., 2018), Pd (Voronov et al, 2022), Mn (Vicens et al., 2021), Cr (Fawzy et al., 2016), Ir (Berrier & Merola, 2021) are considered as a significant field of chemistry because they were used either alone or a binary mixture as catalysts. Palladium is a versatile metal applied in homogenous catalysis, most studies using Palladium as catalyst have employed it in the form of palladium(II) chloride (Fawzy, 2015; Chimatadar et al., 2002; Singh et al., 2009; Gligorich & Sigman, 2009), which exists as [PdCl₄]²⁻ in aqueous solution.

Our literature review reveals that there are no reports on the kinetics of oxidation of aspartic acid by quinolinium dichromate (QDC) catalysed by palladium (II) in aqueous perchloric acid medium. In this paper we have studied the kinetics of oxidation of aspartic acid by QDC in aqueous HClO₄ medium, in order to identify the catalytic efficiency of Pd(II) catalyst, the various active species of Cr(VI) and to explore the suitable mechanism.

II. EXPERIMENTAL

A. Material

All the chemicals employed in the present work were of reagent grade and their solutions were prepared by dissolving the required amounts of the sample in doubly distilled water at room temp. Stock solution of L-Aspartic acid [LOBA Chemie], Quinolinium dichromate(QDC C₁₈H₁₆Cr₂N₂O₇)[Aldrich], Perchloric

acid[AVANTOR], and Palladium(II)chloride (Sigma Aldrich) were prepared in double distilled water and standardized iodometrically, HClO_4 and NaClO_4 were employed to maintain the required ionic strength and acidity respectively.

B. Kinetic Measurements

All the kinetic runs have been carried out under pseudo-first order conditions, i.e., L-Aspartic acid concentration always in excess as compared to QDC. Solution of the oxidant (QDC) and the mixture containing L-Aspartic acid substrate, perchloric acid and palladium (II) and water were taken in a separate stoppered boiling tube and thermostat at 20°C . The oxidant (QDC) was then added to the mixture. The progress of reaction was followed spectrophotometrically by monitoring the decrease in the absorbance of QDC at its absorption λ_{max} 440nm using Systronics Spectrophotometer 166. The pseudo first order rate constant k_{obs} were calculated from the slope of the plots of log absorbance versus time.

III. RESULTS AND DISCUSSION

A. Reaction Order

The orders of the reaction with respect to the reactants were determined. The effect of QDC (Oxidant) on the rate was studied by varying the concentration from 3.0×10^{-4} to 10×10^{-3} at constant [aspartic acid], $[\text{H}^+]$, $[\text{Pd(II)}]$ and temperature. The order with respect to QDC was found to be unity, and plots of log absorbance versus time in minutes were linear and there was no variation in the slope for different QDC concentration (Fig.-1).

The order of the reaction with aspartic acid in the concentration range 1×10^{-2} - 10×10^{-2} mol dm^{-3} , at constant concentration of oxidant, $[\text{Pd(II)}]$, $[\text{H}^+]$ and temperature was also found to be unity shown in (Fig-2).

At constant temperature and other conditions remaining constant, the acid effect on the reaction rate was studied in the concentration range 2.0 - 4.0 mol dm^{-3} . It is observed that as concentration of H^+ increases k_{obs} also increases. The plots of k_{obs} versus H^+ are linear indicating the order of reaction is unity (Fig-3).

The palladium (II) catalyst concentration was varied from 1×10^{-6} - 5×10^{-6} mol dm^{-3} , keeping all other reactant concentration constant including $[\text{H}^+]$ [QDC], [aspartic acid] and the temperature also constant. It was found that the rate of reaction increases with increase in the concentration of palladium (II). The order was found unity (Fig-4).

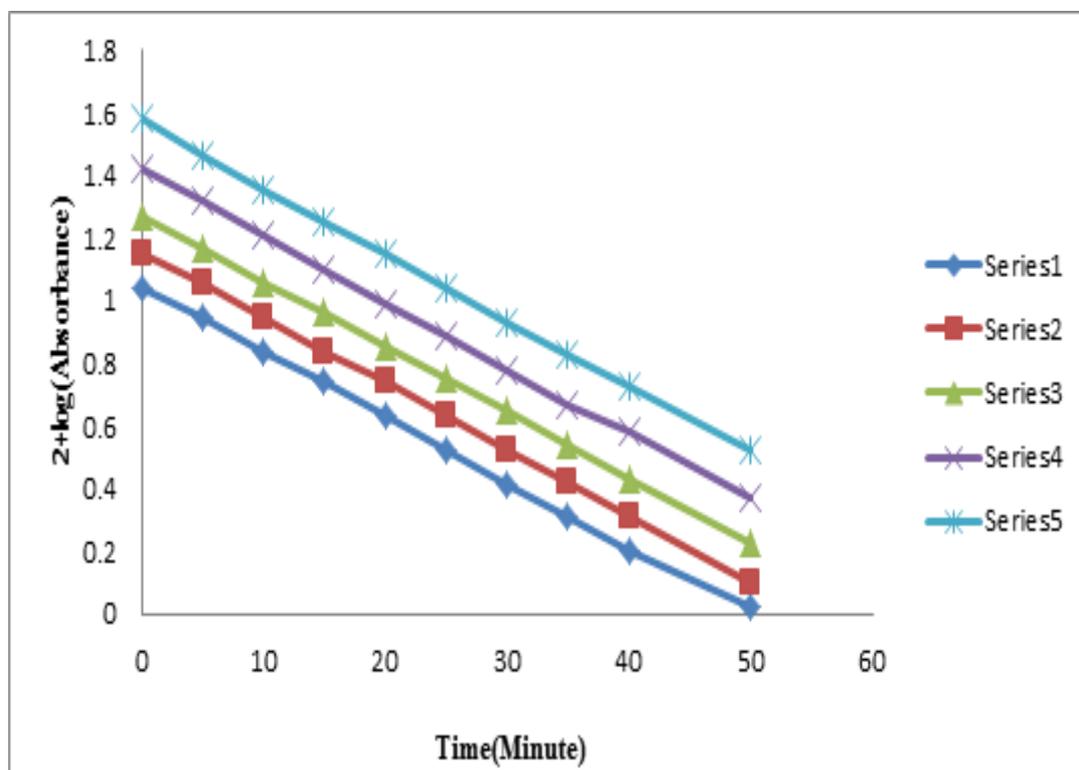


Figure-1 Variation of QDC

$[\text{QDC}] = (1) 3 \times 10^{-4}$ mol dm^{-3} , (2) 4×10^{-4} mol dm^{-3} , (3) 5×10^{-4} mol dm^{-3} , (4) 7×10^{-4} mol dm^{-3} , (5) 10×10^{-4} mol dm^{-3} [Aspartic acid] = 5×10^{-2} mol dm^{-3} , $[\text{Pd(II)}] = 3 \times 10^{-6}$ mol dm^{-3} , $[\text{H}^+] = 3$ M, Temp. = 293 K.

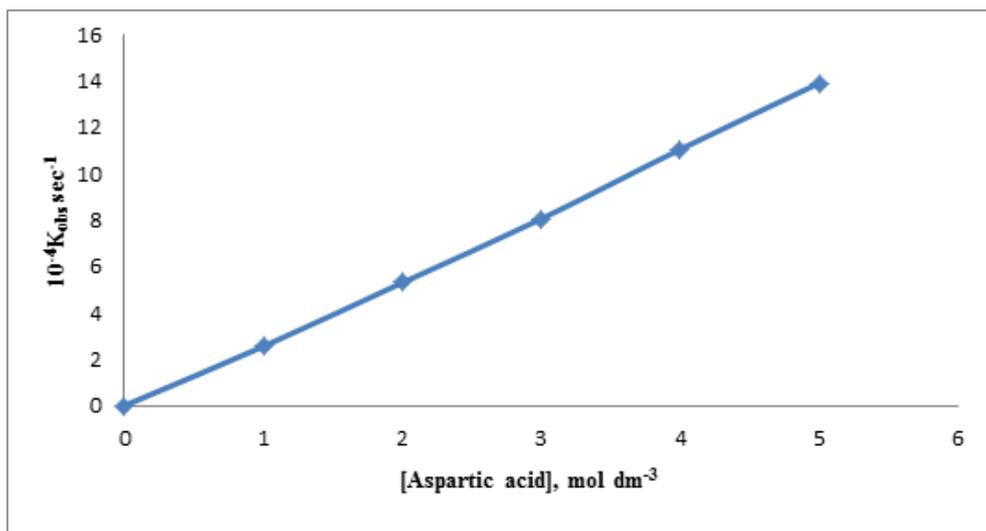


Figure-2. Effect of aspartic acid on the rate of reaction

[QDC] = 5×10^{-4} mol dm⁻³, [H⁺] = 3.0 mol dm⁻³, [Pd] = 3×10^{-6} mol dm⁻³, Temp. = 293 K.

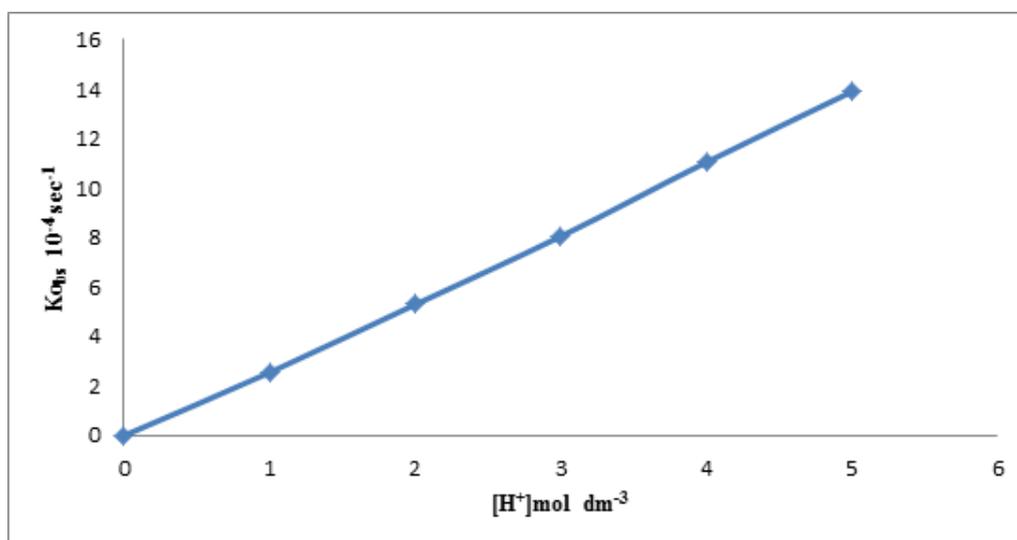


Figure-3 Effect of [H⁺] on the rate of reaction

[QDC] = 5×10^{-4} mol dm⁻³, [Aspartic acid] = 5×10^{-2} mol dm⁻³, [Pd(II)] = 3×10^{-6} mol dm⁻³, Temp. = 293 K.

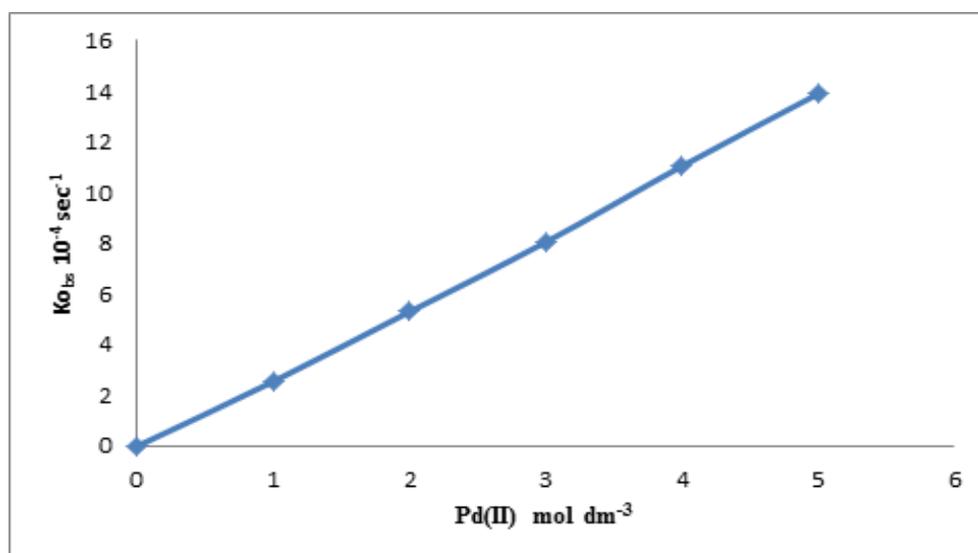


Figure-4 Effect of Pd [II] on the rate of reaction

[QDC] = 5×10^{-4} mol dm⁻³, [Aspartic acid] = 5×10^{-2} mol dm⁻³, [H⁺] = 3.0 mol dm⁻³, Temp. = 293 K.

B. Spectroscopic Changes

The spectral changes of palladium (II) catalyzed oxidation of L-aspartic acid by quinolinium dichromate in perchloric acid medium are shown in Figure (5). The scanned spectrum observed of QDC band located at $\lambda=440$ nm with time disappearance of 440 nm reduced and formation of isobestic point at 622 nm Figure (6). These spectral features are consistent with the formation of an adduct between palladium (II) catalyst and aspartic acid.

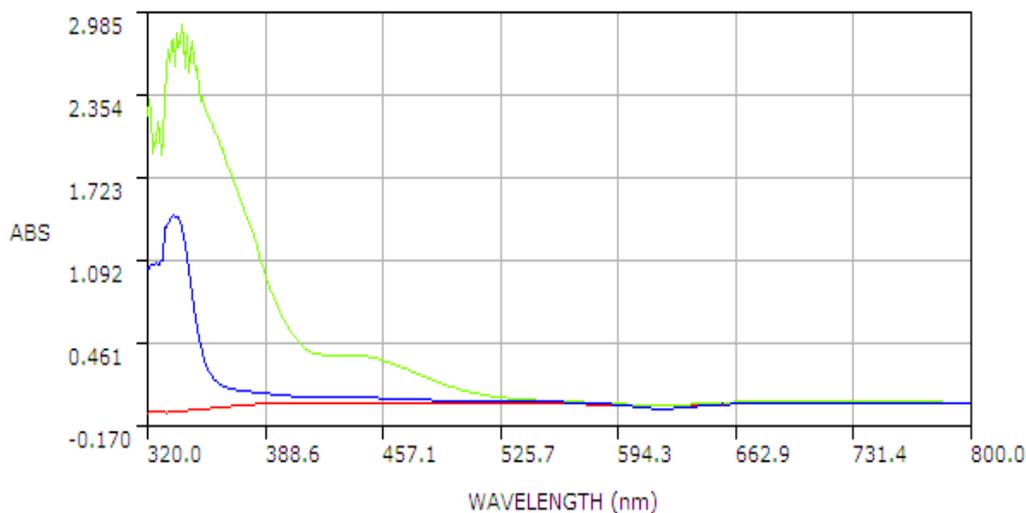


Figure-5 Spectral change

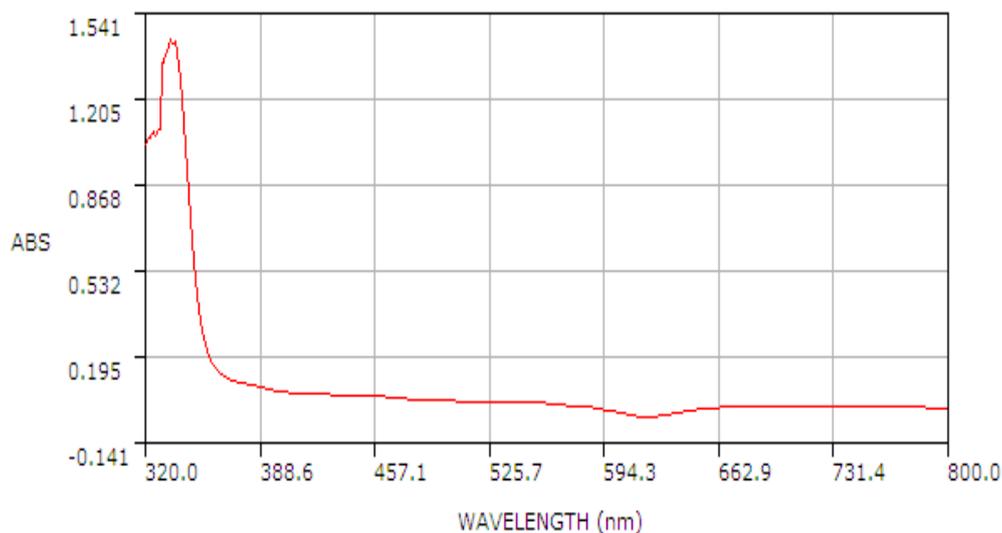
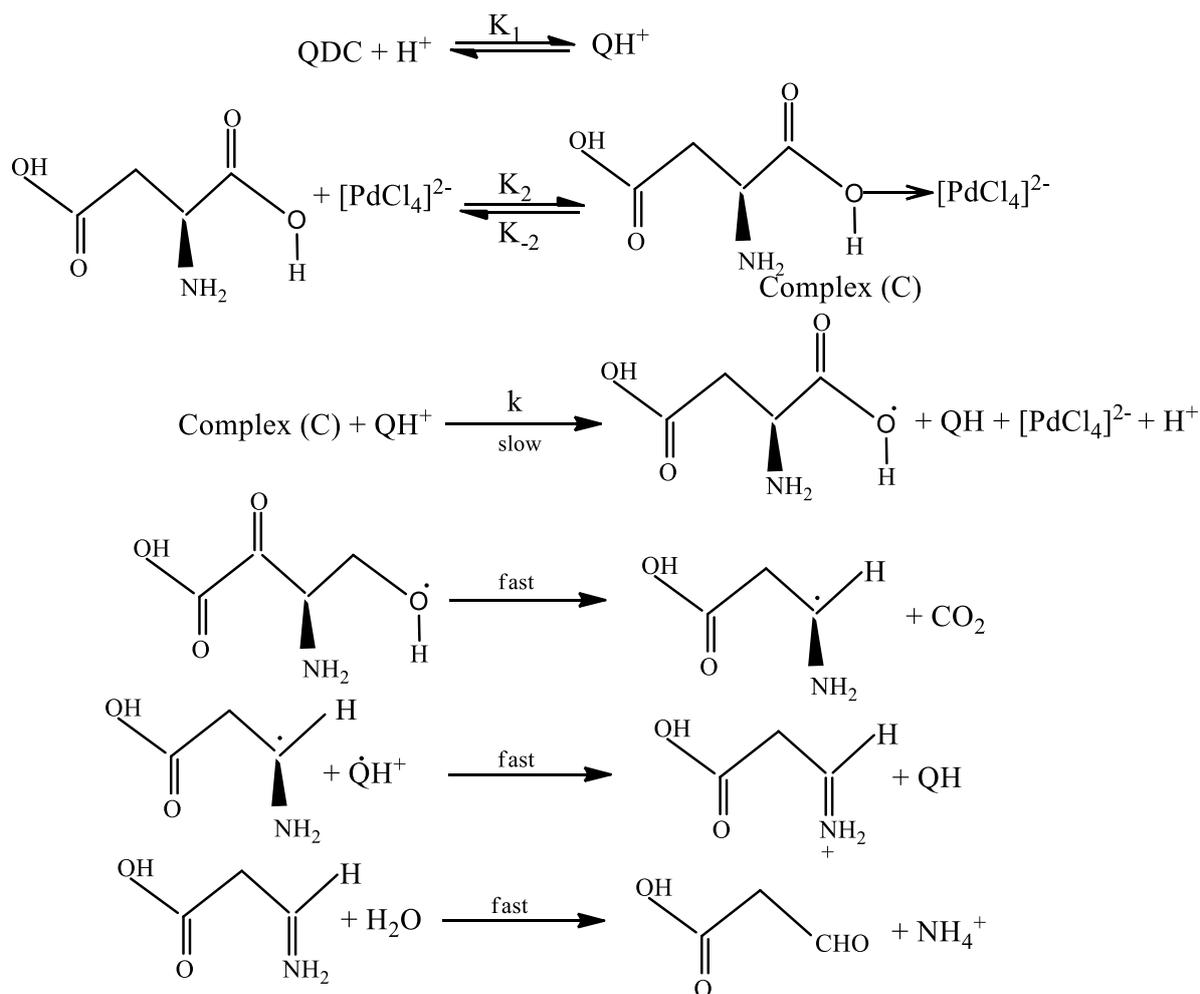


Figure-6 Isobestic point observed at 622 nm

Figure: Spectroscopic changes associated with palladium (II) catalysed oxidation of L-Aspartic acid by QDC in HClO₄ medium [AA] =0.03, [QDC] = 0.001, [H⁺]= 3.0 M, [Pd] = 0.000003

C. DISCUSSION

It is well known in aqueous acid solution quinolinium dichromate (QDC) exists mainly in the form of the chromate ion (Wiberg, 1965; Lyngdoh, 2001) HCrO₄⁻. The oxidation of aspartic acid by QDC is not observed in the absence of Pd (II) catalyst at 20°C but occurs at measurable speed in the presence of Palladium (II) in perchloric acid medium. The rate of reaction increased with an increase in [Aspartic acid] at constant concentration of [QDC], hydrogen ion and temperature (Table-1) and the plot of k_{obs} versus aspartic acid (Fig.1) showed that the order with [Aspartic acid] was unity. On the basis of experimental results, the mechanism of oxidation reaction proposed is illustrated in scheme-1. The mechanism suggests that amino acid combines with [PdCl₄]⁻² to form an intermediate complex (C). In the further step the complex (C) slowly react with one mole of QH⁺ to give the free radical and catalyst PdCl₄⁻² was regenerated. In the next step CO₂ is released followed by fast step in which amino acid free radical react with second mole of QH⁺ to give imine which on hydrolysis gives acid.



Scheme- 1

$$\text{Rate} = k [\text{C}] [\text{QH}^+]$$

$$= \frac{K_1 K_2 k [\text{AA}] [\text{QDC}] [\text{H}^+] [\text{Pd(II)}]}{K_{-2}}$$

Increasing the rate of reaction with increasing ionic strength and dielectric constant of the reaction medium suggest that the reaction in the rate determining step occur between two similarly charged ion (Amis, 1996; Laidler, 1965). The reaction rate was linearly dependent on the concentration of $[\text{H}^+]$ suggesting the involvement of a protonated Cr (VI) species in the prior equilibrium step. G. Mangalami (Mangalami, G., & Sundaram, S. M. (1991), etc. and K.B. Wiberg and coworker (Weissberger, 1974) reported the involvement of such species in chromic acid oxidation. The kinetic study of aspartic acid oxidation by QDC in presence of Pd(II) were performed at three different temperature in the range of 293-303K, at constant concentration of the reactants.

Table 1. Effect of variation of QDC, Aspartic acid, Palladium(II), and Perchloric acid concentration on the oxidation of Aspartic acid by QDC in Perchloric acid medium at Temp. 293 K

$10^4 [\text{QDC}], \text{mol dm}^{-3}$	$10^2 [\text{Aspartic acid}] \text{mol dm}^{-3}$	$10^6 [\text{PdII}] \text{mol dm}^{-3}$	$[\text{H}^+] \text{mol dm}^{-3}$	$10^4 k_{\text{obs}, \text{sec}^{-1}}$
3	5	3	3	8.06
4	5	3	3	8.06
5	5	3	3	8.05
7	5	3	3	8.06
10	5	3	3	8.06
5	1	3	3	1.77
5	3	3	3	4.85
5	5	3	3	8.05

5	10	3	3	14.8
5	5	1	3	2.55
5	5	2	3	5.30
5	5	3	3	8.05
5	5	4	3	11.05
5	5	5	3	13.9
5	5	3	2	4.96
5	5	3	2.5	6.39
5	5	3	3	8.05
5	5	3	3.5	9.31
5	5	3	4	10.2

It is important to know the probable species of PdCl₂ in acid media. Cotton F.A. and co-workers (Cotton & Wilkinson, 1998) reported the different possible mono nuclear complexes of Pd(II). Elding (Elding, 1972) reported that the presence of Cl⁻ ion in palladium (II) chloride exists as [PdCl₄⁻²] and in the aqueous solution, it may be further hydrolyzed to [PdCl₃(H₂O)]. Homogeneous Pd(II) catalyst has been employed in the form of palladium (II) chloride in most of the studies.

The activation parameters of the reaction were calculated from the Arrhenius plots of log k_{obs} versus 1/T (Fig-7). Activation parameters listed in (Table-2) may be discussed as follows. The observed negative value of ΔS[#] indicates the compactness of the formed acid – palladium (II) adduct and such activated adduct is more ordered than the reactants, due to loss of degree of freedom. The experimental values of ΔH[#] and ΔS[#] were both favourable for electron transfer process. The positive value of ΔG[#] and ΔH[#] confirm endothermic formation of the intermediate complexes and their non spontaneity respectively.

D. Stoichiometry and Product Analysis

Reaction mixtures containing different sets of concentration of reactants were kept for over 24h at 293K in closed vessels for completion of the reaction. The unreacted QDC concentration was analysed spectrophotometrically by measuring its absorbance at 440 nm. The results indicated that two moles of QDC react with one mole of aspartic acid as shown in the following stoichiometric equation.

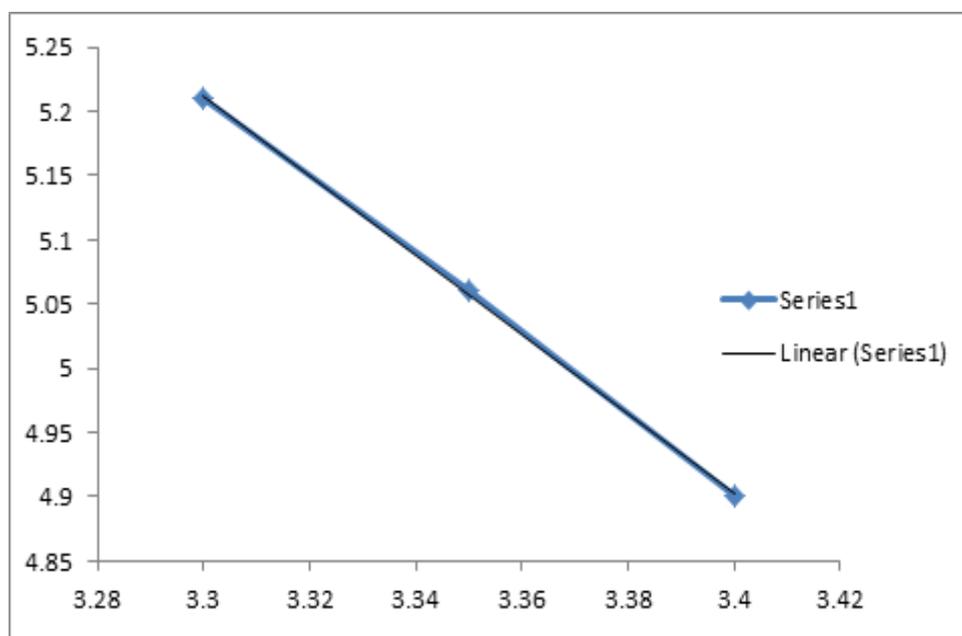
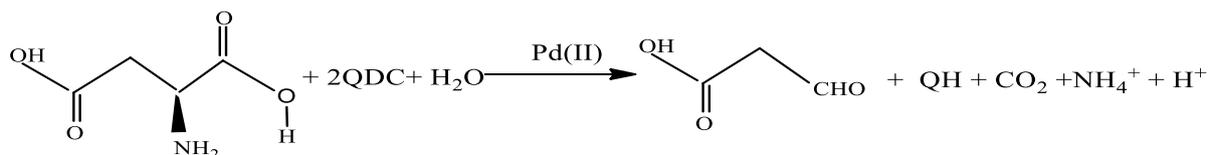


Figure-7 log k versus 1/T

Table-2 Activation parameters of the reaction

Temp. variation	Activation Parameters			
	E _a	ΔH	ΔS	ΔG
293	59.179 kJ mol ⁻¹	56.74 kJ mol ⁻¹	-102.05 Jk ⁻¹ mol ⁻¹	29.84 kJ mol ⁻¹
298				
303				



The main reaction product was identified 3-oxopropanoic acid which was confirmed by quantitative test and further 2,4-dinitrophenyl hydrazone derivatives was also obtained which is confirmed by FTIR spectrum (Fig.-8). CO₂ was identified by lime water test.

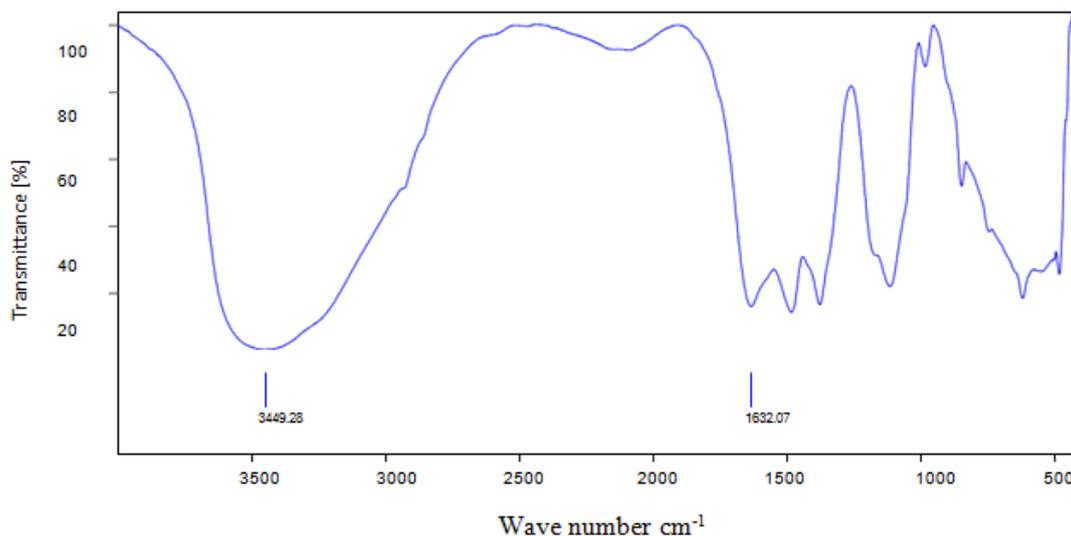


Figure.-8. The FT-IR Spectra of the oxidation product of oxidation of Aspartic acid

IV. CONCLUSION

The oxidation reaction of Aspartic acid and QDC in perchloric acid medium does not proceed in the absence of palladium(II) catalyst and occurs in a significant rate in the presence of palladium (II) catalyst. A probable reaction mechanism has been described. The orders of kinetic oxidation are first order with respect to QDC, aspartic acid and hydrogen ion. The oxidation products of the reaction were identified as the 3-oxopropanoic acid, carbon dioxide and ammonium.

REFERENCES

1. Afanasenko, A., Hannah, R., Yan, T., Elangovar, S., & Barta, K. (2019). Ruthenium and Iron- catalysed decarboxylative N- alkylation of cyclic α -Amino Acids with alcohols: Sustainable routes to pyrrolidine and piperidine Derivatives. *Journal of Chemistry and Sustainability, Energy and Materials*, 12(16), 3801-3807.
2. Amis E. S. (1996). Solvent effect on reaction rates and mechanism. Academic press, New York. 28.
3. Balasubramanian, K., & Prathiba, V. (1986). Quinolinium dichromate-A New reagent for Oxidation of alcohols. *Indian Journal of Chemistry Section B-Organic Chemistry Including Medicinal Chemistry*, 25(3), 326-327
4. Barnhart, J. (1997). Chromium in soil: perspectives in chemistry, health and environmental regulation. *Journal of Soil Contamination*, 6, 561-568.
5. Beattie, J. K., & Haight, G. P. (1972). Chromium (VI) oxidations of inorganic substrates. *Inorg. React. Mech*, 17, 93-145.
6. Berrier, C.M. & Merola, S.J. (2021). Design of Iridium N-Heterocyclic carbene amino acids catalysts for asymmetric transfer hydrogenation of aryl ketones. *Catalysis: Molecular Catalysis*, 11(6), 671.
7. Bhattacharjee, M. N., Chaudhuri, M. K., Dasgupta, H. S., Roy, N., & Khathing, D. T. (1982). Pyridinium fluorochromate; A new and efficient oxidant for organic substrates. *Synthesis*, 1982(07), 588-590.
8. Bin, P., Huang, R., & Zhou, X. (2017). Oxidation resistance of the sulphur amino acids: methionine and cysteine. *BioMed research international*, 2017.
9. Chimatadar, S.A., Kowalagi, S.B., & Nandibewoor, S.T. (2002). Kinetics of palladium(II) catalysed oxidation of mercury (I) by iron(III)-2,2-bipyridyl complex. *Indian, Journal of Chemistry*, 41A, 316-320.

10. Climate, F., Camporeale, M., Mello, R., Troisi, L., & Curci, R. (1989). *Journal of the Chemical Society, Perkin Transactions 2*, 417.
11. Corey, E. J., Barrette, E. P., & Magriotis, P. A. (1985). A new Cr (VI) reagent for the catalytic oxidation of secondary alcohols to ketones. *Tetrahedron letters*, 26(48), 5855-5858.
12. Corey, E. J., & Schmidt, G. (1979). Useful procedures for the oxidation of alcohols involving pyridinium dichromate in aprotic media. *Tetrahedron Letters*, 20(5), 399-402.
13. Cotton, F. A., & Wilkinson, G. (1998). *Advanced Inorganic Chemistry: A Comprehensive Text*, 5th Ed. John Wiley & Sons
14. Elding, L.I. (1972) "Palladium(II) halide complexes. I. Stabilities and spectra of palladium(II) chloro and bromo aqua complexes. *Inorganic Chimica Acta*. 6, 647-651.
15. Fawzy, A. (2016). Palladium (II)-catalyzed oxidation of L-tryptophan by hexacyanoferrate (III) in perchloric acid medium: a kinetic and mechanistic approach. *Journal of Chemical Sciences*, 128(2), 247-256.
16. Fawzy, A., Ashoure, S.S., Musleh, M.A., Hassan, R.M., & Asghar, B.H. (2016). Kinetics and mechanistic approach to the chromic acid oxidation of L-tryptophan with a spectral detection of chromium(III) product. *Journal of Saudi Chemical Society*, 20, 450-458.
17. Gligorich, K.M., & Sigman, M.S. (2009). Recent advancements and challenges of palladium (II)-catalysed oxidation reactions with molecular oxygen as the sole oxidant. *Chemical communication*, 45(26), 3854-3867.
18. Gupta, M., Srivastava, A., & Srivastava, S. (2019). Comparative Study of Kinetic and Mechanistic Study of Oxidation of L-Alanine and L-Proline by Sodium Periodate Catalyzed by Osmium (VIII) in Micromolar Concentrations. *Russian Journal of Physical Chemistry A*, 93(1), 48-58.
19. Katz, S. A., & Salem, H. (1994). *The biological and environmental chemistry of chromium*, VCH Publishers, New York.
20. Khan, A. A. P., Mohd, A., Bano, S., & Siddiqi, K. S. (2011). Kinetics and mechanism of deamination and decarboxylation of 2-aminopentanedioic acid by quinolinium dichromate (QDC) in aqueous perchloric acid medium. *Industrial & engineering chemistry research*, 50(17), 9883-9889.
21. Kiss, D. J., & Ferenczy, G. G. (2019). A detailed mechanism of the oxidative half-reaction of D-amino acid oxidase: another route for flavin oxidation. *Organic & Biomolecular Chemistry*, 17(34), 7973-7984.
22. Klein, C.B. & Chang, L.W. (1996). *Toxicology of Metals*, C.R.C. Lewis, Publisher, New York.
23. Laidler, K. J., & Keith, J. (1965). *Chemical kinetics (Vol. 2)*. New York: McGraw-Hill.
24. Lyngdoh, C. B., Das, S., & Mahanti, M. K. (2001). Kinetics of oxidation of pyruvic acid by quinolinium dichromate. *Oxidation Communications*, 24(3), 382-387.
25. Mangalami, G., & Sundaram, S. M. (1991). Kinetics and Mechanism of the Oxidation of Aryl Methyl Sulphides with Pyridinium Dichromate. *Journal of The Indian Chemical Society*, 68(2), 77-80.
26. Du, P., Liu, W., Cao, H., Zhao, H., & Huang, C. H. (2018). Oxidation of amino acids by peracetic acid: Reaction kinetics, pathways and theoretical calculations. *Water research X*, 1, 100002.
27. Raj, D. (2021). Kinetic study of oxidation of some amino acids by various oxidants of chromium, A Review. *Journal of Emerging Technologies and Innovative Research*, 8(5) b834-b840.
28. Salman, N. Y., & Al-niami, K. H. I. (2019, July). Kinetic and mechanistic study of alanine oxidation by N-chlorosuccinimide using Mn²⁺ as catalyst. In *IOP Conference Series: Materials Science and Engineering (Vol. 571, No. 1, p. 012076)*. IOP Publishing.
29. Sanjana, M., Patnaik, A. K., Badamali, S. K., & Mohanty, P. (2013). Kinetics and Mechanism of Electron Transfer to Heptavalent Manganese by DL-Aspartic Acid in Alkaline Aqueous and Micellar Media. *Journal of Chemistry*, 2013.
30. Sharma, G.G. & Mahanti, M.K. (1999). *Bulletin de la Société Chimique de France*, 128, 449.

31. Singh, A. K., Jaiswal, J., Singh, R. A., & Singh, K. (2009). Mechanism of Pd (II) Catalysis in Ce (IV) Oxidation of Amines in Acidic Medium. *Asian Journal of Chemistry*, 21(2), 858-862.
32. Singh, P. (2011). Kinetic Investigations on Pd (II) Catalyzed Oxidation of Some Amino Acids by Acid Bromate. *SINET: Ethiopian Journal of Science*, 34(2), 133-138.
33. Suzuki, Y. J. (2019). Oxidant-mediated protein amino acid conversion. *Antioxidants*, 8(2), 50.
34. Vaijayanthi, S. P., & Mathiyalagan, N. (2013). Kinetics of oxidation of amino acids by a newly synthesized oxidant, N-chloropyrazinamide in aqueous acetic acid medium. *International Letters of Chemistry, Physics and Astronomy*, 11.
35. Vicens, L., Olivo, Dr. G. & Costas, Dr. M. (2021). Remote Amino Acid Recognition Enables Effective Hydrogen Peroxide Activation at a Manganese Oxidation Catalyst. *Angewandte Chemie International Edition*, 61.
36. Voronov, A., Botla, V., Montanari, L., Carfagna, C., Mancuso, R., Gabriele, B., & Della Ca, N. (2022). Pd-Catalysed oxidative carbonylation of α -amino amides to hydantoins under mild conditions. *Chemical Communications*, 58(2), 294-297.
37. Weissberger A (1974) In Investigation of Rates and Mechanism of Reactions in Techniques of Chemistry, John Wiley & Sons.
38. Wiberg, K.B. (1965), Oxidation in organic chemistry. Part A, Academic press, New York, 69.

Bimstec: India's Prospective in Contemporary World Order

Mohan Singh

Economics, Army Cadet College Wing, IMA, Dehradun, India

ABSTRACT

In the age of globalisation inter-dependency and mutual-reliance is the dire need of time. Contagious process of economic development demands larger market access for greater outcome. India has been important economic and political element of integrated world. Besides, evolution of regional group turned out to be emergent need for higher mutual benefit and better international bargaining. The Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) is one of such multilevel cooperation groups initiated in 1997 and formally established in 2004. BIMSTEC's progress has never been motivating for India but after the SAARC getting faded, India started taking interest in BIMSTEC with hope for better cooperation among neighbouring countries. Gradually, BIMSTEC is getting place in regional cooperation by expanding fields of cooperation from four to fourteen with better policies and firm commitments. Comparative data of India's trade with BIMSTEC countries vis-à-vis SAARC countries and rest of world underline our faster trade growth with BIMATEC group. BIMSTEC is especial for India for covering a wide range of mutual concerned issues such as transport and person-to-person connectivity, the Energy center and the Center on Climate, inter-connectivity of energy grid, joint counter terrorists exercise etc. which are never part of other conventions. Although, this forum has not fulfilled India's aspiration in time frame, we can expect more intensified economic cooperation after the instituting of the preferential trade agreement. The worry areas such as delay in progress on different projects and conventions, lack of FTA, influence of China on many countries, dearth of trust among nations etc. create doubt in the success of the forum. BIMSTEC can be proved to be very useful for India's economic, geo-political and strategic aspiration. India is biggest economy of the group and so has the largest consumer. India needs fast progress on its prime concerned issues- market access, energy requirement and security issues of this close neighbouring group. Sensing the aptness and potency of the group in its emergence as self-reliant regional economic power, India has aggressively started to strengthen it.

Keywords: BIMSTEC, FTA, Foreign Trade, Economic Development, Regionalism, SAARC

INTRODUCTION

Economic progress is a complex and comprehensive process which is indivisible. Larger extent of market and mutual benefits of comparative cost differences enables countries to yield maximum outcomes. Thus, globalization is economic prudence and mutual inter-dependency is need of time. India has been an important political and economic member in world since ages. India, owing to its large population, abundant natural resources and upheld highest human ethos, marks its prominent presence even in the modern era of globalization. We have trade relation with almost every important country and are trying to capitalize the maximum gains from trade with apparent justice. We are important member of almost every important international political and economic institutions like the World Bank, WTO, IMF, UNCTAD, International Finance Corporation, Asian Infrastructure Investment Bank, ADB, New Development Bank etc. but has the right to protect self-interest. As the economic dividend does not occur- has to be divided, the share from the benefit has to be taken. It is also the fact of economics that the best gets the highest and so blind race in free trade does not guarantee welfare of low developed nations are protected. This becomes matter of greater concern when the developed countries use to create inner group for better mutual benefit and protection from the evil of free trade. India being one of the largest countries of the region has the responsibility and opportunity to create such a political-economic environment where mutual help among the convenient group can promote the economic dividend and protect from economic evils on the name of natural law. India can emerge as eventual leader of such local group which can balance the economic-political powers across the globe.

Although there is less difference between trade within regional countries and farther countries but localized trade has its own benefits such as better understanding, similar state of economic development, sharing the traditional and cultural practices, low transportation costs, indigenous feelings, easily access in time of need etc. Hence, every country tries to develop such comfortable regional trade group along with the usual trade with the other countries of the world. India, being the natural leader of South Eastern Asia, had been initiator and founder member of many regional groups and trade agreements such as South Asia Association for Regional Cooperation (SAARC) and South Asia Free Trade Agreement (SAFTA), India Brazil South Africa (IBSA) Dialogue Forum, Mekong Ganga Cooperation (MGC), Shanghai Cooperation Organization (SCO), Heart of

Asia – Istanbul Process, ASEAN Regional Forum, BRICS - Brazil, Russia, India, China and South Africa, EAS - East Asia Summit, Asia Cooperation Dialogue, Asia-Pacific Economic Cooperation, IORA-Indian Ocean Rim Association, Quad etc. Along with several bilateral agreements with the different countries and been member of many international economic organisation, India try to promote regional cooperation as its strategic and long-run policy. The Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) is one of such organizations which assumes to fulfil India's political and economic aspiration of setting up field for India in contemporary world scenario. In the backdrop of losing significance of SAARC, BIMSTEC has gained popularity among South Asian countries as a platform for better and multidimensional regional cooperation having potential to bridge between South Asia and South East Asia. India's increased interest in the group can be evidenced by attendance of the leaders of the BIMSTEC countries in Prime Minister Narendra Modi's swearing-in ceremony in 2019 at the place of the leaders of the SAARC countries who attended his swearing-in ceremony in 2014. The present study is an effort to assess the progress of BIMSTEC as the emerging regional group and its potential to meeting India's regional aspiration, especially in the field of economy and trade.

Inception of BIMSTEC

The BIMSTEC is a multidimensional regional forum initiated in form of Bangladesh, India, Sri Lanka, and Thailand-Economic Cooperation (BIST-EC) by the mentioned four countries of Asia to establish a bridge linking South and Southeast Asia. This was the first attempt to build an Intra-regional integration between South and South-east Asia. On the proposal of Thailand, the forum came into existence in Bangkok in June 1997. Further, it was expanded by the inclusion of Myanmar in December 1997, followed by Nepal and Bhutan in February 2004. During its first summit in Bangkok on 31 July 2004, the group rechristened itself to its current identity – the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) and many areas were included into the scope of the group. Subsequent to the decision of its third summit in 2014, BIMSTEC Secretariate was established in Dhaka in 2014 itself. Unlike the Free Trade Agreements (FTAs) BIMSTEC is a sector-driven group cooperation with focus on six sectors (trade, technology, energy, transport, tourism, and fisheries) initially in 1997 but later expanded in 2008 to incorporate agriculture, public health, poverty alleviation, counter-terrorism, environment, culture, people-to-people contact and climate change augmenting the scope and reach of the group up to 14 sectors. Apparently, BIMSTEC is steadily emerging as multi-sectoral wider scoped negotiation to cover major areas of mutual concerns of the member countries, although it still in waiting to have its own status free trade agreement.

Table 1: Economic Indicators of BIMSTEC Nations (2020)

S. No	Year of Join	Country	GDP (US \$ Million)	Population (Million)	Per Capita GDP (US \$)	FDI Inflow Stock (US \$ Million)	Trade of Goods (UD\$ Million)	Trade of Services (US\$ Million)
1	1997	Bangladesh	322240	164.689	1957	2563.58	86409	14715
2	2004	Bhutan	2551	0.772	3306	2.51	1550	361
3	1997	India	2679578	1380.004	1942	64061.91	649156	357178
4	1997	Myanmar	92102	54.410	1693	1834.21	34639	7891
5	2004	Nepal	27852	29.137	956	126.49	10712	2000
6	1997	Sri Lanka	80668	21.413	3767	433.87	26102	7019
7	1997	Thailand	499669	69.800	7159	-6099.73	438460	78761

Source: UNCTAD Database, Extracted from <https://unctadstat.unctad.org> dt 22 March 2022

BIMSTEC is a considerably important economic identity and a large market with a combined size of more than US\$3.7 trillion economy and a total of almost 1.75 billion population. Although, it is also spatially heterogeneous, given the variations in respect of per capita incomes from US\$ 956 of Nepal to US\$ 7159 of Thailand. The size of the group is overwhelmingly inclined towards India, which accounts for 72 per cent of its total economy and 79 per cent of its population. Thailand is the second largest economy of the group in terms of GDP, accounting for around 13.5 per cent of BIMSTEC's gross domestic product, while Bangladesh is second largest country in terms of population accounts for almost 9.37 per cent of the total population of the group. Noticeably, per capita GDP of Bhutan (3306), the smallest economy of the group is third highest from Thailand and very close to that of Sri Lanka (3767).

Sector-Based Approach

BIMSTEC is a sector-based declaration focuses on the particular issue of mutual concerns. In its 17th Ministerial Meeting held on 1st April 2021 in India, it was agreed to form seven group of the areas for potential cooperation. Each group (or sector) is led by specified member country for coordination and operation. All other additionally explored sectors are clubbed with other sector so that each Lead Country (or Chair Country) can be given responsibility of implementation of sector related projects. The details of groups are given below:

Table 2. BIMSTEC Sectors of Cooperation

S No	Lead Country	Sector
1	Bangladesh	Trade, Investment and Development
2	Bhutan	Environment and Climate Change
3	India	Security Sub-sectors: (i) Counter Terrorism and Transnational Crime (CTTC) (ii) Disaster Management (iii) Energy
4	Myanmar	Agriculture and Food Security Sub-sectors: (i) Agriculture (ii) Fisheries & Livestock
5	Nepal	People-to-People Contact Sub-sectors: (i) Culture (ii) Tourism (iii) People-to-People Contact Forums
6	Sri Lanka	Science, Technology & Innovation Sub-sectors: (i) Technology (ii) Health (iii) Human Resource Development
7	Thailand	Connectivity

Source: <https://bimstec.org> extracted on 23 march 2022.

Keeping the pace with time the BIMSTEC use to identify additional sectors of cooperation and now the total sectors increased to 14, progressively. Two specialised centres have been established to support sectoral cooperation. First, the Energy Centre which is set up in Bengaluru, India as decided in the first BIMSTEC Energy Ministers Conference held on 04 October 2005 in New Delhi. It aims to focus on sharing experience in reforms, restructuring, regulation and best practice in the energy sector. Second, the Centre on Weather and Climate which was proposed by India during the 1st BIMSTEC Summit but could be set up after third summit in 2014. It is again located in the National Centre for Medium Range Weather Forecasting (NCMRWF) Noida, Uttar Pradesh, India. The objective of the centre to tackle the transnational threat of climate change by promoting coordination among the members for scientific research and propagation the information in area of climate and weather prediction. In addition, a BIMSTEC Business Council has also been set up to provide a platform to encourage and promote trade and business among member nations.

Bimstec Matters

BIMSTEC is primarily set up to focus on common regional concerns of economic and social development rather to focus on geo-politics of Southern Asia. Since very beginning, BIMSTEC promotes members to engage deeper on common issues and progressively included many sectors of mutual interest. From a South Asian perspective, it was seen to cover the lacks of the South Asian Association for Regional Cooperation (SAARC) with an attempt to evolve itself as a meaningful platform for regional cooperation and development of member countries. The effectiveness of SAARC as a regional forum has been adversely affected by the estranged interests of India and Pakistan – the two largest countries of the association. Such issues, hopefully, would not affect functioning of BIMSTEC. The two largest members–India and Thailand–also balance the economic strength with affability within the group and provide foundation of comfort and confidence for the other members. This is evidenced from the progress of BIMSTEC as trade among the member countries reached six percent of its total trade in just a decade, while trade among SAARC countries remained around five percent since its inception.

Success of any group depends on trust and comfort of every member country also with motivating outcome. BIMSTEC is very democratic forum where smaller countries like Bangladesh, Nepal and Bhutan can develop connectivity with neighbours in ASEAN countries without any fear of dominance by big powers. The success of BIMSTEC would also help the South and South-east Asian countries to get better connected with BIMSTEC and can expedite their projects in this region. The Trade Negotiation Committee of BIMSTEC in working on its 2004 resolution to adopt a framework to establish its FTA but it has not yet been recognized by the World Trade Organisation. As the FTA negotiations allow sufficient market access among members not only in trade of goods and services but also in investment which help in accelerating economic integration among members. Thus, the FTA will be another important mile stone for progress and survival of BIMSTEC. It will help in intensifying cross-border production linkages and generate new value chains which are inseparably needed for cooperation in other sectors.

BIMSTEC is taken as an important political breakthrough for India and supposed to assume larger economic significance in the future. India's persistent involvement as a founding member of BIMSTEC reveals its importance in furnishing India an edge in world economy. BIMSTEC also fits well in line of India's active strategic interests in increasing interface with its neighbouring countries for mutual handling of cross boarder shared concerns. India's increasing interest in BIMSTEC in tandem with its 'Look East' and 'Act East' policies is seen to help in India's energy requirements and counter terrorist activities. India is focusing on connectivity projects around the Bay of Bengal not only to connect India's landlocked Northeast states but also with the Himalayan countries like Bhutan and Nepal. Further, physical connectivity among BIMSTEC nations would also help India to integrate itself better with ASEAN's Master Plan of Connectivity 2025. Disheartened by the difficulties come across in the SAARC in achieving its maximum potential, India became keen on exploiting the opportunities from BIMSTEC leading India to become regional power and better position in contemporary world.

India's Trade with BIMSTEC

Economic benefits as explained in terms of trade dividend is one of the basic needs for any cooperation. Although BIMSTEC FTA has yet to come into force, it is imperative for the members to overcome major barriers in order to facilitate trade. One such obstacle is the degree of preferential market access that already exists between several BIMSTEC members through other trade agreements like South Asian Free Trade Agreement (SAFTA) where India has bilateral trade agreements with Sri Lanka and Thailand. India is already linked to Thailand and Myanmar through the India-ASEAN FTA and its access to the Southeast Asian markets is expected to be further enhanced by the completion of the ongoing Regional Comprehensive Economic Partnership talks in this forum. The progress on the FTA of BIMSTEC depends largely on the roles played by the major partners- India and Thailand- who have highlighted the need for several market accesses issues, such as the liberal movement of professionals and easy investment conditions in retail operations. The present condition of trade and its progress is better explained with the help of comparative trade data. Additionally, it also expresses the significance of BIMSTEC countries in India's foreign trade over a period of time.

Table 3: India's Export to BIMSTEC Countries (Values in US\$ Million)

SN	Country	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
1.	Bangladesh	6,451.47	6,034.94	6,820.11	8,614.35	9,210.06	8,200.75	9,691.56
2.	Bhutan	333.94	468.95	509.28	546.12	657.33	738.60	701.02
3.	Myanmar	773.24	1,070.65	1,107.89	966.19	1,205.60	973.89	772.56
4.	Nepal	4,558.77	3,902.70	5,453.59	6,612.96	7,766.20	7,160.35	6,838.46
5.	Sri Lanka	6,703.72	5,310.75	3,913.15	4,476.46	4,710.21	3,800.91	3,498.23
6.	Thailand	3,464.83	2,987.86	3,133.44	3,653.83	4,441.40	4,299.30	4,237.59
	Total	22,285.9	19,775.9	20,937.5	24,869.9	27,990.8	25,173.8	25,739.4

Source: Export Import Data Bank, Department of Commerce, GOI; Downloaded from <https://tradedat.commerce.gov.in/eidb/default.asp> on 24 March, 2022.

Table 3 highlights significant increments in India's export to the BIMSTEC countries. The total export to these countries which was nearly US \$ 22286 million in 2014-15 has increased to US \$ 25739 million, a total of more than 15 percent rise in last seven years, after the draft of FTA finalized and agreed to increase the mutual trade by reducing multiple barriers and pacifying the trade hurdles. If we see the country specific export within the group, Bangladesh is our biggest export partner counting around 37.65 percentage whereas Bhutan is the least export consumer. Although Thailand is the largest economy after India but our export to Thailand is only of US \$ 4237.6 million in 2020-21 count for a little more than 16 percent of total export and stands at the third position after Bangladesh and Nepal across the seven years of assessment.

India's import data, as given in table 4, also reflects importance of these countries in India's foreign trade. The country's total import from BIMSTEC increased from US \$ 9264.74 million in 2014-15 to US \$ 11375.6 in 2018-19 recording around 23 percentage growth. Although India's import from these countries reduced in next two years to US \$ 10621.4 in 2019-20 and US \$ 9049.82 in 2020-21 owing to different temporary causes and the COVID-19 pandemic. Our largest import partner in the group is Thailand which is the most developed nation in the group and is the second largest economy in the member countries after India. Our import from Thailand remained more than 50 percent of our total import from the BIMSTEC countries. If we see the growth rate of import trade, we see the import from Bhutan, the smallest nation of the group, has increased fastest to record a 188.67 percent rise as highest in the group where as our import from Myanmar is decreased the most from US \$ 1231.54 million in 2014-15 to only US \$ 526.79 million in 2020-21, a negative growth of more than 57 percent, has come to less than half in last seven years.

Table 4: India's Import to BIMSTEC Countries (Values in US\$ Million)

S. No	Country	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
1.	Bangladesh	621.37	727.15	701.68	685.65	1,044.80	1,264.74	1,091.66
2.	Bhutan	149.87	281.27	307.82	377.99	370.96	405.73	433.00
3.	Myanmar	1,231.54	984.27	1,067.25	639.64	521.49	547.25	526.79
4.	Nepal	639.91	470.59	445.13	438.38	508.14	711.61	673.16
5.	Sri Lanka	756.17	742.79	602.20	772.63	1,488.40	903.69	642.94
6.	Thailand	5,865.88	5,510.16	5,415.40	7,134.46	7,441.81	6,788.38	5,682.27
Total		9,264.74	8,716.23	8,539.49	10,048.7	11,375.6	10,621.4	9,049.82

Source: Export Import Data Bank, Department of Commerce, GOI; Downloaded from <https://tradestat.commerce.gov.in/eidb/default.asp> on 24 March, 2022.

Increasing importance of BIMSTEC countries for India is evidenced from the foreign trade data shown in table 3 and 4. Initially BIMSTEC did not stress upon the trade and preferential trade agreements, still it has potential to cater augmented trade aspiration of member country. India has opportunity to increased export to and import from the member country as being natural trade partners sharing common geo-political situation and low transportation cost on account of been nearer. Once connectivity is developed as per plan and the group succeeded to obtain the FTA status, the trade among members is bound to increase unprecedentedly. Although many member countries have linked trade relation being partners of different free trade agreements and regional trade negotiations, having additional and inclusive trade agreements on basis of regional common concerns will further boost the trade and investment on the basis of mutual benefits among the member countries and thus help the important countries of third world to develop a sustainable trade partnership to help their development requirements.

Table 5: Share of BIMSTEC Countries in India's Trade (Values in US\$ Million)

Year	Export			Import		
	Total	BIMSTEC	% Share	Total	BIMSTEC	% Share
2014-15	310,338.48	22,285.9	7.1812	448,033.40	9,264.74	2.0679
2015-16	262,291.09	19,775.9	7.5397	381,007.74	8,716.23	2.2877
2016-17	275,852.43	20,937.5	7.5901	384,357.02	8,539.49	2.2218
2017-18	303,526.16	24,869.9	8.1937	465,580.98	10,048.75	2.1583
2018-19	330,078.09	27,990.8	8.4801	514,078.41	11,375.61	2.2128
2019-20	313,361.04	25,173.8	8.0335	474,709.27	10,621.40	2.2375
2020-21	291,808.48	25,739.4	8.8207	394,435.87	9,049.82	2.2944

Source: Export Import Data Bank, Department of Commerce, GOI; Downloaded from <https://tradestat.commerce.gov.in/eidb/default.asp> on 24 March, 2022.

The comparative data given in table 5 show the relative position of BIMSTEC reflected in terms of share of its trade to India in India's total foreign trade. It is also evidenced from the data that India's trade with the BIMSTEC countries is increasing with the passes of time. In 2014-15 India's total export to the BIMSTEC country was 7.18 percent of country's total import, which increased to 8.82 of the country's total import in 2020-21. Similar trend is also observed in the case of our imports too. Our total import from the BIMSTEC countries which was 2.07 percent of the total import in 2014-15, increased to 2.21 percent of our total import in 2020-21. The decrease in export and import in recent years, after 2018-19 as visible in table 5, is attributed to Covid-19 conditions which affected the total world trade. But the share of India's trade to BIMSTEC out of its

total world trade increased from 4.16 percent in 2014-15 to 5.07 in 2020-21 showing the enhanced significance of BIMSTEC for India. With approval of the BIMSTEC FTA, the trade trajectory is going to improve and India expected to be the largest gainer.

Table 6: Growth Rate of India's Trade with BIMSTEC Counties (Year to year basis)

Year	Percentage Growth in Export		Percentage Growth in Import	
	Total Trade	BIMSTEC	Total Trade	BIMSTEC
2014-15	-1.29	16.44	-.48	8.12
2015-16	-15.48	-11.26	-15.96	-5.92
2016-17	5.17	5.87	0.88	-2.03
2017-18	10.03	18.78	21.63	17.67
2018-19	8.75	12.55	10.42	13.20
2019-20	-5.06	-10.06	-7.66	-6.63
2020-21	-6.88	2.25	-16.91	-14.80

Source: Export Import Data Bank, Department of Commerce, GOI; Downloaded from <https://tradedat.commerce.gov.in/eidb/default.asp> on 24 March, 2022.

The fluctuation is a usual phenomenon of foreign trade of any county owing to different temporary and international reasons but the growth trajectory of trade with a country explains its fostering importance. The data in table 6 flaunts the growth of our county's trade vis-à-vis growth of trade with the BOMSTEC countries. In 2014-15 India's total export was reduced by 1.29 percentage in respect to the previous year's export but our export to BOMSTEC countries increased by 16.44 percentage in the same year. Evidently, India's performance in Trade with the BIMSTEC countries remain better than its overall trade performance. Export to BIMSTEC countries had been growing faster than total trade growth during last seven years except year 2019-20. Performance in import trade had also been better, befitting the export trends, except a few years. It can be derived that our country's improving trade relation with the BIMSTEC countries and will gain better from increased trade integration and strategic partnership.

One of the important objectives of this forum is to attain the status of Preferential Trade Agreement (FTA) enabling the counties to create a safeguard against the WTO provision while negotiating for intensifying trade and investment among the member country for maximizing the benefits. One of the potential perceptions behind delay in its recognition may be Chinese influence on some members like Nepal to include China in BIMSTEC leading to complications. Nonetheless, the progress on internal connectivity initiatives, such as the transport movement amongst India (towards its north-eastern states), Bangladesh and Nepal is encouraging step for progress on a broader trade agreement. It further provides vent for India to East and East-south Asia through different initiatives such as the India-Myanmar-Thailand trilateral highway project. The other positive development is signing of a memorandum of understanding (MoU) in its fourth summit to establish the BIMSTEC Grid Interconnection. It will provide a framework of cooperation for trade in electricity with a view to promoting rational and optimal power transmission in the BIMSTEC region.

CONCLUSION AND SUGGESTIONS

Economic development, ultimate objective to maximize materialistic welfare, is outcome of comprehensive, inter-related and inter-dependent efforts. Not all the countries are similarly endowed by nature and equally empowered with technology. Hence, mutual cooperation across the globe becomes compulsion to cultivate collective economic dividend. Establishment of many regional and global institutions is the outcome of deliberate efforts for shared concerns and economic growth. The inception of the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) is one of such initiatives of regional cooperation for multi-sectoral collaboration. It is the first kind of agreements for India targeting to reduce the gap among the countries in addition to augmenting trade benefits. The wider objectives of this forum include better connectivity, access of wider market and handling the issues of common concerns. Consequently, it aims to build a close group having geo-political impact in the area along Bay of Bengal and further extended to the East and East-south Asia. The potential of BIMSTEC can easily be understood by the consented declaration during its 4th Summit held in Kathmandu, Nepal on 30-31 August 2018. A variety of issues including combating terrorism, strengthening regional connectivity, creating robust institutional arrangements for expanding regional co-operation and enhancing trade and investment among members had been discussed. The forum also agreed to enhance cooperation in the fields of agriculture, energy, technology, public health and culture.

More than two decades passed since its inception but BIMSTEC has not been able to gather the expected momentum and so been labelled as a low-profile and under discussed regional association. Several issues which are long been in discussion but yet to attain the substantial stature and produce the desired outcomes. Example, the FTA framework was adopted way back in 2004 but still in awaited to be recognized by the WTO. Transport and energy connectivity are potential issue which can galvanise BIMSTEC into action group. Divided regional geopolitical interests may come in the way of completion of mutual projects. For example, Nepal and Thailand did not participate in the first BIMSTEC anti-terror military exercise conducted at Pune in India, 10-16 September 2018, possibly under tacit pressure of China. Hopefully, the other issues pertaining to economic, social and human development might not witness similar fractions among the members. BIMSTEC must figure out a pragmatic approach of thriving its agenda. Many agendas such as the Belt and Road Initiative across the South Asia, the Free and Open Indo-Pacific region and the Asia Africa Economic Corridor are expected to be executed on securing participation of other than member countries. BIMSTEC's great challenge is to stay relevant in the contemporary discourse in Asian regionalism. It risks to marginalised in the backdrop of China led regional groups are aggressively progressing and China's tainted influence contradiction every independent Indian initiative. In the era of globalisation the local conventions proved to be instrumental to protect and augment mutual interests. But the reason behind India's keen interest in this group to set its own place in regional geo-political arena and empowering itself for better bargaining at international political and economic domain. Assumably, after BIMSTEC APTA come into existence, member countries having similar socio-cultural-economic conditions can be proved to be natural trade alliance and will have the political and economic advantages in new world order.

REFERENCES

1. Banik, N. (2006). How Promising Is BIMSTEC. *Economic and Political Weekly*, 41(51), 5264–5268.
2. Batra, A. (2010). Asian Economic Integration and Sub-Regionalism: A Case Study of the BIMSTEC. *International Studies*, 47(1), 1–25. doi:10.1177/002088171104700101
3. Bhattacharya, S. K. and Bhattacharya, B. N. (2006). Prospects of Regional Cooperation in Trade, Investment and Finance in Asia: An Empirical Analysis on BIMSTEC Countries and Japan. Retrieved October 4, 2019, <https://ssrn.com/abstract=905761>
4. Erokhin, V. (2016). Rising Economic Powers among Economies in Transition: Is There Enough Space on the Global Market?. in V. Erokhin (Ed.), *Global Perspectives on Trade Integration and Economies in Transition*, Hershey, PA: IGI Global, 1–25. doi:10.4018/978-1-5225-0451-1.ch001
5. Gupta, S. (2018). Constraints to India's Support for Regional Economic Integration. *Asia Pacific Bulletin*, July 11, 2018, Retrieved on March 24, 2019 from EastWestCenter.org/APB
6. Kabir, M. and Salim, R. (2010). Can Gravity Model Explain BIMSTEC's Trade?. *Journal of Economic Integration*, 25(1), 143–165. doi:10.11130/jei.2010.25.1.144
7. Leela, P. (2007). Evolution of BIMSTEC: Towards a Bay of Bengal Economic Community. in T. Nirmala Devi (Ed.), *India and Bay of Bengal Community: The BIMSTEC Experiment*, Gyan Publishing House, New Delhi, India, 172–178.
8. Mehta, R. (2002). Establishment of Free Trade Arrangement among BIMSTEC Countries Some Issues. *Research and Information System for Developing Countries*, BIMSTEC, New Delhi, India
9. Palit, A. and Tieri, S. (2019). Prospects for Reconnecting the Bay of Bengal. *Special Report Issue No. 3*, Institute of South Asian Studies, National University of Singapore, Singapore
10. Prabir, D. (2016). Strengthening BIMSTEC Integration. *BIMSTEC Newsletter*, 72 (1), http://www.bimstec.org/uploads/pages/Events/eNewsletter/BIMSTEC_eNewsletter_June2016.pdf.
11. Say, J., B. (2009). *A Treatise on Political Economy*. Ludwig von Mises Institute (first published 1815)
12. Siddique, A. (2007). Regionalism, Trade and Economic Development: Theories and Evidence from the Asia-Pacific Region. in M. A. B. Siddique (Ed.), *Regionalism, Trade and Economic Development in the Asia-Pacific Region*, Edward Elgar Publishing, Cheltenham, UK, xiii-iv, 3-22.
13. Simkhada, S. R. (2018). BIMSTEC as A Regional Organization: Déjà Vu or New Beginning?. *National Security*, III (1), 1-11.
14. Singh, M. (2021), India and Regional Trade Agreements: A Case Study of Asia Pacific Trade Agreement (APTA). *Bihar Research Journal*, 13(02), 6-17.

15. Sundaram, D. (2013). Look East Policy. *International Journal of Advancements in Research & Technology*, 2(5), 169-185. Retrieved on March 30, 2019.
16. Vadranam, S. and Sahoo, J. (2020). South Asian Association for Regional Cooperation (SAARC) Countries and the Role of Regional Development. *Quest Journals, Journal of Software Engineering and Simulation*, 6(3), 18-24. www.questjournals.org.
17. UNCTAD Database, Extracted from <https://unctadstat.unctad.org> dt 22 March 2022
18. <https://bimstec.org> extracted on 23 march 2022
19. Export Import Data Bank, Department of Commerce, GOI; Downloaded from [https:// tradestat.commerce.gov.in/ eidb/default.asp](https://tradestat.commerce.gov.in/eidb/default.asp) on 24 March, 2022

Chemical Fractionation of Calcium, Iron, Copper, Cadmium, Zinc and Lead in Soils near in Vicinity of Coal Based KSTPS in Kota City, Rajasthan

Manju Meena*, Bharat Singh Meena, Aparna Yadav and Manju Bala Yadav
Department of Chemistry, Government College, Kota- 324001, Rajasthan, India

ABSTRACT

Heavy metals are toxic to human life and environments. Hence, the sequential fractional procedure was confirmed as suitable for accessing the content and availability of heavy metals in the Kota City soils. Soil samples were collected from fifteen different sites near coal based Kota Super Thermal Power Plant Station (KSTPS) in Kota City, India in winter season of 2019 - 20. Soil samples assessment was done to study physico-chemical properties, total heavy metal concentration and chemical speciation of the heavy metals as a function of soil properties. Sequential chemical extraction procedure (SCE) was used to measure the lability of heavy metals such as Ca, Fe, Cu, Cd, Pb and Zn in soils to separate the metals into water soluble, MgCl₂, NH₄-acetate, hydroxylamine hydrochloride, HNO₃/H₂O₂ and HF/ HNO₃ extractable fractions. Ca and Fe associated with HF/ HNO₃ and Na-acetate extracted fractions, copper with Fe-Mn oxide and HF/ HNO₃ extracted fractions, Cd with HF/ HNO₃ and hydroxylamine hydrochloride extracted fractions, Pb with organic and Fe-Mn oxide bound extracted fraction & Zn with hydroxylamine hydrochloride and carbonate extracted fractions.

Keywords: Sequential fractional procedure, Soil samples, Kota Super Thermal Power Plant Station, physico-chemical properties, heavy metals.

1. INTRODUCTION

In nature, heavy metals occur in rocks, soils, sediments and water but anthropogenic activities has enhanced significantly since the industrial revolution. This elevation has caused serious environmental problem that has disturbed the natural food chain and consequently the health of organisms, including humans [1]. An anthropogenic activity such as mining, agriculture, metal industries and traffic emissions has increased the level of metals found in superficial soil and vegetation of areas. The mobility of metals from anthropogenic sources tend to be more than lithogenic ones [2].

In Kota city, Kota Super Thermal Power Station (KSTPS) generates large amount of fly ash, which is a homogeneous mixture of various metal oxides in the atmosphere. Other industries (small and large scale) including Kota stone factories further increase the heavy metal load in the atmosphere [3].

Lime concretion at varying depths from shallow to very deep is present in alluvium soils of Kota district. The distribution of heavy metals in soil altered due to sorption/desorption, precipitation, dissolution, redox reaction and penetration in the solid components of soil [4]. Soil environments having clay minerals with a high density of negative surface charges (high CEC values), high surface areas (small sizes) and also weak vander Waal forces between the structural layer has an increased tendency for the absorption and migration of metal compounds [5 - 6].

In recently there has been increased interest in the research on speciation or chemical forms of heavy metals in polluted soils and sediments using sequential extraction techniques because these provide information on metal affinity to soil components and the firmness with which they are bound to matrix [7].

Sequential extraction methods selectively extract metals bound by specific soil fractions with little effects on the soil components. Usually, sequential fractionation schemes have been used to find the element distribution with operationally defined soil samples [8].

The main objective of our study is determination of the total concentrations and extractability of Ca, Fe, Cu, Cd, Pb and Zn in surface soil near coal based Kota Super Thermal Power Plant (KSTPS) in Kota City, India with a view of providing knowledge about the level of contamination. Thus, it becomes important to evaluate the levels of physico-chemical properties, spatial distribution and chemical speciation of heavy metals in soil to study their potential hazards to humans.

2. MATERIALS AND METHODS

2.1. Study Area

Kota, the main industrial city of Rajasthan state in India, has an area of 527 km². The climate of Kota city is semi arid having temperature ranging from 6°C in winter (January) to 47°C in summer (June). According to

GPS (Global Positioning System), 15 sampling sites were selected as per ASTM D 5111 Standards [9]. Location of various sampling sites of Kota city has been shown in Fig. 1.

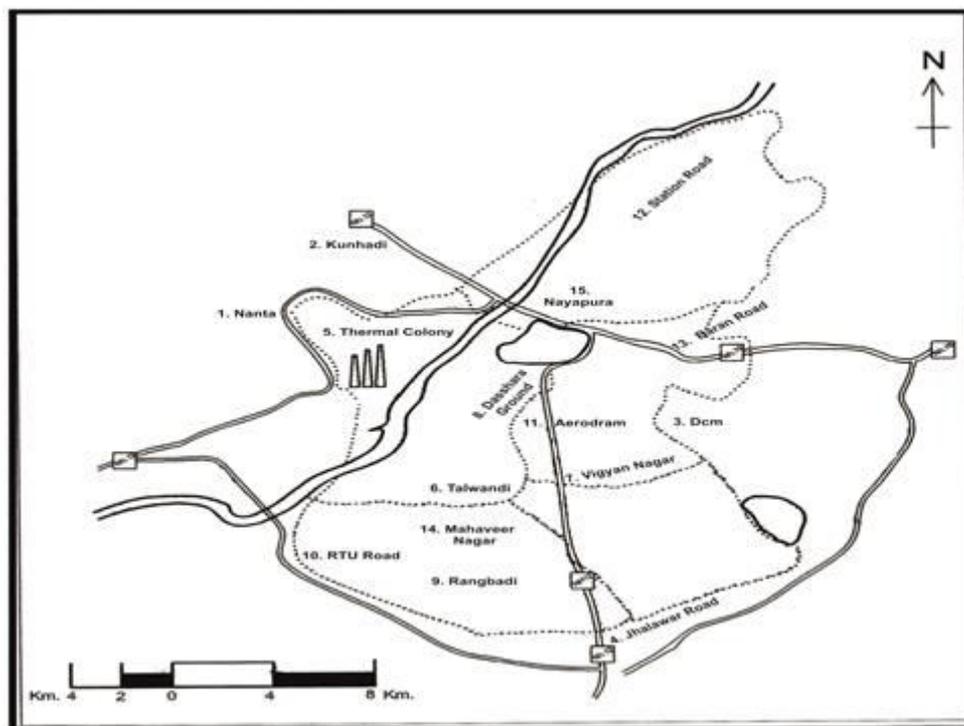


Fig. 1: Location of different sampling sites of Kota city.

2.2. Soil Sampling and Analysis

Soil samples (n=60) in requisite amount are collected from topsoil (0- 10 cm), at 15 selected sampling sites during winter (November, December, January, February) seasons of 2019-20. All soil samples are first air dried, then gently crushed and sieved for collecting soil particles smaller than 2mm. The obtained dried samples are then passed through the sieves with 100 BSS openings ($<149\mu\text{m}$) followed by suitable digestion.

2.3. Physico-Chemical Analysis of the Soil Samples

PH & EC [10], CEC [11], organic carbon content [12], particle size [13] and total heavy metals [14] were determined by the methods described in earlier research.

2.4. Sequential Extraction Procedure

The procedure of Ma and Rao, 1997, which is a modified from of procedure explained by an earlier researcher [6], was used to separate the heavy metals into six operational defined geochemical fractions (F1 to F6) [15]. Two grams of soil was placed in a 50 ml polypropylene centrifuge tube which was subjected to the following extraction processes:

Water-soluble fraction (F1): Soil extracted with 20 ml of deionized water for 2 hours.

Exchangeable fracton (F2): F1 residue was further extracted with 20ml of 1molL^{-1} MgCl_2 at pH 7 for 1 hour.

Carbonate-Bound Fraction (F3): Residue from F2 extracted with 20 ml 1molL^{-1} $\text{NH}_4\text{OC}_\text{c}$ at pH 5 for 5 hours.

Fe-Mn oxide-bound fraction (F4): Residue from F3 extracted with 20 ml 0.04molL^{-1} $\text{NH}_2\text{OH}\cdot\text{HCl}$ in 25% (v/v) CH_3COOH at 90°C with occasional stirring.

Organic-Bound Fraction (F5): F4 residue was extracted using 15ml 30% H_2O_2 at pH 2 (adjusted with nitric acid) for 5.5 hours (water bath, 85°C). After cooling, 5ml of 3.2molL^{-1} $\text{NH}_4\text{OA}_\text{c}$ in 20% nitric acid was mixed and shaken for 30 minutes and then diluted to 20 ml with deionized water.

Residual Fraction (F6): Residue from F5 was digested using a HF/HNO_3 digestion metod.

All the F1 to F6 solid phases were washed using 10 ml of deionized water before further extraction and the washes were collected with supernatant from the previous fraction. The supernatant was separated by centrifugation at 10, 000 rpm for 30 minutes after each extraction. The sum total of metal recovered from the sequential extraction steps is verified by determination of concentration of Ca, Fe, Zn, Cu, Cd, and Pb separately on the sample after $\text{HF}/\text{aqua regia}$ digestion.

Quality control was assured using triplicates and procedural blanks. Coefficients of variation were less than 6% for all elements, in the replicate analysis of the soil samples. The recovery of heavy metals in the sequential extraction steps was within 100+ 10%.

Following digestion, Direct Air–Acetylene Flame method (Atomic Absorption Spectrophotometer – Shimadzu - 6300) was used to determine the concentrations of 6 metals (Fe, Zn, Cu, Cd and Pb). Flame Photometer (Systronics -128) was used to measure Ca metal concentration.

2.5. Statistical Analysis

All the data obtained from the experiments were analysed using SPSS version16.0.

3. RESULTS AND DISCUSSION

3.1. Physicochemical Characteristics

The physico-chemical properties of the soil samples at various sites are displayed in Table 1. pH of soil is the main factor which influences the availability of micronutrients and heavy metals in the soil to plants [16]. Soil samples from Mahaveer Nagar were found to be acidic (pH 5.35). The availability, mobility and toxicity of heavy metal ions in the soils is regulated by acidity. Most metals are less mobile in soil having high pH because they form insoluble complexes [17]. Soil salinity is measured by electrical conductivity which indicates fast movement of charged particles than that of the less charged particles because of more soluble salts in the soil samples from the all sampling sites [18 – 19]. Organic matter acts as a major adsorbent for metals through the formation of chelates and makes them immobile [20]. Deficiencies in potassium (K⁺), magnesium (Mg²⁺) and other cations develop in soils with low CEC, while high CEC soils are less susceptible to leaching of these cations [21 – 22]. As the texture of the soil plays a very major role in the plant species development and also affects physical parameters of the soil. According to the table 2 all the soil samples were all sandy soils with very high percentage of sand and low clay & slit contents. Soils having high sand content exceeding 70% will have weak surface aggregation and such soils will be porous with high rate of water infiltration and air circulation [23].

Table 1: Some physico-chemical properties of surface soil in the Kota city.

Sample Sites	pH	EC (Siemens / meter)	Organic matter (%)	CEC (cmol/kg)	Sand (%)	Clay (%)	Slit (%)
Nanta (S1)	6.62	564.8	1.94	11.1	83.2	11.1	5.7
Kunhadi (S2)	8.99	9.48ms	2.66	83.3	81.6	12.6	5.8
DCM (S3)	6.51	384.4	3.54	78.1	76.9	10.1	13.1
Jhalawar (S4)	6.68	674.7	1.92	10.9	86.2	8.9	4.9
Thermal (S5)	8.69	571.1	2.21	12.1	77.3	10.9	11.8
Talwandi (S6)	7.62	468.0	7.59	20.2	72.1	10.2	15.7
Vigyan nagar (S7)	6.49	364.4	3.47	18.9	74.6	12.1	13.3
Dashara (S8)	6.77	333.5	3.70	18.2	74.1	10.9	15.0
Rangbadi (S9)	6.86	589.2	2.28	12.3	83.9	11.1	5.0
RTU (S10)	7.21	898	6.35	10.4	82.8	7.8	9.4
Aerodram (S1i)	6.63	424.9	3.99	18.1	74.1	13.1	14.8
Baran road (S12)	6.89	3.496ms	2.15	10.8	83.9	8.9	7.2
Station road (S13)	6.62	611.8	2.23	11.9	68.3	5.2	26.5
Mahaveer nagar (S14)	5.35	2.012ms	4.69	16.1	69.3	13.6	17.1
Nayapura (S15)	6.55	339.3	2.97	14.3	73.9	12.6	13.5

3.2. Total Metal Concentrations

Table 2: Characteristic levels of total heavy metals (mg kg⁻¹) in surface soil in the Kota city.

Sample Sites	Ca	Fe	Cu	Cd	Zn	Pb
Nanta	288.18	7.0135	2.5915	0.9865	4.5417	2.5103
kunhadi	258.12	6.1361	1.2235	1.0981	4.6928	2.3247
DCM	254.87	5.0428	3.1157	0.9813	2.2758	3.9617
Jhalawar	284.15	7.5167	1.8931	0.8683	1.8947	3.2158
Thermal	249.01	5.5691	4.9052	1.0812	4.1939	2.9831
Talwandi	269.91	3.8381	3.3901	1.3105	6.5447	4.4183
Vigyan nagar	283.31	4.8275	2.9901	1.0354	7.5771	3.8458

Dashara	274.81	6.1539	1.4303	0.8134	1.2528	2.3623
Rangbadi	288.49	5.3162	2.3634	0.6981	1.1867	2.2432
RTU	287.82	6.3057	3.3131	1.3513	6.3719	3.1245
Aerodram	279.75	5.5741	2.3152	1.5013	6.6737	4.8325
Baran road	280.89	7.0293	1.5506	0.8971	1.1141	1.9129
Station road	270.08	5.9782	2.8123	0.7345	0.9459	2.1703
Mahaveer nagar	271.83	3.8161	3.3213	1.2324	5.3847	3.7329
Nayapura	281.38	6.7064	2.4946	1.0035	6.5882	4.9533

Table 2 shows the heavy metal concentration and its distribution in all sites. The soil sample showed Ca, Fe, Cu, Cd, Zn and Pb levels ranging from 249.01 - 288.49, 3.8161-7.5167, 1.2235-4.9052, 0.6981-1.5013, 0.9459-7.5771 and 1.9129-4.9533 mg/kg respectively. The high concentration of Pb and Cd metals at these sites could be due to air particulate matter from coal based Kota Super Thermal Power Plant Station, car exhaust fumes depositing lead and other pollutants to the atmosphere, automobile repair process along with industrial activities occurring close to the automobile workshops.

3.3. Fractionation and Distribution of the Heavy Metals in the Soil Samples

The quantity of different metal (Ca, Fe, Cu, Zn, Pb and Cd) found in an extraction fraction is expressed as a percentage of the total mass of that metal in the complete extraction fraction as shown in Fig. 2 to 7.

3.3.1. Calcium: Calcium was mainly concentrated in the residual fraction (F6) with a range of 37.85-41.52% in all the sampling sites (Fig. 2).

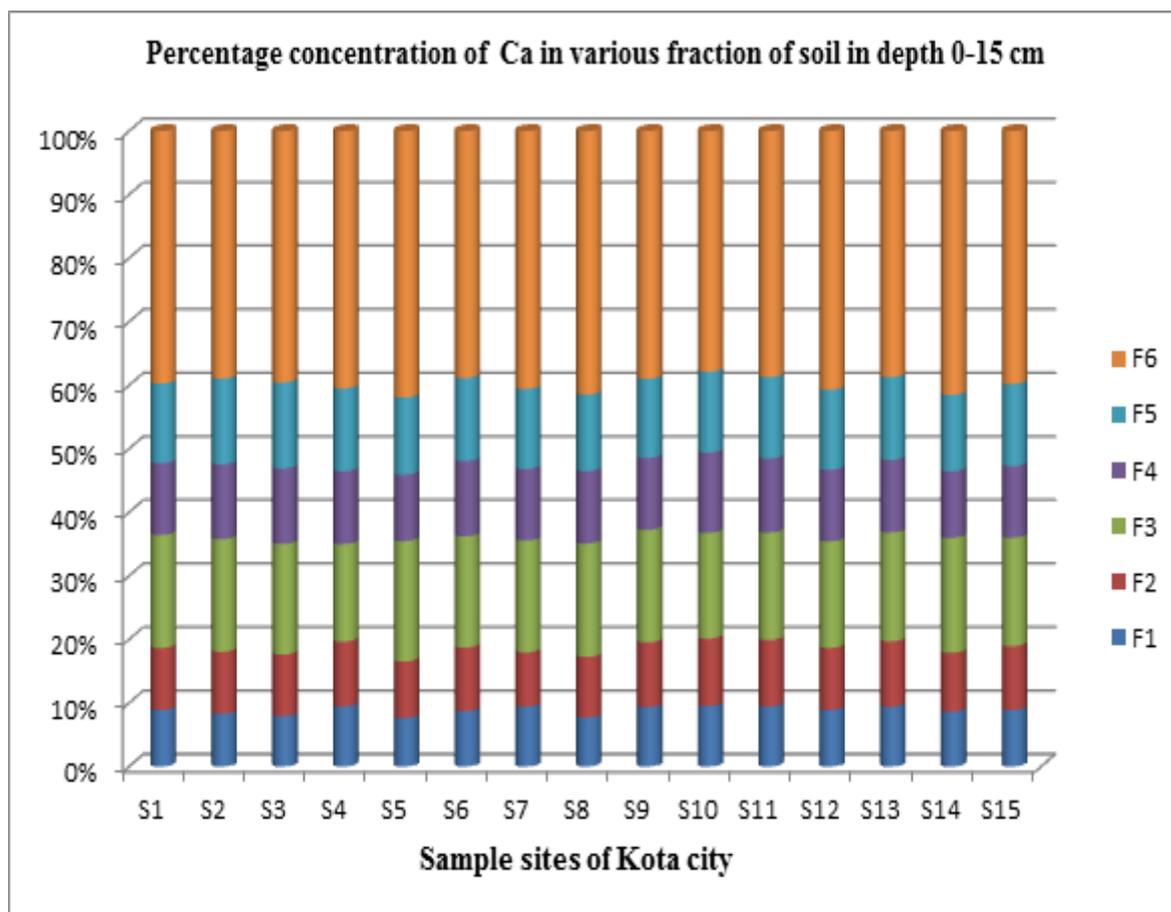


Fig 2: Percentage of Ca in the various geochemical phases as function of total Ca content of soil.

This was followed by the carbonate fraction (F3), organic bound fraction (F5) and Fe-Mn oxide bound (F4) with average percentages of 16.53-18.91%, 11.9-13.08% and 10.46-12.62% respectively. The exchangeable fraction (F2) and water soluble fraction (F1) had the lowest average percentage of 9.71 % and 8.57% respectively.

3.3.2. Iron: Iron was also mainly concentrated in the residual fraction (F6) with a range of 21.86-34.26% all the sites (Fig. 3). Similar research of iron association to residual fraction was reported earlier [24- 25].

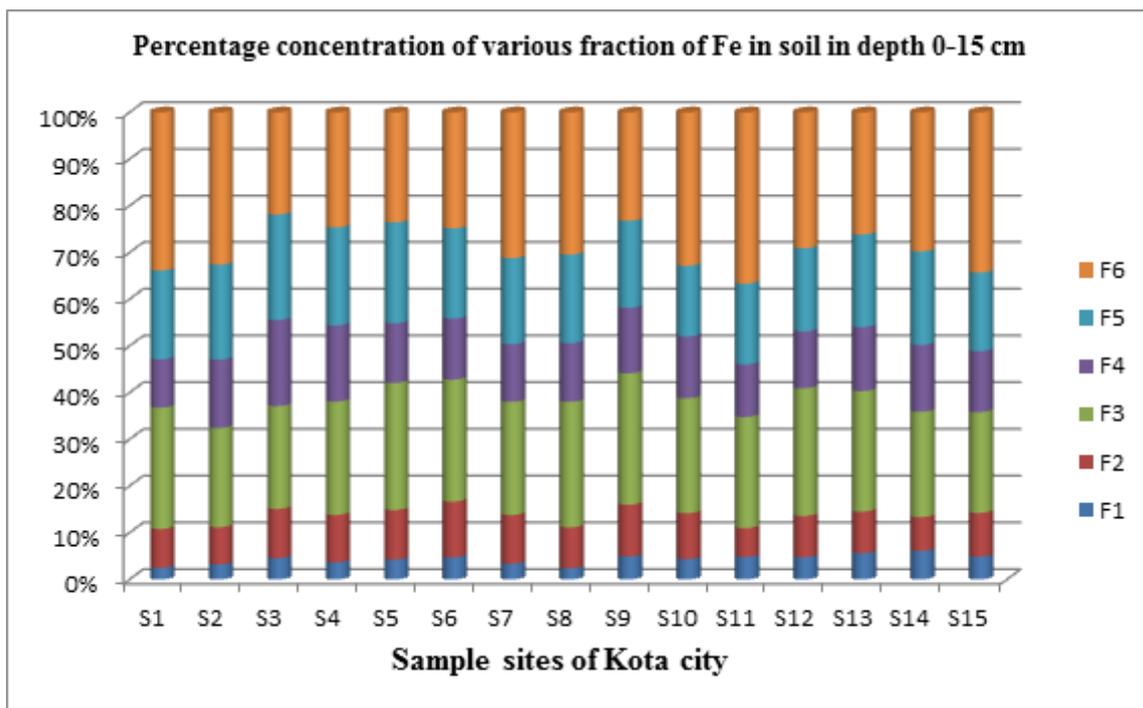


Fig 3: Percentage of Fe in the various geochemical phases as function of total Fe content of soil.

This was followed by the carbonate bound (F3), organic bound fraction (F5) and Fe-Mn oxide bound fraction (F4) ranging of 21.25-28.15%, 15.54-21.34% and 11.23-18.42% respectively. The exchangeable fraction (F2) and water soluble fraction (F1) had the least portion with a range of 6.16-11.92 and 2.39-6.10% respectively. As iron is easily absorbed and used by plants and other organisms in the soil environment, there is low iron metal content in the exchangeable and water soluble fraction [4].

3.3.3. Copper: Copper distribution in various chemical fractions depends on the total Cu content of the soils. Result of this research shows that Copper was found mostly in the Fe-Mn oxide bound (F4) with a range of 29.98-21.18%. The residual fraction (F6) is next with a range of 11.66-24.21 % and then organic bound fraction (F5) with a range of 10.52-21.63%. More Cu was associated with the non residual fractions, which increased potential Cu mobility and bioavailability in the carbonate, Fe-Mn oxide, organic fractions and Cu in the exchangeable and residual fractions decreased. The carbonate fraction (F3), the exchangeable fraction (F2) and the water soluble fraction (F1) has 11.04-16.65%, 8.19-14.08% and 4.24 10.66% respectively .

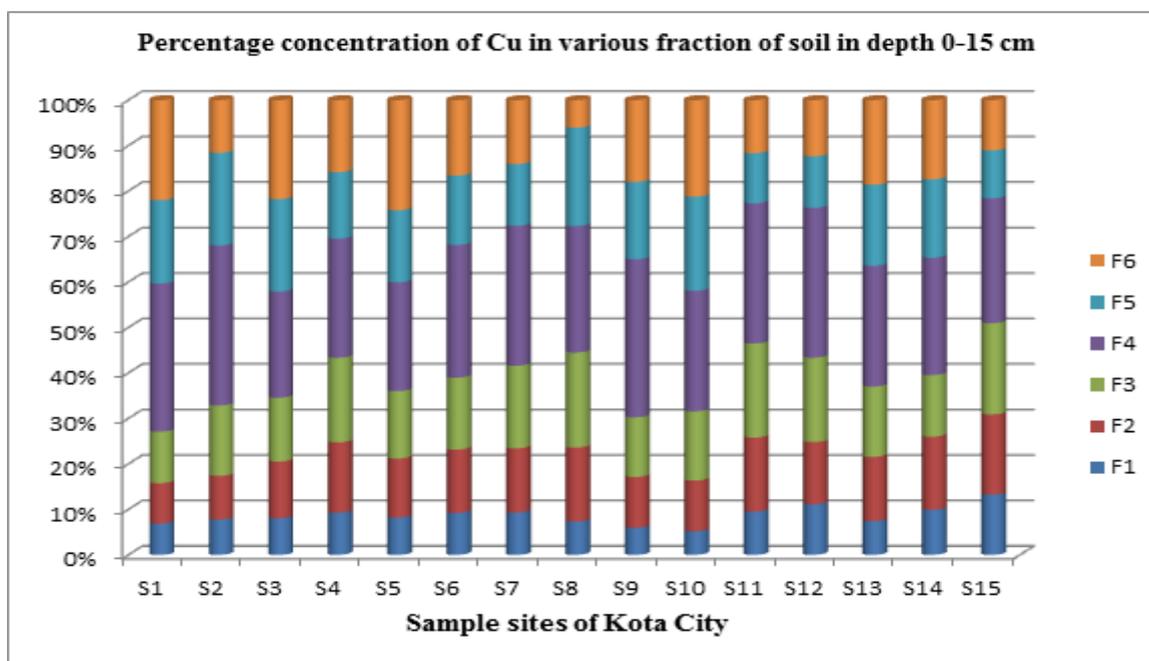


Fig 4: Percentage of Cu in the various geochemical phases as function of total Cu content of soil.

3.3.4. Cadmium: Cadmium was mostly concentrated in the residual fraction ranging from (27.01-44.05%). The strong association of Cd with the residual fraction is in agreement with the observation of Kuo et. al. about distribution pattern of Cd in the studied soils [26 – 28].

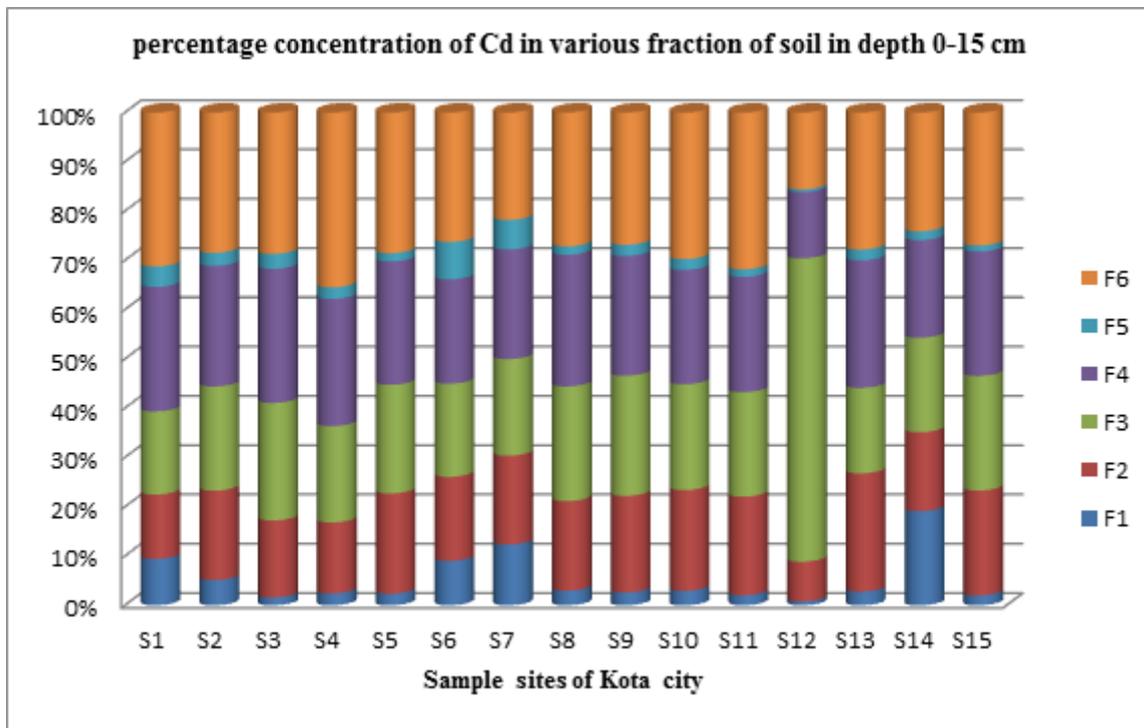


Fig 5: Percentage of Cd in the various geochemical phases as function of total Cd content of soil.

This was followed by the Fe-Mn oxide bound fraction (F4) in the range of 24.51-35.74%. The carbonate fraction (F3), exchangeable fraction (F2) and organic bound fraction (F5) were in the range of 20.25-30.05%, 15.72-27.21% and 1.45-5.01% respectively. Low concentration of water soluble was found between 1.11 to 4.56%.

3.3.5. Zinc: The distribution pattern in each fraction followed the order: Fe-Mn oxide bound > carbonate > residual > organic > exchangeable. The largest portion of F4 with the range of 29.69-50.53% was found. Majority of Zn was associated with Fe-Mn oxide fraction, which may be due to high stability constants of Zn oxides. This was followed by carbonate (F3), residual (F6), organic (F5), exchangeable (F2) and water soluble (F1) respectively having percent concentration between 18.04-32.48%, 10.59-22.77%, 5.96-13.92%, 1.36-17.62% and 1.09-2.62% [27].

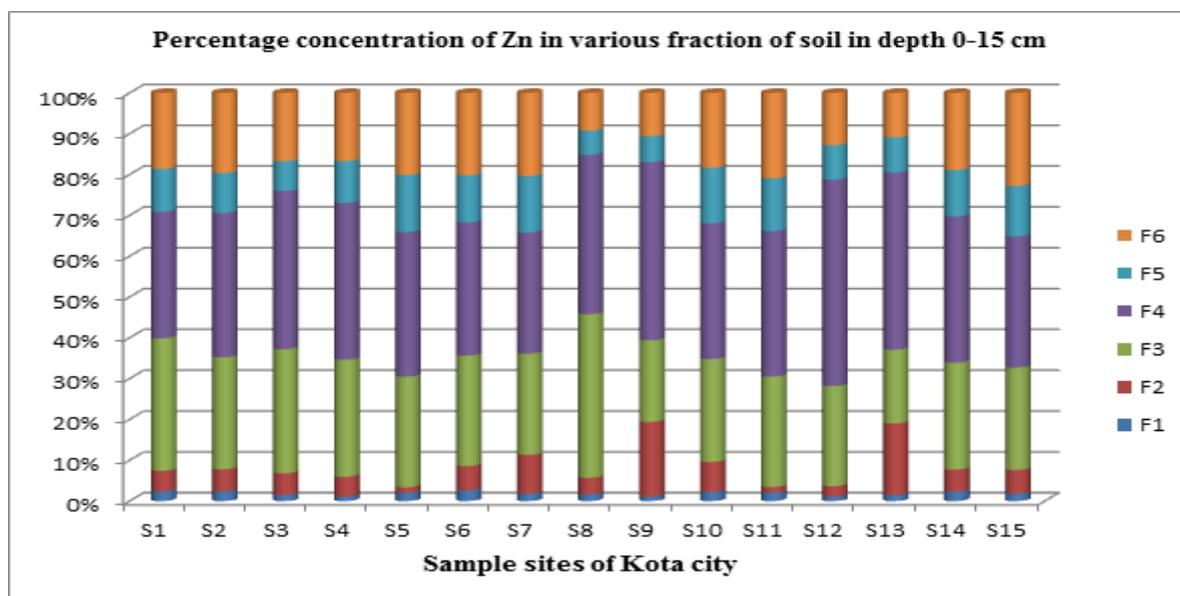


Fig 6: Percentage of Zn in the various geochemical phases as function of total Zn content of soil.

3.3.6. Lead: Lead was mainly found in the organic bound fraction (F5) ranging from 21.61-30.57% (Fig. 7).

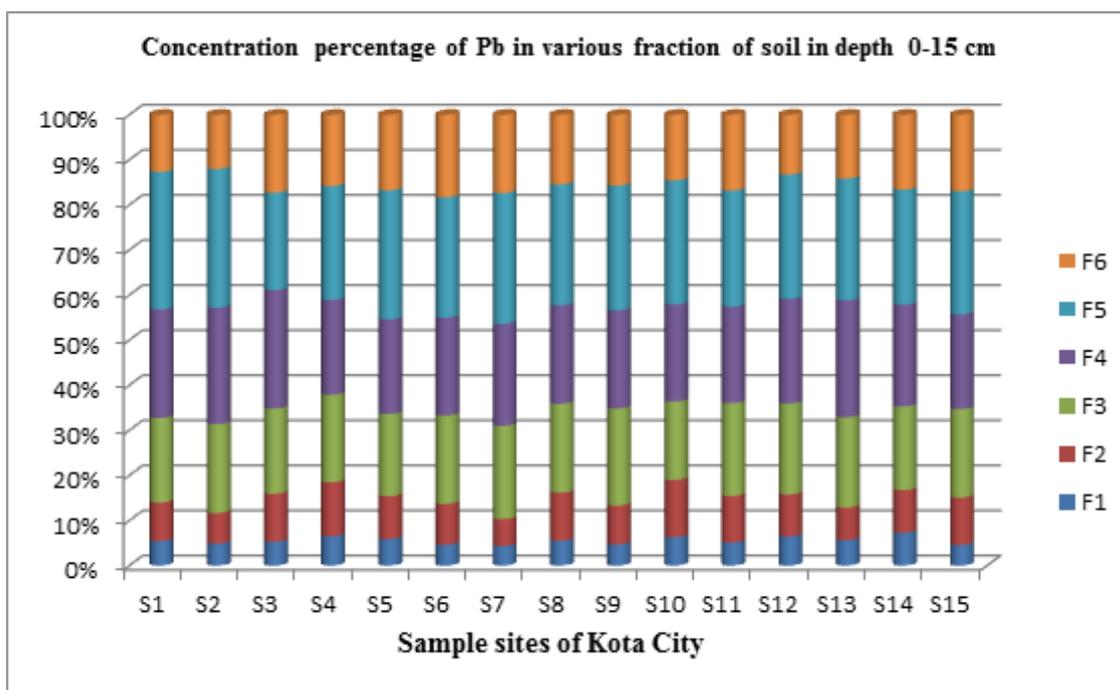


Fig 7: Percentage of Pb in the various geochemical phases as function of total Pb content of soil.

Coprecipitation of the metal with various silicate species may have occurred due to their adsorption into the mineral lattice because of the sandy nature of the soil [29]. This was followed by the Fe-Mn oxide bound fraction (21.05-26.70%), organic fraction (17.37-21.55%) residual fraction (12.03-18.30%) exchangeable fraction (7.22-12.72%) and water soluble (4.34-7.26%). Probably, it seems that the oxide fraction scavenges Pb in natural and polluted soils [30].

4. CONCLUSION

The presence of heavy metals in the environment represents one of the most critical environmental hazards. The results show that the soils of the studied regions are polluted with these metals, mainly given the high total concentrations which are steadily being released into the bioavailable forms and subsequently into solution which can lead to absorption into the plants system close to coal based Kota Super Thermal Power plant and cause biomagnification along the food chain.

The sequential extraction used in this study is useful to indirectly assess the potential mobility and bioavailability of the heavy metals in Kota city soil. The mobility of these metals is related to their solubility and geochemical forms, and it decreases in the order of extraction sequence i.e. exchangeable>carbonate>Fe-Mn oxide bound>organic>residual. This sequence is just a generalisation and offers only qualitative information of metal mobility. The first two phases can release their metal loads by decreasing the pH and are more mobile than the other phases. Accordingly, these two phases influence the mobility and hence the bioavailability.

5. ACKNOWLEDGEMENTS

The authors are thankful to Govt. College, Kota for analytical support for this work.

6. REFERENCES

1. Forstner U, Wittmann GTW. Metal Pollution in the Aquatic Environment. New York, Springer-Verlag. 1981.
2. Chlopek AJ, Bacon R, Wilson MJ, Kay J. Journal Environment Quality. 1996; 25:69-79.
3. Meena M, Meena BS, Chandrawat U, Rani A, Aerosol and Air Quality Research, 2016; 16: 990-999.
4. Chukwujindu MA, Iwegbue GE, Nwajei OE, Ogala JE, Chemical Speciation and Bioavailability, 2009; 21(2): 98 - 110.
5. Dube A, Zbitniewski R, Kowalkowski T, Cukrowska E, Buszewski B, Polish J. of Environ. Studies, 2001 10(1): 1-10.
6. Mohan D, Pittman UPJ, J. of Hazardous Materials, 2007; 142(1-2): 1-53.

7. Amanda JZ, Weindorf DC, *International Journal of Analytical Chemistry*, 2010; 1-7.
8. Norvell WA, *Soil Science Society of America Journal*, 1984; 48:1285-1292.
9. ASTM, *Standard Guide for Choosing Locations and Sampling Methods to Monitor Atmospheric Deposition at Non – Urban Locations: D 5111*. West Conshohocken, PA, 1996.
10. Rayment GE, Higginson FR, *Australian Laboratory Handbook of Soil and Water Chemical Methods*, Melbourne, Inkata Press, 1992.
11. Anegebe B, Okuo JM, *Nigeria Journal of Applied Science*, 2013; 31: 126-135.
12. Davies BE, *Soil Sci. Amer. Proc.*, 1974; 38: 150.
13. Asagba EU, Okieimen FE, Osokpor J, *Chemical Speciation and Bioavailability*, 2007; 19(1): 9 – 15.
14. Okuo JM, Eloho R, Anegebe B, *Nigeria Journal of Applied Science*, 2016; 34: 43-55.
15. Ma LQ, Rao GN, *J. Environ. Qual.*, 1997; 26: 264.
16. Igwe JC, Nnorom IC, Gbaruko BC, *African J. of Biotechnology*, 2005; 4(13):1541 – 1547.
17. Anegebe B, Eguavoen IW, Oviawe AP, Ogbeide O, Osayande AD, *Biological and Environmental Science Journal for the Tropics*, 2014; 11(2): 84-93.
18. Arias ME, Gonzalez-Perez JA, Gonzalez-Villa FJ, Ball AS, *International Microbiology*, 2005; 8: 13-21.
19. Karaca A, *Geoderma*, 2004; 122: 297- 303.
20. Lawan IB, Stephen SH, Goni AD, Muhammad T, *ARPN Journal of Science and Technology*, 2012; 2(2): 50-55.
21. CUCE, Cornell University Cooperative Extension; Cation Exchange Capacity (CEC), *Agronomy Fact Sheet Series No 22*, Department of Crop and Soil Sciences, College of Agriculture and Life Sciences, Cornell University, 2007.
22. Okieimen FE, Emwanta DO, Odilayo OO, *International Journal of Applied Environmental Sciences*. 2012; 7(2): 215-232.
23. Gbadegesin, AS, Abua MA, *J. Geography and Geol.*, 2011; 3(1): 94-103.
24. Obasi NA, Akubugwo EI, Kalu KM, Ugbogu AE, Okorie UC, *Journal of Experimental Biology and Agricultural Sciences*, 2013; 1(6): 441-453.
25. Godwin AE, Imaobong AE, Helen SE, *Annals. Food Science and Technology*, 2014; 15(1): 162-171.
26. Adamo, P, Dudka, S, Wilson, MJ, McHardy, W., 1996. *Environmental Pollution*, 1996; 91 (1): 11–19.
27. Anju D.K. Banerjee, *Environmental Pollution*, 2003; 123: 95–105.
28. Taylor, SR, In: Aherns, L.H. et al. (Eds.), *Physics and Chemistry of the Earth*. Pergamon Press, New York, 1965; 133–213.
29. Manceau AN, Tamora S, Celestre RS, MacDowell AA, Sposito G, Padmore HA, *Environmental Geochemical Group Hillard Hall University of California*, 2006; 1-4.
30. Yusuf K A, *Journal of Agronomy*, 2007; 6(2): 331-337.

Resurfacing Myth: A Critical Analysis of Amish Tripathi's Narrative Technique

Pratibha Meena^{1*} and Vinita Shukla²

¹Department of English, PNKS Govt. P.G. College, Dausa, India

²Department of English, Govt. Arts College Kota, Kota, India

ABSTRACT

The practice of retelling mythology in literature is not a new genre but the contemporary writers, especially in Indian writings in English, have been practicing reinterpretation of such mythical texts in accordance with the present context. The common practice of retelling age old mythical stories seeks remarkable changes in the stories and characters of these texts to reach out the expectations of the modern readers. By practicing this genre Amish Tripathi also has tried to quench the thrust of the modern readers through fictionalized gods in human form in order to bring them closer to people. This paper explores the narrative technique of Amish Tripathi experimented in his fictional works in a larger spectrum. Further, it involves close textual analysis of 'Ramchandra Series' and 'Shiva Trilogy' to rationalize his practice of resurfacing myths of India in his literary works.

Keywords: Myth, Narrative Technique, Amish Tripathi, Ramchandra Series, Shiva Trilogy.

I. OBJECTIVES

1. To find perspective behind the experimentation of the new narrative technique.
2. To identify the use of Indian myths in the novels.
3. To find the modernity in the novels.

I. INTRODUCTION

Narrative technique is a method of composing stories in an effective way. This narrative technique involves the depiction of plot, introduction of characters etc [1]. In the contemporary time, writers like Amish Tripathi are using myths to discuss about the social, Political and other major issues of the nation. These myths function like the tools which expose the burning problems of contemporary India like casteism, social injustice, men- women relationship etc [2]. Amish Tripathi is known as India's first literary pop star. He has been a banker before becoming a famous writer but his inclination towards Indian culture and mythology made him a myth writer. The publication of 'Shiva Trilogy' spread sensation among the readers of India, moreover, this series turned into India's fastest selling books. 'Shiva Trilogy' and 'RamChandra Series' are the major literary works of Amish Tripathi dealing with India's age old myths in modern perspective [3].

II. DISCUSSION

A narrative is generally a story which can be either in prose or in verse comprising events, characters, dialogues and so on [1]. Likewise narrative techniques involve methods and literary devices used by a writer to craft the elements of a story. The key elements of narrative techniques fall into plot, character, perspective, theme, style and genre [4]. In the age of globalization and advanced technology, Tripathi has tried to exercise the age old practice of writing mythical fantasy in a larger spectrum. His mythical fantasy involves the imagination of the mythical gods like Shiva and Ram in the human forms. His works have the remarkable contribution in the Indian writings in English. His works are very close to the taste of the English speaking and reading Indian youth. His narrative techniques are the fusion of linear and cyclical strategies as it involves continuity and discontinuity of the previous mythical narrative. Tripathi has proved the never ending relevance and resourcefulness of mythologies through his fiction. The modern perspective of Tripathi towards Mythology is grounded upon the linguistic, historical, cultural study and fantasy as well.

Amish Tripathi has crafted the mythical characters according to the taste of the modern readers. He had added little 'masala' in the content to make it more alluring and appetizing to the contemporary readers by spinning mythology with imagination. He follows the new genre of deconstruction of old myths and has presented them with a new perspective. Both 'Shiva Trilogy' and 'Ramchandra Series' talk about legendary figures like Shiva, Sati, Ram, Sita etc. and their adventures as well. These characters have been portrayed as human beings with flesh and blood who raise themselves up to the dimension of the divine by their great deeds. Amish through his fiction has tried to vindicate that lord Shiva and Ram were not pre-existing characters from Mythology instead the individuals from the history. He has adapted some Vedic ideas from religious texts and explored in his works as science.

Amish has made the books more engaging by adding some 'spicy' components. The writer through his creative ability has produced another universe of imagination for the readers. Amish's Fiction is semi - mythopoeic as they are the fusion of myth and history but give semi logical clarifications which provide the deep understanding of 'somras', Shiva's blue throat, sati's death by flame, Kali's extra hands and Ganesh's elephant head. The exploration of the concepts like 'somras' and 'blue throat' appeal to the judicious readers [5].

Amish has challenged the Patriarchal mores by drawing strong female figures like Sita, Sunaina who is the real 'Queen' of Mithila and Samichi, the chief of a male - dominated police force of Mithila [6]. In the large part of the narrative all the women are shown with strong and major role wherein male characters are relegated backstage. Moreover, Ram has a last part of the book. Amish exposes clearly the woman V/ S woman machinations and court intrigues which become the reason for Ram and Sita's exile. This subtle creative power of the writer touches every act of the plot which circulates the freshness in the quite familiar narrative of the Ramayan. While Amish has given his best efforts in the creation of Sita as a strong character but he has prepared the platform also for succeeding volumes by putting in sufficient clues about the conspiracies and surprises that may occur there. The fabricated rivalry between Vishwamitra and Vashistha, expanding the role of Jatayu and Hanuman has been dealt adeptly.

Amish has added an independent flavor to his fiction through hyper linking the narratives. This multi-linear narrative technique helps him to focus on each major character [7]. He narrates their stories from the beginning and gets all the threads together in ending volumes. This technique consists multiple truths combined with the various characters. 'Ram Chandra Series' has a multi layered platform wherein the ancient and the contemporary are interwoven and divided as well which is a bit overwhelming. The author has tried to draw parallel to the recent events and situation too in the narrative. 'Ramchandra series' has reference to the Nirbhaya rape case and Jallikatu festival and caste based discrimination [8]. Moreover the scene of Sita's swayamvar has been entirely revamped and rather resembles a scene from the Mahabharat [6]. It is quite impressive how Amish has built up the stories of lord Parshuram lord Rudra and their respective tribes Malaya putras and vayuputras[9]. The plots of Amish's fiction are fast paced and fresh. There are requisite twists in the scripts to keep the readers engrossed till the very last page. All the novels come with the stupendous covers. The characters are introduced at the beginning pages and the maps are also given at the end which helps the readers to grasp to the plots better. The description of lands and buildings in 'Shiva Trilogy' is picture perfect which resembles children literature [10].

Amish has used 'counter- narration' also to re-coin the existing narratives and makes the marginalised prominent by giving them agency and performativity. Counter narratives challenge and combat against dominant and hegemonic great narratives which have been playing a part in drawing up a social ideology over a long period of time setting them up as normative.(11) The ancient Epic Ramayana is a multi-layered narrative of Prince Ram and his wife Sita and their role in the politics of power, administration and patriarchy. It is an important and major narrative that surmises the submissiveness of the women as normative. Sita, in the Ramayan, has been portrayed as someone who meets oppression and marginalization and is a victim of the dominant narrative of patriarchy. Amish has practiced this theory of counter narrative in his fiction and recasts the character of Sita deconstructing the myth of passivity. So 'Ram: Scion of Ikshvaku' relates the story of Sita not only from her perspective but also introduces to the audience to 'Amish's Sita'. The author breaks the stereotype image of lady Sita as a docile and helpless woman. Amish's Sita is an intelligent, quick, volatile diva who can smash skulls with stick, kill with her knife throwing skill and has courage to be the prime minister of Mithila and a key strategist too to govern her Kingdom.

However, the "Re- presentation" of sita from her perspective is not a new thing in literature, but Amish has demolished the established image of Sita and has created a fresh epic character for his fiction. Although, he builds a new one but maintains a balance between the delicate feminine and feminist traits in Sita's character. She resists the pre-established norms of the dominant narrative and has been portrayed as the silent receptor and goes against the patriarchal ideology prescribed through the major narrative. Amish has challenged and analyzed the hegemony and narrative silence in the Ramayan by creating women characters powerful and capable in education, warfare and state governance. This counter-narrative has been practiced in 'Shiva Trilogy' as well. Sati in 'Shiv Puran' burned herself due to the humiliation experienced at her father's home but Amish recasts Sati as a strong character who opposes all Patriarchal norms which go against her dignity. Like Sita, she also is a powerful figure, a skilled warrior and keen follower of laws.

Thus the writer has tried his best in the implementation of new narrative technique in retelling age old myths. He has used several techniques like counter narration, hyperlinking, re-casting ancient characters in new forms,

multi-layered narrative, symbolism, Bollywoodization of scenes etc. The author has tried to break the stereotypes and strived hard to build new social constructs.

III. CONCLUSION

The books are fine sample of Amish's ingenuity and talent of rewriting myths. The books are full of several fruits of the writer's imagination, but it is for the audience to search them, meet them and judge them. Both fictional works are like a Bollywood movie, with all the requisite drama, action and comedy masala according to the taste of the modern high-tech audience and consequently became bestselling books. Thus, in the end the readers found not just a mythological story retold but also a fabrication to define the philosophy of a perfect society, the role of Dharma and duty, the duties of citizens and how the rulers should rule over a kingdom. Much of the matter in the narrative comes from the discussions on the significance of social system and convention, the balance between the feminine and masculine ways of life etc. Thus the author has tried to break the stereotypes and strived hard to build new social constructs. Readers will find that the fiction of India is going through a generational change and such writers, for their works, target Indian audience to make them read more about their own past or roots.

IV. REFERENCES

1. Abrams, M.H. *A Glossary of Literary Terms*. United States of America: Heinle and Heinle, 1999. Print.
2. https://www.ijamsr.com/issues/6_Volume%203_Issue%2012/20210203_022027_3952.pdf
3. https://en.wikipedia.org/wiki/Amish_Tripathi
4. <https://study.com/academy/lesson/narrative-techniques-in-writing-definition-types-examples.html>
5. https://www.academia.edu/27334438/Rewriting_Myth_A_Critical_Analysis_Of_Amish_Tripathi_S_Shiva_Triology
6. Tripathi, Amish. *Sita: Warrior Mithila*. . New Delhi: Westland Ltd., 2017. Print.
7. https://en.wikipedia.org/wiki/Hyperlink_cinema
8. Tripathi, Amish. *Ram: Scion of Ikshavaku*. . New Delhi: Westland Ltd., 2015. Print.
9. Tripathi, Amish. *The Oath of Vayuputras*. New Delhi: Westland Ltd., 2013. Print.
10. Tripathi, Amish. *Immortals of Meluha*. New Delhi: Westland Ltd., 2012. Print.
11. <https://en.wiktionary.org/wiki/counternarrative>

Phytochemical Qualitative and Quantitative Analysis of Euphorbia Hirta and Euphorbia Heterophylla

Shameem A, Akilan P, Chandrasekaran V and Bhadusha N

Department of Chemistry, Government Arts College (Autonomous), Salem- 7, India

ABSTRACT

A wide range of components that can be utilised to make both natural and synthetic medications are enriched in plants. Thus, screening and evaluating medicinal plants is of significant interest to scientists in order to encourage the development of novel medications with fewer side effects and greater synergistic effects. The efficacy of a plant towards therapeutic medications was examined using a variety of pharmacological assays. In the current study, the main bioactive components of the medicinally significant plants *Euphorbia hirta* and *Euphorbia heterophylla* are analysed quantitatively and qualitatively. Both the samples *E. hirta* and *E. heterophylla* were extracted in methanol and ethyl acetate. On comparison methanolic extract shows better activity. In quantitative phytochemical analysis methanolic extract was taken for quantifying alkaloid (22 % and 34%), Flavonoid (16.98 % and 23.94 %) and Phenols (34.68 % and 49.72 %). When compared to the methanolic extract of *E. hirta*, the *E. heterophylla* exhibits higher activity. Therefore, the medicinal properties of the plant is by the presence of these phytochemicals.

Keyword: Medicinal plant, *Euphorbia hirta*, *Euphorbia heterophylla*, Phytochemical, Alkaloid, Flavonoid, Phenol

INTRODUCTION

Individuals' health has been given healing potential by herbs. The demand for this plant for medical purposes is rising daily (Gupta et al., 2002). According to Ayurveda, Siddha, Unani, and other traditional systems, there are about 35,000 medicinal plants that are employed for therapeutic effects. Humans are well aware of plants' significance. In recent years, there has been a growing understanding of the significance of medicinal plants. The plant kingdom offers a vast collection of potential medications. These days, both the scientific community and the general public pay close attention to the use of natural products derived from plants in the treatment, prevention, and improvement of health. Researchers have been very interested in the availability of these medicinal plants since it offers a resource that is less expensive and has less side effects to produce new medications. Plant materials are a key component in the drug-synthesizing process in plant-based traditional medicine, which has a lengthy history dating back to ancient civilizations (Chanda and Dave, 2009).

Drugs made from plants are widely available, inexpensive, efficient, and safe, and they seldom ever cause side effects. The most obvious choice for looking at the current quest for therapeutically effective novel medications, such as anticancer drugs, antibacterial drugs, and antihepatotoxic chemicals, is the plants that have been selected for medical use over thousands of years. The World Health Organization (WHO) states that the best source for a wide range of medications would be medicinal plants. People in developed countries employ traditional medicines, which contain ingredients derived from medicinal plants, in about 80% of cases. However, more research should be done on these plants to learn more about their characteristics, security, and effectiveness (Arunkumar and Muthuselvam, 2009). The scientific community is becoming more and more interested in the study of substances with a plant origin, especially in underdeveloped nations where people frequently employ herbal remedies to meet their most basic medical needs (Yadav, 2018). Asthma, stomach issues, skin conditions, respiratory and urinary problems, liver and cardiovascular illness, as well as other diseases, have all been treated with medicinal herbs throughout history (Egamberdieva et al., 2016).

Phytochemicals are physiologically active, naturally occurring chemical compounds found in plants that provide health benefits for humans beyond those associated with macronutrients and micronutrients (from the Greek word phyto, meaning plant) (Gupta et al., 2018). They contribute to the plant's colour, aroma, and flavour while safeguarding it against illness and injury. Generally speaking, phytochemicals are the plant compounds that shield plant cells from environmental dangers like pollution, stress, dehydration, UV exposure, and from other diseases (Taguiling, 2016). When their dietary intake is significant, it is now well established that they play a part in protecting human health. More than 4,000 phytochemicals have been categorised by protective function, physical properties, and chemical characteristics (Gahlawat et al., 2014), and roughly 150 of them have undergone in-depth research (Kesari et al., 2007; Itharat and Houghton, 2004). Tannins, alkaloids, sugars, terpenoids, steroids, and flavonoids are some of the chemical compounds found in medicinal plants that have defined physiological effects on humans (Edoga et al., 2005). The primary or more accurately secondary

metabolism of living things produces these chemicals. Secondary metabolites are incredibly diverse chemically and taxonomically and have unknown purposes. They are extensively employed in a variety of fields, including veterinary medicine, agriculture, scientific research, and numerous others (Vasu et al., 2009). The ability to synthesise complicated chemical substances will benefit from knowledge of the chemical components of plants (Parekh and Chanda, 2007; 2008).

Around the world, euphorbia plants are abundant in nature and range from herbs and shrubs to trees in both tropical and temperate climates (Bremer, 1994). The plant is a local remedy known as "spurge weed" (Mosango, 2008). The family, Euphorbiaceae has 280 genera and 730 species with the largest genus, Euphorbia having roughly 1600 species. In India, *E. hirta* and *E. heterophylla* are quite important economically. Small new-borns with skin diseases are bathed in a cold leaf extract. In traditional medicine, it is used to treat feminine diseases. The plant has been utilised for many feminine illnesses due to its milky latex, which is known to increase milk flow in women, according to a variety of ethno-medical types of literature (Al-Snafi, 2017). Additionally, it stated that the plant is utilised as a cancer preventative, anti-inflammatory, anti-diabetic, and spasmodic agent (Patil et al., 2009). They typically have distinctive milky latex. Traditional medicine makes use of *E. heterophylla* leaf as a laxative, anti-gonorrhoea, migraine, and heart remedy. Fish poison and pesticides have been made from plant latex in the past (Falodun et al., 2003). In the field of biomedical research, systematic plant screening with the objective of finding new bioactive chemicals is a common practise. Therefore, to analyse phytochemical components both qualitatively and quantitatively, crude extract of *E. hirta* and *E. heterophylla* was used.

MATERIALS AND METHODS

Collection of Plant Materials

Fresh samples of *E. hirta* and *E. heterophylla* were randomly gathered from Tamil Nadu's Yercaud Hills. Sample components were cleaned with running water, allowed to air dry, and then homogenised into a fine powder and stored in airtight containers in the refrigerator.

Preparation of Extracts

Soxhlet extraction technique was used to create the crude sample extract. A consistently distributed 20gm of powdered sample material was placed in a thimble before being extracted with 250ml of ethyl acetate and methanol separately. The extraction procedure must be continued for 24 hours or until the solvent in the extractor's syphon tube becomes colourless. The extract was then placed in a beaker and cooked on a hot plate at 30 to 40 °C until the solvent had evaporated. Until use, dried extract was kept in a refrigerator at 4°C.

Phytochemical Screening

According to established procedures outlined by Brain and Turner, 1975 and Evans, 1996 preliminary phytochemical analysis of methanol and ethyl acetate extracts from *E. hirta* and *E. heterophylla* was performed.

Quantitative Phytochemical Analysis

Estimation of Alkaloids

Using the Harborne (1973) approach, for determination of alkaloids 200 ml of 10% acetic acid in ethanol and 5ml of the methanolic extract of the *E. hirta* and *E. heterophylla* sample were put to a 250 ml beaker, capped, and left still for 4 hours. After filtering, the extract was concentrated to a quarter of its original volume on a water bath. Until the precipitation was finished, concentrated ammonium hydroxide was applied drop by drop to the extract. After allowing the entire solution to settle, the precipitated material was collected, cleaned with diluted ammonium hydroxide, and then filtered. The alkaloid, which was dried and weighed, is the residual.

Estimation of Flavonoids

At room temperature, 100 ml of 80% aqueous methanol was used to extract five ml of the methanolic extract of *E. hirta* and *E. heterophylla* several times. The liquid was then funnelled through a filter into a 250 ml beaker that had been previously weighed. The filtrate was put into a water bath, allowed to dry completely, and then weighed. By comparing weight differences, the percentage flavonoid content was estimated (Krishnaiah et al, 2009).

Determination of Total phenols

The phenolic component was extracted from the fat-free sample by boiling it in 50 cc of ether for 15 minutes. 10 ml of distilled water were added after pipetting 5 ml of the methanolic extract of *E. hirta* and *E. heterophylla* into a 50 ml flask. Additionally, 5 ml of concentrated amyl alcohol and 2 ml of ammonium hydroxide solution

were added. The *E. hirta* and *E. heterophylla* samples were prepared according to specifications and allowed to react for 30 min to develop colour. 505 nm was used to measure it (Siddhuraju and Decker, 2003).

RESULT AND DISCUSSION

The phytochemical analysis was carried out for qualitative and quantitative analysis for both the extracts (methanol and ethyl acetate) of *E. hirta* and *E. heterophylla*. The qualitative phytochemical analysis of *E. hirta* methanol extract shows the presence of alkaloids, flavonoids, phenols and carbohydrates where as in ethyl acetate extract only carbohydrates, oils and resins were found. In *E. heterophylla* methanolic extract major phytoconstituents were found that is alkaloids, flavonoids, steroids, Terpenoids, phenols, tannin and carbohydrates were present where as in ethyl acetate extract flavonoids, steroids, Terpenoids, carbohydrates, oils and resins were found. When compared methanolic extract was found to be better than ethyl acetate extracts.

Table: Qualitative Phytochemical Analysis of in Methanol Extract

Phytochemicals	Euphorbia hirta		Euphorbia heterophylla	
	Methanol Extract	Ethyl Acetate Extract	Methanol Extract	Ethyl Acetate Extract
Alkaloids Mayer's test	+	-	++	-
Flavonoids H ₂ SO ₄ test	+	-	++	+
Steroids Liebermann-Burchard test	-	-	++	+
Terpenoids Salkowski test	-	-	++	+
Arthroquinone Borntrager's test	-	-	-	-
Phenols Ferric chloride test	+	-	+	-
Saponin	-	-	-	-
Tannin	-	-	+	-
Carbohydrates	+	+	+	+
Oils & Resins	-	+	-	+

Figure: Qualitative Phytochemical Analysis of Euphorbia hirta in Methanol and Ethyl Acetate Extract

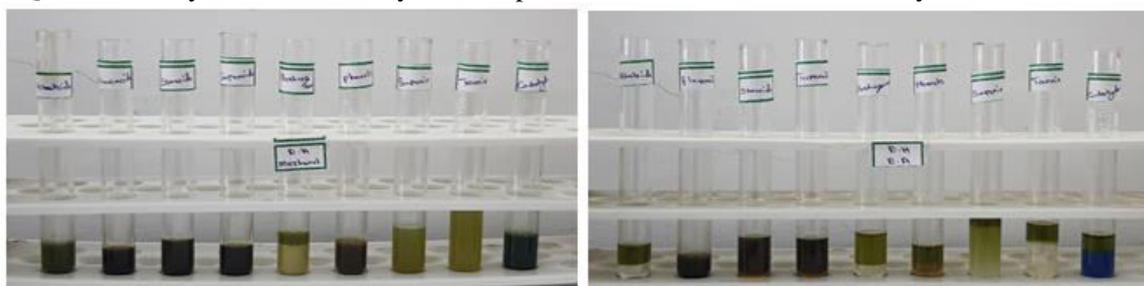
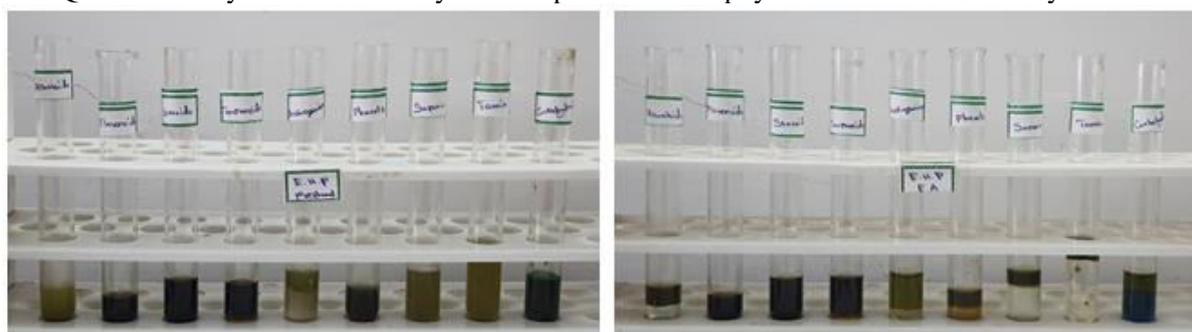


Figure: Qualitative Phytochemical Analysis of Euphorbia heterophylla in Methanol and Ethyl Acetate Extract



Ethiopia is one of the developing nations where traditional medicine is used extensively, and medicinal plants are an important component of this system of care (Tesfahuneygn and Gebreegziabher, 2019). Alkaloids, which are metabolic waste products formed from amino acids, are one of the primary and most abundant components that plants create (Naseem, 2014). Flavonoids are a large class of polyphenol chemicals, and evidence suggests that flavonoids and some other secondary phenolic metabolites are just what cause the wide range of pharmacological activity (Mahomoodally et al., 2005; Pandey 2007). Tannins are typically employed in the tanning process and as therapeutic agents for gonorrhoea, piles, inflammation and burns (Boroushaki et al., 2016). Prednisone, cortisone, vitamin D, and various sex hormones, such as testosterone and estradiol, are examples of medications that reduce edoema and inflammation (Hill et al., 2007). Significant pharmacological effects of terpenoids include antiviral, antibacterial, antimalarial, anti-inflammatory, cholesterol synthesis inhibition, and anti-cancer properties (Boroushaki et al., 2016).

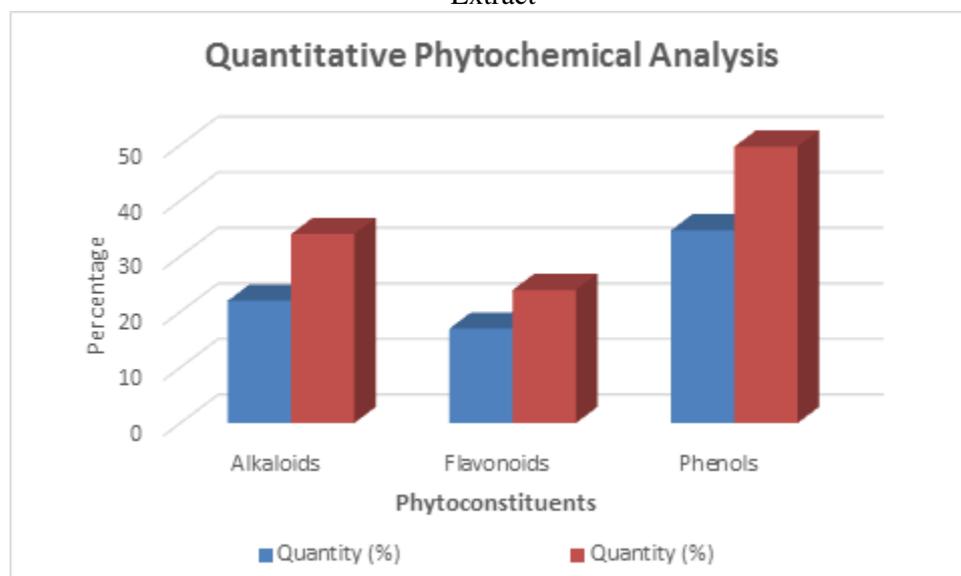
Quantitative Phytochemical Analysis

Quantitative phytochemical analysis were carried out for both the methanolic extract of *E. hirta* and *E. heterophylla* analysed for alkaloids, flavonoids and phenols. Screening of phytochemicals provides detailed description about the medicinal importance and aptitude of plant. In the current study bioactive constituents that report biological active nature to the plant were analysed and results confirmed the existence of Alkaloids, 22% in *E. hirta* and 34% in *E. heterophylla*, Flavonoids shows 16.98% and 23.94% whereas in Phenols it shows 34.68 % and 49.72%.

Table: Quantitative Phytochemical Analysis of *Euphorbia hirta* and *Euphorbia heterophylla* in Methanol Extract

S.No	Phytoconstituents	Quantity (%)	
		<i>Euphorbia hirta</i>	<i>Euphorbia heterophylla</i>
1	Alkaloids	22	34
2	Flavonoids	16.98	23.94
3	Phenols	34.68	49.72

Figure: Quantitative Phytochemical Analysis of *Euphorbia hirta* and *Euphorbia heterophylla* in Methanol Extract



According to reports, the diverse groups of compounds provide the plants different medical properties. Plants have antioxidant characteristics because of the presence of flavonoids, a water-soluble antioxidant with anticancer and free radical scavenging abilities (Yadav and Agarwala, 2011). Terpenoids were well known because of their antibacterial, anti-inflammatory, anticancer, and antiviral characteristics, while alkaloids were well known for having both analgesic and antibacterial properties (Nassar et al., 2010; Khan et al., 2015). The antibacterial, antiallergic, antidiabetic, antioxidant, anti-inflammatory, antimutagenic, and anticarcinogenic activities of plants are due to phenolic chemicals and phytosterol (Manjunatha, 2006).

CONCLUSION

The results of the current investigation demonstrated that the methanolic extract of *E. hirta* and *E. heterophylla* contains a variety of phytochemicals, many of which are recognised to have therapeutic benefits. As a result of

this evaluation, *E. heterophylla* was determined to be a therapeutically significant plant. To assess and comprehend a clearer picture illustrating the uses of this plant against illnesses, more research is required. Due to the presence of numerous components that are essential for good health, these phytoconstituents appeared to have the potential to serve as a source of helpful medications and to improve the health condition of the users.

REFERENCES

1. Gupta D., M. Kumar, V. Gupta, An in vitro investigation of antimicrobial efficacy of *Euphorbia Hirta* and *Murraya koenigii* against selected pathogenic microorganisms, *Asian J. Pharmaceut. Clin. Res.* 11 (2018) 359–363.
2. Taguiling M.A.L.G., Phytochemical screening and antibacterial activity of *Mircromelum minutum*, *Int. J. Green Herb. Chem.* 5 (2016) 171–179.
3. Gahlawat D.K., S. Jakhar, P. Dahiya, *Murraya koenigii* (L.) Spreng: an ethnobotanical, phytochemical and pharmacological review, *J. Pharmacogn. Phytochem.* 3 (2014) 109–119.
4. Kesari A.N., S. Kesari, S.K. Singh, R.K. Gupta, G. Watal, G. Kesari, A. N, S. Kesari, S.K. Singh, R.K. Gupta, Watal, Studies on the glycemic and lipidemic effect of *Murraya koenigii* in experimental animals, *J. Ethnopharmacol.* 112 (2007) 305–311.
5. Itharat E.-A.E. A, P.J. Houghton, In vitro cytotoxic Activity of Thai medicinal plants used traditionally to treat cancer, *J. Ethnopharmacol.* 90 (2004) 33–38.
6. Chanda S., R. Dave, In vitro models for antioxidant activity evaluation and some medicinal plants possessing antioxidant properties: an overview, *Afr. J. Microbiol. Res.* 3 (2009) 981–996.
7. Vasu, K., Goud, J.V., Suryam, A., Singara, Chary, M.A. 2009. Biomolecular and phytochemical analyses of three aquatic angiosperms. *Afr. J. Microbiol. Res.*, 3(8):418-421.
8. Criagg, G.M., David, J.N. 2001. Natural product drug discovery in the next millennium. *J. Pharm. Biol.*, 39: 8-17.
9. Mojab, F., Kamalinejad, M., Ghaderi, N., Vanidipour, H.R. 2003. Phytochemicals screening of some species of Iranian plants. *Iran. J. Pharm. Res.*, 3: 77-82.
10. Parekh, J., Chanda, S. 2007. Antibacterial and phytochemical studies on twelve species of Indian medicinal plants. *Afr. J. Biomed. Res.*, 10: 175-181.
11. Parekh, J., Chanda, S. 2008. Phytochemicals screening of some plants from western region of India. *Plant Arch.*, 8: 657- 662.
12. Edoga, H.O., Okwu, D.E., Mbaebie, B.O. 2005. Phytochemicals constituents of some Nigerian medicinal plants. *Afr. J. Biotechnol.*, 4(7): 685-688.
13. Arunkumar, S., Muthuselvam. 2009. Analysis of phytochemical constituents and antimicrobial activities of *aloevera L.* against clinical pathogens. *World J. Agril. Sc.*, 5(5): 572-576.
14. Gupta SK, Prakash J, Srivastava S (2002) Validation of traditional claim of *Tulsi*, *Ocimum sanctum* Linn, as a medicinal plant. *Indian J Exp Biol* 40: 765- 773. Link: <http://bit.ly/2XUMC7i>.
15. Pattanayak P, Behera P, Das D, Panda SK (2010) *Ocimum sanctum* Linn A reservoir plant for therapeutic applications An overview. *Pharmacogn Rev* 4: 95-105. Link: <http://bit.ly/2XXBGpl>.
16. Yadav V. K., “Phytochemical and pharmacognostical studies of *Blumea lacera*,” *International Journal of Green Pharmacy*, vol. 12, no. 1, 2018.
17. Tian X.-R., J.-T. Feng, Z.-Q. Ma et al., “Three new glycosides from the whole plant of *Clematis lasiantha* Maxim and their cytotoxicity,” *Phytochemistry Letters*, vol. 10, pp. 168–172, 2014.
18. Egamberdieva D., N. Mamedov, E. Ovidi, A. Tiezzi, and L. Craker, “Phytochemical and pharmacological properties of medicinal plants from Uzbekistan: a review,” *Journal of Medicinally Active Plants*, vol. 5, no. 2, pp. 59–75, 2016.
19. Pradeepa S., S. Subramanian, and V. Kaviyaran, “Evaluation of antimicrobial activity of *Pithecellobium Dulce* pod pulp extract,” *Asian Journal of Pharmaceutical and Clinical Research*, vol. 7, pp. 32–37, 2014.
20. Bremer K. *Asteraceae Cludistics and Classification*, Timber Press Portland Oregon, 1994.

21. Mosango D.M. *Euphorbia heterophylla* L. in: G.H Schumelzer and A.Gurib-Fakim, (Editors). *Prota* 11(1). Medicinal Plants PROTA, Wageninge: Netherlands, 2008.
22. Falodun A., E.O.P. Agbakwuru, and G.C.Ukoh. Antibacterial Activity of *Euphorbia heterophylla* Linn (Family Euphorbiaceae). *Pakistan Journal of. Scientific Research* 46(6), 2003, 471 – 472.
23. Al-Snafi AE. Pharmacology and Therapeutic Potential of *Euphorbia hirta* (Syn: *Euphorbia pilulifera*) - A Review. *IOSR Journal of Pharmacy*. 2017; 7(3): 07- 20.
24. Patil SB, Nilofar S, Naikwade NS, Magdum CS. Review on Phytochemistry and Pharmacological Aspects of *Euphorbia hirta* Linn. *J. Pharma. Res. Health Care*. 2009; 1(1):113-133.
25. Yadav, R. N. S., & Agarwala, M. (2011). Phytochemical analysis of some medicinal plants. *Journal of phytology*, 3.
26. Nassar, Z. D., Aisha, A. A., & Majid, A. M. S. A. (2010). The pharmacological properties of terpenoids from *Sandoricum koetjape*.
27. Khan, M. K., Karnpanit, W., Nasar- Abbas, S. M., Huma, Z. E., & Jayasena, V. (2015). Phytochemical composition and bioactivities of lupin: a review. *International journal of food science & technology*, 50(9), 2004-2012.
28. Manjunatha, B. K. (2006). Antibacterial activity of *Pterocarpus santalinus*. *Indian journal of pharmaceutical sciences*, 68(1), 115.

Study on Effect of Concentration of Emulsifying Agents in Emulsion

Swami Avinash B*, Pathan Fiza Y, Nagdare Anirudha A, Patil Devpriya R, Nakhate Rohit C,
Nagoba S. N, Kawdewar D. R, Zingade S. G and Bansode Prashant S
Channabasweshwar Pharmacy College (Degree), Latur- 413512, Maharashtra, India

ABSTRACT

The main aim of research work was the development of emulsions by changing type, varying concentration of emulsifying agent and to study its effect on stability of emulsion. Emulsions are biphasic dosage form and are usually unstable; to make it stable it is necessary to add emulsifying agent regardless of its type i.e. oil soluble or water soluble. Research comprises formulation of total 9 batches of emulsion using 3 different emulgents i.e. acacia, tragacanth and sodium lauryl sulphate. The emulsion was prepared by dry gum method by using mortar - pestle. All 9 formulations were evaluated for parameters like appearance, pH, spreadability, viscosity and stability. Results showed all batches appeared as turbid milky white except formulation containing acacia appeared as brown turbid. pH of all batches were ranged from 4.1 to 6.0. Viscosity obtained is in the range of 1208 to 1600 centipoise. Spreadability of all formulations was found to be within range of 8.56 to 33.56 g.cm/min. The stability studies of all batches were conducted for 1 month with exposure to daylight and at 4°C in refrigeration. Stability study conducted shows that all batches were stable at 4°C however exposure to daylight makes them unstable except formulation containing tragacanth.

Keywords: Emulsion; Dry gum method; acacia; tragacanth; stability study

INTRODUCTION

An emulsion is a thermodynamically unstable system consisting of at least two immiscible liquid phases one of which is dispersed as globules in the other liquid phase; stabilized by a third substances called emulsifying agent. Emulsifying agent are the substance added to an emulsion to prevent the coalescence of the globules of the dispersed phases. They act by reducing the interfacial tension between the two phases and forming of a stable emulsion.

An emulsifier is a substance which stabilizes an emulsion commonly surfactant. So it is needed to characterize the emulsion with respect to its stability by change in type and concentration of emulgent into emulsion. The aim of the research is to develop emulsions by changing type, varying concentration of emulsifying agent and to study its effect on stability of emulsion.

MATERIALS & METHODS

Materials

Following are the materials required

A] Chemicals: Sodium lauryl sulphate, Acacia and Tragacanth was obtained from Himedia laboratories Pvt. Ltd., Mumbai. & Lobachem. And all other chemicals such as liquid paraffin, sodium benzoate vanillin, chloroform and glycerin, used are of analytical grade.

B] Apparatus: Mortar – pestle, weighing balance, beaker, measuring cylinder, butter paper, spatula, glass rod, etc.

METHODS

Formulation of Emulsion:

Emulsions were formulated using dry gum method by using mortar and pestle. Total 9 formulations were prepared by making primary emulsion in the ratio of 3:2:1 of oil, water and gum. First of all, emulgent were taken in dry mortar and mixed in oil; triturated both in clockwise direction with the help of pestle. Then other organoleptic excipients like flavor, preservatives and viscosity modifier were added to the primary emulsion and triturated. Finally, the volume was made up to 50 ml with purified water. Ingredients and quantities taken were mentioned in table no. 2.

Table No. 2: Formulation table

Ingredients	F1	F2	F3	F4	F5	F6	F7	F8	F9
Tragacanth (gm)	3	6	12	-	-	-	-	-	-
Acacia (gm)	-	-	-	3	6	12	-	-	-
SLS (gm)	-	-	-				3	6	12

Liquid paraffin (ml)	25	25	25	25	25	25	25	25	25
Sodium benzoate (gm)	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Vanillin (gm)	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Chloroform (ml)	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Glycerine (ml)	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Purified water (ml)	Upto 50								

EVALUATION OF EMULSION:

Organoleptic Properties of Emulsion:

Freshly prepared emulsions were investigated organoleptically (color, appearance). Organoleptic characteristics of emulsions kept at different storage conditions were noted. The formulations were tested for their homogeneity by visual appearance after the emulsion was applied as a thin layer on the slides.

PH

Previously calibrated pH meter was used to measure pH. Prepared formulation was filled in glass beaker and pH electrode was dipped in it and allowed to stabilize. Value displayed was noted. pH of emulsion was estimated by digital pH meter (Lab India) at room temperature

Spreadability

It is determined by apparatus which consists of a wooden block, which is provided by a pulley at one end. The spreadability is measured on the basis of 'Slip' and 'Drag' characteristics of emulsion. A ground glass slide is fixed on this block. An excess of emulsion under study is placed on this ground slide. The emulsion is then sandwiched between this slide and another glass slide. A 1 g weight is placed on the top of the two slides for 5 minutes to expel air and to provide a uniform film of the emulsion between the slides. By putting a weight of 1 g, the time (in seconds) required by the top slide to cover a distance of 7.5 cm with the help of string attached to the hook is noted. A shorter interval indicates better spreadability, which is calculated by the formulae:

$$S = \frac{M \times L}{T}$$

Where,

S = Spreadability

M = Weight tied to upper slide

L = Length of glass slides

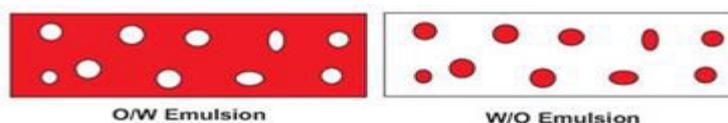
T = Time in second

Viscosity

Viscosity was determined using rotating spindle viscometer (Brookfield viscometer DV2T). Viscosity was determined at RT using spindle no. 5 at 10 rpm. The Brookfield viscometer determines viscosity by measuring the force to turn the spindle in the formulation at a given rate. To measure the viscosity, spindle is immersed in the formulation and rotated at a defined speed. The force required in order to keep this speed constant is a measurement for the dynamic viscosity.

Dye Test

In an emulsion, a water-soluble dye is mixed (sudan red) and observed under the microscope. If the continuous phase appears red, it means that the emulsion is o/w type as water is in the external phase and the dye was dissolved in it to give colour.



Dilution Test:

Test was carried out to find the type of emulsion and performed by addition of water and oil to the preparation separately and state of the preparation was checked. The results confirm O/W type of emulsion if it is diluted with water and remain stable that means water is a continuous phase; such emulsion breaks if it is diluted with oil and vice versa for W/O.

Creaming & Phase Separation:

Developed emulsions were evaluated by visual observation for the creaming process. The emulsion samples were poured into 100 ml glass cylinders instantly after preparation. Then emulsions were observed for phase separation i.e., three phases; oil phase, unseparated emulsion and water phase from the top. The volume ratios of each separated phase were measured

Stability Study:

The stability study of all batches was conducted for 1 month with exposure to daylight and at 4°C in refrigeration. The formulations were observed for creaming, cracking and phase inversion.

RESULTS & DISCUSSION

Organoleptic Properties of Emulsion

Patient acceptability of any formulations is largely depended over organoleptic properties of the product. Hence freshly prepared emulsions were tested for appearance, and colour. Prepared emulsions i.e., w/o emulsions made up of different emulgents were sticky, glossy and off-white to brown in colour having characteristics odour of oil and emulgents. Results are presented in Table 3.

Table 3: Organoleptic properties of emulsions

Formulation batch	Appearance	Colour	Homogeneity
F1	Milky	Off white to white	Homogeneous
F2	Milky	Off white to white	Homogeneous
F3	Milky	Off white to white	Homogeneous
F4	Cloudy	Buff soily	Homogeneous
F5	Cloudy	Faint brown	Homogeneous
F6	Cloudy	Dark brown	Homogeneous
F7	Milky	White	Homogeneous
F8	Milky	White	Homogeneous
F9	Milky	White	Homogeneous

PH:

PH of the formulations was near to neutral region but slightly acidic. Results are presented in Table 4.

Table 4: pH of all emulsions

Formulationbatch	pH
F1	5.2
F2	5.8
F3	6.0
F4	4.1
F5	4.9
F6	5.5
F7	5.2
F8	5.3
F9	5.5

Viscosity:

Viscosity was determined using Brookfield viscometer and noted below. Viscosity of the formulations showed noticeable variation between formulations prepared with different emulsifier and its concentration. Results showed that batches containing tragacanth was slightly high viscous than acacia and SLS containing batches.

Table 5: Viscosity of all emulsions

Formulationbatch	Viscosity (Centipoise)
F1	1482
F2	1580
F3	1600
F4	1221
F5	1259

F6	1283
F7	1208
F8	1266
F9	1273

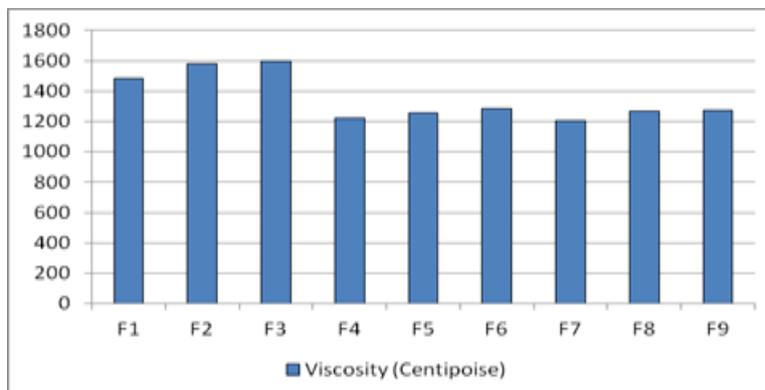


Figure 4: Graph of viscosity of all emulsions

Spreadability

Spreadability test conducted on all the batches. Results obtained were concluded that natural emulgents containing batches shows less spreadability as compared to synthetic emulgent. In case of natural emulgents, it was found that as the concentration increases spreadability decreases however there is no affect with synthetic emulgent.

Table 6: Spreadability of all emulsions

Formulationbatch	Spreadability(g.cm/sec)
F1	15.56
F2	12.98
F3	8.56
F4	30.76
F5	26.60
F6	21.51
F7	31.78
F8	31.98
F9	33.56

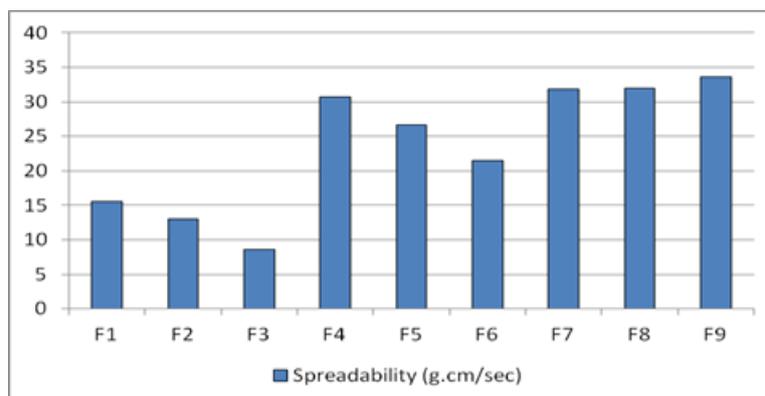


Figure 5: Graph of spreadability of all emulsions

Identification Test

Dye Test

In dye test, 2 ml of all the formulations were mixed with sudan red i.e. water soluble dye and observed under microscope. It was observed that, colorless oil globules are dispersed in reddish background; confirming the formation of o/w emulsion.

Dilution Test

In dilution test, 2 ml of all the formulations were mixed with equal portion of water, which formed the diluted product. There was no distinct layer observed which could be due to miscibility of outer aqueous phase of the emulsion with added water confirming the formation of o/w emulsion.

Creaming & Phase Separation:

All batches were poured in measuring cylinder and visually observed for creaming and phase separation volume.

Table 7: Results Creaming & Phase separation

Formulation batch	Creaming	Phase separation volume (ml)	
		Oil phase: Un-separated emulsion:	Water phase
F1	-	0.5 : 49.5	: 0
F2	-	0.2 : 49.8	: 0
F3	-	0 : 50	: 0
F4	+	4 : 45	: 0
F5	+	2 : 47	: 0
F6	++	2 : 45	: 0
F7	+	0 : 45	: 1
F8	++	0 : 42	: 0
F9	+++	0 : 40	: 0

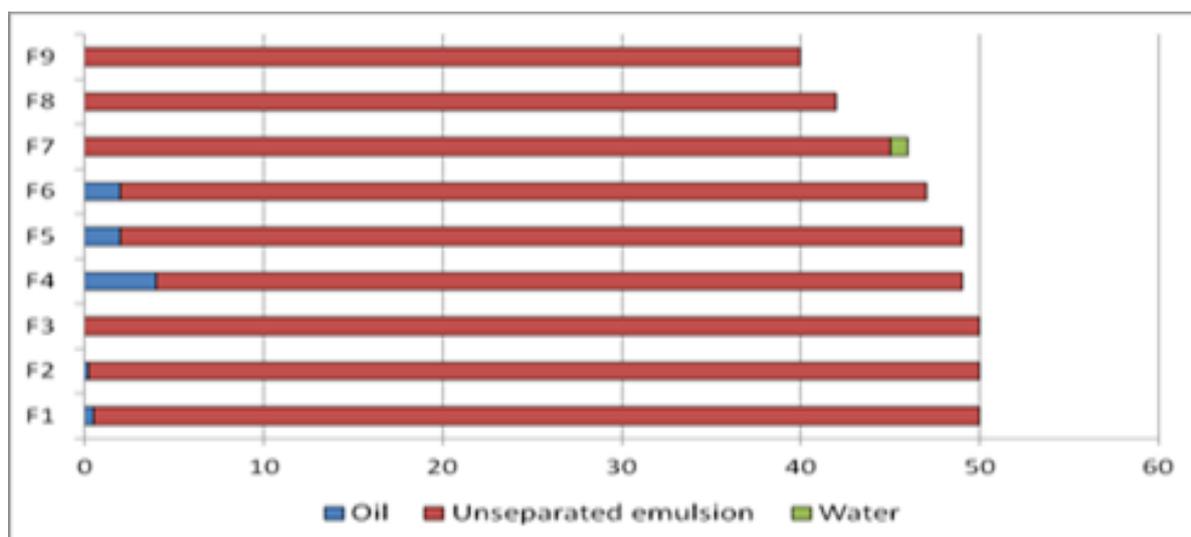


Figure 5: Graph of phase separation volume ratio of all emulsions

Stability Test

The stability study of all batches was conducted for 1 month with exposure to daylight and at 4°C in refrigeration. The formulations were observed for creaming, cracking and phase inversion.

Table 8: Physical state after stability study

Formulation batch	Stability condition	
	Exposure to daylight	At 4°C
F1	No phase separation	No phase separation
F2	No phase separation	No phase separation
F3	No phase separation	No phase separation
F4	Cracked	No phase separation
F5	Cracked	No phase separation
F6	Creaming	No phase separation
F7	Upward creaming	No phase separation
F8	Upward creaming	No phase separation
F9	Upward creaming	No phase separation

CONCLUSION

From the research executed it can be concluded that, changing concentration and type of emulsifying agent will influence final stability of emulsion prepared. Results have reported increasing the concentration of emulsifying agent will increase the viscosity of emulsion and decrease the spreadability. It also showed that creaming occurs with synthetic emulsifier as compared to natural emulsifier; however emulsion with natural emulsifier is stable at both daylight exposures and refrigeration temperature.

REFERENCES

1. E. Chrisman, V. Lima, P. Menechini, Crude Oil Emulsion- Composition Stability and Characterization, in: M.E.-S. Abdel-Raouf (Ed.), InTech, 3rd ed., InTech, Janeza Trdine 9, 51000 Rijeka, Croatia, Egypt.
2. T. Ichikawa, Electrical demulsification of oil-in-water emulsion, Colloids Surfaces A Physicochem. Eng. Asp.
3. R. Pal, Novel shear modulus equations for concentrated emulsions of two immiscible elastic liquids with interfacial tension.
4. H. Zhu, Z. Guo, Understanding the Separations of Oil / Water Mixtures from Immiscible to Emulsions on Super-wettable Surfaces, J. Bionic Eng.
5. V. Hoshyargar, A. Marjani, F. Fadaei, S. Shirazian, Prediction of flow behavior of crude oil-in-water emulsion through the pipe by using rheological properties, Orient. J.Chem.
6. H. Auflem, Influence of asphaltene aggregation and pressure on crude oil emulsion stability, Norwegian University of Science and Technology, 2002.
7. J.T. Foley, P. Forest, R.H. Rogers, United States Patent 0, 1966.
8. M.F. Ali, M.H. Alqam, Role of asphaltenes, resins and other solids in the stabilization of water in oil emulsions and its effects on oil production in Saudi oil fields, Fuel.
9. B.B. Filippini, John J, Deborah A, Water-in-Oil Emulsion, US Patent, 2004.
10. E.O. Fridjonsson, B.F. Graham, M. Akhflash, E.F. May, M.L. Johns, Optimized Droplet Sizing of Water-in-Crude Oil Emulsions Using Nuclear Magnetic Resonance, Energy & Fuels. 28 (2014) 1756–1764.
11. M. Fingas, B. Fieldhouse, Formation of water-in-oil emulsions and application to oil spill modelling., J. Hazard. Mater. 107 (2004).
12. M.E.-S. Abdel-Raouf, Factors affecting the stability of crude oil emulsions, in: Manar ElSayed Abdul-Raouf (Ed.), Crude Oil Emuls. Stab. Charact., 2012.
13. A.Y. Khan, S. Talegaonkar, Z. Iqbal, F.J. Ahmed, R.K. Khar, Multiple emulsions: an overview., Curr. Drug Deliv.
14. G. Muschiolik, Multiple emulsions for food use, Curr. Opin. Colloid Interface Sci.
15. R. Pal, Rheology of simple and multiple emulsions, Curr. Opin. Colloid Interface Sci.
16. R. Pal, Rheology of simple and multiple emulsions, Curr. Opin. Colloid Interface Sci.
17. J. Jiao, D.J. Burgess, Rheology and stability of water-in-oil-in-water multiple emulsions containing Span 83 and Tween 80., AAPS PharmSci.
18. D. Langevin, S. Poteau, I. Hénaut, J.F. Argillier, Crude oil emulsion properties and their application to heavy oil transportation, Oil Gas Sci. Technol.
19. Ashok KG (2005). Introduction to pharmaceutical-1. CBS Publishers, Delhi, India, pp.116-120.
20. Carter SJ (2005). Tutorial Pharmacy. CBS Publishers, Delhi, India, pp. 65-66.
21. Christopher AL, Dawn B (2008). Pharmaceutical compounding and dispensing. RPS, Cambridge, UK, pp. 65-70.
22. Fie Y, Liu S, Xu J, Lan Q, Wei F, Sun D (2006). Pickering Emulsion Stabilized Solely By Layered Double Hydroxides Particles: The Effect of Salt on Emulsion Formation Stability. J. Colloid. Interface. Sci., 302: 159-169.

23. Figen T, Ozlem K (2005). A topical w/o/w multiple emulsions prepared with Tetronic 908 as a hydrophilic surfactant: Formulation, characterization and release study. *J. Pharma.*
24. Gilbert SB, Christopher RT (2002). *Modern pharmaceuticals*. CRC Press, London, UK, pp. 265-268.
25. Gilberte MM, Franscoise N (2002). Emulsions applications- An Overview. *J. Disp. Sci. Technol.*, 23 (1-3): 419-439.
26. Herbert AL, Martin MR, Gilbert SB (1996). An Experimental Study of Stability of Emulsion, *Fuel. Proc. Technol.*, 86: 499-508.
27. Leon S, Alan HM, Paul FS, Larry NS (2004). *Comprehensive Pharmacy Review*. Lipponcott Williams and Wilkins, Philadelphia, USA.

2.2 Sampling and Analytical Method

Twenty groundwater samples have been taken in 1L pre-cleaned polyethylene bottles from ten villages in Phalodi Tehsil throughout March 2021 for summer and November 2021 for rainy seasons. Each water sample was tested for ten physicochemical parameters, including pH, TDS, EC, TH, CaH, MgH, total alkalinity, chloride, nitrate, and fluoride, using standard analytical protocols specified by the American Public Health Association (2005).



Figure 2. Geographical locations of sampling sites (<https://earth.google.com>)

3. RESULT AND DISCUSSION

Tables 1 and 2 show several physicochemical characteristics examined using standard analytical procedures for the pre-and post-monsoon period. Tables 3 and 4 provide statistical analyses of samples' pre-and pre- and post-period data.

Table 1. Pre-monsoon data study in Phalodi Tehsil and its agglomerates

Groundwater Sample No.	pH	Total alkali.	TH	CaH	MgH	CL	NO3	F	TDS	EC
PH1	8.2	230	540	250	300	1210	5	2	2850	4270
PH2	8.3	340	540	220	320	740	25	0.7	1980	2970
PH3	7.7	400	470	200	280	780	28	1.1	2210	3310
PH4	8	360	450	200	250	840	12	1.6	2140	3210
PH5	7.9	460	530	300	240	1010	195	2.5	3060	4590
PH6	7.7	360	720	320	400	1420	6	2.6	3630	5440
PH7	8	300	1020	420	600	2550	20	5.4	5790	8110
PH8	7.6	150	330	140	210	500	10	0.2	1120	2040
PH9	7.8	200	320	120	200	230	40	1	750	1120
PH10	7.3	650	600	270	310	850	12	2.5	2080	3850

Table 2. Post-monsoon data study in Phalodi Tehsil and its agglomerates

Groundwater Sample No.	pH	Total alkali.	TH	CaH	MgH	CL	NO3	F	TDS	EC
PH1	8.8	280	560	260	300	1120	23	2	2620	3930
PH2	7.6	310	640	300	340	1010	15	0.8	2770	4150
PH3	7.9	340	670	300	370	1030	12	1.2	2800	4100
PH4	7.9	420	540	300	250	1000	190	2.4	3110	4660
PH5	7.8	140	850	340	500	1660	1	2.4	4220	6330
PH6	8	340	700	300	400	1430	5	2.7	3750	5620
PH7	8	310	1080	480	600	2450	16	5.5	5750	8620
PH8	7.3	250	480	250	210	750	4	0.6	1540	2940
PH9	7.3	300	420	200	220	450	40	1.6	1350	2540
PH10	7.6	220	530	240	300	580	10	2.7	1720	3120

Table 3. Regular statistical study of groundwater quality parameters in the pre-monsoon season-March 2021 (Min- Minimum, Max- Maximum, AM- Arithmetic mean, SD- Standard deviation, CV- The coefficient variation, Q1- Median of the lower half, Med- Median, Q3- Median of upper half)

Parameters	Min	Max	AM	SD	CV	Q1	Med	Q3
pH	7.3	8.3	7.85	.2953	3.762	7.7	7.85	8
Total alkali.	150	650	345	143.00	41.450	247.5	350	390
TH	320	1020	552	202.91	36.759	455	535	585
CaH	120	420	244	88.969	36.462	200	235	292.5
MgH	200	600	311	117.32	37.725	242.5	290	317.5
Cl	230	2550	1013	634.94	62.679	750	845	1160
NO3	5	195	35.3	57.176	161.97	10.5	16	27.25
F	.2	5.4	1.96	1.4645	74.721	1.025	1.8	2.5
TDS	750	5790	2561	1419.2	55.416	2005	2175	3007.5
EC	1120	8110	3891	1931.8	49.645	3030	3580	4510

Table 4. Regular statistical study of groundwater quality variables in the post-monsoon season-November 2021

Parameters	Min	Max	AM	SD	CV	Q1	Med	Q3
pH	7.3	8.8	7.82	.4315	5.5183	7.6	7.85	7.97
Total alkali.	140	420	291	75.931	26.093	257.5	305	332.5
TH	420	1080	647	195.56	30.226	532.5	600	692.5
CaH	200	480	297	75.726	25.497	252.5	300	300
MgH	210	600	349	124.49	35.671	262.5	320	392.5
Cl	450	2450	1148	583.16	50.798	812.5	1020	1352.5
NO3	1	190	31.6	56.774	179.66	6.25	13.5	21.25
F	.6	5.5	2.19	1.3900	63.470	1.3	2.2	2.65
TDS	1350	5750	2963	1347.4	45.477	1945	2785	3590
EC	2540	8620	4601	1834.49	39.871	3322.5	4125	5380

3.1 Physico-Chemical Parameters of Water Quality

- a. **PH-** The pH of the research area ranges from 7.3 to 8.3 during the summer and from 7.3 to 8.8 during the rainy seasons. The maximum values were observed in PH1 (Post) and a minimum for site PH10 (pre), PH8 (post), and PH9 (post). Except for one site (PH1-Post), the pH readings from the study are within the Indian standard (BIS) limit. Mine wastes, industrial effluents, power plants, and other sources of acidic gases are the main factors that lower the pH and increase pH due to agricultural lime, alkaline soil, and oil and gas brine.
- b. **Alkalinity-** The observed alkalinity values ranged between 150 to 650 mg/L in summer and 140 to 420 mg/L in the rainy season. Higher alkalinity was observed at site PH10 for summer and the lowest was at site PH5 rainy season. In both seasons, virtually all of the samples were found to be above the BIS recommended limit. When the soil or bedrock around groundwater sources including carbonate, bicarbonate or, hydroxide compounds get dissolved with the water, the decomposition of plants, living species, and Organic waste also increases alkalinity.
- c. **Total Hardness-**Total Hardness is referred to as the total of Ca and Mg hardness. Total hardness varied between 320 to 1020 mg/L in summer and 420 to 1080 mg/L in the rainy season. Site PH7 (post) had the highest concentration and site PH9 has the least in the pre-monsoon.
- d. **Calcium Hardness-** Ca+2 ions can occur as a result of the dissociation of salts in water such as calcium chloride and calcium sulfate, making it hard. Agricultural runoff, precipitation, weathering of soil, and discharge of sewage and wastewater enhance its concentration. The range of calcium ions present in our study varied from 120 to 420 mg/L during summer and 200 to 480 mg/L during the rainy season with PH7 having the highest value(post-monsoon) and PH9 the least (pre-monsoon).
- e. **Magnesium Hardness-**The range of magnesium ions in water that causes hardness in water varied between 200 to 600 mg/L during summer and 210 to 600 mg/L during the rainy season with PH7 (pre and post) having the highest value and PH9 the least(pre-monsoon).
- f. **Total Dissolved Solid-** The observed TDS values ranged between 750 to 5790 mg/L in summer and 1350 to 5750 mg/L in the rainy season. Site PH7 (pre) had the highest concentration and site PH9 (pre) had the least

concentration. The inorganic solid material dissolved in water is determined by TDS. Higher TDS raises the visual color of the water and decreases the rate of photosynthesis.

- g. Electrical Conductivity-** The values of EC in summer varied from 1120 to 8110 $\mu\text{s}/\text{cm}$ and 2540 to 8620 $\mu\text{s}/\text{cm}$ in the rainy season. Site PH7 (post-monsoon) had the highest and site PH9 (pre-monsoon) had the least. Due to the presence of chloride, phosphate, and nitrate, a poorly functioning drainage system would raise conductivity, but oil pollution would decrease conductivity.
- h. Chloride-** A high chloride content in water is an indicator of pollution. The observed chloride concentration ranged between 230 to 2550 mg/L in summer and 450 to 2450 mg/L in the rainy season with PH7 (pre) having the highest value and PH9 (pre) the least.
- i. Nitrate-** The concentration of Nitrate was 5 to 195 mg/L during summer and 1 to 190 mg/L during the rainy season with PH5 (pre) having the highest value and PH5 (post) the least. Increased nitrate concentrations in water are caused by agricultural chemicals, untreated wastewater, industrial pollution or fecal contamination.
- j. Fluoride-** The observed value of Fluoride in the research area varied from 0.2 to 5.4 mg/L in summer and .6 to 5.5 mg/L in the rainy season with PH7 (post) having the highest value and PH8 (pre) the least. Excess fluoride consumption can result in fluorosis, which damages the teeth and bones and contrary to common belief, minimal fluoride consumption aids in the prevention of tooth cavities.

A comparative spider chart of Physico-chemical parameters-pH, Total alkalinity, EC, and TDS during the summer and rainy season is given in figure3; the outcome of seasonal variations in the concentration of different ions is shown in figure4.

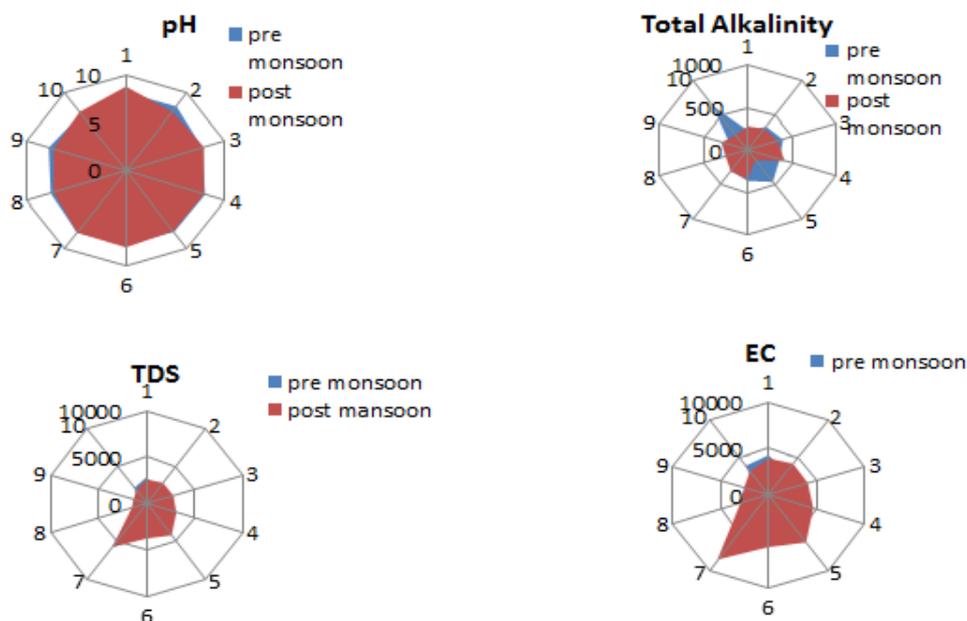


Figure3. Comparative spider charts of different Physico-chemical parameters showing seasonal variation

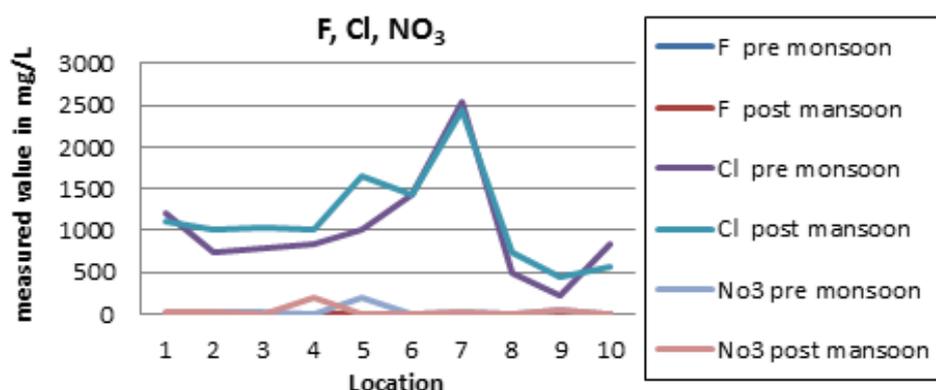


Figure 4. The trend of anions at different locations of Phalodi Tehsil shows seasonal variation

3.2 Water Quality Index (WQI)

WQI is a simple and extensively used for representing the quality of the water which has played a major part in the management of water resources. The WQI value calculated for twenty groundwater samples were used to monitor the quality of the groundwater of different villages in Phalodi Tehsil, and BIS desired values were used as the standard value for calculating WQI for each site. Table 7 shows the standard parameters for water quality and WQI calculation for site PH6 in the pre-monsoon season. A similar calculation is performed for all other sites, and the WQ Index values of these groundwater samples are shown in Table 5.

It was found from the tabulated WQI that the values range from 44.39 to 526.20 during the summer season and 78.04 to 535.25 during the rainy season, implying a poor status of the quality of water, which can be classified into five categories ranging from "Excellent water" to "Water unfit for drinking". Table 6 provides the percentage of water samples that range into each category of quality. A comparative graph of WQI showing seasonal variation is given in figure 5.

Table 5. WQI in pre-monsoon and post-monsoon area of Phalodi Tehsil

S.No.	Type of sample	Sampling Sites	WQI	
			Pre-monsoon	Post monsoon
1	Tap water	PH1	209.9867	214.6642
2	Tap water	PH2	103.7869	111.0509
3	Tap water	PH3	129.5155	149.0491
4	Hand pump	PH4	169.5732	245.279
5	Hand pump	PH5	252.9385	261.7266
6	Hand pump	PH6	268.0351	277.9933
7	Tap water	PH7	526.2065	535.2528
8	Tap water	PH8	44.39706	78.04446
9	Hand pump	PH9	111.7346	162.4156
10	Hand pump	PH10	247.3444	262.9418

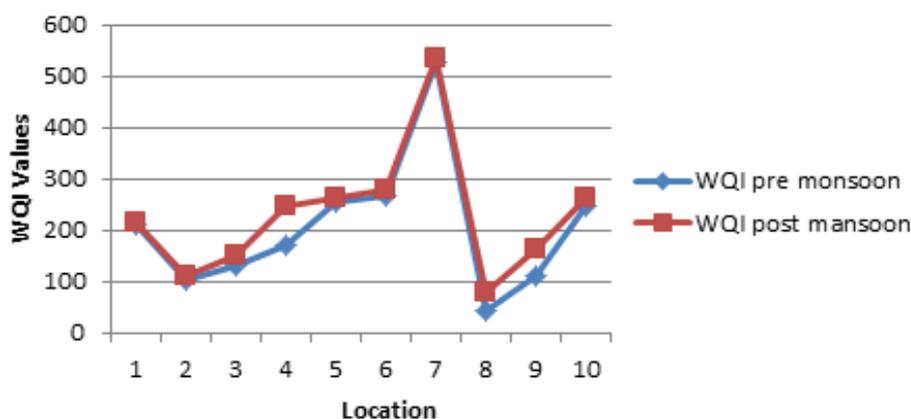


Figure 5. WQI of water samples showing seasonal variation

Table 6. Water quality classification based on WQI in summer and rainy season

S. No.	WQI value	Grade	water quality	Representing samples in summer	Percentage	Representing samples in rainy season	percentage
1	50 and below	A	water Quality is excellent	8	10%	None	0
2	50-100	B	water Quality is good	None	0	8	10%
3	100-200	C	water Quality is poor	2,3,4,9	40%	2,3,9	30%
4	200-300	D	water Quality is very poor	1,5,6,10	40%	1,4,5,6,10	50%
5	300 and above	E	Water unfit for drinking	6	10%	7	10%

Table 7. Water quality parameters and computed average value of WQI for site PH6 in pre-monsoon of Phalodi Tehsil

Parameters	BIS standards(Sn)	1/Sn	$\sum 1/Sn$	K	Wn	Vo	Vn	Vn/Sn	Qn	WnQn
pH	8.5	0.117647	1.202203	0.831807	0.09786	7	7.7	0.46	46	4.501541
Total alk.	200	0.005	1.202203	0.831807	0.004159	0	360	1.8	180	0.748626
TH	300	0.003333	1.202203	0.831807	0.002773	0	720	2.4	240	0.665445
CaH	75	0.013333	1.202203	0.831807	0.011091	0	320	4.266667	426.6667	4.732055
MgH	30	0.033333	1.202203	0.831807	0.027727	0	400	13.33333	1333.333	36.96918
CL	250	0.004	1.202203	0.831807	0.003327	0	1420	5.68	568	1.889864
NO3	45	0.022222	1.202203	0.831807	0.018485	0	6	0.133333	13.33333	0.246461
F	1	1	1.202203	0.831807	0.831807	0	2.6	2.6	260	216.2697
TDS	500	0.002	1.202203	0.831807	0.001664	0	3630	7.26	726	1.207783
EC	750	0.001333	1.202203	0.831807	0.001109	0	5440	7.253333	725.3333	0.804449
		1.202203			1					268.0351

3.3 Statistical Analysis

Correlation matrix analyses were performed to find the most important parameter of water quality and its relationship with other Physico-chemical parameters. The correlation matrix of 10 Physico-chemical and the WQI value for the 20 groundwater samples (10 pre + 10 Post) was computed in this study and is represented in Table 8 (pre) and Table 9 (post) below. It is seen from the matrix for both the season that TDS exhibited a significant positive linear correlation with EC (0.9), Total Hardness (0.9), Calcium Hardness (0.9), Magnesium Hardness (0.9), Chloride (0.9), Fluoride (0.9) and Fluoride (0.8 post-monsoon). The highest positive correlation of all the parameters was seen with conductivity except pH, Nitrate and alkalinity. The correlation matrix for both seasons indicates a positive correlation of Total Hardness with that of MgH, CaH and Cl inferring the presence of chloride salts of magnesium and calcium present in water which also increases the amount of total dissolved solids and thereby increasing the conductivity of the water. The correlation of Fluoride with EC and TDS indicates the presence of fluoride salts dissolved in samples.

Table 8. Correlation Matrix of Phalodi Tehsil in summer

	pH	Alkali.	TH	CaH	MgH	CL	NO3	F	TDS	EC
pH	1									
Alkali	0.43015	1								
TH	0.13349	0.25234	1							
CaH	0.11417	0.36853	0.95595	1						
MgH	0.17155	0.09436	0.97394	0.86921	1					
CL	0.22604	0.07801	0.95998	0.93049	0.94362	1				
NO3	0.07468	0.25201	-	0.15023	-	-	1			
F	0.04110	0.27216	0.92231	0.92487	0.86222	0.92329	0.091185	1		
TDS	0.23686	0.14729	0.95378	0.95834	0.91291	0.98672	0.065339	0.92339	1	
EC	0.14849	0.23442	0.96226	0.97899	0.90651	0.97995	0.054891	0.93069	0.99163	1

Table 9. Correlation Matrix of Phalodi Tehsil in rainy season

	pH	Alkali.	TH	CaH	MgH	CL	NO3	F	TDS	EC
pH	1									
Alkali	0.15869	1								
TH	0.29439	0.13895	1							

CaH	0.28425 1	0.06241 6	0.95742 8	1						
MgH	0.30857 5	- 0.22203	0.98425 2	0.89537 2	1					
CL	0.42006	- 0.03909	0.96504 1	0.95544 3	0.92817 6	1				
NO3	0.06385 4	0.64471	-0.257	0.04786	0.33961	0.14997	1			
F	0.32638 6	0.03589 8	0.74542 6	0.75970 9	0.73255 2	0.76743 7	0.04739 1	1		
TDS	0.41567 6	0.04872 7	0.95484	0.95026 7	0.92517 7	0.97933 3	- 0.02566	0.77096 6	1	
EC	0.35647 2	0.00142 8	0.96239 3	0.95773 6	0.93006 5	0.98434 5	- 0.05309	0.80829 8	0.99393 1	1

CONCLUSION

For most physicochemical characteristics, the results of analyzed water samples were above the Indian Standards (BIS) suggested limits. According to the WQI study, the water in Phalodi Tehsil is too polluted to be used for drinking. Only 10% of water samples in summer are classified as having "good water quality", while the remaining 40%, 40%, and 10% of samples had poor, extremely poor, and unfit for drinking water, respectively. In the rainy season, only 10% of water samples have good quality, 30% have bad quality, 50% have extremely low quality, and 10% have water samples that are unsafe for human consumption. Untreated sewage, animal waste, and household solid waste discharge in the rainy season with the drainage system of the potential water supply system and also the number of households at village clusters, which translates to further contamination and thus raises the WQI. The quality of water is further impacted by the use of pesticides, chemically treated fertilizers, and agricultural wastewater that enters water systems when the monsoon rains are heavy. The results of the study show that high levels of TDS, TH, CaH, MgH, Cl, NO₃, F, and conductivity cause WQI to rise during the post-monsoon season. Since increased turbidity, hardness, and conductivity of the tested water sample strongly correlate with and affect the TDS of water. This relationship is depicted in a correlation matrix. Because of the diffusion of different salts into the post-monsoon groundwater from recharge water and the presence of chloride salts of magnesium and calcium in the water, post-monsoon samples with higher TDS concentrations show poorer water quality than pre-monsoon samples. The existence of salt industries in Phalodi is another major factor contributing to the high chloride concentration. The summer months are when salt is produced. Since work is not being done during the rainy season, chloride ions are left in the water and increase the water's propensity for corrosion. Infrastructure and the quality of drinking water are both impacted by corrosion in water distribution systems. Chronic renal disease is becoming more common because water samples contain too much calcium. Furthermore, the presence of fluoride in drinking water has drawn considerable attention in the scientific community due to the looming problems with human health and wellbeing, as well as for the next generation. As a result, contaminated drinking water is unhealthy and can cause water-borne diseases.

As a result, it is essential to build a system for monitoring and maintaining the quality of drinking water on a regular basis. Regular disinfectants like chlorine or heating water first before using, using less pesticide, implement inexpensive, environmentally friendly defluoridation processes, and improving sanitation procedures are all strongly advised.

REFERENCES

1. Tripathi V.M.; Tewari D.D.; Tewari H.D.; Tewari S.; Uppadhyaya M.P., (2008), Physico-chemical characteristics of river Rapti nearby industrial area Balrampur of UP, India, *Natl. Environ. and pollu. Technol.*, 7(1), 73-77.
2. Tyagi S.; Sharma B.; Singh P., (2013), Water Quality Assessment in Terms of Water Quality Index, *American Journal of Water Resources*, 1(3): 34-38.
3. Chatterjee R.; Tarafder G.; Paul S., (2009), Groundwater quality assessment of Dhanbad district, Jharkhand, India, *Bulletin of Engineering Geology and the Environment*, 69(1): 137-141.
4. Sharma S.; Chhipa R.C., (2016), Seasonal variations of ground water quality and its agglomerates by water quality index, *Global J. Environ. Sci. Manage.*, 2(1): 79-86.

5. Ramakrishnaiah C.R.; Sadashivaiah C.; Ranganna G., (2009), Assessment of Water Quality Index for the Groundwater in Tumkur Taluk, Karnataka State, India, *E-Journal of Chemistry*, 6(2): 523-530.
6. Nagarakan R.; Natarajan R.; Mahendran U.; Senthamilkumar S., (2010), Evaluation of groundwater quality and its suitability for drinking and agricultural use in Thanjavur city, Tamil Nadu, India, *Environmental Monitoring and Assessment*, 171(1): 289-308.
7. Kangabam R.D.; Bhominathan S.D.; Kanagaraj S.; Govindaraju M., (2017), Development of a water quality index(WQI) for the Loktak Lake in India, *Appl Water Sci*, 7: 2907-2918.
8. <https://www.latlong.net>.
9. Chauhan A.; Singh S., (2010), Evaluation of Ganga water for drinking purpose by water quality index at Rishikesh, Uttarakhand, India, *Report Opinion*, 2(9): 53-61.
10. Label L., (2005), Carbon and water management in urbanization, *Global Environmental Change*, 15(4): 293-295.
11. Singh A.K.; Jayakumar S., (2016), Water Quality Assessment of Kanwar Lake, Begusarai, Bihar, India, *Imperial Journal of Interdisciplinary Research*, 2(4): 793-803.
12. Rizvi N.; Katyal D.; Joshi V., (2015), Assessment of water quality of Hindon River in Ghaziabad and Noida, India by using Multivariate statistical methods, *Journal of Global Ecology and Environment*, 3(2): 80-90.
13. Bhadja P.; Vaghela A., (2013), Status of River water quality of Saurashtra, Gujarat, India, *International Journal of Advanced Biological Research*, 3(2): 276-280.
14. Chauhan S.B.; Sagar S.K., (2013), Impact of Pollutants on Water Quality of River Sutlej in Nangal Area of Punjab, India, *Biological Forum- An International Journal*, 5(1), 113-123.
15. Bhateria R.; Jain D., (2016), Water quality assessment of lake water: a review, *Sustainable Water Resources Management*, 2: 161-173.
16. Jagaba A.H.; Kutty S.R.M.; Hayder G.; Baloo L.; Abubakar S.; Ghaleb A.A.S.; Lawal I.M.; Noor A.; Umaru I.; Almahbashi N.M.Y., (2020), Water quality hazard assessment for hand dug wells in RafinZurfi, Bauchi State, Nigeria, *Ain Shams Engineering Journal*, 11(4): 983-999.
17. Nas B.; Berktaş A., (2006), Groundwater contamination by nitrates in the city of Konya, (Turkey): A GIS perspective, *Journal of Environmental Management*, 79(1): 30-37.
18. Sehn P., (2008), Fluoride removal with extra low energy reverse osmosis membranes: three years of large scale field experience in Finland, *Desalination*, 223(1-3): 73-84.
19. Singh P.; Rani B.; Singh U.; Maheshwari R., (2011), Fluoride contamination in groundwater of Rajasthan and its mitigation strategies, *Journal of Pharmaceutical and Biomedical Science*, 6(9).
20. Simoes F.S.; Moreira A.B.; Bisinoti M.C.; Gimenez S.M.N.; Yabe M.J.S., (2008), Water Quality index as a simple indicator of aquaculture effects on aquatic bodies, *Ecol Indic*, 8: 476-484.
21. Rubia Khan; Jhariya D., (2017), Groundwater Quality Assessment for Drinking Purpose in Raipur City, Chhattisgarh Using Water Quality Index and Geographic Information System, *Journal of the Geological Society of India*, 90(1): 69-76.
22. Hameed A.; Alobaidy M.J.; Abid H.S.; Maulood B.K., (2010), Application of water quality index for assessment of Dokan Lake ecosystem, Kurdistan Region, Iraq. *J. Water Res. Prot.*, 2(9): 792-798.
23. Dr. Sangeeta Purohit, (2015), Seasonal Variation In Physico-Chemical Parameters Of Groundwater Of Jodhpur Old City (Raj.) India, *International Journal of Science, Technology and Management*, 4(1).
24. Ramakrishna C.H.; Rao D.M.; Rao K.S.; Srinivas N., (2009), Studies on groundwater quality in slums of Visakhapatnam, Andhra Pradesh, *Asian J. Chem.*, 21(6): 4246-4250.

Contemporary Trends in Educational Institutions – A Descriptive Study

Dhananjay Awasarikar

Suryadatta Institute of Management and Mass Communication, Pune, India

ABSTRACT

The Contemporary Trends mean Conforming to the Modern or Current Ideas in Style, Fashion or Design. Around twenty five years earlier; the Educational Institutions were charitable. The overall trends in Educational Institutions are changing drastically and dramatically. No one would really have imagined last decade that the Educational Institutions would take the shape they have taken today. Though they are legally regarded as Charitable; they are Professional; in consequence.

Some significant Contemporary Trends in Educational Institutions are related to Organization Culture; Speedy Percolation of 'Best Practices' and Superiors' Attitude towards Employee Weaknesses. Moreover; bad Management Practices can certainly be overcome after adopting specific measures.

In this Research Paper; the Researcher has described the Contemporary Trends in Educational Institutions and has suggested a practical measure to overcome bad Management Practices affecting the employees quite adversely.

Keywords: (a) 'Tea Party' at night, (b) Exchange of 'Best' Practices, (c) Employee Weaknesses, (d) 'Peculiar' Threat

INTRODUCTION

At the start; indeed; it is quite imperative on the part of the Researcher to introduce as to what is exactly meant by the Contemporary Trends; as far as this Research Paper is concerned; as the interpretation as regards the meaning of the term 'Contemporary Trends' may change from person to person. It means **Conforming to the Modern or Current Ideas in Style, Fashion or Design.**

Around twenty five years earlier; the Educational Institutions were charitable in practical nature. The overall trends in Educational Institutions are changing drastically and dramatically; with the passage of time. No one would really have imagined last decade that the Educational Institutions would take the shape they have taken today. Though they are legally regarded as Charitable; in fact; they are Professional; in consequence.

It is very difficult to describe all the Contemporary Trends in one Research Paper; however; the Researcher has attempted all the best to include a few significant trends. It is quite interesting to study the changing Trends in the Educational Institutions from time to time.

The Educational Institutions have the Social Responsibility of developing the ideal citizens of the country through the establishment of the best trends. However; the trends in these Institutions themselves are changing very fast when they are expected to be stable. On this Social background; indeed; it is imperative to study the Contemporary Trends in the Educational Institutions.

RESEARCH PAPER OBJECTIVES

The following are the Objectives of the Research Paper.

- (a) To Study Contemporary Trends in Educational Institutions
- (b) To Suggest a Measure to overcome Bad Management Practices

RESEARCH PAPER SCOPE

The Scope of the Research Paper extends to the Educational Institutions in and around Pune City.

RESEARCH PAPER METHODOLOGY

Primary Data for the Research Paper is collected through **informal or unofficial (Personal or Mobile) interactions** with the Professors; with **unstructured disguised questionnaire.**

Sampling Plan for the Mobile Survey –

(I) Population

- (a) Professors working in Educational Institutions in and around Pune

(II) Sample Unit

- (a) A Professor working in an Educational Institute in and around Pune

(III) Total Sample Size – 100

Sampling Methodology for the Mobile Survey

The Sampling Methodology adopted for the Opinion Survey was **Non Probability – Stratified (Demographic) resulting into Purposive and Convenience Sampling.**

Sample Category

The sample consisted of the following two different categories.

Sr. No	Category	Population	The Sample Unit	Sample Size
1	Professor	Professors working in Educational Institutions in Pune	Select Professor working in Educational Institution in Pune	75
2	Professor	Professors working in educational Institutions around Pune	Select Professor working in Educational Institution around Pune	25
			Total Sample Size	100

The following are a few significant Contemporary Trends in Educational Institutions.

A. Organizational Culture

B. Speedy Percolation of ‘Best Practices’ in Educational Institutions

C. Superiors Attitude towards Employee Weaknesses

Let us describe these Trends one by one in the following lines.

A. Organizational Culture

When any Researcher starts thinking on the lines of an Organization Culture; the first and the foremost question crops up as to what is Culture and the next logical and rational question arises as to who is prima facie responsible for its Creation. Organization Culture defines the proper way to behave within the Organization. This Culture consists of Shared Beliefs and Values established by the Organizational Leaders and subsequently communicated and reinforced through various Official or Formal Methods, ultimately shaping not only Employee Perceptions and Behaviors but also Organizational Understanding; as a Functional Unit.

Moreover; the members of the Top Management themselves are totally responsible for the Development of their Organization’s Culture; whether good or bad from the contemplation of their Stakeholders. It is needless to point out; over here; that whatever may be good from the contemplation of the stakeholders may be interpreted as bad from the contemplation of the members of the Top Management; as Good and Bad both are relative and not absolute as well as abstract Concepts in practice. Thus; at the outset; it is quite imperative on the part of the Researcher to define in clear terms as to what is good culture so that it can certainly be distinguished or differentiated from the bad culture and hence subsequently; it can be experienced accordingly. When the Organizational Factors are reasonably; may not be fully; favorable for the Employees; the Organizational Culture can certainly be regarded as Good. Some such Factors are related to; Employee Recruitment and Selection; Salary Structure; Working Conditions; Increments and Privileges; Incentives and Fringe Benefits; Incidental or Ancillary Facilities; Promotional Policies; Post Retirement Benefits; etc.

Further; a member of the Top Management who wants to develop a Good Culture within the Organization can be called as a Good Member and vice versa. Normally; as a Good Member of a Top Management who intends to develop good culture within the Organization likes to recruit a Good Employee -**Cooperative and Collaborative**; logically a bad Member of a Top Management prefers to recruit a bad Employee - **Non-Cooperative and Selfish**. On the other hand; a bad Member of a Top Management who intends to develop good culture within the Organization may recruit a good employee. Therefore; the total number of Good or Bad Employees in an Organization is in direct proportion with the **Number and the Attitude of either Good or Bad Members of the Top Management**. In other words; **more is the number of the Good members of the Top Management and favorable attitude of the Bad Members; vicariously more is the number of good employees in an Organization.**

When the total number of Bad Employees exceeds the number of Good Employees; as the majority prevails in practice or rules in reality; naturally Bad Culture is experienced in an Organization. As a matter of fact; the **Members of the Top Management; particularly bad; blame the employees; especially Good for the development of Bad Culture** within the Organization. In simple words; **those persons who create bad Organization Culture themselves blame their own Creation which is in fact; a Deliberate Creation.** The

Dramatic Irony of the situation is that many stakeholders do not realize this reality and they too; blame the Good Members of the Organization for the prevalent Bad Culture.

B. Speedy Percolation of ‘Best Practices’ in Educational Institutions -

It is also observed especially after the deep study in the field of Organization Culture that basically there exist two kinds of Educational Institutions; as expected; Good and Bad; as described aforesaid in detail. At the same time; the overall number of Good Educational Institutions is less as compared to the number of Bad Institutions; at present. As a matter of fact; it is an altogether different but interesting Research Topic that really needs to well explored in respect of an Academic field.

The members of the Bad Organizations – Educational Institutions have been noticed to maintain a tendency to **convert** a Good Organization into Bad. The Researcher himself was deeply shocked when he heard the same news. The utter surprise of the Researcher; over there; was to ascertain as to how the said conversion may actually be taking place; in reality.

On a thorough investigation into the matter; the Researcher realized that almost all the members of the Top Management of majority of the Educational Institutions meet either once or twice a month; preferably **at night for a ‘Tea’ party**. The Pure and Prime Objective of such parties is **to exchange all the ‘Best Practices’ (Malpractices)** being followed within the Institute. At the same time; it is apart fact that exceptionally hardly any Good Practice too is also shared with all the other present members. As a result; one Bad Practice prevailing in one of the Educational Institutions also gets **slowly percolated** to all the Institutions. The speed of such a spread is seen more than that of a **fire**.

C. Superiors Attitude towards Employee Weaknesses -

No employee in any Educational Institute is found full of all the Strengths; that is; devoid of at least a Weakness. In fact; an employee; neither of an Educational Institute nor a Corporate House can survive with his weakness for long time. However; **in order to de-motivate a particular employee; especially the one whose level of acceptance among the peers is relatively high; the Superiors; sometimes; unnecessarily but deliberately keep on highlighting the weakness of an employee; though he might have overcome the same over a period**. The weakness; referred to; over here; may be related to either Planning; Organizing; Directing or Controlling an Academic Activity like Guest Lecture; Seminar; Workshop; Quality Improvement or Faculty Development Program or Social Events resulting in the discharge of Corporate Social Responsibility or Meeting of a Statutory Committee or a Forum; Annual Get-together (Gathering); etc.

The benefit of doubt under such circumstances can certainly be given to the Superiors when they really forget a fact or fail to realize a reality that an employee has actually overcome the weakness. The truth can rationally be realized through their Behavioral reflections. Such reflections can; at times; be political in practical nature; though they may not be for any gain whatsoever; as in general; it is experienced that whenever politics is played; it is meant for some gain.

The inference as regards Superiors’ ‘Inner Core;’ should be arrived at; quite cautiously and carefully. Otherwise; there may result misunderstanding; misinterpretation or wrong impression about the Superior if he is diplomatic and not straight forward. In the Organizational walk of life; the subordinates come across a variety of Superiors’ behaviors; therefore; a subordinate should be alert always and should remain stable even if the weakness; especially the past weakness is pointed out.

When all the Opinion Leaders of employees in an Organization are targeted; as above; it becomes easy for the Managements to rule over the other employees. In simple words; **‘Attack Employee Weakness (Real or Pseudo) and Rule’** is one of the Contemporary Management Trends observed in most of the Educational Institutions.

Measure to Overcome Bad Organizational Policies and Practices

The employees; Good and Bad both; of the Bad Organizations; sometimes suffer; quite miserably because of the Bad Policies and Practices adopted by the members of the Top Managements. It becomes very difficult for them to function or even to survive amidst nasty Organizational Environment. Under such circumstances; these employees find it problematic as to how to control or overcome the Policies and Practices of the Top Management.

In order to mould the Employee Bad Policies and Practices into good; a Bad member of a Top Management needs a special kind of treatment in the practical form of a **peculiar threat**. However; its creation may not be possible in case of every Organization and that too; in each Organizational Situation. But; the experience and

the observation teaches; as a matter of a Strategy that very harsh criticism in blunt words or a threat to approach several Social Media to disclose Organizational Facts causing injustice to the employees; does serve as a solution to many tough organizational situations.

RESEARCH PAPER LIMITATIONS

Full intellectual concurrence with all the Views and Opinions of the Researcher expressed in the Research Paper and also of the other Respondents; interviewed for the purpose of the Research; is certainly not possible; thus; not expected also.

The Researcher has mentioned the figures of percentage wherever possible. However; in case of some parameters; the same was quite difficult; thus; it is not mentioned.

The Researcher has attempted to include some significant Contemporary Trends in Educational Institutions for want of Length of the Research Paper.

SCOPE FOR FUTURE RESEARCH

During the Course of the Study of this Research Paper, the Researcher found out that there is an ample Scope and Potential for Research in future for the following topics.

- (a) Ascertainment of the Number of 'Good' Educational Institutions in and around Pune
- (b) An Elaborative Study of the Changing Trends in the Educational Institutions in and Around Pune from 2014 to 2022

REFERENCE

1. Chakraborty S. K. Education in India: A Tree without Roots; Shastra Dharma Prachar Sabha; India; Kolkata; edn1; 2010.

A Study of Cryptocurrencies and the Future: Specifically Looking at Bitcoin in Indian Markets

Mr. Hardik Majithia¹ and Hitesh G. Suthar²

¹Maniben Nanavati Women's College, India

²GNVS Institute of Management, India

ABSTRACT

Fintech, particularly crypto-currencies like Bit-coin, has transformed the world in several ways, and owing to the Covid epidemic, its growth has sped to new heights previously unimaginable. Due to global risks such as pandemics and the Russia-Ukraine war, it has advanced by at least 20 years. The study aimed to comprehend the many aspects of how bit-coin works, the hazards involved with it, particularly because it is an intangible asset, and so on. Also, an attempt is made to comprehend how much acceptability and commerce it has in India, as well as the legal restrictions surrounding it. To achieve the study's aim, the research approach relied heavily on secondary data gathered from a wide range of sources.

This research tries to investigate crypto-currency, namely Bit-coin, from several perspectives to create a complete picture. This study will attempt to improve the current understanding of crypto- currencies and expand existing literature on the subject. Based on the secondary data analysis, conclusions and suggestions have been generated that indicate to crypto-currencies, particularly bit- coin, have a significant role in being a monetary solution for the future. Crypto-currency is the driving force behind the most innovative and exciting new digital technologies.

Keywords: Bit-coins, Crypto-currencies, Indian Market

INTRODUCTION

Bitcoin is the most extensively used and well-known cryptocurrency in the world, and its popularity has recently been gradually rising. It operates on the same core premise as when it was initially released in 2008, but continual alterations in the worldwide market have led to a growing demand for cryptocurrencies that is substantially higher than its preliminary performance. When using cryptocurrencies, users may trade value in digital format without the requirement for any third-party control. The theoretical underpinning of cryptocurrency is the solution of encryption algorithms, which results in the formation of unique hashes with a finite quantity. Because of the mix of encryption and a network of computers that verify transactions, users may exchange hashes as if they were transferring actual cash. Because there is a limit to the number of bitcoins that can ever be created, there will never be an overabundance of them, keeping them precious and scarce. Despite its importance as a resource that sustains life, water is widely seen as being free or inexpensive due to its availability. This is even though water is essential for life to exist. Water would be more valuable than precious stones if it were scarce due to its expensive cost. Bitcoin has value because its users believe that, even if they recognize it as remuneration, they will be able to spend it on other products and services that they want or need (Kelly, 2014). It makes no difference what the valued thing is as long as consumers continue to believe in it. The value of bitcoin is determined by the environment in which it is utilized, the same as how Native Americans used wampum, a seashell, as their territory's money (Kelly, 2014). Bitcoin lacks the intrinsic worth of gold since it cannot be used to create physical things of value, such as jewellery. These things can be made of gold. Regardless, worth endures as long as there is trust and acceptance. The present legal and financial systems were not designed with a technology like this in mind when they were created. The groundwork for today's financial institutions was created with far older kinds of cash. It has certain parallels to the information technology sector in various ways. The transmission and processing of ones and zeros remain the most fundamental feature of computing, offering just two dimensions of data input. However, because of its broad acceptance and development, as well as a lack of demand for more advanced systems, all of our current technology is based on this technologically obsolete system. If cryptocurrency-based transactions become the conventional means of conducting business on a global scale, traditional techniques of commercial exchange would need considerable adjustment to accommodate the increased level of competitiveness. As a result, cryptocurrencies have the potential to be the single most disruptive technology to the world's financial and economic institutions. BitPay, the world's largest bitcoin processor, reportedly boosted transaction volume by a factor of 110 percent over the previous year (Team, 2016).

PROBLEM OF STATEMENT

As a result of technological breakthroughs and the rising use of digital money, the world is heading toward cashless transactions. It is a worldwide currency that is not regulated by any authority or central bank. Many governments, however, have abstained from embracing this new type of currency due to the obstacles associated with it. China is one of the countries that has done so. India is one of the nations where it is illegal to use or mine bitcoins. However, as of today, dealing in Bitcoin is no longer deemed unlawful in India, according to the Supreme Court judgment. As a result, it is critical to have a thorough grasp of Bitcoin trading in India, including how it works, how it evolved in India, and the numerous parties engaged in this sort of transaction.

RESEARCH OBJECTIVES

- To understand the concept of bitcoin and how it operates in the context of routine trade.
- To learn more about the validity of Bitcoin and its trading in India.
- To compare the hazards of investing in gold and Bitcoin.

RESEARCH METHODOLOGY

For this study, the researcher has selected to perform their inquiry utilizing an analytical research approach. To achieve the study's objectives, the researcher relied on secondary data obtained from a broad range of publications, including those generated by financial websites, journal articles, national newspapers, books, magazines, and so on.

BITCOIN IN INDIA

Digital Currency

A country's actual money is digitally represented as a digital currency. Digital currency is only a digital representation of actual currency. Because digital currency can be kept electronically, it can be used for exchanges and any other operations that would typically be performed using physical currency. They are governed by the government and can be gained by using debit or credit cards or by performing internet transactions.

Virtual Currency

The government neither issues nor regulates virtual money, thus none of these statements can be made concerning government participation. Virtual currencies are created by the app and game developers and may subsequently be used to make purchases inside their platforms. They have no inherent value and can only be used theoretically; that is, they cannot be traded for traditional currencies like dollars or euros (digital or physical form). The phrases "virtual currency" and "digital currency" are sometimes used interchangeably, however, the distinction is clear given the data stated.

Crypto-currencies are a type of decentralized money that is not regulated by anybody and may be used anywhere around the globe. They are created using encryption, which makes the system even safer by removing the chance of double spending. Because there are no intermediaries, payments can be transferred directly to the recipient's digital wallet rather than through a third party.

How does the BITCOIN System Operate?

Each Bitcoin is simply a computer file that is stored on a user's computer or mobile device, such as a smartphone, in an application known as a "digital wallet." Other individuals can transfer Bitcoin (or a piece of a Bitcoin) to your digital wallet, and you can send Bitcoin to them. The blockchain is a public list that records every transaction that occurs. As a result, it is feasible to trace the history of Bitcoin and prevent anyone from spending coins they do not own, reversing transactions, or copying them.

How do Individuals Get BITCOINS?

Individuals can obtain bitcoin through one of three basic routes. If you choose, you may buy Bitcoin using "actual" money. If you want to, you may sell products and accept Bitcoin payments from clients. Alternatively, they might be created with a computer.

How are New BITCOINS Brought into Existence?

Users can opt to have their computers handle transactions on behalf of the whole Bitcoin network for the network to function effectively. The computers are programmed to conduct incredibly difficult computations. They may earn a Bitcoin as a reward from time to time, which will be kept by the owner. People construct powerful computers only to attempt to earn Bitcoin. This is referred to as mining. The computations necessary to halt the generation of an excessive amount of bitcoin, on the other hand, are getting increasingly complicated.

Why do BITCOINS Have Such a High Value?

In addition to monetary currency, gold and diamonds are examples of valued items in contemporary culture. The Aztecs used cocoa beans as money. Individuals are eager to sell their bitcoin for services, goods, and even cash, which adds to the cryptocurrency's value.

Weaknesses of BITCOIN

Bitcoin is afflicted by several faults that are inherent in its architecture and cannot be easily remedied. The public ledger, also known as the blockchain, ensures that all transactions are visible to all users. There is some anonymity in the sense that Bitcoin wallet owners cannot be immediately recognized, although this might be rather disturbing for some people considering adopting Bitcoin. Because public blockchain technology is available to anybody who uses it, it is vulnerable to being targeted by unscrupulous actors due to its widespread use (King, 2013). To date, the Bitcoin network has been subjected to a series of "stress tests," which are better correctly defined as DDoS attacks (Hileman, 2016). These so-called "tests" were started by Bitcoin exchanges and miners to show a point about Bitcoin's design, namely that the network is incapable of handling a high transaction rate.

One of Bitcoin's design problems is that people who participate in crypto-currency transactions can put the network to a standstill to make a point. These two characteristics of Bitcoin's architecture are critical to its operation and cannot be changed. Regardless of these qualities, the acceptance of this function by apprehensive consumers must occur. As a result of recent events, bitcoin has earned a questionable reputation among many people. Not alone may stories like the one about Silk Road give Bitcoin a poor name; digital currencies, in general, can suffer from this view.

WazirX

WazirX, which was established in 2018, is now regarded as one of the most reliable exchange platforms in India. It places its primary emphasis on exchange-escrowed peer-to-peer (P2P) services to ensure that customers can continue to withdraw INR. WazirX is a cryptocurrency exchange that adheres to the KYC standards, offers a smartphone app for users of both Android and iOS, and claims to be capable of providing multiple thousand transactions per second.

BITCOIN AND RBI

The Indian government has generally been skeptical of cryptocurrency. The Reserve Bank of India (RBI), India's central bank, proposed introducing its cryptocurrency dubbed Lakshmi in 2017. This scheme has subsequently been scrapped. Furthermore, it has been looking at ways to promote the use of blockchain technology in banking and payment institutions. However, the government has shown little interest in cryptocurrencies, preferring to criminalize their usage through jail and legal petitions. Bitcoin is not recognized as legal cash and a measure to prohibit cryptocurrencies and control official digital currencies has been submitted as of July 23rd, 2019. Uno-coin, an Indian exchange, used to allow customers to swap Bitcoin but has now discontinued this feature. Despite this, Bitcoin may still be purchased and traded on Indian digital currency exchanges including Zeb Pay, Coin Delta, and Coin Secure. A considerable proportion of Bitcoin dealers buy the cryptocurrency through expatriate networks in countries where it is legal tender.

Is It Okay to use BITCOIN in India?

In his budget statement on February 1, 2018, India's Finance Minister Arun Jaitley stated that the government should do all in its power to stop the usage of bitcoin and other virtual currencies in India for illicit reasons. He reiterated that India does not recognize them as legal tender and that the nation will instead promote the usage of blockchain technology in various payment systems. "Because the government does not recognize cryptocurrencies as legal cash or coin, all efforts will be made to eliminate the use of such digital currencies in financing illicit operations or as a component of the payment network," Jaitley said. "The government will use all means to eliminate the use of these digital currencies in supporting unlawful operations or as part of the payment network." The Reserve Bank of India (RBI), India's central bank, said at the beginning of 2018 that it will restrict the selling or acquisition of cryptocurrencies by organizations that it controls. The draught of the Banning of Cryptocurrency and Regulation of Official Digital Currency Bill 2019 proposes a ten-year prison penalty for anybody who mines, really makes, owns, sells, exchanges, disposes of, issues, or deals in cryptocurrencies. This covers anybody who mines, develops, holds, sells, exchanges, disposes of, issues, or deals in cryptocurrency. In 2019, the Internet and Mobile Association of India petitioned the Supreme Court of India, seeking the validity of cryptocurrencies and requesting a directive or order prohibiting the transaction of digital currencies. The Supreme Court of India ruled in March 2020 to lift the RBI's ban on cryptocurrency trading. In 2021, the government is considering introducing a state-backed virtual currency that would be

approved by the Reserve Bank of India. At the same time, private digital currencies such as Bitcoin would be forbidden.

CONCLUSION & SUGGESTIONS

Cryptocurrency appears to have progressed beyond the early stages of deployment that are characteristic of the introduction of new technology. These phenomena affected even moving vehicles, such as cars. Bitcoin has already begun to carve out a specialized industry, which may help cryptocurrencies gain popularity; alternatively, it may be the key reason why it fails. Because cryptos are still in their infancy, it is difficult to forecast whether or not they will ever find a home in the mainstream of any market around the globe. Through technical innovation and the resolution of long-standing difficulties, the investment sector is attempting to enter the public consciousness. Other sorts of virtual currencies have also emerged and developed their fan groups; while they are all slightly separate from Bitcoin, some believe that they are on a similar footing in terms of legitimacy. Some countries, such as Iceland, have already begun the process of generating their national cryptocurrency (Hofman, 2014). Cryptocurrencies such as Bitcoin may probably play an essential role as major currency solutions in the future, and Bitcoin will play an important role in preparing the way for the success of other cryptocurrencies. The number of Bitcoin transactions in Europe, the United Kingdom, and Latin America is increasing, indicating that the money is being used legitimately in those countries. There is a wealth of supplementary information available on Bitcoin and other cryptocurrencies, which may be investigated. An extensive study on the economic consequences of Bitcoin's effect on the performance of long-standing fiat currencies should be done, and the results should be compared to those of nations that are beginning to embrace state-sponsored cryptocurrencies. A more thorough market and cost analysis is necessary to establish whether cryptocurrency's capacity to undertake micro-transactions allows it to bridge an economic gap that traditional state-sponsored currencies cannot. Furthermore, the blockchain technology that supports Bitcoin may have uses in other situations, such as smart contracts (Hileman, 2016). These contracts involve predefined payments that are made if a certain condition is satisfied. Because a company's whole accounting department is often in charge of carrying out established payment arrangements, this gives a tremendous opportunity for further transformation. Finally, cryptocurrency is the consequence of utilizing cryptography to create a digital asset.

REFERENCES

1. Bearman, J. (2015, May). The Untold Story of Silk Road, Pt. 1. Retrieved from Wired.com Website: <https://www.wired.com/2015/04/silk-road-1/>
2. Bitcoin: A New Global Economy. (2015, August 4). Retrieved July 2016, from BitPay, Inc. Website: <https://blog.bitpay.com/bitcoin-a-new-global-economy/>
3. Bovaird, C. (2016, June 24). Bitcoin Rollercoaster Rides Brexit As Ether Price Holds Amid DAO Debacle. Retrieved June 2016, from CoinDesk Website: <http://www.coindesk.com/bitcoin-brexit-ether-priceroller-coaster/>
4. Desjardins, J. (2016, January 5). It's Official: Bitcoin was the Top Performing Currency of 2015. Retrieved from The Money Project Website: <http://money.visualcapitalist.com/its-official-bitcoin-was-the-topperforming-currency-of-2015/>
5. Gerber, R. (2015, January 29). Why Apple Pay And Dollars Are Killing Bitcoin. Retrieved from Forbes Investing Website: <http://www.forbes.com/sites/greatspeculations/2015/01/29/why-apple-pay-and-dollars-are-killing-bitcoin/#23ac58a0b4b6>
6. Hileman, G. (2016, January 28). State of Bitcoin and Blockchain 2016: Blockchain Hits Critical Mass. Retrieved from Coindesk Website: <http://www.coindesk.com/state-of-bitcoin-blockchain-2016/>
7. Hofman, A. (2014, March 6). The Dawn of the National Currency – An Exploration of Country-Based Cryptocurrencies. Retrieved from Bitcoin Magazine Website: <https://bitcoinmagazine.com/articles/dawn-national-currency-exploration-country-based-cryptocurrencies-1394146138>
8. Kar, I. (2016, June 30). Everything you need to know about the bitcoin „halving“ event. Retrieved from Quartz website: <http://qz.com/681996/everything-you-need-to-know-about-the-bitcoin-halving-event/>
9. Kasiyanto, S. (2016). Bitcoin's potential for going mainstream. *Journal of Payments Strategy & Systems*, 10(1), 28-39.
10. Kelly, B. (2014). The Bitcoin Big Bang : How Alternative Currencies Are About to Change the World.
11. King, R. S. (2013, December 17). By reading this article, you're mining bitcoins. Retrieved from Quartz.com Website: <http://qz.com/154877/by-reading-this-page-you-are-mining-bitcoins/>

12. Magro, P. (2016, July 16). What Greece can learn from bitcoin adoption in Latin America. Retrieved July 2016, from International Business Times Website: <http://www.ibtimes.co.uk/what-greece-can-learn-bitcoin-adoption-latin-america-1511183>
13. McMillan, R. (2014, March 3). The Inside Story of Mt. Gox, Bitcoin's \$460 Million Disaster. Retrieved from Wired.com Website: <http://www.wired.com/2014/03/bitcoin-exchange/>
14. Patterson, J. (2015, August 04). Bitcoin: A New Global Economy. Retrieved from Bitpay Website: <https://blog.bitpay.com/bitcoin-a-new-global-economy/>
15. Perez, Y. B. (2015, October 24). European Exchanges React to Bitcoin VAT Exemption. Retrieved from Coindesk Website: <http://www.coindesk.com/european-exchanges-react-to-bitcoin-vat-exemption/>
16. Price, R. (2016, June 17). Digital currency Ethereum is cratering because of a \$50 million hack. Retrieved from Business Insider Website: <http://www.businessinsider.com/dao-hacked-ethereum-crashing-in-value-tens-of-millions-allegedly-stolen-2016-6>
17. PwC. (2015, August). Money is no object: Understanding the evolving cryptocurrency market. Retrieved from PricewaterhouseCoopers, LLP. Financial Services Website: <https://www.pwc.com/us/en/financialservices/publications/assets/pwc-cryptocurrency-evolution.pdf>
18. Reuters. (2016, July 6). Two-Year High on Gold Prices Fueled by Brexit-Spooked Investors. Retrieved from Fortune.com Website: <http://fortune.com/2016/07/06/brexit-gold-prices/>
19. Saito, M. (2016, February 18). Exclusive: Amazon expanding deliveries by its 'on-demand' drivers. Retrieved from Reuters Website: <http://www.reuters.com/article/us-amazon-com-logistics-flexidUSKCN0VR000>
20. Team, B. (2016, January 20). Understanding Bitcoin's Growth in 2015. Retrieved from Bitpay Website: <https://blog.bitpay.com/understanding-bitcoins-growth-in-2015/>

A Study on Moral and Ethical Leadership Post Covid-19

Usha Kumar

GNVS Institute of Management, India

ABSTRACT

This article 'Moral and Ethical Leadership- Post Covid 19' throws light on Moral and Ethical leadership and tries to find out the Leadership traits which are required to lead others after the Pandemic. The Pandemic which threatened humanity as a whole has shaken the existing definitions of Ethical and Moral Leadership. After reviewing many articles and research papers the conclusion which is drawn is that Leaders should be humane, empathetic, good collaborators and above all a good human being. It requires a great deal of patience, understanding and selfless love and care to support and motivate the workforce to get back to work and gain normalcy.

Keywords: Leadership, Ethical, Social, Pandemic, Team, Humane

INTRODUCTION

Leadership is the ability of an individual or a group of individuals to influence and guide followers or other members of an organization. Leadership involves making sound -- and sometimes difficult -- decisions, creating and articulating a clear vision, establishing achievable goals and providing followers with the knowledge and tools necessary to achieve those goals.

Although different definitions generally converge in the theory that great leaders have the ability to make strategic and visionary decisions and convince others to follow those decisions. The consensus is - leaders create a vision and can successfully get others to work toward achieving that goal, great leaders know how to both inspire people and get followers to complete the tasks that achieve the leader's goal.

MORAL LEADERSHIP

Moral leadership is defined as "a leader's behavior that demonstrates superior virtues, self-discipline, and unselfishness" (Cheng et al., 2004, p. 91). It entails "setting an example for others about the rightness or wrongness of particular actions" (Fairholm and Fairholm, 2009, p. 132), and exemplifies the exercise of integrity and fulfilling obligations, never taking advantage of others, and serving as a selfless paragon (Farh et al., 2008).

Moral leaders, model personal integrity, and they teach and inspire others to develop their own moral characters. Moral leaders are skilled at self-management and emotional intelligence -- the ability to read and respond compassionately to the cues of others. Moral leadership is not necessarily connected to position or status, as anyone can become a moral leader. ..

Moral leaders can persuade others to behave correctly, mostly by practicing what they preach. In the world of business, moral leaders avoid shortcuts to success that involve compromising moral and ethical values and breaking the law. They don't make excuses or try to rationalize their mistakes. Moral leaders generously focus on developing the skills of others rather than drawing attention to their own achievements. They aren't afraid to act as whistleblowers when the situation demands. Because moral leaders are motivated by core values of justice and fairness, their actions are service-oriented.

Moral leaders have social skills and self-control. They strive for consensus and often are seen as the conscience of their group or organization. Moral leaders are accountable, pursue excellence and think about consequences before they act. They avoid favoritism, prejudice and blame. Moral leaders can visualize goals and lead others to achieve them. They're reflective and welcome criticism as an impetus for growth and self-improvement.

ETHICAL LEADERSHIP

Ethical leadership is leadership behavior that adheres to certain principles and values and is recognized by the majority as a solid foundation for the common good.

Ethical leadership is the art of leading people and making good decisions based on a defined set of values, such as fairness, accountability, trust, honesty, equality, and respect. In fact, these values form the core foundation of ethical leadership.

"Ethical leadership is knowing your core values and having the courage to live them in all parts of your life in service of the common good"- Anonymous

The 4-V Model of Ethical Leadership

The 4-V model of ethical leadership was created by Dr. Bill Grace which aligns the belief and values of the organization with the behavior and actions of the people at executive level. These four Vs are:

Values are at the top of the triangle representing the starting place for ethical leadership. This includes integrating the unique values of the individual with the choice making at all the levels of our lives.

Vision involves creating a picture of what should be.

Voice involves articulating the vision to others in an authentic and convincing way that animates and motivates them to act ethically.

Virtue stands for common good.

An Ethical leader - "The best way to do is to be." – Lao Tzu

Leaders play a crucial role in corporations, as they have been chosen to guide others. The ethical traits which they have are- they know their strengths and values, they have consistent ethical behavior, they are responsible, respectable, build ethical relationships, communicate desired behaviors and put mechanisms in place to support them, acknowledge others by praising their work etc.

The COVID-19 pandemic has revealed many areas of strength, weakness, opportunity, and potential threat in businesses, organizations, and societies around the world. The COVID-19 crisis has laid bare the need for leaders who have integrity, who demonstrate compassion and respect for others, who are humane and humble, who value and speak the truth, and actively listen.

The first critical step for any leader is to analyze the impact Covid-19 had on their organization, a leader who responds with compassion and empathy, digs deeper. They will think about the people behind and understand what new challenges they too are facing as everyone's world has changed.

Hybrid work will be here to stay, and the Great Resignation is not showing any signs of stopping.

According to Microsoft's 2022 Work Trend Index Report published this week, hybrid work is up seven points this year to 38%, and the percent of people looking to transition to hybrid has risen to 53%. In addition, 52% of those surveyed say they will be looking to change jobs in the next three years.

The workplace of yesterday, when employees unquestionably jumped through their employers' hoops is on the way out.

In order to sustain and carry forward the strategic goals of the company, effective leadership is absolutely necessary for an organization and its people, and requires physical, psychological and emotional fortitude. Effective management blends static, core values of crisis management with dynamic adjustments to meet their own personal needs and those of the workforce during critical incidents. As a prolonged adjustment to the "new normal," responsible, thoughtful leaders should prepare for a significant shift in operational priorities. The leadership style – which likely has served well up to this point – will need to be revisited and adapted to this extraordinary and unprecedented crisis.

COVID-19 has prompted commitments from some leaders to focus on the workforce, be it adopting hybrid models, placing more attention on well-being and good work, or both. For example, Satya Nadella, CEO of Microsoft, is looking at reducing the time employees spend in the office to less than 50% and talks openly about empathy and wellness as hallmarks of the corporate culture. Jane Fraser, first female CEO of Citibank, is openly talking about the challenges women face, including their role as working parents.

Leadership Post Pandemic Would Require the Following Strategies:

1. Managers need to be Good Communicators

"Communication is the key pillar to success in most aspects of our lives," from forming first impressions to personal relationships, good communication leads to business success and good bonding. Poor communication on the other hand, mostly leads to business failure. With good effective communication, we not only begin to form bonds with our team and our clients but reap long-lasting rewards as well.

2. Ability to Respond and Act for Better Solutions

Now more than ever, people are striving for change and seeking ways to take the lead in policy transformation. A post-pandemic leader needs to know where to start, and how to respond and take action.

When one focuses on policy transformation, new innovative strategies for effective policy implementation are created inclusive of public service. A leader who is able to develop sustainable public services that uphold the public good is a leader who leads with social impact.

Empathy and Vulnerability to Help the Community

COVID-19 has made people look at the bigger picture of systemic change, – leaders are more aware of the challenges hounding the system. Progressive steps are being taken to ensure that various communities, especially the vulnerable, get the support they need.

Leading with empathy is now a top priority. Leaders equipped with compassion can put themselves in the shoes of others and understand their needs.

3. Good Collaborators

“Post Covid leadership is all about collaboration and is based on setting examples and guidance rather than enforcing rules,” “It is no longer punitive, and it does not drive performance or innovation by dangling job security as the ultimate reward.

“Collaborative leadership is different from the theoretical as well as the practical aspects which we have experienced and learned till now. On the contrary, collaborative leadership which leads to corporate success values health, corporate creed, learning and commonality of interests. Collaboration depends on individuals having a mutual goal and are all committed to making it work. Which means even if the original idea is not from you, you are still committed to its success as you buy into its vision and take ownership of it like others in the relationship. A collaborative relationship, therefore, has some uniqueness to it. For it to work, individuals are respectful towards one another and support efforts to enhance the output quality.

4. Prioritize Health, Family Values, Learning and Commonality of Interests

“The global pandemic wiped out the old-school leadership. Successful business performance is now determined by personal connectivity and corporate fluidity. Employees will perform better when they feel that their needs are understood rather than when they fear being fired.” Collaboration, empathy and understanding are the skills which are required now to augment and command an executive's presence in the boardroom.

“The new type of collaborative leadership which promotes corporate success focuses on health, family values, learning and commonality of lifestyle interests. These are values that transcend rigid corporate rules and risk mitigation policies.”

5. Taking Vested Interest in One's Team

"When you take a vested interest in your team's lives and help them jump through multiple hurdles, the lasting impact is very fulfilling", opines many.

“We all work for money, and we spend many hours of our lives doing this work. Sometimes, we also forget that it's okay to have fun with it. We should find ways to make our work meaningful for ourselves and our team or customers. If we take a real interest in our team mates lives, we create a community that is more caring and that is worth so much more.”

6. Focusing on Team's Needs and Desires

When the team mates' needs and desires are known it is much easier to understand what they want and channelize the efforts to ensure that it is satisfied to a great extent. This will prove to be a win-win situation because more the people's needs are fulfilled, greater will be the dedication displayed by way of productivity. It will strengthen the bonds of human relations.

7. More Emphasis on Recreation

It is never late to indulge in de-stressing activities. It's important that, regardless of what stage they are in their journey, team mates stay young at heart. “In other words, go outside, unplug, toss a ball around. A fresh perspective will always allow people to relook their work with a fresh approach. Proper rejuvenating sessions at equal intervals will always break the monotony of the daily routine.

CONCLUSION

Post-pandemic world will require new leadership archetypes based on hard and soft skills in order to get results while engaging across an ever-expansive array of cultures, interests and perspectives. A Leader in the post-pandemic times should place the interests of others above their own, possess intelligence and emotional stability, and focus on involvement and collaboration. Leadership responsibilities should be distributed to teams across the organization to optimize decisions made in solving complex problems. Variety of

communication channels need to be used by Leaders to convey information clearly and frequently to all stakeholders in a clear, comprehensive, and flexible style. Outlining a new course for post-pandemic leadership will require new policies that empower collaboration across sectors, equipping groups of private and public leaders to address social issues with a multidisciplinary set of skills, competencies, and resources.

REFERENCES

1. Avolio, B. J., Walumbwa, F. O., & Weber, T. (2009). Leadership: Current theories, research and future directions.
2. Annual Review of Psychology, 60, 421-449. <http://dx.doi.org/>
3. Bass, B. M., Avolio, B. J., Jung, D. I., & Berso, Y. (2003). Predicting Unit Performance by Assessing
4. Transformational and Transactional Leadership. Journal of Applied Psychology, 88, 207-218. <http://dx.doi.org/10.1037/0021-9010.88.2.207>
5. Brown, M. E., Treviño, L. K., & Harrison, D. A. (2005). Ethical leadership: A social learning perspective for construct development and testing. Organizational Behavior and Human Decision Processes, 97, 117-134. <http://dx.doi.org/10.1016/j.obhdp.2005.03.002>
6. Buble, M. (2012). Interdependence of Organizational Culture and Leadership Styles in Large Firms. Management: Journal of Contemporary Management Issues, 17(2), 85-97.
7. Caldwell, C., Dixon, R., Floyd, L., Chaudoin, J., Post, J., & Cheokas, G. (2012). Transformative Leadership: Achieving Unparalleled Excellence. Journal of Business Ethics, 109(2), 175-187. <http://dx.doi.org/10.1007/s10551-011-1116-2>
8. Eisenbeiß, S. A., & Brodbeck, F. (2014). Ethical and unethical leadership: A cross-cultural and cross-sectoral analysis. Journal of Business Ethics, 122(2), 343-359. <http://dx.doi.org/10.1007/s10551-013-1740-0>
9. Giessner, S., & Quaquebeke, N. (2010). Using a Relational Models Perspective to Understand Normatively Appropriate Conduct in Ethical Leadership. Journal of Business Ethics, 9543-9555.
10. Gomez-Mejia, L. R., Balkin, D. B., & Cardy, R. L. (2008). Management: People, Performance, Change (3rd ed.). New York
11. Akers J. (1989), "Ethics and Competitiveness: Putting First Things First", Sloan Management Review, Vol. 30(2), pp. 69-71.
12. Barnes M. Christopher (2010), "What does Contemporary Science say about Ethical Leadership", Military Review, pp. 90-93.
13. Enderle G. (1987), "Some Perspectives of Managerial Ethical Leadership", Journal of Business Ethics, Vol. 6(8), pp. 657-663.
14. Fulmer M. Robert (2004), "The Challenge of Ethical Leadership", Organizational Dynamics, Vol. 33, No. 3, Pg 307-313.
15. Isaac Mostovicz, Nada Kakabadse, Andrew Kakabadse (2009) "CSR: The Role of Leadership in Driving Ethical Outcomes", Corporate Governance, Vol. 9, Iss: 4, pp.448 – 460.
16. Jones H. B. (1995), "The Ethical Leader: An Ascetic Construct", Journal of Business Ethics, Vol. 14(10), pp. 867-874.
17. Kelly D. J. (1990), "Ethics: The Tone at the Top", Management Accounting, Vol. 70(10),

A Study on Designing Organizations and Managing People

Avishek Ganguly

GNVS Institute of Management, India

ABSTRACT

Companies whenever they want to expand their business usually merge or acquire other companies. In simple terms whenever two company become one that is known as a merger and when one company takeover another company it is known as acquisition.

The reason for the merger and acquisition activity is to become more effective, profitable and get competitive advantage over the competitors. But the activity of merger and acquisition leads us to more complex decision making areas of legal issues, finance issues, employee issues, organization culture issue and technology issues. Out all the issues handling the employee and culture issues is the most complex as it deals with human beings. The Human resources departments have to manage following four challenges in case of mergers and acquisition.

1. Understanding and assessing the differences arise due to difference in culture.
2. The complications of downsizing and retaining the employees.
3. Managing the contracts and benefits of both the companies.
4. Handling the new rules and regulations.

A similar situation aroused when the Lemon Holding Pvt Ltd took over PGB. This case highlights the challenges faced by the acquiring company and various solutions adopted by them to manage the challenges.

Keyword: Mergers, Acquisitions, turnaround time, Lemon Holding, PGB.

INTRODUCTION

PGB One Source was a leading BPO in India with business services in both the domestic and international markets. Right from its inception in 1999, they have been providing innovative, customer-centric Business Process Management (BPM/BPO) solutions to the world's leading organizations – across the Telecommunications & Media, Banking & Financial Services, Insurance, Healthcare and Publishing industries. Serving over 100 global clients – from multiple delivery centers and in various languages – PGB One Source led by a 26,000+ global workforce in India, the Philippines, Sri Lanka, the USA, and the UK grew phenomenally between 1999 and 2006 with revenues and profit margins growing every year.

In 2006, Lemon Holdings Pvt. Ltd, a leading investment company in the UK bought over PGB One Source in a then landmark deal and the new merged entity was called Lemon Source. The stock prices went up post-merger and the general feeling about the company was rather upbeat. Lemon Source went on an expansion drive in 2007 acquiring new clients and hiring activity went through a 'ramp up'.

In spite of this, poor integration & communication coupled with inconsistent selection policies led to the rise of attrition from 7.3% to 19.8% by the middle of 2008. While the turnover increased because of recently acquired businesses, profit margins started coming down with every quarter. In the first quarter of 2009 – the company showed a 'net loss' for the first time in its history. Share price that had been on a downward spiral had hit the rock bottom. The company was now in crisis.

Ravi Shukla (pseudonym), head Human Resource, Lemon Source, Asia, realized that if something is not done immediately, this slide would galvanize into catastrophic proportions. He decided to hire a team of external consultants specializing in Organizational Behavior, Human Resource Management and Business Management to find the 'cause and effect' and render 'remedial measures'.

PROBLEM STATEMENT AND ANALYSIS

The team of experts got down to work immediately. The first thing that was studied was the merger itself. PGB is a leading private bank in India with a strong brand value. In 1999, when they decided to set up a BPO, the new entity (the BPO) rode on brand PGB and made inroads into the BPO industry as PGB One Source. The BPO industry was in a nascent stage and PGB used this window to establish itself as a leading BPO, lending expertise to the field of outsourcing and thereby acquiring many clients over several countries.

Lemon Holdings Pvt. Ltd is a UK based company with no presence in India prior to the merger. Lemon Source inherited a 14000 + strong workforce from PGB India. Most of them were customer care executives coming from very middle class backgrounds with an average salary of Rs. 6500. These customer care executives were the bed rock of the organization, working 9 hours a day, 6 days a week on rotational shifts, servicing customers of a leading telecom company in India, round the clock. PGB's main client in India was this telecom company. More than 9000 employees were deployed to work for this client from various contact centers all over India. While the client paid PGB handsomely for their outsourced assignment, they had high and exacting expectations vis-à-vis deliverables from PGB. This telecom client was the single biggest revenue generator for PGB India.

When the merger happened, Lemon Source hired a British CEO with years of experience and exposure in the BPO domain to oversee the migration process and look after the India and South East Asia operations going forward. He replaced the very competent outgoing CEO Mr. Kiran Shankar (pseudonym) who had the option to stay back and oversee the migration and merger operations but fell out with the new management on 'remuneration' and 'control' issues. Mr. Kiran Shankar had been with the company right from the inception and had guided the company through many difficult and tricky phases, shepherding the organization with his able and visionary leadership and thereby maximizing its growth, making it a leading BPO company in the industry in his time.

Marcin Broad (pseudonym), the current CEO, while having years of BPO leadership experience in the European market had very little 'insider information' on the nitty-gritty of the Indian market. The complexities and contradictions of running a bottom heavy company in India in the service industry has its own challenges and requires requisite expertise, something he struggled to relate to. It led to a 'leadership deficit' at the top, percolating its way down the line to the upper management onwards to the middle management and finally reaching the lower level of customer care executives creating a leadership crisis within the company.

There was another major problem that the new management failed to perceive. After the merger, Lemon Source also moved some of its top management from UK to India to head its operations and impart leadership and direction.

Since all these new leaders were from a different culture and nationality, there should have been an 'integration with the local culture' program to understand Indian work places better. However no such program was undertaken showing a rather myopic management style of functioning. The leadership that should have taken cognizance of these local issues, facts and facets, was completely oblivious to them. They were surely not in touch with ground realities. This was also a case of inept leadership, lack of proper coordination with various departments and certainly lacking in vision and foresight.

Another critical mistake made by the top management was to go an expansion drive right away after the merger. It was a case of too much and too soon. In its findings the team noted that while all technical aspects of the merger were well executed by the 'transition team', there were other issues that were under addressed. Unlike PGB which being a local brand was well known to the Indian market, Lemon Source was a little known name. There were 'branding issues'. The brand was not properly advertised, the merger news came out in business papers and journals but the Corporate Communication department failed to sufficiently bring out the news through popular forums to the public at large. As a consequence, there was very little employment interest in this brand.

When the Human Resource department was asked to go on a 'ramp up' to hire for the newly acquired businesses, this became their first stumbling block. Since not many prospective employees knew about this new brand, they were skeptical about considering it for employment opportunities. In its haste to go on an 'expansive drive' the new management made the critical and crucial error of assuming that Lemon Source would have the same brand value as that of PGB One Source. Even though essentially at that point of time, nothing had changed, they failed to realize the importance of an all new branding exercise for Lemon Source before going all out with the 'recruitment processes. They simply assumed that everything will continue to work on 'auto pilot' mode. They failed to take into account the typical Indian mindset of being "brand conscious".

Shakespeare said "What's in a Name?"

The answer to that is there is everything in a name at least physiologically here in India.

When recruitment actually began in full throttle 2007, the HR department had to first spend on branding (a task that should have been undertaken by Corporate Communication). That was inevitable. The brand had to be

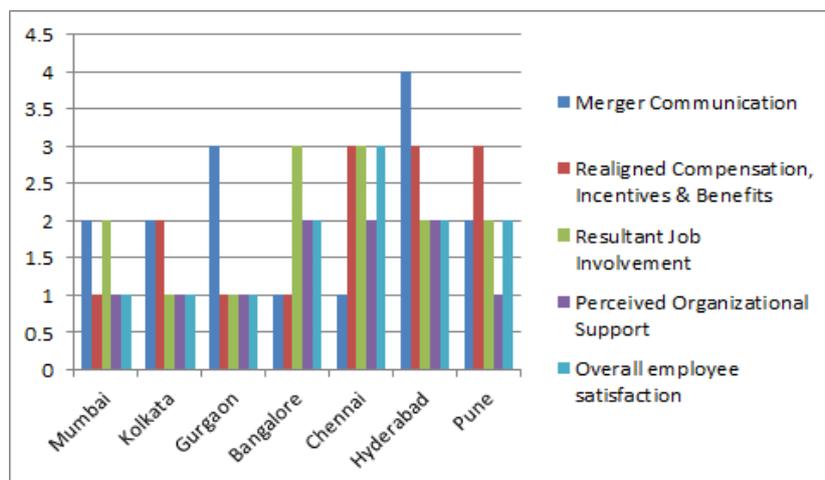
rebuilt. The PGB history to the company had to be highlighted. Money was spent on press coverage both in the print as well as electronic media. This was time consuming and with tight deadlines, recruitment budgets went overboard and the cost per hire (CPH) went up from Rs. 750 to Rs. 1500. The expense on account of recruitment was already double now, but it did not stop there.

The team also found out that a new 'lean salary structure' was adopted by new top management. Perks, incentives, leave benefits and recreational benefits that are critical to the service industry were either taken away or watered down. This was very much inspired from the parent company working culture. This proved to be a major dampener for the existing employees, most of them have been around for a long time. The reduction of perks and benefits lead to the decline of employeemoraleleading to random absenteeism and other deviant workplace behaviors and fall in job productivity.

Since existing salaries had been revised and moderated, the HR department could not find enoughnew customer care executives to join the contact center at that salary level. This led to a mini crisis, as it was imperative to service the newly owned businesses well to ensure their longevity. Since the 'turnaround time' (TAT) was only 14 days, the HR department decided to revise the salary structure in the upward direction for the new joiners, leaving it same for existing employees. This new salary structure attracted many new joiners but increased chaos and confusion and left the older existing employees fuming, demotivated and desperate. Employees felt that there were being short changed and it lead to the dip in job involvementand employee satisfaction. What added to their frustration was that now new employees were being hired at a better salary package than the existing ones.

The team of experts decided to do an internal survey of current employees who have been with the company before the merger for at least a period of 2 years. The result of this survey was quite revealing (as enclosed in Analysis -A).

ANALYSIS A



(Source: Primary Data)

The Scale:

1 – Very dissatisfied 2 – Dissatisfied 3 – Neutral 4 – Satisfied 5 – Very satisfied

Sample Size: 1800 employees (who have been with the company from January 2004 to September 2009 (that is till date).

Except the Hyderabad center, all other centers felt that the 'merger communication' was not clearly spelt out; its scope, nature and implications (both short term and long term) were relatively opaque to the existing employers triggering a sense of insecurity and uncertainty. Insecurity was even heightened when the parent company moved some of its top management from UK to India to head the operations. This increased negative competition and took out all the control from existing management who were successfully handling the business all these years. It was felt that the new management took these decisions arbitrarily and did not take the views of the loyal and existing employees into account. Another very clear finding of the survey was the lack of perceived organization support.

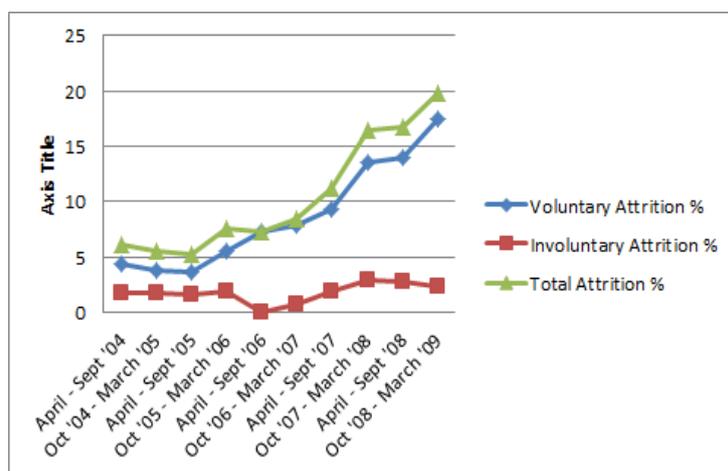
As deviant workplace behaviors increased, productivity went down, so did the profitability of the company. It led to increase and enhanced problems for the employees as the 'job environment' became tense and vitiated.

Managers, team leaders and unit leaders came under fire from the top management as the first strains on profitability were felt. The ramp up had already been initiated, there was pressure to deliver and meet client standards at all levels. The onus of delivering these service level agreements (SLAs) was felt by the existing employees even as the new employees began to find their feet in the organization. Surely it was expecting too much of the new employees to start performing at an optimum level right away. A minimum of 8 to 9 months of gestation period is a standard for new employees before they start optimizing their work outputs.

But with the integration having gone terribly wrong, the older and more seasoned employees were now a demotivated and a disjointed lot. They were actively looking for jobs elsewhere, the ones who got the right jobs left right away. The attrition had gone up from 7.3% to 19.8%, which meant additional recruitment expenditure to cater to this 'back fill'. Others who could not get relevant jobs right away stayed on in the system but their work output went down significantly even as deviant behavior at workplace increased. Employee morale was an all-time low level. This negative environment rubbed off even on the 'new joiners' and it had a wide spread negative cascading effect.

The attrition analysis (Analysis B) done by the team of experts also confirms the same. Pre-merger and post-merger attrition analysis showed a gradual increase in attrition as more and more existing and seasoned employees quit the organization. A study of the 'exit interview analysis' of the period October 2007 to March 2009 paved the way for some very interesting findings.

ANALYSIS B



(Source: Primary Data)

Before June 2007 the three main reasons for turnover were –

- 1) Better opportunity with another organization,
- 2) Lack of growth in the current organization, and
- 3) Personal reasons.

But since June 2007 the three main reasons for turnover as per the 'exit interview analysis' were-

- 1) Perceived Lack of Organization Support
- 2) Negative Work Environment, and
- 3) Lack of growth in the current organization.

It was evidently clear that internal work dynamics had undergone a change in the intervening period leading to an altogether different set of reasons for the turnover.

No wonder then, that the profit margins started coming down with every quarter with the fall of optimum productivity of the current employees coupled with 'support costs' going up dramatically even as recruitment budgets went into an overdrive to augment current requirements and mandates. By 2009 first quarter, the company had entered into the 'red' for the first time in its corporate history. Alarm bells were ringing in the management. There was an environment of distrust and confusion – as found out by the experts – as they engaged in random one on one conversation with existing and older employees cutting across departments and geographical locations.

Solutions Offered by the Experts & Implemented by the Company

A. Leadership

Leadership is a vital cog in every organization. Like the captain of the ship, it acts as a lodestar guiding the company through its various phases. The problem with the acquisition was the drastic change in the leadership. The failed negotiations with the earlier CEO Mr. Kiran Shankar and his subsequent exit left a gaping hole in the leadership. A non-Indian CEO in that role only compounded an already existing problem. The leadership's understanding of the Indian work environment was limited. The Indian employees also could not connect with the new leadership.

The team of experts opined that the management should go all out and get Mr. Kiran Shankar back into the fold. A seasoned hand like him would be the best bet to oversee this transition phase and lead the company out of this crisis situation. The current CEO could be moved out to oversee the ever growing operations of PGB Philippines. This was Plan A. If Plan A failed, then the Plan B suggested by the team of experts was to draft in an experienced and BPO tenured top management Indian executive as Chief Operating Officer (COO) who would report in to the current CEO Mr. Marcin Broad, but would effectively run the India operations of the organization.

The management weighed the pros and cons of this solution and after deliberations with shareholders and other stakeholders decided to approach Mr. Kiran Shankar afresh. He declined to come back into the saddle paving the way for the company to hire a new COO, Mr. Nitin Kapoor, who had years of experience working in the Indian service sector. This was a major shot in the arm for the company. Mr. Kapoor was working with a rival company and he was a well-known name in the industry. It was certainly an inspired move; the market reacted very favourably to this movement. He came on board with the perspective to act as a layer between the top management (filled with people from the parent company) and the senior middle management (filled with Indian top managers) and thereby becoming the bridge that connected the two sides effectively.

He brought it fresh perspective right away and restored the standard Indian BPO work fabric in the organization. Being an Indian, he was well versed already at running Indian BPO contact centres effectively and efficiently.

B. Integration with the Local Culture and Merger Communication

There is a famous old saying - When in Rome, do as the Romans do! This statement truly reflects the problems that arose out of the merger integration. The team of experts highlighted that cultural integration was a vital and intrinsic part of a smooth transition. The management should have made an effort to closely study and monitor the Indian workplace environment and bring in the changes that would be well buffeted into this system and not upset the apple cart. Indians have a certain style of work; the management should not try to overhaul it. Instead an effort should be made to enhance it by encouraging employees to imbibe best work practices from other cultures while retaining the core self.

The management took note of this advice – they accepted that the merger communication was shabbily handled, both internally as well as externally. A diverse workgroup was set up to understand problems faced by the customer care executives. This group became a part of a department called 'Friend Source'. This team was entrusted with corporate communication. The team was given a clear mandate to communicate with all employees on all policy decisions taken by the top management clearly and transparently. They made communication a two way process and encouraged employees to share their views and give feedback on all policy decisions taken by the top management. They also ensured that the market and general public heard all the right noises from the company. This dedicated effort led to better publicity and greater goodwill.

In the times to come, this initiative helped to integrate the two work cultures and what came out was a combined work culture that had imbibed the best of both the worlds. Better work culture led to better job productivity and better profitability.

C. Expansion Drive

It was advised by the panel of experts to put on hold further expansion plans for the moment. The badly planned expansion between 2007 and 2009 had two fallouts. First, due to increased demand, selection processes became lax, hence not all selected candidates conformed to the standard level. Second, this also led to offering uneven compensation to get more candidates. As a consequence, company had both new and older employees leaving the organization whilst for different reasons.

The company took note of this analysis. The management admitted that it had been rather hasty in the expansion drive. All further expansion plans were put on hold and the migration managers were told to consolidate the existing business portfolios. It was important to bring an air of stability in all the various processes run by the company for its various clients.

The move was well appreciated by the current clients. In the long run, this proved to be very beneficial for the company. Established and efficiently running campaigns led to clients giving more business to the company in the times to come paving the way for natural expansion of its base.

D. Improving Employee Morale, Employee Engagement, Employee Satisfaction and Job Involvement

The disparity in compensation and the quality of people selected lead to extensive internal conflict. This conflict was two pronged - the experienced ones felt that there was no correlation between compensation and competence. Most of these existing employees were working with the telecom process which gave maximum revenue to the organization. The new employees were being hired for the newly acquired processes with a better salary package.

The prevailing vicious and unequal work environment leads to plummeting level of job involvement. Unhappy employees rarely feel good about their job. This led to lower employee morale and employee satisfaction and consequently higher turnover. The team of experts advised setting up a dedicated team within the Human Resource (HR) department that would constantly monitor employee morale, employee engagement and employee satisfaction. It was advised to completely overhaul the current Employee Engagement team.

Employee engagement is a workplace approach designed to ensure that employees are committed to their organisation's goals and values, motivated to contribute to organisational success, and are able at the same time to enhance their own sense of well-being.

One of the most important changes incorporated by Lemon Source was to create a complete pan India department named "Genie" to focus only on employee engagement. One of the first steps undertaken by Genie was a 'feedback survey' of current employees on their pain areas. This led to standardization of salary scale for customer care executives for all processes. Clear and transparent guidelines were laid down for salary considerations. Perks and incentives that are typical of the industry were reintroduced. A cell was set up in every contact centre, where executives could approach the Genie team with any professional or personal problem for assistance. Trained counsellors were inducted into the Genie team who had the wherewithal to deal with diverse physiological problems of the company employees.

These measures led to renewed employee morale, now that their fears and insecurities had been assuaged. Felt perception about the company improved significantly, the employees felt the company does really care for them. Friday contests were introduced and fun and games were drafted into the work window by the Genie team. Gift vouchers were doled out to the winners. The world of the average BPO executive is a very stressful world. This initiative turned out to be real stress buster.

The Genie team encouraged managers to have one on one KRA discussion sessions with their teams. These discussions were focussed to make every employee aware about his/her role in the company, motivate them and make them feel of value.

E. Recruitment, Selection, Remuneration and Attrition

The team of experts also advised the company on a host of recruitment and selection related issues. The salient points are provided in a bullet format herewith.

1. Standard Salary Grid should be maintained for all customer care executive positions. No deviation from the grid is advisable.
2. The company should involve a team of dedicated external manpower supply agencies (job agencies) to cater to the steady recruitment needs of the company. This would ensure two things. Firstly the recruitment agencies would ensure a certain minimum acceptable quality of candidates and secondly the cost per hire for the company would also come down.
3. Selection procedures should be strictly in accordance with client specifications and guidelines.

The company made certain changes in its recruitment process taking cognisance of the advice given by the team of experts. Salary levels were standardized for all entry level positions. This communication was reflected on company notice boards as well as on the intranet. As a goodwill gesture the company gave a one time 10% appraisal hike to all employees of the firm.

The company drafted in leading BPO job agencies from all over the country as recruitment partners. These vendors were given recruitment contracts and the recruitment team was entrusted with the job of ensuring that the vendors were well taken care of and to ensure that were on the same page as the company. Good solid vendor management lead to a constant supply of filtered high quality candidates from the consultants. This made the recruitment process easier.

From time to time the company also participated in recruitment publicity campaigns. On - Campus recruitment drives were initiated, advertisements in the newspaper were given periodically (as opposed to earlier when a lot of money was spent on print advertisements on a weekly basis). The company also started taking part in the annual Times Job Fair held across all leading cities in India alongside other branded companies.

These recruitment initiatives paved the way for better sourcing paving the way for better selection. The HR team led down standard selection procedures and no deviations were allowed under any circumstances. Senior members of the operations team were also involved in the selection process to ensure the right kind of intake onto the floor.

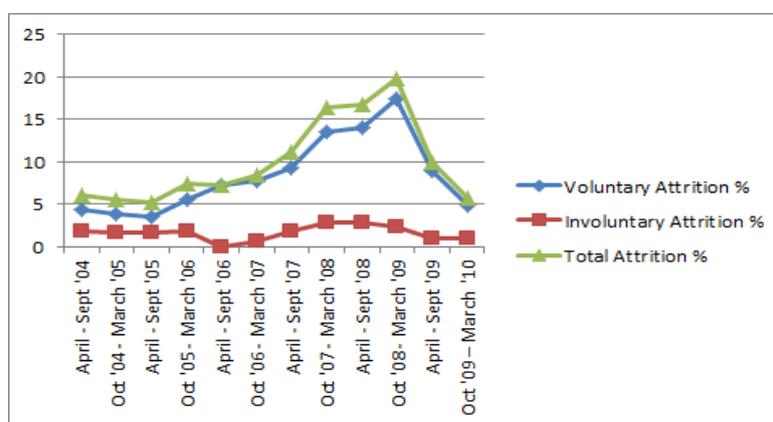
Attrition came down as a result of all the aboveundertakeninitiatives by the company. The cost per hire was also normalized.

CONCLUSION

PGB One Source was an iconic Indian BPO company. Post-merger Lemon Source did hit a major road block even though it was entirely of its own doing. However the management realized at the nick of time that they were going wrong somewhere. At the behest of the Human Resource Head Mr. Ravi Shukla, the management hired a team of experts.

The subsequent analysis and solutions rendered and the subsequent execution, integration and implementation of these solutions led to the following results as reflected in Analysis C and Analysis D respectively.

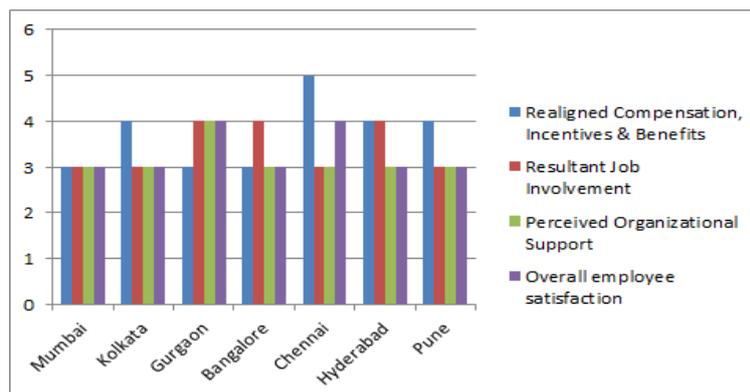
ANALYSIS C



(Source: Primary Data)

The attrition level drastically went down to the lowest 5.8% in the company's history within a span of one year. CPH(Cost per hire) also went from Rs1500 to Rs950.

ANALYSIS D



(Source: Primary Data)

The Scale:

1 – Very dissatisfied 2 – Dissatisfied 3 – Neutral 4 – Satisfied 5 – Very satisfied

Analysis D also reflected a much improved perceived organization support leading better job involvement and superior employee satisfaction as compared to Analysis B.

Concluding Summary

In the final analysis it could be well and truly said that it was a classic case of Lemons (sour) to Oranges (sweet). Very often, during mergers and acquisitions, companies tend to ignore OB and HR issues and focus on other financial and technical aspects of the merger. This has a detrimental effect on companies and Lemon Source was a perfect example of that. The management's willingness to investigate and correct a catastrophic situation led to the 'sour' times paving the way for the 'sweet' times. Even though global recession in 2007 and 2008 had impacted businesses worldwide, in India the impact of recession was marginal. Organizational Behavior and managing people form the crux of every organization. Any organisation is as good as its employees and their demeanour. Attitude of employees is shaped on the behaviour and consistency of the 'thought of the management'. Everything is retrievable but to change attitude and perception in the workplace environment takes lot of effort. So it is important for an organisation not to ignore the well being of their human capital. Motivation/ job satisfaction/recognition/unbiased distribution of resources are cornerstones of a healthy and productive workplace. In pursuit of sales and services, the fundamental pillars should never be neglected.

Lemon Source moved out of the red in 2010 first quarter and since then the profit percentages have been on the ascendancy over every financial year. The share prices have gone up even as the company's stocks have risen in this period. In 2013 Nascom awarded the Best Workplace Practice of the Year Award to Lemon Source. In 2014, The Economic Times carried out a survey of attrition pattern in the service industry. Lemon Source had third best minimum attrition percentage across 193 considered companies. In 2015 Lemon Source is the second largest domestic BPO Company in India with a combined workforce of 21000 + employees. The turnaround has been simply amazing. The orange has just got sweeter!

REFERENCES

1. Armstrong, A. R., Galligan, R. F., & Critchley, C. R. (2011). Emotional intelligence and psychological resilience to negative life events. *Personality and Individual Differences*, 51(3), 331–336. doi: 10.1016/j.paid.2011.03.025
2. Bar-On, R. (1997). The Emotional Quotient Inventory (EQ-i): A test of emotional intelligence.
3. Toronto, Canada: Multi-Health Systems, Inc.
4. Block, J., & Kremen, A. M. (1996). IQ and ego-resiliency: Conceptual and empirical connections and separateness. *Journal of Personality and Social Psychology*, 70, 349–361. doi:10.1037/0022-3514.70.2.349
5. Demos, E. V. (1989). Resiliency in infancy. In T. F. Dugan, R. Cole (Eds.). *The child of our times Studies in the development of resiliency (3-22)*. Philadelphia: Brunner/Mazel
6. Dulewicz, V., & Higgs, M. (1999). Can Emotional Intelligence be measured and developed? *Leadership and Organization Development*, 20(5), 242–252. doi: 10.1108/01437739910287117
7. Dulewicz, V., & Higgs, M. (1999b). *EIQ User Manual*. NFER-Nelson, Windsor
8. Dulewicz, V., & Higgs, M. (2000). Emotional Intelligence. A review and evaluation study. *Journal of Managerial Psychology*, 15(4), 341–372. doi: 10.1108/02683940010330993
9. Forgeard, M. J. C., & Seligman, M. E. P. (2012). Seeing the glass half full: A review of the causes and consequences of optimism. *Pratiques Psychologiques*, 18(2), 107–120. doi: 10.1016/j.prps.2012.02.002.
10. Froman, L. (2010). Positive Psychology in the Workplace. *Journal of Adult Development*, 17(2), 59–69. doi: 10.1007/s10804-009-9080-0
11. Goleman, D. (1995). *Emotional intelligence*. New York: Bantam
12. Klohnen, E. C. (1996). Conceptual analysis and measurement of the construct of ego-resiliency. *Journal of Personal and Social Psychology*, 70(5), 1067–1079. doi: 10.1037/0022-3514.70.5.1067

13. Kumpfer, K. L. (1999). Factors and processes contributing to resilience: The resilience framework. In M. D. Glantz, J. L. Johnson, (Eds.), *Resilience and development: Positive life adaptations* (179-224). New York: Kluwer Academic/Plenum Publishers
14. Luthans, F. (2002a). Positive organizational behavior. *Developing and managing psychological strengths. Academy of Management Executive*,16(1), 57-72. doi: 10.5465/AME.2002.6640181
15. Luthans, F. (2002b). The need for and meaning of positive organizational behavior. *Journal of Organizational Behavior*,23, 695-706. doi:10.1002/job.165
16. Luthans, F., Avolio, B. J., Walumbwa, F. O., & Li, W. (2005). The psychological capital of Chinese workers: Exploring the relationship with performance. *Management and Organization Review*,1, 247-269. doi: 10.1111/j.1740-8784.2005.00011.x
17. Matthews, G., Zeidner, M., & Roberts, R. D. (2002). *Emotional Intelligence. Science & Myth* Cambridge, Massachusetts; London, England: The MIT Press
18. Mayer, J. D., Salovey, P., & Caruso, D. R. (2004). Emotional intelligence: Theory, findings, and implications. *Psychological Inquiry*, 15, 197–215
19. Salovey, P., Bedell, B., Detweiler, J., & Mayer, J. (1999). Coping intelligently: Emotional intelligence and the coping process. In C. R. Snyder (Ed.), *Coping: The psychology of what works* (pp. 141–164). New York: Oxford University Press
20. Snyder, C., Irving, L. M., & Anderson, S.A. (1991). Hope and health: Measuring the will and the ways. In C.R. Snyder & D. R. Forsyth (Eds.), *Handbook of social and clinical psychology: The health perspective* (285-305). Elmsford, NY: Pergamon
21. Tugade, M. M., & Fredrickson, B. L. (2004). Resilient individuals use positive emotions to bounce back from negative emotional experiences. *Journal of Personality and Social Psychology*,86(2), 320– 333. doi:10.1037/0022-3514.86.2.320
22. Werner, E., & Smith, R. (1992). *Overcoming the odds: High risk children from birth to adulthood*. Ithaca, NY: Cornell University Press
23. Wolin, S. J., & Wolin, S. (1993). *Bound and determined: Growing up resilient in a troubled family*. New York: Villard

Study of OTT Consumption Habits during the Pandemic

Yashoda Durge, Rukmini Durge and Ashish Vijan
GNVS Institute of Management, Sion, Mumbai, India

ABSTRACT

A nation-wide lockdown was implemented in India between March and June 2020 in order to curb the Corona pandemic. Research (according to Statista.com) showed a 13% growth in over-the-top video consumption in India. Viewers were spending a very high amount of time-consuming video streaming services. The Digital entertainment industry gained from the pandemic. Over-the-top is an umbrella term that encompasses all the different platforms, methods, and devices in which digital content is accessed via the internet. OTT has changed viewing habits and this gives viewers more control over when and where they watch content. This has also disrupted the pricing structure for consuming video content. Pay TV can be watched only on paying a subscription fee to a satellite or cable television company. OTT is streamed directly over the internet and is paid for directly by customers. With housebound consumers watching more content this had a direct effect on advertisers eager to reach out to this audience. This paper aims to study consumer's behaviour in terms of OTT platforms usage. The objectives were to study the preferred OTT platforms. Understanding the subscription purchase decisions i.e., whether customers pay fully or partially or do not pay at all for usage, amount of time spent on the platform, devices and connections used to access the platforms were some of the variables studied. This research shows that there is a long way for companies to go to convert viewers into paying customers.

Keywords: OTT, Content, Advertising, TV Consumption

1. INTRODUCTION

Over-the-top is an umbrella term that encompasses all the different platforms, methods, and devices in which digital content is accessed via the internet. OTT has changed viewing habits and this gives viewers more control over when and where they watch content. This has also disrupted the pricing structure for consuming video content. Pay TV can be watched only on paying a subscription fee to a satellite or cable television company. OTT is streamed directly over the internet and is paid for directly by customers. With housebound consumers watching more content this had a direct effect on advertisers eager to reach out to this audience. The objectives were to study the preferred OTT platforms. Understanding the subscription purchase decisions i.e., whether customers pay fully or partially or do not pay at all for usage, amount of time spent on the platform, devices and connections used to access the platforms were some of the variables studied.

2. REVIEW OF LITERATURE

Research had been conducted to understand the impact of OTT platforms on the lifestyle of youth. The consumption of OTT rose during the lockdown and this had an effect on the viewer's body language, gestures, language and changed perceptions (gupta, 2021). Consumption of OTT Media Streaming in COVID-19 Lockdown: Insights from PLS Analysis discusses how consumers can be given an option to accept ad-supported content, i.e., advertising in exchange for 'free' non-subscription content (gupta, 2021). More such studies are required in order for OTT platforms and advertisers to identify their target audiences.

3. METHODOLOGY

Primary data was collected by administering a questionnaire to 276 respondents pan India. The objectives were to study the preferred OTT platforms. Understanding the subscription purchase decisions i.e., whether customers pay fully or partially or do not pay at all for usage, amount of time spent on the platform, devices and connections used to access the platforms were some of the variables studied.

4. FINDINGS AND DISCUSSION

4.1.1, 4.1.2, & 4.1.3 Profile of Respondents: The largest age group were 23-32 years of age (58.3%). Students constituted (45.3%) followed closely by those in service (43.8%) and Post graduates were (62%)(See Table 4.1.1, 4.1.2, & 4.1.3).

Table 4.1.1

Age		N	%
1	Upto 22 Years	91	33.0
2	23 - 32 Years	161	58.3
3	33 Years & Above	24	8.7
4	Total	276	100.0

Table 4.1.2

Occupation		N	%
1	Service	121	43.8
2	Self-employed	30	10.9
3	Student	125	45.3
4	Total	276	100.0

Table 4.1.3

Education		N	%
1	12th Standard	17	6.2
2	Graduate	88	31.9
3	Post-Graduate	171	62.0
4	Total	276	100.0

4.1.4 & 4.1.5 Individual Income and Family Income: Those not earning (44.9%) and those earning (55.1%) were almost equal in numbers. Respondents with family incomes were evenly distributed over the lowest to highest categories (See Table 4.1.4 & 4.1.5).

Table 4.1.4

Individual Income		N	%
1	Not earning	124	44.9
2	<2.5 lakhs	53	19.2
3	2.5 - 5 lakhs	48	17.4
4	5 Lakhs & Above	51	18.5
5	Total	276	100.0

Table 4.1.5

Family Income		N	%
1	<2.5 lakhs	56	20.3
2	2.5 - 5 lakhs	70	25.4
3	5 - 10 lakhs	76	27.5
4	10 lakhs & Above	74	26.8
5	Total	276	100.0

4.2.1 Channels Watched: Amazon Prime (84.8%), Netflix (82.6%) and Disney+Hotstar (65.6%) were the top three channels viewed.

Table 4.2.1

Channels Watched

	Amazon Prime		Netflix		Disney+ Hotstar		SonyLiv		Zee5		Voot		Alt-Balaji		Viu		Hoichoi		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
Yes, Watch	234	84.8	228	82.6	181	65.6	82	29.7	77	27.9	60	21.7	41	14.9	8	2.9	1	.4	Yes, Watch
Do Not Watch	42	15.2	48	17.4	95	34.4	194	70.3	199	72.1	216	78.3	235	85.1	268	97.1	275	99.6	Do Not Watch
Total	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	Total

4.2.2 Channels Paid for Fully: Amazon Prime (63%), Netflix (55.1%) and Disney+Hotstar (40.9%) were the top three channels paid for fully by consumers out of the total number of respondents N=276.

Table 4.2.2

Channels Paid for Fully

	Amazon Prime		Netflix		Disney+ Hotstar		SonyLiv		Zee5		Voot		Alt-Balaji		Viu		Hoichoi		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
Yes, Pay Fully	174	63.0	152	55.1	113	40.9	29	10.5	29	10.5	17	6.2	17	6.2	2	.7	1	.4	Yes, Pay Fully
Do Not Pay Fully	102	37.0	124	44.9	163	59.1	247	89.5	247	89.5	259	93.8	259	93.8	274	99.3	275	99.6	Do Not Pay Fully
Total	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	Total

4.2.3 Percentage of Consumers Who Pay for Content Watched on OTT Platforms: Taking the above Tables 4.2.1 and 4.2.2 in conjunction, it is of interest to note that out of those who watched the channels and paid for the same Amazon Prime leads (74.4%), Netflix (66.7%) and Disney+Hotstar (62.4%) and Alt-Balaji (41.5%). These channels have to work towards converting the remaining consumers towards paying for subscriptions.

Table 4.2.3

Percentage of Consumers Who Pay For Content Watched on OTT Platforms

	Amazon Prime		Netflix		Disney+ Hotstar		Alt-Balaji		Zee5		SonyLiv		Voot		Viu		Hoichoi		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
Yes, Watch	234	100.0	228	100.0	181	100.0	41	100.0	77	100.0	82	100.0	60	100.0	8	100.0	1	100.0	Yes, Watch
Yes, Pay Fully	174	74.4	152	66.7	113	62.4	17	41.5	29	37.7	29	35.4	17	28.3	2	25.0	1	100.0	Yes, Pay Fully

4.3 Share Paid Account with Family/ Friends at No Charge: A whopping (76.4%) of respondents reported sharing their paid accounts with Family/ Friends at No Charge.

Table 4.3

Share Paid Account with Family / Friends at No Charge

	N	%
1 Yes, Share	211	76.4
2 Do Not Share	60	21.7
3 NA	5	1.8
4 Total	276	100.0

4.4 Receive an OTT account from Family/ Friends at No Charge: Respondents agreed that they receive/share an OTT account from Family/ Friends at No Charge (48.9%) and those saying not applicable stood at (24.3%).

Table 4.4
Receive an OTT account from Family / Friends at No Charge

		N	%
1	No	74	26.8
2	Yes	135	48.9
3	NA	67	24.3
4	Total	276	100.0

4.5.1 Customers Paying Partially: Netflix (59.1), Amazon Prime (30.1%) followed by Disney+Hotstar (19.2%) have the largest numbers of respondents reporting paying partially and sharing the cost of viewing the channels, out of the total number of respondents N=276.

Table 4.5.1

Customers Paying Partially

	Amazon Prime		Netflix		Disney+ Hotstar		Zee5		Sony Liv		Alt-Balaji		Voot		Viu	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Yes, Pay Partially	83	30.1	163	59.1	53	19.2	22	8.0	16	5.8	13	4.7	12	4.3	1	.4
No	193	69.9	113	40.9	223	80.8	254	92.0	260	94.2	263	95.3	264	95.7	275	99.6
Total	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0

4.5.2 Percentage of Consumers Paying Partially compared with Table 4.2.1 Channels Watched: This shows Amazon and Netflix almost neck to neck in the race, but a substantially larger number of customers watching Netflix only pay partially (71.5%) almost double that of Amazon (35.5%). The channel Zee5 also shows a substantial number of consumers (28.6%) paying partially.

Table 4.5.2

Percentage of Consumers Paying Partially & Channels Watched

	Amazon Prime		Netflix		Disney+ Hotstar		SonyLiv		Zee5		Voot		Alt-Balaji		Viu		Hoichoi		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
Yes, Watch	234	100.0	228	100.0	181	100.0	82	100.0	77	100.0	60	100.0	41	100.0	8	100.0	1	.4	Yes, Watch
Yes, Pay Partially	83	35.5	163	71.5	53	29.3	16	19.5	22	28.6	12	20.0	13	31.7	1	12.5			Yes, Pay Partially

4.6.1 & 4.6.2 Most Watched Genre: Comedy (72.8%), Action (53.6%), Thriller (50.7%) are the top three genres of content watched. The pandemic was a period with consumers housebound and the entire nation was under lockdown. It was a trying period for most. Watching comedy would relieve the pressures of sitting at home and being unable to go out to work, meet friends & family.

Table 4.6.1

Most Watched Genre

	Comedy		Action		Thriller		Crime		Drama		
	N	%	N	%	N	%	N	%	N	%	
Yes, Watch	201	72.8	148	53.6	140	50.7	127	46.0	123	44.6	Yes, Watch
Do Not Watch	75	27.2	128	46.4	136	49.3	149	54.0	153	55.4	Do Not Watch
Total	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	Total

Table 4.6.2

	Sci-Fi		Romance		Horror		Reality Shows		Anime		Docuseries		K-Drama		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
Yes, Watch	101	36.6	94	34.1	86	31.2	58	21.0	50	18.1	44	15.9	28	10.1	Yes, Watch
Do Not Watch	175	63.4	182	65.9	190	68.8	218	79.0	226	81.9	232	84.1	248	89.9	Do Not Watch
Total	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	Total

4.7 Most Preferred OTT Platform: Netflix (58.7%) was the most preferred OTT platform. Amazon was lagging behind at (21%). Although **Table 4.2.1 Channels Watched** showed consumers actually watching Amazon Prime (84.8%), Netflix (82.6%) and Disney+Hotstar (65.6%) were the top three channels viewed. This could possibly be due to Amazon bundling and offering its video content with audio on Amazon Prime.

Table 4.7

Most Preferred OTT Platform

	N	%
1 Netflix	162	58.7
2 Amazon Prime	58	21.0
3 Disney Hotstar	42	15.2
4 AltBalaji	5	1.8
5 Voot	4	1.4
6 Sony Liv	2	.7
7 Thop TV	1	.4
8 NA	1	.4
9 hoichoi	1	.4
10 Total	276	100.0

4.8 Subscription Length: Largest number of respondents (64.5%) had been subscribing since more than a year. The period of 1-6 months (14.9%) may indicate that newer consumers had taken up subscriptions during the period.

Table 4.8

Subscription Length

	N	%
1 One month	19	6.9
2 1 - 6 months	41	14.9
3 6 - 12 months	38	13.8
4 More than a year	178	64.5
5 Total	276	100.0

4.9 Time Spent Watching on OTT Platforms: A whopping (39.9%) spent 5-7 hours per week watching content on OTT platforms. The Binge Watching (watching multiple episodes in rapid succession) category was also substantial (14.9%).

Table 4.9

Time Spent Watching on OTT Platforms

	N	%
1 1-2 Hours per week	101	36.6
2 5-7 Hours per week	110	39.9
3 10-15 Hours per week	24	8.7
4 Binge Watching	41	14.9
5 Total	276	100.0

4.10 Re-subscribe to Most Preferred OTT Platform after Current Subscription Ends: Respondents re-subscribing (89.5%) points out to stickiness created by the existing OTT platforms such that subscribers do not switch to other platforms.

Table 4.10
Re-subscribe to Most Preferred
OTT Platform after Current
Subscription Ends

		N	%
1	Yes	247	89.5
2	No	29	10.5
3	Total	276	100.0

4.11 Internet Connection Used to Watch OTT Content: Largest numbers reported the use of Wi-fi (81.2%) followed by mobile data users (16.7%). ‘Bundling media services with their telecom plan is the prime reason behind spending more on their mobile and fixed broadband bills, according to a study by analyst and consultancy firm Ovum on behalf of US-based software services provider Amdocs’

Table 4.11
Internet Connection Used to
Watch OTT Content

		N	%
1	Wi-Fi	224	81.2
2	Mobile Data	46	16.7
3	Dongle	6	2.2
4	Total	276	100.0

4.12 Have Subscriptions as part of a Network Provider’s Bundle. Growing a business involves acquiring new customers and retaining existing ones. The latter is less expensive than the former. Bundling of services is a great way to retain old customers and increase their lifetime by offering a variety of services at a discounted rate if purchased together. Consumers have access to or subscriptions of more than one OTT platform. Telecom providers too, provide free access to subscriptions with their own data plans. Such a tie up helps OTT platforms in market penetration.

Table 4.12
Have Subscriptions as part of a Network
Provider’s Bundle

		N	%
1	No	184	66.7
2	Yes	89	32.2
3	Had Previously	3	1.1
4	Total	276	100.0

*eg: Disney+ Hotstar and Jio. Vi and Zee5 bundle

4.13& 4.13.1 Viewers Who Watch YouTube& Time Spent on Watching YouTube: Barring two respondents all other watch YouTube. Those watching 1-2 hours per week (44.6%) followed by 5-7 hours (36.6%) points to the popularity of this platform. Hence advertisers need to plan the kind of media they create to best engage and convert their audiences.

Table 4.13

		N	%
1	Yes	274	99.3
2	No	2	.7
3	Total	276	100.0

Table 4.13.1

		N	%
1	1 - 2 hours a week	123	44.6
2	5 - 7 hours a week	101	36.6
3	10 - 15 hours a week	34	12.3
4	Binge watching	18	6.5
5	Total	276	100.0

4.13.2 Crosstabulation: Age by Watch YouTube: All respondents up to the age of 32 years watch YouTube. Of the 33 years and above age group only two respondents reported not watching YouTube. This is a great platform to advertise and reach out to all age groups.

Table 4.13.2

		Watch YouTube					
Age		Do Not Watch		Yes		Total	
1	Upto 22 Years	0	0.0%	91	100.0%	91	100.0%
2	23 - 32 Years	0	0.0%	161	100.0%	161	100.0%
3	33 Years & Above	2	8.3%	22	91.7%	24	100.0%
4	Total	2	.7%	274	99.3%	276	100.0%

% within Age

4.13.3 Crosstabulation: Age by Time Spent Watching YouTube: Younger respondents spend more time watching YouTube i.e., those spending 5-15 hours per week (52.8%). Younger respondents also binge watch. Those above the age 33 years do not do so at all.

Table 4.13.3

		Time Spent Watching YouTube									
Age		1 - 2 hours / week		5 - 7 hours / week		10 - 15 hours / week		Binge Watching		Total	
1	Upto 22 Years	38	41.8%	32	35.2%	16	17.6%	5	5.5%	91	100.0%
2	23 - 32 Years	72	44.7%	61	37.9%	15	9.3%	13	8.1%	161	100.0%
3	33 Years & Above	13	54.2%	8	33.3%	3	12.5%	0	0.0%	24	100.0%
4	Total	123	44.6%	101	36.6%	34	12.3%	18	6.5%	276	100.0%

% within Age

4.14 Gadgets Used to Watch Content: Mobile Phones (87.7%) followed by Laptop (45.3%) were the most popular gadgets used to watch content. TV has fallen behind as a medium to watch content on, possibly due to the portability of mobile phones in carrying them everywhere. Content needs to be developed to suit mobile screen sizes.

Table 4.14

Gadgets Used to Watch Content

	Mobile Phone		Laptop		TV		Desktop		Tablet		
	N	%	N	%	N	%	N	%	N	%	
Yes	242	87.7	125	45.3	89	32.2	36	13.0	23	8.3	Yes
No	34	12.3	151	54.7	187	67.8	240	87.0	253	91.7	No
Total	276	100.0	276	100.0	276	100.0	276	100.0	276	100.0	Total

4.15 Crosstabulation: Age by Genre: Comedy is popular and is watched across all age groups, up to 22 years (75.8%), 23-32 years (72.7%), and 33 years and above (62.5%). The younger age group of up to 22 years also watched Action (73.6%) and Drama preferred by the older 33 years and above ages (54.2%).

Table 4.15

Crosstabulation: Age By Genre

Age Upto 22 Years

Genre	Do Not Watch		Yes, Watch		Total	
1 Comedy	22	24.2%	69	75.8%	91	100.0%
2 Action	24	26.4%	67	73.6%	91	100.0%
3 Thriller	34	37.4%	57	62.6%	91	100.0%
4 Crime	48	52.7%	43	47.3%	91	100.0%
5 Drama	52	57.1%	39	42.9%	91	100.0%
6 Sci_Fi	53	58.2%	38	41.8%	91	100.0%
7 Romance	55	60.4%	36	39.6%	91	100.0%
8 Horror	51	56.0%	40	44.0%	91	100.0%

% within Age

Age 23 - 32 Years

Genre	Do Not Watch		Yes, Watch		Total	
1 Comedy	44	27.3%	117	72.7%	161	100.0%
2 Action	86	53.4%	75	46.6%	161	100.0%
3 Thriller	86	53.4%	75	46.6%	161	100.0%
4 Crime	86	53.4%	75	46.6%	161	100.0%
5 Drama	90	55.9%	71	44.1%	161	100.0%
6 Sci_Fi	102	63.4%	59	36.6%	161	100.0%
7 Romance	107	66.5%	54	33.5%	161	100.0%
8 Horror	116	72.0%	45	28.0%	161	100.0%

% within Age

Age 33 Years & Above

Genre	Do Not Watch		Yes, Watch		Total	
1 Comedy	9	37.5%	15	62.5%	24	100.0%
2 Action	18	75.0%	6	25.0%	24	100.0%
3 Thriller	16	66.7%	8	33.3%	24	100.0%
4 Crime	15	62.5%	9	37.5%	24	100.0%
5 Drama	11	45.8%	13	54.2%	24	100.0%
6 Sci_Fi	20	83.3%	4	16.7%	24	100.0%
7 Romance	20	83.3%	4	16.7%	24	100.0%
8 Horror	23	95.8%	1	4.2%	24	100.0%

% within Age

4.16 Crosstabulation: Age by Most Preferred OTT Platform: Respondents with age Upto 22 years (64.8%) preferred Netflix. Age is inversely related to preference for Netflix. This is opposite in the case of Amazon. With an increase in age the viewership is increasing especially between the upto 22 years to above 22 years age groups.

Table 4.16

Crosstabulation: Age By Most Preferred OTT Platform

Age	Most Preferred OTT Platform										Total									
	Netflix	Amazon Prime	Disney Hotstar	AltBalaji	Voot	Sony Liv	Thop TV	NA	hoichoi											
1 Upto 22 Years	59	64.8%	13	14.3%	11	12.1%	4	4.4%	2	2.2%	1	1.1%	1	1.1%	0	0.0%	0	0.0%	91	100.0%
2 23 - 32 Years	93	57.8%	39	24.2%	27	16.8%	1	.6%	1	.6%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	161	100.0%
3 33 Years & Above	10	41.7%	6	25.0%	4	16.7%	0	0.0%	1	4.2%	1	4.2%	0	0.0%	1	4.2%	1	4.2%	24	100.0%
4 Total	162	58.7%	58	21.0%	42	15.2%	5	1.8%	4	1.4%	2	.7%	1	.4%	1	.4%	1	.4%	276	100.0%

% within Age *Most Preferred OTT Platform (check only one)

4.17 Crosstabulation: Age by Time Spent on an OTT Platform: Of interest to note is the 23-32 years of age binge watching content (19.3%) and (40.4%) watching between 5-7 hours per week.

Table 4.17

Crosstabulation: Age By Time Spent on an OTT Platform

Age	Time Spent on an OTT Platform					Total				
	1-2 Hours per week	5-7 Hours per week	10-15 Hours per week	Binge Watching						
1 Upto 22 Years	41	45.1%	36	39.6%	6	6.6%	8	8.8%	91	100.0%
2 23 - 32 Years	52	32.3%	65	40.4%	13	8.1%	31	19.3%	161	100.0%
3 33 Years & Above	8	33.3%	9	37.5%	5	20.8%	2	8.3%	24	100.0%
4 Total	101	36.6%	110	39.9%	24	8.7%	41	14.9%	276	100.0%

% within Age

4.17.1 Crosstabulation: Family Income by Time Spent on an OTT Platform: Lower income groups spend lesser time on OTT platforms, the largest numbers watching 1-2 hours per week (44.6%). The higher the income group the more the time spent on watching OTT platforms. The binge-watching category is particularly of interest to note which shows a direct relation between family income and the number of hours spent watching OTT platforms.

Table 4.17.1

Crosstabulation: Family Income By Time Spent on an OTT Platform

Family Income	Time Spent on an OTT Platform					Total				
	1-2 Hours per week	5-7 Hours per week	10-15 Hours per week	Binge Watching						
1 <2.5 lakhs	25	44.6%	20	35.7%	6	10.7%	5	8.9%	56	100.0%
2 2.5 - 5 lakhs	28	40.0%	28	40.0%	6	8.6%	8	11.4%	70	100.0%
3 5 - 10 lakhs	32	42.1%	29	38.2%	6	7.9%	9	11.8%	76	100.0%
4 10 lakhs & Above	16	21.6%	33	44.6%	6	8.1%	19	25.7%	74	100.0%
5 Total	101	36.6%	110	39.9%	24	8.7%	41	14.9%	276	100.0%

% within Family Income

4.18 Crosstabulation: Age by Length of Time of Usage of an OTT Platform: The 23-32 years old respondents have been the longest users of OTT platforms possibly due to having the income and the willingness to spend on the same. The 33 years and above category sees a jump (20.8%) in using OTT platforms in the 1-6 months period. Large number of respondents in the up to 22 years (16.5%), 23-32 years (11.8%), and 33 years and above (16.7%) had started watching OTT platforms in the previous 6-12 months. This is a result of the nationwide lockdown where everyone was forced to stay at home and turn to OTT platforms for their entertainment.

Table 4.18

Crosstabulation: Age By Length of Time of Usage of an OTT Platform

Age	Length of Time of Usage of an OTT Platform									
	One month		1 - 6 months		6 - 12 months		More than a year		Total	
1 Upto 22 Years	6	6.6%	17	18.7%	15	16.5%	53	58.2%	91	100.0%
2 23 - 32 Years	9	5.6%	19	11.8%	19	11.8%	114	70.8%	161	100.0%
3 33 Years & Above	4	16.7%	5	20.8%	4	16.7%	11	45.8%	24	100.0%
4 Total	19	6.9%	41	14.9%	38	13.8%	178	64.5%	276	100.0%

% within Age

5. CONCLUSION

1. Amazon Prime, Netflix, and Disney+Hotstar were the top three channels viewed and were also were the top three channels paid for fully by consumers out of the total number of respondents N=276.
2. Out of those who watched the channels and paid for the same Amazon Prime, followed by Netflix, Disney+Hotstar and Alt-Balaji. These channels have to work towards converting their remaining consumers towards paying for subscriptions as a whopping number of respondents reported sharing their paid accounts with Family/ Friends at No Charge.
3. The pandemic was a period with consumers housebound and the entire nation was under lockdown. It was a trying period for most. Watching comedy would relieve the pressures of sitting at home and being unable to go out to work, meet friends & family. OTT platforms need to take cognizance of this and increase their comedy content.
4. Bundling media services with telecom plan can help increase viewership. Many companies such as Reliance Jio and Airtel are already doing so. Service providers who can tie up with and provide multiple OTT platforms will stand to gain as consumers need more than one channel to cater to the needs of different family members.
5. YouTube has excellent viewership to justify special attention by advertisers to plan the kind of media they create to best engage and convert their audiences.

India is a huge market for OTT media services. Innovative plans to meet the needs of different consumer types and segments are the way forward to capture this market.

REFERENCES

1. <https://www.techcircle.in/2020/02/18/indians-want-telecom-carrier-bundled-ott-services-ovum-amdocs> accessed 07/06/2022

BIBLIOGRAPHY

1. Gupta, v., 2021. Impact of Over-the-Top (OTT) platform on the changing lifestyle of youth residing in Uttarakhand during Covid-19 pandemic lockdown.
2. Gupta, g., 2021. Consumption of OTT Media Streaming in COVID-19 Lockdown: Insights from PLS Analysis.

Analysis and Evaluation of Digitally Managed Social Welfare Schemes with Reference to Delhi NCR

Deepika and Himanshu Kataria
Jagannath University, NCR Haryana, India

ABSTRACT

A social welfare system is a scheme that provides financial assistance to people or families in need in a community. Social welfare programmes, which are typically funded entirely or partially by the government, are designed to cover expenses like food, housing, healthcare, and childcare, among many other things. Following independence, the Indian government prioritized social welfare projects and policies. The notion of social welfare, according to this viewpoint, has existed in India since the dawn of civilization. It is defined as the support given to the poor or the general public in money, supplies, services, or other types of assistance to raise their standard of living. The aim of the study is to look at the current state of digitization of social welfare programmes and to suggest policy measures to improve the level of social upliftment through the digitalization of social welfare schemes. The research is descriptive and exploratory. The information was gathered using a survey approach or questionnaires is designed to observe the responses, as well as data was collected through personal interviews. The study focuses on the analysis and evaluation of digitally managed social welfare schemes regarding Delhi NCR. The study was conducted on 500 randomly chosen respondents, which reside in urban communities of Delhi-NCR. The researcher used several journals; books, magazines, newspapers; reports, and publications as secondary data collection. SPSS, ANNOVA, excel sheets are used in the study. The study of regional characteristics of digitalization, the function of basic higher education (technical or humanitarian), and advanced training of social experts appears promising. Governance structure, ID architecture type, data localization, interoperability, accountability, blockchain support, and GDPR compliance are all important factors to consider when considering any DIS.

Keywords: Digital identity; social welfare; E-Governance; Technology assessment; Welfare Scheme

1. INTRODUCTION

A social welfare system is a programme that helps persons and families in need in a community. Social welfare programmes, which are often sponsored wholly or partially by the government, cover things like food, housing, healthcare, and childcare, among other things. Individuals, households, and communities who are most vulnerable (those who have no other means of support, such as single-parent homes, victims of natural disasters or civil strife, disabled people, or the impoverished poor), households, and communities are helped to meet a social floor through social assistance schemes. Social welfare is a sort of government assistance aimed at ensuring that community members have access to necessities such as food and shelter. Perhaps social security is misunderstood to relate to welfare or to social insurance programmes that only pay benefits to those who have contributed (e.g., most pension systems) instead of social welfare programmes that only provide benefits based on need (such as food stamps and Medicaid) (e.g., most disability advantages). International Labor Organization definitions of Social Security include aid for the elderly, help with childcare, health care and parental/ill-leave benefits as well as unemployment and disability benefits as well as assistance to workers injured on the job. Following independence, the Indian government made social welfare programmes and initiatives the main priority. In actuality, the term "social welfare" relates to a long-standing concept that dates back to the dawn of civilization. The notion of social welfare, according to this viewpoint, has existed in India since the dawn of civilization. It is defined as the support given to the poor or the general public in the form of money, supplies, services, or other types of assistance to raise their standard of living.

Digital identity (DI) can be thought of as a digital representation of a physical one. In general, an individual's identity is made up of a variety of data pieces that are connected with their unique characteristics. A secure and long-term digital economy is built on the foundation of a reliable digital identity. Verifying and authorizing someone's eligibility for service is at the heart of an identity management system. A digital identification system is used in the digital world to prevent fraudulent service access by recognized organisations that provide any service - Service Providers. The deployment of an electronic identification system by the public sector has a positive impact on the utilization of e-government services. Users can use DISs to verify that they are who they claim they are, which is critical when using public or commercial services. DI has become a must as a result of the global digital tsunami, and it has opened up a new vista for people's progress and empowerment. The pursuit of technical solutions to solve one set of problems frequently culminates in the rise of a new set of problems.

For instance, IoT-based technologies are seen to have cooperated with an individual's privacy, which is a basic human right (Ziegeldorf, et al., 2014).

With the increasing digitization of our lives and witnessing a paradigm shift in how digital technologies are employed to provide social welfare programmes and have a societal impact. Open Digital Ecosystems (ODEs), also called population-scale platforms, are a sort of digitalization that has the potential to change how social services are delivered. "Open and secure digital platforms that enable a community of actors to uncover revolutionary solutions for society, based on a rigorous governance structure," according to the definition of an ODE. IndiaStack, which is based on the Aadhaar foundation layer and provides different services to Indian people, is an example of such an ecosystem.

The government is progressively building and mainstreaming ODEs across various areas, including health, education, and agriculture. It is hoped that by helping people verify identities, digitizing records, measuring progress, and facilitating grievance resolution, the welfare system has been streamlined. With proper planning and implementation, ODEs may be able to close the delivery gaps, stop payments from going astray and improve coordination issues that plague our present welfare delivery systems.

The ODE tech architecture's welfare distribution relies heavily on social registrations. As a social register, the government's database of welfare recipients has the potential to connect various pieces of information about a person or family (like income, property, education, marital status, employment, disability, etc.). An information system may be created to assist with outreach, applications, registrations, and the determination of prospective eligibility for social welfare programmes after it has been set up. However, a social-register can be a threat to civil rights and exacerbate issues of exclusion if it does not include privacy-preserving protections and other appropriate precautions.

The use of social registries as a foundation for eligibility under welfare distribution programmes has made progress but must remain cautious in our confidence. Exclusionary mistakes in social registrations exacerbate already-existing structural disparities in India because of the country's digital divide and a general lack of knowledge about technical remedies. Furthermore, these devices might be used for spying, putting civil rights at danger if no effective controls are in place.

The integration of all social strata and groups into the digital sphere has become a major source of worry in today's quickly changing society. Because not all people begin with the same possibilities, greater emphasis should be placed on assisting socially vulnerable segments of the population as they develop their careers. This is precisely what social workers are intended to accomplish. With the widespread adoption of digital technology, the profession of social work is being challenged on several levels, including the macro, meso, and micro levels of analysis., digitalization is required in the advancement of social work practice.

Furthermore, in today's environment, there is not enough research on how social workers use digital technologies in their day-to-day job if the tools are designed to help people in need, what new possibilities and risks they present to social workers, etc. The necessity to evaluate practitioners is becoming increasingly necessary. To enhance professional activities, it is necessary to understand what use of digital tools and platforms may provide, what the problems associated with their use are, and what is required to improve and raise the present digital potential for development.

In today's changing society, integrating all social strata and groups into the digital arena has become a critical endeavour. Because not everyone has the same starting point for this, greater focus should be dedicated to assisting socially vulnerable populations. This is precisely what social work is designed to do. At the macro, meso, and micro levels, the cultural revolution brought on by the expansion of digital technology is posing a challenge to social work practice. According to the study, there is a need for digitization in the growth of social work.

The problem is that today, there is not enough study on how social workers utilize digital technologies in their everyday job if the technologies are geared at helping people in need, what new opportunities and threats they bring, and so on. As a result, it is becoming increasingly important to interview practitioners. It is essential to understand the advantages and disadvantages of employing digital technology and tools, as well as what is required to enhance and grow the digital potential for professional operations.

2. BENEFITS OF DIGITALLY MANAGED SOCIAL WELFARE SCHEMES

- a) **24*7 Availability:** Social welfare programmes made available digitally enable the target audience to get access to and benefit from the scheme information from any location at any time of day or night.

- b) **No Need to Stand up in Queues to Submit Documents and KYC:** Beneficiaries of the schemes are not needed to wait in long lines for the submission of qualifying paperwork to take advantage of the schemes; instead, they may simply do so by uploading and submitting the documentation online as part of the programmes. Additionally, they can receive immediate online acknowledgement of their input.
- c) **Transparency and Monitoring:** Welfare programmes that are delivered through an online platform can be readily monitored and administered. By posting a feedback form on the online portal of the relevant welfare scheme, it is possible to quickly determine how many applicants are taking advantage of the benefits out of the targeted population, as well as what problems other applicants are encountering when attempting to take advantage of the schemes. This aids in the preservation of transparency in the scheme's monitoring.
- d) **Empowerment of Citizens:** One of the most significant advantages of providing welfare programmes online is that it provides residents with a sense of control over their lives. When using digital resources (such as a mobile phone or a computer), users must have a working understanding of how to use the resources and how to operate them. For example, to make use of bank Aadhaar connected welfare services, persons must have bank accounts linked to their Aadhaar numbers so that welfare funds may be sent directly to their bank accounts linked to their Aadhaar numbers.
- e) **Improvement in Standard of Living:** It is one of the most significant advantages of digitally managed benefit programs that it contributes to the rising of the standard of life by boosting the literacy status of all individuals who are targeted by these schemes and programmes.

3. SOCIAL WELFARE SCHEMES MANAGED DIGITALLY IN DELHI NCR

The Indian government periodically launches new welfare programmes to address the country's residents' economic and social well-being. Many socio-economic difficulties faced by citizens are addressed by these welfare programmes, which contribute to the upliftment of society in a variety of ways. The following are among the welfare programmes that have recently been announced and executed in Delhi NCR:

a) **Mukhyamantri Covid 19 Pariwar Aarthik Sahayata yojana**

To assist families whose breadwinner has died because of the pandemic virus 19 (COVID-19) infected persons, the Department of Social Welfare, Delhi, launched a financial assistance programme on June 22, 2021. Additionally, the government is contemplating enrolling a single member of a displaced household as a civil defence volunteer as part of the initiative. The scheme is open to anybody who has suffered the loss of a family member because of the covid 19 epidemic. All families who have suffered the loss of a loved one due to the Covid 19 epidemic were asked to fill out questionnaires by a team of 100 Revenue Department officers, who make sure that the strategy is carried out successfully. By the policy, lump-sum payment of Rs. 50000 was paid to the victim's family in addition to the Rs. 2500 in monthly assistance. The physical and educational needs of children who have lost one or both of their parents because of covid19 are addressed through the payments offered under the plan. To make use of the benefit, one must go to the web portal located at <http://edistrict.delhigovt.nic.in/>.

b) **Digital Bharti Covid Scholarship**

Parliamentarians in collaboration with Innovators for India have launched the Digital Bharti scholarship to assist children who have lost one or both of their parents as a result of the covid outbreak in the country. As part of this programme in India, such troubled pupils from classes 1 to 12 are given financial assistance vouchers to go towards the purchase of educational subscriptions for online courses at eric enterprises. Some pupils have been given computers and tablets to use for digital learning, while others have not. The project provides online counselling and career coaching to all qualifying candidates for the next five years, as well as other benefits. Candidates who are interested in participating can click into Buddy4study.com and register using their Facebook account, email address, or mobile number.

4. IMPORTANCE OF THE SOCIAL WELFARE SCHEMES

The Government of India, in collaboration with the State Governments, operates a variety of social welfare initiatives that provide direct benefits to the poor and disadvantaged in India. Many women livings with HIV/AIDS, tribals who live in remote areas, people from disadvantaged castes, and those who fall into the economically vulnerable category, which does not have a significant source of income, are heavily reliant on these programs to support their livelihoods to survive. The Indian government and the state governments collaborate on a wide range of social welfare programmes that directly aid the poor and disabled in the country. Many women livings with HIV/AIDS, tribals who live in remote areas, people from disadvantaged castes, and

those who fall into the economically vulnerable category, which does not have a significant source of income, are heavily reliant on these programmes to support their livelihoods to survive.

5. HEALTHCARE WELFARE SCHEMES

a) Ayushman Bharat Yojana

The Ayushman Bharat Yojana is a public health insurance programme advocated in the National Health Care Policy in 2017 and launched by the Ministry of Health and Family Welfare in 2018. It is a national healthcare programme that strives to provide low-income individuals and families with access to free healthcare services throughout the country. It is estimated that around 50% of the country's poorest citizens qualify for this programme. India's Prime Minister Narendra Modi launched this insurance policy to benefit the country's 50 million inhabitants. Over 4406461 beneficiaries have been accepted, and more than 10 billion e-cards have been distributed as of September 2019, according to reports. It is expected that the number of empaneled hospitals, hospital admissions, and e-cards would increase to 22796 hospitals, 109 crore hospital admissions, and 12.55 crore e-cards in 2020.

The plan is open to all qualified recipients across the country, with preference given to female children, mothers, and older persons in particular. Each household is provided with a benefit cover of Rs.5 lakhs per year under the Ayushman Bharat Programme, which cover every secondary care product as well as the majority of area care items. Pre- and post-hospitalization fees, as well as a set transportation allowance, are included in the benefits provided under the system. In addition, the system is wholly sponsored by the government, with the expense of implementation being shared equally by the federal and state governments. Public hospitals are compensated at the same rate as private hospitals for the health care they provide.

With the introduction of the Pradhan Mantri Jan Arogya Yojana (PMJAY), the government hopes to eliminate the need for cash payments for secondary and territorial healthcare services. All qualifying patients must apply and acquire an e-card before they may receive treatment at any of the empanelled institutions around the country. Health insurance coverage benefits are available to those who meet several eligibility requirements set out by the Scheme. National Sample Survey Organization statistics show that about 85.9 per cent of rural families do not have access to any kind of healthcare or insurance programme. If a household is registered in the Rashtriya Swasthya Bima Yojana, it may also be eligible for the PMJAY.

b) Aarogya Setu App

National Informatics Centre-developed Aarogya Setu is a smartphone app for the Indian market developed by the Ministry of Electronics and Information Technology. Developed by the Indian government, this healthcare application was introduced on April 2, 2020, to connect individuals with necessary health services to combat the disease known as covid 19. It makes use of contact information to keep track of all the individuals come into contact with daily as going about daily lives and activities. If someone who was previously our contact later samples were positive and are contacted promptly, preemptive medical aid is offered to the individual in question. The app contributes to the government's endeavours by giving timely information on the best practices to be followed as well as essential advisory information relative to the containment of Covid 19 promptly.

6. THE PUBLIC DISTRIBUTION SYSTEM

In India, the British government implemented food rationing in 1939, which led to the establishment of the main parts of the public distribution system in 1942. During the Bengal famine of 1943, four million people perished from malnutrition (Sen, 1981), lending political legitimacy to the PDS. It has been one of India's most stable food policy features since then, maintaining food security for the great majority of the country's poor. Through a statewide network of fair price shops, the government provides grains (mainly rice, wheat, and coarse cereals) to beneficiaries at subsidized prices known as the central issue price. The government gives farmers a minimum support price for the grain they supply (Aayog, N. I. T. I., 2016).

The PDS is managed by the federal and state governments in collaboration. Beneficiaries are identified depending on their economic vulnerability. The Planning Commission's assessments of poverty are used by the federal government to estimate the number of people living in poverty in states and union territories. State governments must identify impoverished households and provide the necessary infrastructure (such as FPSs and delivery vehicles) to guarantee that grains are delivered to them on time, transparently, and effectively. A ration card is supplied to recipients to keep track of their entitlements and actual grain consumption after they have been recognized. Food Corporation of India (FCI), a government organisation established in 1965, is the principal source of grain under this arrangement. The decentralized procurement strategy has been used by various Indian governments in recent years to take on procurement obligations and request subsidies. (Drèze, J., & Khera, R., 2013).

7. AADHAAR-BASED PDS (APDS)

Technology-based solutions are integrated into the APDS to increase operational and financial efficiency. It ensures that food grains are provided only after the biometric confirmation of a family member. Under the APDS, food grains are delivered last-mile via a Point of Sale (PoS) device (Figure 1) linked to a cloud-based repository that includes data from state-owned ration cards and Aadhaar cards (operated by UIDAI) (Adekunle, S. E., 2020).



Figure 1: PoS machine

To seed their ration cards with Aadhaar numbers, all PDS beneficiaries must use this procedure. The beneficiary's benefits are issued if the data on the Aadhaar card matches the biometric readings on the PoS at the FPS. The entire identification and authentication process should take no more than a few seconds. To prevent ineligible people from obtaining food grains and dishonest FPS dealers or other stakeholders in the PDS supply chain from diverting or pilfering the food grains, a fully automated PDS is required. Both the states and the federal government may use the technology to track the movement of food grains in real-time. It was announced in August 2015 that the federal government assist state governments with the installation of Point-of-Sale (PoS) systems in FPS.

8. LITERATURE REVIEW

United Nations General Assembly (1949) stated that evaluation is determining the value of a project by examining its conception, execution, and impact. As a result, when assessing DIS, keep in mind the following factors: the technology used, the utility, the resources necessary, the rights of citizens, and the safety precautions. To conduct this research, the authors dug deep into the available literature on evaluating IT and e-government initiatives.

Pade-Khene, C., & Sewry, D. (2011) shown that IT and e-governance play a significant role in society's growth and evolution. In the past, the evaluation of such systems has been limited to simple instruments that may be simply altered. It is not always apparent which components of the scheme should be examined, as academics have mostly concentrated on the assessment procedure pre-and post-implementation evaluations of the project have been examined in certain research. It is not enough to be aware of the alterations brought about by a project. Understanding which parts of the project are accountable for a certain change is more powerful. To comprehend the relationship between project components and the project's conclusion, a complete assessment strategy is necessary.

Ferguson, L., & Harman, S. (2015) conducted that the previous decade, electronic governance has gained a lot of traction. E-Government is a broad term that encompasses a variety of other fields of study. E-governance initiatives have been evaluated either before or after they have been implemented. Through very complicated procedures, e-governance initiatives have an impact on several aspects of society. The sociopolitical, socioeconomic, environmental, and socio-technical components of society all have an influence. When reviewing big, complicated e-government initiatives, especially when the public is engaged, identifying, and analyzing these consequences is crucial. The term "evaluation" refers to the process of determining the value of a project by examining its design, execution, and consequences.

Khatchatourov, A., Laurent, M., & Levallois-Barth, C. (2015) examined that the researchers primarily addressed digital identification systems from the standpoint of privacy. In addition, a comparison of four national digital identity systems is performed to evaluate the impact of privacy on adoption. Large projects fail for several reasons, involving design and reality gaps, a lack of certainty, content quality, needed skills,

implementation, regulatory concerns, technology problems, and a lack of feedback and effective communication procedures.

Singh, S. (2016) explained that the Mahatma Gandhi National Rural Employment Guarantee Act is a significant social welfare initiative in India that attempts to reduce rural poverty by providing new jobs. The purpose of this study is to look into and evaluate the MGNREGA system's performance in India. To quantify a state's overall efficiency in terms of technical, solely technical, and scale efficiency, an Indian nonparametric technique called Data Envelopment Analysis (DEA) is utilized. The Government of India has issued a statement. This sample data set was created using data from the Ministry of Rural Development. Researchers use both input and output-oriented DEA models to estimate how successfully states use their resources and create outputs over the financial year 2013–14, based on three specified input parameters (expenditure indicators) and five output parameters. (Indicators of employment creation.) To evaluate the influence of size on performance, the relative performance research used both constant and variable returns to scale assumptions. Research shows that inefficiency is primarily caused by both technology and managerial practices. Globally, eleven states operate at peak technical efficiency, as opposed to eighteen that operate at peak technical or organisational effectiveness. State Medicaid programmes may need to be scaled back in some cases to keep up with those of the top-performing states. Inefficient states have input and output objectives, as well as resource savings and productivity increases. As per research, an average of 17.89 percent of overall spending and \$780 million could have been saved if all inefficient states ran at optimal input and output levels. Most inefficient states fall short when it comes to women and low-income groups (SC&ST) participating in the programme. For inefficient states to catch up with the best-performing states, an additional 133 per cent more women are needed on average. The states are also graded based on cross-efficiency, and the findings are examined. Punjab and Puducherry come after Tamil Nadu and Puducherry and Punjab and Rajasthan. To the best of my knowledge, this is the first national-level research that objectively and completely evaluates the MGNREGA programme.

Nooreydzan, M., & Mehta, D. (2016) evaluated that the group covers more than a third of India's population. On the other hand, these children are not given their due or their legal rights, and as a result, they are disregarded. The problem is that children's life through the eyes of adults rather than seeing them as individuals. As a result, the state and its institutions fail to adequately address the rights of children who require care and protection from the law or who are in confrontation with the law. The right to be heard in one of these rights that is frequently disregarded. It is possible to see Child Welfare Committees (CWCs) as first-class magistrates, which means that lawyers might play a role in protecting children from needless and harmful court processes by providing legal assistance or representation. In the Delhi Rules for Juvenile Justice, both of these functions are stated (Care and Protection). Additionally, the CWCs must ensure that all participants have the opportunity to be heard. However, the authors' empirical study has revealed that there is a significant gap between what is supposed to be and what is. The failure to appoint attorneys when the terms of prior attorneys expire, the inadequacy generated by regulations that do not mandate the presence of a lawyer at all times, and the lack of sensitivity towards children regarded as a result of poor lawyer training are just a few of the numerous concerns. A problem arises when a compromise is sought between children's legal rights to be heard within the scope of these organisations and judicial magistrate authorities. The goal of this study is to find out how well legal help is available for children who need care and protection. Even though there has been some debate in the past about whether or not a lawyer should be present at a CWC, because these meetings aren't exactly like court hearings, this debate has focused on what is best for the child as seen through the eyes of the people who are supposed to look after and protect the child. There hasn't been enough focus on the child's right to be heard and how the child is heard. Furthermore, this study seeks to investigate if direct encounters, rather than those supplied through an intermediary, might ensure that CWCs maintain a well-maintained practice while holding each other in check in terms of sensitivity and legislation.

Saini, S., et al. (2017) recommended a phased implementation of direct benefits transfer in the Indian food business (DBT). The paper evaluates each state's readiness to transition from the current physical grain distribution system under PDS to the ICT-based DBT, in which food subsidy amounts (rather than PDS grain entitlements) are directly converted into the Aadhaar-linked bank accounts of identified beneficiaries, depending on three broad parameters: demographics, the performance of the existing Public Distribution System (PDS), and banking infrastructure. It has been determined that all 36 states can adopt DBT-food by 2022 and this should be done in four stages, starting with the year 2020. States with a high concentration of people who live in urban areas, who have easy access to open markets for grain, who are more socially inclusive, and who have lower rates of poverty and malnutrition are more likely to make the switch quickly. An IT-based PDS system with beneficiary identification verification is now in place. According to research issued

this week, DBT can only survive if states/UTs construct and invest in open markets, inclusive banking infrastructure, alternative payment methods, large food subsidies, and political commitment to change the PDS through DBT. As explained in this article, DBT might be used to construct social security or universal basic income system, in which each citizen receives a fixed amount of money based on his or her particular needs and vulnerabilities.

Thanh, N. V., Yoon, H., & Hwang, J. (2018) investigated that the significance of interoperability in the adoption of e-government information systems and found that risk management, communication and cooperation, and technical abilities were all significant factors influencing the interoperability of information systems such as e-government websites. Another disadvantage is that the majority of e-government systems are highly generalized context-sensitive systems that focus primarily on government side goals while ignoring public wishes. Another reason for needing a context-specific evaluation approach to evaluate a DIS with a significant impact on the nation's politico-social-cultural aspects is that it is context-specific.

World Bank. (2018) discussed about World Bank's Digital Identity Evaluation Framework for Social Welfare 403, a research project on DIS technology, provides an overview of the advantages and disadvantages of several DIS systems. Assessments are based on six primary parameters, each of which includes several sub-parameters, which are then broken down into sub-sub-parameters for each of the sub-sub-parameters.

Goswami, A. K. et al. (2019) examined that the proportion of elderly people has grown due to demographic change. For their day-to-day survival, elderly people have a higher level of economic reliance in India. Social welfare initiatives run by the Indian government give monetary assistance. When older people are financially self-sufficient, their health improves. The aim of the study was to determine how well older people in Delhi's urban resettlement colony were aware of and used social assistance programmes. From February to May 2018, community-based cross-sectional research was undertaken. The self-developed semi-structured interview schedule was delivered by two specifically selected interviewers. It included sociodemographic information, awareness, and the use of diverse systems. Even though older people were aware of social assistance programmes, their use might be improved significantly. The old guys, as well as the younger elderly, require special attention.

Mir, U. B., et al. (2020) discussed that governmental and private-sector activities, such as fostering the growth of digital economies and boosting the effectiveness of social safety nets, identification systems are essential. All of these benefits, along with rapid technical improvements, have led many governments, especially in emerging nations, to build a new foundational digital identification system (DIS) or modify an existing paper-based identity system. Critics of DISs have raised concerns about security, privacy, monitoring, and the denial of services to which people are entitled. An evaluation process that can help determine whether or not a DIS is appropriate for a given situation is needed. Based on the methodologies, principles, and technologies employed in this study, the researchers have developed a conceptual framework for DIS assessment.

Bhandari, V., Trikanad, S., & Sinha, A. (2020) evaluated that non-technical identification elements, which are as vital for a successful DIS, are not assessed, even though it allows practitioners and stakeholders to compare alternative identification technology solutions. Digital identity (DIS) is analyzed using a proposed technique in another study. While DIS encompasses numerous aspects, the framework is primarily concerned with the utility side of an identification system. To examine DIS, a thorough procedure covering all of its essential building blocks, including technological, managerial, usage, legal, and social-political, is required. Filling that void, this article does so. In this study, the authors lay up a detailed methodology for assessing DIS by examining a wide range of parameters. An understanding of how powerful a DIS is may be gained through this paradigm and it has helped authorities such as policymakers, lawmakers, and technology vendors to coordinate their implementation and execution of DIS appropriately.

Singh, R., & Singh, S. (2021) stated that women's empowerment primarily refers to strengthening women's social, political, and economic standing, especially that of the traditionally impoverished. There must be no physical or emotional abuse or exploitation or prejudice that women are the most vulnerable in society to achieve this goal. Recognizing the significance of women in the growth of the nation's economy, the Indian government and state governments have made many initiatives to improve the situations of women generally. The government is gradually moving its attention to fostering women's entrepreneurship to encourage women to participate in economic activities. The purpose of this article is to examine the necessity for women's empowerment in India, as well as the techniques and programmes for women's empowerment. In our daily lives, researchers see how women are afflicted by a variety of social ills. Women's empowerment is a critical tool for increasing women's capacity to access resources and make meaningful life decisions. It refers to the

process of protecting them from all types of violence. The study is entirely based on secondary sources. Despite the government's efforts, women in India are largely powerless and have a lesser status than males. It has been shown that women continue to accept unfair gender standards in society. The report closes by stating that basic amenities and the implementation of different initiatives are enabling elements for women empowerment.

Vdovina, M. V, (2021) summarized the findings of empirical research done by the writers in 2020 using the approach of an online questionnaire survey. Respondents are Russian social workers. The goal of the study is to establish the features of social workers' and managers' usage of digital technology in their professional activities. The authors wonder if the primary goal of using digital technology is to help service recipients or to solve organisational problems. The article considers the benefits of using digital technologies as well as the challenges that come with them. The authors also want to figure out how to tackle these problems so that social work digitalization may be more efficient. The responses indicated that increasing a labour organization's efficiency (Data processing speed, document management automation, online transactions, and delivery are all important factors to consider) and acquiring essential information, especially from other departments, are two of the most significant benefits. The following are the most significant disadvantages: duplicating data and software imperfections as a result of system failures.

9. AIMS AND OBJECTIVE

The aims and objectives of the study are:

- To examine the current status of digitalization of social welfare schemes.
- To identify gaps in implementation of digitally managed social welfare schemes.
- To investigate social awareness about digitalization social welfare schemes.
- To evaluate the effect of digitalization of social welfare schemes on social upliftment.
- To suggest policy measures to improve the level of social upliftment through digitalization of social welfare schemes.

10. RESEARCH METHODOLOGY

The research is descriptive and exploratory. The information was gathered using a survey approach or questionnaires is designed to observe the responses, as well as data, was collected through personal interviews. Testing is done using a hypothesis. Statistical methods were used to determine the correlations between demographic factors. The study was conducted on 500 randomly chosen respondents, which reside in urban communities of Delhi-NCR. The study targeted the young population of Delhi-NCR, which have either used the welfare schemes, or those who have a high need of some welfare schemes. The researcher used several journals; books, magazines, newspapers; reports, and publications as secondary data collection in the study. SPSS, ANNOVA, excel sheets are used in the study.

11. RESULTS

As per the findings, out of 500 respondents the age of 20-30 is 27.8 %, the age of 30-40 is 26.2 %, the age of above 40 is 13.8% whereas the age below 20 is 32.2 % in the study. Female are 26.8 % and the male are 73.2 % out of 500 respondents. As per social group, above poverty line is 42.6 % whereas below poverty line is 57.4 % in the study. According to education, 12th is 25.2 %, below 12th is 21.8 % , PHD is 10.6 %, while Postgraduate is 20.4 and Undergraduate is 22.0 in the study.

Table 1: Chi-square of Have you heard about Social Welfare Schemes managed digitally

Have you heard about Social Welfare Schemes managed digitally?					
What all welfare measures you are aware about?		Yes	No	Chi-square value	Sig. value
		online welfare schemes	111	83	6.323
offline welfare schemes	108	57			
both	99	42			
After digital transformation of welfare schemes under digital India Mission I prefer to use	online welfare schemes	105	82	7.185	0.028
	offline welfare schemes	113	54		
	both	100	46		

The table 1 define the association between the have you heard about Social Welfare Schemes managed digitally & What all welfare measures you are aware about. It shows that sig value is 0.042 which is less than 0.05, it shows the significant association between the Have you heard about Social Welfare Schemes managed digitally

and what all welfare measures you are aware about. And the association between the Have you heard about Social Welfare Schemes managed digitally & after digital transformation of welfare schemes under digital India Mission I prefer to use. It shows that sig value is 0.028 which is less than 0.05, it shows the significant association between the Have you heard about Social Welfare Schemes managed digitally and after digital transformation of welfare schemes under digital India Mission I prefer to use.

Table 2 : Chi-square of Are you aware about any of welfare schemes provided digitally by Govt

Are you aware about any of welfare schemes provided digitally by Govt?					
What all welfare measures you are aware about?		Yes	No	Chi-square value	Sig. value
		online welfare schemes	127		
offline welfare schemes	126	39			
both	92	49			
After digital transformation of welfare schemes under digital India Mission I prefer to use	online welfare schemes	121	66	7.975	0.019
	offline welfare schemes	129	38		
	both	95	51		

The table 2 define the association are you aware about any of welfare schemes provided digitally by Govt & What all welfare measures you are aware about. It shows that sig value is 0.044 which is less than 0.05, it shows the significant association between the are you aware about any of welfare schemes provided digitally by Govt & What all welfare measures you are aware about. And the association between the are you aware about any of welfare schemes provided digitally by Govt & after digital transformation of welfare schemes under digital India Mission I prefer to use. It shows that sig value is 0.019 which is less than 0.05, it shows the significant association between the are you aware about any of welfare schemes provided digitally by Govt and after digital transformation of welfare schemes under digital India Mission I prefer to use.

Table 3 Correlations of social welfare and what all welfare measures you are aware about

Correlations			
		social welfare	What all welfare measures you are aware about?
social welfare	Pearson Correlation	1	.057
	Sig. (2-tailed)		.202
	N	500	500
What all welfare measures you are aware about?	Pearson Correlation	.057	1
	Sig. (2-tailed)	.202	
	N	500	500

The table 3 defines the correlation between the “social welfare” and “What all welfare measures you are aware about” they are statistically not significantly correlated between the “social welfare” and “What all welfare measures you are aware about” because sig value is >0.202, (i.e., sig value is more than 0.05).

12. CONCLUSION

The study of regional features of digitalization, the function of basic higher education (technical or humanitarian) and advanced training of social professionals looks promising. Governing structure, ID architecture type, data localization, interoperability, accountability, blockchain support, and GDPR compliance are all significant considerations when evaluating any DIS. Remove outdated technology and inefficient procedures from the proposed system using a framework for DIS assessment to uncover any needless losses that may have occurred. Because of its importance in understanding the system's success or failure, policymakers and those working on the DIS may find this data helpful in the future.

Government attention to women's empowerment in India has been increasing in recent months. Aside from programmes and laws, there are many other areas that must be taken into consideration in order to deal with the necessary issues. In order for these plans and programmes to succeed, our developing country must be a wealthy and well-developed nation by that point in its growth cycle. A number of programmes have been established by the government to improve the well-being of children and women. A new and more capable atmosphere is needed for women to be able to make their own right judgements for themselves as well as their families, society, and the nation. They must be given the authority to do so. The empowerment of women in the country is a critical component of attaining the government's development goals. Women in leadership roles in the

public sector are encouraged to progress by public and private organisations. Women in government leadership roles are critical for a country's success. Representing women in the public sector is simply a matter of justice; nevertheless, in order for this to be effective, all perspectives on women's empowerment must be expressed. As a result, India has a number of initiatives targeted at enhancing the status of women. Everywhere in America, this day has finally arrived. Focusing on improving the suggested framework by adding primary data sources for analysis and testing the proposed framework on additional DISs have led to better insights in the future.

REFERENCES

1. Aayog, N. I. T. I. (2016). Evaluation study on efficacy of minimum support prices (MSP) on farmers. URL http://niti.gov.in/writereaddata/files/writereaddata/files/document_publication/MSP-report.pdf.
2. Adekunle, S. E. (2020). A Review of Electronic Voting Systems: Strategy for a Novel. *International Journal of Information Engineering & Electronic Business*, 12(1).
3. Bhandari, V., Trikanad, S., & Sinha, A. (2020). Governing ID: Principles of Evaluation. *Centre for Internet & Society, Digital Identities Project*.
4. Drèze, J., & Khera, R. (2013). Rural poverty and the public distribution system. *Economic and Political Weekly*, 55-60.
5. Ferguson, L., & Harman, S. (2015). Gender and infrastructure in the World Bank. *Development Policy Review*, 33(5), 653-671.
6. Goswami, A. K., Ramadass, S., Kalaivani, M., Nongkynrih, B., Kant, S., & Gupta, S. K. (2019). Awareness and utilization of social welfare schemes by elderly persons residing in an urban resettlement colony of Delhi. *Journal of family medicine and primary care*, 8(3), 960.
7. Khatchatourov, A., Laurent, M., & Levallois-Barth, C. (2015, August). Privacy in digital identity systems: models, assessment, and user adoption. In *International Conference on Electronic Government* (pp. 273-290). Springer, Cham.
8. Mir, U. B., Kar, A. K., & Gupta, M. P. (2020, December). Digital Identity Evaluation Framework for Social Welfare. In *International Working Conference on Transfer and Diffusion of IT* (pp. 401-414). Springer, Cham.
9. Nooreydzan, M., & Mehta, D. (2016). Need for legal aid: Reflections on child welfare committees. *Institutionalised Children Explorations and Beyond*, 3(1), 46-54.
10. Pade-Khene, C., & Sewry, D. (2011, October). Proposed stages of a rural ICT comprehensive evaluation framework in ICT for rural development projects. In *Proceedings of the South African Institute of Computer Scientists and Information Technologists Conference on Knowledge, Innovation and Leadership in a Diverse, Multidisciplinary Environment* (pp. 326-329).
11. Saini, S., Sharma, S., Gulati, A., Hussain, S., & von Braun, J. (2017). Indian food and welfare schemes: Scope for digitization towards cash transfers. *ZEF-Discussion Papers on Development Policy*, (241).
12. Sen, A. (1981). Public action and the quality of life in developing countries. *Oxford Bulletin of Economics and Statistics*, 43(4), 287-319.
13. Singh, R., & Singh, S. (2021). Welfare Schemes in India for Women Empowerment: A Study.
14. Singh, S. (2016). Evaluation of world's largest social welfare scheme: An assessment using non-parametric approach. *Evaluation and program planning*, 57, 16-29.
15. Thanh, N. V., Yoon, H., & Hwang, J. (2018). A study on the factors affect to technological adoption of e-Government information system interoperability in Vietnam. *The International Technology Management Review*, 7(1), 125-143.
16. United Nations. General Assembly. (1949). *Universal declaration of human rights* (Vol. 3381). Department of State, United States of America.
17. Vdovina, M. V., Firsov, M. V., Karpunina, A. V., Sizikova, V. V., & Bogatov, D. S. (2021). The Impact of Digitalization on Social Work Development. *Revista Geintec-Gestao Inovacao E Tecnologias*, 11(4), 4366-4377.
18. World Bank. (2018). *Technology Landscape for Digital Identification*. World Bank.
19. Ziegeldorf, J. H., Morchon, O. G., & Wehrle, K. (2014). Privacy on the Internet of Things: threats and challenges. *Security and Communication Networks*, 7(12), 2728-2742.

IOT based Electronic Voting Machine

Sudhir A Kadam¹ A Y Prabhakar² and Asit Kittur³

^{1,2}Bharati Vidyapeeth (Deemed to be University) College of Engineering Pune, Maharashtra, India 411043

³Bharati Vidyapeeth's College of Engineering, Kolhapur, Maharashtra, India -416013

ABSTRACT

A malpractice in the election process is not an uncommon thing be it for any country in the world. Multiple voting, bribing the voters, booth capturing, removing the newly registered voters because the ruling administration does not like these new voters and many more continue to hinder the voting process. With IoT based fingerprint voting machine, every person's unique identification will be stored since everyone has a unique fingerprint. Firstly, enrolling of fingerprint takes place with their data stored in link with their Aadhar card. Hence, the people can now vote on the Election Day by using their unique identity and will no longer need to bring their Aadhar cards with them. This project includes real time database pupation of the voting process wherein a new column of Aadhar card number is also included for more security and hassle-free voting process for each and every citizen of our country. It consists of the Wi-Fi model on the Node MCU wherein the Wi-Fi chip is included in the controller to give the security key and Wi-Fi password known as the host name and said, till the time it's not able to find the right password it will show as connecting, all the code being written in embedded c language.

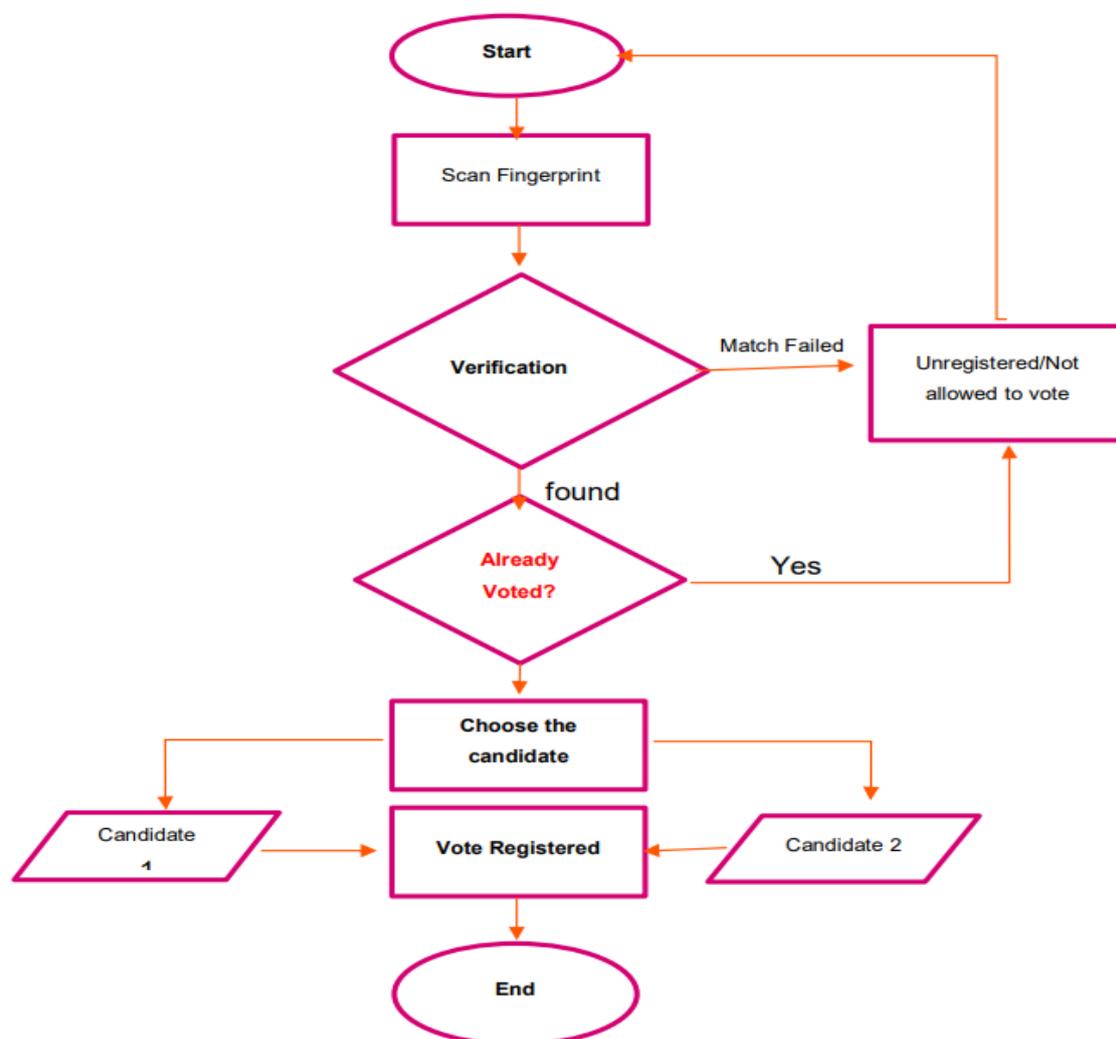
Keywords: Embedded C language, Fingerprint module, Wi-Fi module, Microcontroller

1. INTRODUCTION

Electronic voting machines have revolutionized the Indian political process, making elections more free, fair, environmentally friendly, and cost-effective. The technology elements have been linked with the polling procedure as specified by the Election Commission of India through continual improvement and severe quality checks. Every democratic country requires elections where citizens hold the power of selecting suitable candidates for smooth future functioning of the country. have the ability to express their preferences on a variety of matters, such as constitutional amendments, legislation, and selecting the best person to lead them. There is an electoral system in place to lay out the election regulations.[2] Although political elections are the most common, election is an important aspect of many different fields' organizational activities. Business, informal organizations, and non-profit organizations all rely on elections. Other than these, it contains LCD for showing results, fingerprint module for taking the fingerprints and switches for taking the votes for different candidates.

Voting is an important way for citizens in a democratic society like India to express themselves. Normally, people vote by casting their ballots at polling booths. With the advancement of technology, electronic voting machines are now employed to cast votes. When EVMs are utilized for huge populations, their efficiency and quick turnaround time become even more important. The size of India's recent general election attests to how EVM technology combats electoral fraud and simplifies the electoral process. All the Electronic based voting machines yet made were profit seeking and therefore, this project is made keeping in mind the problem of malpractices in the voting process, to give a process more secure and smooth. This paper is focused on the latest model which is R307 used for fingerprint scanning[1].The latest model even has the numbers inscribed in Braille for enabling the visually challenged to vote. Since, our project is based on fingerprint module, it is even feasible for visually challenged people to cast their vote.

2. EXISTING SYSTEM



Our IoT-based project is built around the ESP8266 NODE MCU WIFI MODULE. It can connect to the WIFI network and build up its own network for devices to connect to directly. It has 128 kilobytes of RAM and 4 megabytes of flash memory, as well as a real-time operating system, making it even more adaptable. The device translates USB signals to serial, allowing the ESP8266 chip to be programmed and communicated with from a computer.[5]

3. PROPOSED SYSTEM

The EVM's Eco-friendliness has been mentioned earlier. It saves about 10 000 tons of ballot paper (roughly 2 000 000 trees) per national election. It also saves the enormous costs of printing paper, ballot paper and counting of votes by huge manpower. The EVM has sped up vote counting. The ballot unit is designed to operate on the basis of one vote per person. With or without tampering, pressing the button again will lock the machine completely.

The working starts with enrollment of fingerprint of the voter. Firstly, the voter is asked to scan his fingerprint on the R307 module.[4] Post this, it is checked if the voter has already been a part of the voting process or not. If not, his fingerprint image is recorded and cross checked with the database which shows his name and Aadhar number. A unique identifying number or a digital signature has been assigned to the microchip Filter by PSO algorithm (Kadam & Chavan, 2019b). The EVM would become buzzy if this number did not match the one stored in the control unit, or if the voter has already been a part of the voting process.

Fingerprint process involves 2 parts- fingerprint enrollment, fingerprint detection- checking from the given database if already enrolled or already voted.

For the fingerprint enrollment, the module takes the fingerprint 2 times for more accuracy to store in the fingerprint library. For detecting, it uses extraction algorithm and matching algorithm which searches the whole

fingerprint library for that matching finger. In all cases, the system gives the result out on LCD. A unique identifying number or a digital signature has been assigned to the microchip. The EVM would become buzzy if this number did not match the one stored in the control unit, or if the voter has already been a part of the voting process. Only when his identity has been verified, his signature has been taken, and permanent ink has been placed to his forefinger is a voter authorized to vote. The integrity of all seals is once again checked on the day of counting.

When a voter presses a button against the chosen candidate's name, a vote gets recorded with a beep sound for 5 seconds. Every time a vote is cast, a beep sound is heard. This indicates that a vote has been cast. A meticulous record of the total votes is kept. The 'Result' button is then pressed to confirm it. By this, the poll is closed, and the results are saved(Kadam & Chavan, 2019a).

The Board also looks into altering the program to favor one contestant over another. Since the candidate-by-candidate allotment of key numbers (on EVMs) is unknown, there can be no favorize. Another advantage of this model is that it is wireless and portable due to which there can be no tampering in the wired connections as in the past. Creating fields that are greater than EMI norms would be impractical at the polling place. All 'write' and 'read' actions are immediately confirmed. As a result, the potential of "faulty logic, improper algorithm, erroneous data flow, error in circuit design, errors in software code, and mistakes in data base" is ruled out.

4. MOBILE APPLICATION

Step 1:

Here the display informs that the fingerprint sensor and Wi-Fi are connected with the system.



Figure 1 Informs that the fingerprint sensor

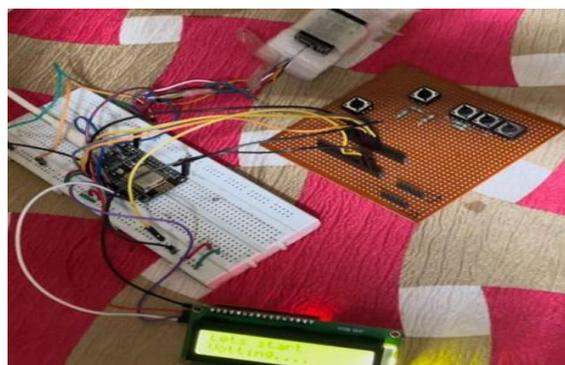


Figure 2 Voting System

Step 2:

As we move forward, we can see enrollment of voter's fingerprint takes place and gets stored in the database.



Figure 3 enrollment of voter's

Step 3:

After the enrollment, the display shows the information of voter i.e., its name and Aadhar number. Then voter is allowed to cast his/her vote which is then successfully submitted.



Figure 4 voter submitted.

Step 4:

If the voter's fingerprint is not enrolled before, the display shows "No match found" whereas if the voter has already voted, it shows that message.



Figure 5 Already voted

DISCUSSION & LIMITATIONS

As compared to the previously published projects on Electronic Voting Machines, our IOT based Electronic Voting Machine can provide security and confidentiality to the whole voting process by verification of fingerprints of the voters. It also includes the Aadhar card verification providing more security. Unlike previous models, our model is small, portable, and easy to carry. [6] To add more to its advantages, it also helps the specially abled voters to vote effectively without any malpractices involved. As our machine is user-friendly to the specially-abled voters, it helps in preventing frauds and scams. The machine runs through Wi-Fi connection which makes the base for our project. This complete process is paperless, therefore being environment-friendly and hassle free.

At present, our project is a prototype of the newly added features and accessibility based on IOT, it contains few limitations. The fingerprint-based module requires the user's database to be stored online, but to due to high number of voters in each sector, it is not feasible to store such large amount of data in the database. [7] Moreover, the online storage of database is not very secured as it can get hacked and the database or the results could get easily manipulated. Lastly, our project stores one fingerprint for each single user which can create serious problems if the user meets with any unavoidable circumstances.

5. FUTURE SCOPE

There are many features that can be added to our existing app such as allowing patients not only to discuss symptoms but also to upload his/her test report where we can apply named entity recognition to get the relevant information.

Continuous training pipeline, keep getting more data from the user and feed it back to the model for training. Detecting completely irrelevant information more accurately. There is also a scope of including voice recognition so that the user does not need to type all the time.

6. CONCLUSION

The goal of the project "IoT based fingerprint voting machine" was to create an advanced version of the already made electronics voting machine that aids in the free and fair conduct of elections, which is the foundation of a democratic society like India. The whole system is the result of IoT based hardware in combination with real time database software consisting of various algorithms, main tests to check the systems and analysis of results. To conclude, the prototype device was able to successfully enroll voters' fingerprints in the fingerprint module

flash memory, checks the status of voters (enrollment or multiple voting), matches the new fingerprint input with the one saved in the fingerprint library, then allow voters to cast their votes and produce results. [8] To conclude, the device is an amazing alternative to other systems which are time consuming, less reliable, uses more paper, especially the ballot voting system. At a later stage of development, the prototype device could be improved further. For example, a WIFI module might be added to help deliver results wirelessly to the host computer, and external memory space could be added to help store any amount of fingerprint data.

ACKNOWLEDGEMENT

We would like to extend our sincere gratitude to our respected project guide Dr. Sudhir Kadam, who gave us his careful and ardent guidance because of which we are able to complete this project. More words won't suffice to express our gratitude to his untiring devotion. I would also like to thank the Principal Dr. Vidula Sohoni, Head of Department Electronics & Telecommunication, Dr. Shruti K Oza, for nurturing a congenial yet competitive environment, which motivates all the students not only to pursue their goals but also to elevate the Humanitarian level.

REFERENCES

1. K. Sharma, A. Raghuvanshi and V. K. Sharma, "Biometric System- A Review," *International Journal of Computer Science and Information Technology*, vol. 6, p. 1, 2015.
2. Kadam, S. A., & Chavan, M. S. (2019a). Design of digital filter by genetic algorithm. *International Journal of Engineering and Advanced Technology*, 8(6), 397–400. <https://doi.org/10.35940/ijeat.E7808.088619>
3. Kadam, S. A., & Chavan, M. S. (2019b). Performance of particle swarm optimization for reducing system delay. *International Journal of Scientific and Technology Research*, 8(11).
4. R. Haenni, E. Dubuis, and U. Ultes-Nitsche, "Research on e-voting technologies." *Bern University of Applied Sciences, Technical Report 5*, 2008.
5. G.V.L. N. Rao. *Democracy at Risk! Citizens for Verifiability, Transparency & Accountability in Elections*, New Delhi,
6. K. Agarwala, D. T. Shahani, and P. V. Indiresan. *Report of the expert committee for evaluation of the upgraded electronic voting machine (EVM)*. Sept. 2006.
7. Wikipedia. Results of the 2009 Indian general election by parliamentary constituency Sanjay Kumar, Manpreet Singh, "DESIGN OF A SECURE ELECTRONIC VOTING SYSTEM USING FINGERPRINT TECHNIQUE", *IJCSI International Journal of Computer Science Issues*, Vol. 10, Issue 4, No 1, July 2013

Advertising on Electronic Media-An Analysis of Its Impact on Buying Behavior with Special Emphasis on Television and Internet Advertising

Varsha Rahul Singh and Rajesh Mankani
JIT University, Rajasthan, India

ABSTRACT

The present paper objective was to determine whether print media such as newspapers, magazine, Posters and Billboards are more or less effective than electronic media such as TV, Radio, internet and mobile ads in attracting consumers towards their respective products or services, this paper explained about how the both medias use strategies for attracting consumers. For that determinants like different media channels, media ads appeals, different types of media ads and media strategies used for my research work for comparing both Medias strategies. A sample of all consumers was selected with structure questionnaire for comparing both Medias. The results showed that there is a significant difference in the mean variances in print media and electronic media with regard to diff. types of media channels, diff. types of media ads, media ads appeals, and media strategies Electronic media strategy have significant impact on consumer purchase behaviour.

Keyword: electronic media, consumer behaviour

ELECTRONIC MEDIA-AN INTRODUCTION

To communicate with one another is a compulsive urge of human beings. Civilizations and cultures progress to the extent communications have made them possible. Speech (unaided for its propagation) has a limited distance range. Communication within the family and every closely living family helped the primitive communities. As movement also was limited, there could have been thousands of languages as despaired in the expression 'Babel of tongues.' After speech, the next important development was writing. It helped preservation of Ideas, of thoughts, of agreements and their transmission from generation to generation. Until paper and printing were invented, even writing could help only to a limited extent for communication between far-flung communities and societies. Printing helped the multiplication of information and knowledge and their easy availability to tens of thousands of people. Even though paper and printing extended the range of communication, they could not influence the rapidly of transmission.

Audio and videocassette recording and their multiplication in million is enabling the spread o instruction and training and entertainment and education. Electronics, computers and telecommunication media are enabling the simultaneous printing newspapers from several centers. Electronic book publishing is another rapidly growing activity. Personal computers, access databases over telecom media, and print out a mass of information in whatever formats it is wanted. They are a great aid for information storage, retrieval and processing.

Radio, Television and Internet are the most important electronic media, in which this study concentrates only on Television and Internet and also on Television and Internet advertising and hence, here afterwards, researcher talks only on Television and Internet in general and Television and Internet advertising in particular. These media have been selected for the study with the intention that both Television and Internet media form second group of advertising commercial media.^

Television and Mass Communication

It is widely believed that mass media has an Important role to play in achieving national goals. The UNESCO report^ on various aspects of communication and society provides eight following functions of mass media: (1) Dissemination of information; (5) Education; (2) Socialization; (6) Cultural Promotion; (3) Motivation; (7) Entertainment; and (4) Promoting debates and discussion; (8) Integration. Television, the electronic medium, performs all these functions effectively and with perfection. Television is one of the nicest inventions of man. It has an edge over other forms of mass media, viz., radio and newspapers, etc. It has overcome the barrier put up by illiteracy, which is the main hurdle with the print media. It provides a unique communication process, in a way helping mass communications becoming very simple and speedy. It is a multimedia system predominated by the visual medium. It is recognized that there is an urgent need for mass education and communication media for accelerating social change, creating awareness and inculcating scientific temper among the masses. It will also inculcate desired attributes and attitudes among the masses necessary for national development

Impact of Technology on Advertising

The need for advertising developed with the expansion of population and the growth of towns with their shops and large stores; mass production in factories; roads and railways to convey goods; and popular newspapers in which to advertise. The large quantities of goods being produced were made known by means of advertising to unknown customers who lived far from the place of manufacture. This process developed some two hundred years ago in industrialised countries

Techniques Used in Electronic Media

(a) **Computer Graphics:** Computer graphics have always been one of the most visually spectacular branches of computer technology. The computer has brought new power, versatility, speed and value that enable one to create high quality images or animations for a variety of uses. With the various software available, one can quickly create complex shapes and edit them in a variety of ways to build three-dimensional objects. One can virtually create any kind of material, by combining colour settings, transparency, and special effects. The materials that can be created are water, glass, and granite, marble among many others.

(b) **Morphing:** Another interesting area within computer graphics is morphing. Morphing is the transition from one image to another in a very short span of time, such that the move appears to be continuous to the viewer. Using various software tools it is now possible to create real life 3D effects. We take a look at the process involved. 16

(c) **Animation:** 2D animation is displaying a rapid succession of images to create the illusion of movement. Conventionally, 2D animation was done by drawing individual frame-up to many of them, for every second of the animation. So for 10-minute film you'd painstakingly create thousands of individual frames and film them in proper sequence, a time consuming affair. Using the computer to do the same task is much more productive. Packages like 'animator pro' offers a host tools and generate the intervening frames to simulate action and motion automatically. Since 2D or cell animation is generally populated by bitmaps, one can use image processing, paint, special effects and illustration programs to create sophisticated characters, background and scenes for animation. Going beyond 2D or plane animation there's solid object or 3D animation - the stuff movies are made of. This is more complex, since it involves the creating of every object in the scene with proper texture, perspective, lighting, shadows and movement. In fact, 3D animation demands good modeling and visualization abilities. Mapping is important in 3D modeling since it frees you from the effort of having geometrically defined every tiny detail. Packages like 3D study ship with whole host o texture libraries, which you can use for the objects - from brick walls to textile finishes. However, the process of modeling and mapping multiple objects is quite time consuming. To speed it up one can use 3D object libraries, which are like clip art. Once the objects in the scene have been created, and the position of the lights and cameras defined, the process of animating can be started.

Computer Image Processing

Computer imaging is the integration of computer graphics system into the creative process. Artists absorb and assimilate the unique character of computer systems and their capabilities, intuitively using them as a vehicle for visual expression, and for visual communication of information. The computer provides the basis for dynamic new directions in art, with unique application ink painting, drawing photography, print-making, laser images, and in graphic design, product design and television graphics. 17

(a) **The Imaging Process:** Computer imaging as multi-dimensional process consists off four basic components. The four basic components are the input process, involving a variety of input devices; image manipulation or image processing instruction sets or software; the output process using a series of output devices; and finally output media involving the integration of computer imagery with another medium.

(b) **Image Transformation:** One of the most valuable capabilities of computer graphics system is image transformation. This is the process of changing the nature of an object or its state or being a metamorphosis.

(c) **Assemblage:** Figures, objects, and images can be super-imposed to create complex compositions. Using a computer graphics system gives the artist access to any figure or element in a picture or composition. These elements can be extracted, scaled, rotated and repeated, and synthesized with other elements. Another technique involves breaking up a composition or fracturing it into pieces, creating some open areas. These fractured compositions are then super imposed on other compositions.

STATEMENT OF THE PROBLEM

T&IA are becoming increasingly important and visible tools for both profit and non-profit firms. This research addresses that gap in the Television and Internet Advertising literature. Hence, problem of the present research is as given below:

The present study is an attempt to analyze the impact of Television & Internet advertisements on buying behavior in Indian scenario. Given the emergence of both Television & Internet promotions, there is a substantial gap in our knowledge on both T&IA. Hence, this study tries to develop both information and comprehensive understanding and analysis of T&IA. The appeal of doing theoretical research in T&IA is obvious for academics and equally promising for practitioners as well. A greater understanding of T&IA 26 holds the promise of several key benefits for practitioners. Such a comprehensive analysis helps in understanding buying behavior, which will be important for practitioners to understand why their T&IA efforts do or do not succeed as well as aiding academics to build a comprehensive literature on T&IA.

OBJECTIVES OF THE STUDY

There exists a substantial gap both in information and analysis of T&IA as stated in preceding paragraphs. Taking this substantial gap in to consideration, the following specific objectives have been set for the current research. In order to understand and analyze:

1. The impact of Television and Internet Advertisements on consumers' buying behavior;
2. Buyers' involvement while going through the ads on Television and on the Internet. Involvement in terms of thoughts, ideas, and images that will occur in the consumers' mind while watching and looking at the ads on Television and on the Internet respectively.
3. The impact of T&IA in marketing of goods and services;
4. Overall opinions on the marketing-mix elements; and 5. the present status and future prospects of T&IA; This study leads to an analysis of T&IA and their impact on buyers' behavior, attitudes, opinions and fills the substantial gap that exists both in terms of information, literature and comprehensive understanding of buyers' behavior towards T&IA.

RESEARCH DESIGN OF CURRENT RESEARCH

A research design is simply the framework or plan for a study used as a guide in collecting and analyzing data. It is the blueprint that is followed in completing a study.[^] A research design is the logical and systematic planning and directing of piece of research. The design results from translating a general scientific model into varied research procedures. The design has to be geared to the available time, energy, and money; to the availability of data; to the extent to which it is desirable or possible to impose upon persons and social organisations, which might supply the data. A research design is not a highly specific plan to be 27 followed without deviations, but rather a series of guideposts to keep one headed In the right direction/ Research Design used in this research work is 'descriptive research design'. A great deal of marketing and advertising research can be considered descriptive research, which is used for number the following purposes:[^] (1) To describe the characteristics of certain groups/respondents. (2) To estimate the proportion of people in a specified populations who behave in a certain way. (3) To make specific predictions. As the name implies, the major objective of descriptive research is to describe something - usually market characteristics or functions.[^] A clear statement of the problem, specific hypothesis, and detailed information needs descriptive research, in contrast to exploratory research. Descriptive research design is used in this research to describe the characteristics/ opinions/ attitudes/ perceptions/behaviour of relevant groups/respondents at Bangalore urban district. So, descriptive research design is a type of conclusive research, which has as its major objective the description of something - here, in this research it is - "Advertising on Electronic I/Vedla - an analysis of its impact on buying behaviour" (With special emphasis on Television and Internet Advertising)

This study is based on the prior formulation of preplanned and structured design, specific hypotheses, primary and secondary data. Descriptive research study basically has two types viz; cross-sectional design and longitudinal design. This study basically follows cross-sectional design, specifically 'single cross-sectional design' in which sample of respondents is drawn from the target population and information is obtained from this sample once.

The Weak Link: Attitude to Behavior

A crucial assumption made in many attitude and persuasion studies is that, ultimately, attitude(s) affect people's behaviors. However, this link was always subject to some debate. La Piere conducted a classic early study into

this relationship^{^o}. La Piere and a young Chinese couple toured the U.S. in the early 1930s, stopping at 251 hotels and restaurants. In only one case were they denied service. Surprisingly, in a follow-up questionnaire responded to by 128 of these businesses, 92% of the restaurants and 91% of the hotels replied "no" when asked "will you accept members of the Chinese race as guests in your establishment?" Although fraught with weaknesses, the study was an early precursor of the difficulties in establishing the attitude to behavior that haunted persuasion researchers for years

FORMULATION OF HYPOTHESIS

To understand and analyse consumers' experiences with television, computers and Internet in general and television and Internet advertising in particular the following hypothesis has been formulated:

H 1: Consumers' experiences with television, television ads, Internet and Internet ads in general are strong

H 2: Advertisements on television and Internet In marketing different types of products / services are strong

H 3: Status of television and Internet ads in formulating marketing strategies for products / services today is strong.

H 4: Firms' strategies for marketing-mix elements on television & Internet advertising are strong.

H 5: Emotional routes of television ads, influence of television ads on purchase decisions, persuasive message on television, do make a great impact on buying behaviour
H 4: Firms' strategies for marketing-mix elements on television & Internet advertising are strong.

H 6: Past & present experience of respondents for the Internet ads Are good, Internet ads are making a great impact on buying behaviour.

LIMITATIONS OF THE CURRENT RESEARCH

Despite all possible efforts to make an analysis more comprehensive and scientific, a study of the present kind is bound to have certain limitations; researcher humbly submits them at this stage. The present study is a research work presented in a descriptive manner. While the importance of previous researches on advertising, television advertising, Internet advertising, persuasion research, have not been disputed, what is proposed in this research is much greater description into specific consumer reactions and opinions to the elements of Television and Internet Advertising (T&IA) in Bangalore urban district. The researcher is well aware of the limitations of the survey and questionnaire method. Further, It is inevitable In a study of this kind that at times analysis has to be made based on the opinions and attitudes of learned respondents. In such cases, the results at best are near to truth. However, an honest attempt has been made to report and analyse the opinions of learned respondents of Bangalore urban district. Understanding even carefully targeted consumers' reactions to any given offer appears to be even more important in today's rapidly evolving electronic media, given that, even careful targeting may not overcome consumers' resistance to T&IA appeals. In understanding consumers' response to T&IA appeals, and the scarcity of research on T&IA, this research work draws on the ELM and the Aad research (reviewed in chapter 3) to provide useful and predictive insights into understating how and why individual consumers react (or fail to react). The researcher has gone in for judgment sampling, which does not allow generalizations due to the dynamic nature of consumers' attitudes. The results would have been different if all the respondents had responded to the survey. Broadly speaking, this thesis can be viewed as a test and application of adapting what we have learned from largely image-centered advertising studies to T&IA, while (in its short history) it can be viewed as information-oriented, is becoming increasingly image-oriented, given the rapid advancement of enabling technologies. The study is confined only to Bangalore urban district. Due to paucity of time and resources, only Bangalore urban district has been selected for primary data collection

REVIEW OF LITERATURE – AN INTRODUCTION

Research into persuasion and time effects of persuasive communication have been conducted since World War I. Research is the strong belief that persuasion is an attempt to effect attitudes - hence the attitude, persuasion and literature on buying behaviour are closely linked, if not inseparable. Given this, a number of representations about how persuasive communications affect attitudes; behavior and intentions have been forwarded over the years.

It is likely that research into persuasion began with the ancients. Aristotle, in his classic works on rhetoric, analyzed and wrote about it. However, like many great social and scientific advances it was, unfortunately, war that gave rise to the roots of modern persuasion research. Lasswell's (1992) dissertation, Propaganda Techniques in the World War, likely founded persuasion research, as we know it today. Observing war-time propaganda by both sides of early theories, exemplified by Lasswell, believed that by simply hitting their target

propaganda messages would be effective (post hoc, these theories have been labeled as "bullet" or "hypodermic needle"). Although rather simple by today's standards, two important foundations were laid in this, and other, early works on propaganda: First, it was an emphasis on the study of attitude change; Second, it was concerned with research into mass communications as a communication vehicle. Both of these areas remain of paramount importance in persuasion research today, especially in promotion.

While attitude and persuasion research continued, the adaptation of these findings to the marketing literature in the early-and mid-1970s moved slowly. One notable exception was Lavidge and Steiner's adaptation of hierarchical communication models leading to their well-known Awareness -> Knowledge -> Liking -> Preference -> Conviction - Purchase model in 1961. However, disdain of research in this period is also evident, most notably in Jacoby's (1978, p. 87) *Journal of Marketing* "State of the Art Review." Jacoby begins: "...it is all too apparent that too large a proportion of the consumer (including marketing) research literature is not worth the paper it is printed on, or the time it takes to read." Arndt (1982, p. 24-5) was slightly less critical of the research to that time, yet still labeled the work of the 1970s as the "Utopian Grand Theories Phase," accusing much of the work as being "limited and culture bound." In retrospect, the criticisms of consumer research may have been justified: However, it must be noted that significant advances were being made towards understanding consumer behavior and the process of persuasion. One notable weakness in consumer research through this period was establishing the tenuous attitude to behavior link, as reviewed next.

PILOT STUDY

This pilot study situates itself at the intersection of global trends in news and journalism, and emergent practises of legacy print media in India. Our aim is to explore how legacy print newspapers are transitioning to the online space. The study will address questions in two thematic clusters:

INTRODUCTION

This pilot study situates itself at the intersection of global trends in news and journalism, and emergent practises of legacy print media in India. Our aim is to explore how legacy print newspapers are transitioning to the online space. The study will address questions in two thematic clusters:

- 1) The work of journalism, and
- 2) How the emergence of the digital, both as a source of news, and the medium of distribution, is shaping the work of newspaper journalists, which has expanded to include various functions particular to the digital environment. And two, newsroom practices, which focus on the different modalities of convergence emerging in Indian newsrooms, and the organisational re-engineering that is being attempted in order to do journalism in a space where professional editors and journalists no longer have dominance with respect to the production and distribution of content.

RESEARCH PLAN

As already mentioned, the study is divided into two thematic clusters: **work of journalism** and **newsroom practises**.

The former will include asking questions related to strategies and skills of information gathering and validation, methods and tools of communicating a news story in an online-first (or simultaneously print and online) environment, personal engagements with audiences via social media websites, new methods of performance assessment and sources and practices of learning and capacity building.

The latter will explore how choice/emphasis of content and reportage is being re-shaped by the digital environment by inquiring into changes in editorial responsibilities, dynamics of decision making, news-making workflows, technical diversity of the work force, and interaction between news producers within an increasingly convergent newsroom.

This being a pilot study, we will conduct intensive interviews with journalists, editors, and management personnel associated with one newspaper in each language market:

- 1) **Hindustan Times** in English,
- 2) **Dainik Jagran** in Hindi, and
- 3) **Malayala Manorama** in Malayalam. We selected these three languages due to their large market sizes and geographic distribution, and selected the newspapers for either their pioneering efforts in adopting digital technologies, or their dominant position in terms of circulation.

The research team includes Zeenab Aneez and Sumandro Chattapadhyay from CIS, and RISJ Director of Research Rasmus Kleis Nielsen. Vibodh Parthasarathi from CCMG, Jamia Millia Islamia, will contribute to the study as an advisor.

REFERENCES

1. Shodhganga .inlibnet.ac.in
2. www.scholars .net
3. www.targetpublicationss.org
4. Docs.google.com
5. www.iosjournals.org
6. www.researchgate.net
7. www.ijariit.com
8. www.etimm.ase.ro
9. Articles on working and non-working women
10. Ahujam.kgupta&Raman (2003) an empirical investigation of online consumer purchasing behavior (electronic version) april 2005
11. Electronic copy available at <http://ssrn.com/abstract=246682>
12. Online shopping trend 2013- most popular categories T(2014) online shopping trends 2013 . most popular categories . top purchase drivers
13. tuttle -B & Tuttle B(2014) - more popular (yet less satisfying than ever)
14. the economic times (2005) online shopping more popular yet less satisfying than ever - 117% growth
15. online shopping all the rage as teens snub traditional retail outlets(online available at

A Study on the Effect of Brand Image on Consumer Preference with Reference to Youth in Mumbai City

Saeed Sawant and Sanjay G. Mishra
JIT University, Rajasthan, India

ABSTRACT

Brand image is the key factor in consumer purchase of a product. Because branded products provide them satisfaction to their mind, status, specified quality and long lasting. The present study analysis the Effect of Brand Image on Consumer Preference with Reference to Youth in Mumbai City. Simple random sampling method was used to collect data from a sample size of 53 consumers belonging to different categories. A well-structured questionnaire, developed in Likert scale was administered among the selected consumers. Statistical Package for the Social Science (SPSS) was used for conducting various parametric tests such as Frequency analysis, Cross Table analysis and One way Anova test for data analysis and interpretation. Secondary data was collected from books, journals, and website. With regard to the frequency of buying the branded products, 52.8% of the respondents buy the branded product only when quality is important as against 21.8% who always buys the branded products. With regard to the use of branded and unbranded products, 35.8% of the respondents have an equal proportion of 50:50.

Keywords: Brand Image, Consumer Preference, Quality, Status

INTRODUCTION

Brand image is the key driver of brand equity, which refers to consumer's general perception and feeling about a brand and has an influence on consumer behaviour. For marketers, whatever their companies' marketing strategies are, the main purpose of their marketing activities is to influence consumers' perception and attitude toward a brand, establish the brand image in consumers' mind, and stimulate consumers' actual purchasing behaviour of the brand, therefore increasing sales, maximizing the market share and developing brand equity. A strong brand image is a powerful asset. Therefore, it was aimed in this study to investigate the relative influence of the brand image on consumer preferences and the formation of strong consumer preferences-brand relationships. Often, consumers will tend to choose a brand that they consider congruent with their self-image. Brand preference is regarded as a key step in consumer decision making, involving elements of choice. This paper is interested to find out the effect of brand image on consumer preferences in Bangalore. The study has been conducted in the southern parts of India. And the study was all about the effect of brand image on consumer preference. This study will help to know the new technology has resulted in a greater demand for branded items. The reason for the preferences are, Brands creates differences, Brand provide peace of mind, Brands add value, Brands express who we are, brands provide better quality and status. Because of these reasons consumers prefer to have branded products and to be loyal to the branded products.

STATEMENT OF THE PROBLEM

Consumer behaviour make changes like yesterday's luxuries are today's necessities. The market survival depends on consumer satisfaction. The satisfaction search for innovation and new technology, which will reduce their work into simple or convenience to their situation. In the entire process of buying consumers are driven by influences such as feelings, motivation, income, lifestyle, opinion, culture, personality etc.

REVIEW OF THE LITERATURE

Ching and Ying (2008) dealt the topic Airline brand equity, brand preference and purchase intentions. They concluded their research it has a positive relationship between brand equity, brand preference and purchase intentions with moderation effect of switching cost affecting the relationship between brand equity and purchase intentions. Whan and Bernard (1986), made research on strategic brand concept, image management. They say that conveying a brand image to a target market is a fundamental marketing activity. The method for maintaining this concept image linkage depends on whether the brand concept is functional symbolic or experiential. Maintaining this linkage should significantly enhance brands market performance. Benedict and Rajeev (2002) did a study on how perceived brand global ness creates brand value. In today's multinational market place it is increasingly important to understand why some consumers prefer global brands to local brands. It is based in the quality. And the purchase is based on the perceived brand global ness. Ulrich and Keven (2008) made research on holistic package design and consumer brand impression. Sincere brand should have natural package design, exciting brands – contrasting design, competent should have delicate design and sophisticated brand have natural or delicate design. And they discussed the potential trade off among the

impressions created by holistic design types and illustrate their findings with numerous real packages. Katherine and Darren (2008), on the influence of dissociate reference group on consumer preference. This study explores males have more negative evaluation of and were less inclined to choose, a product associated with dissociative that is female, reference group than a neutral product. We suggest the mechanism underlying our effects is a desire to present to positive self-image to others. Frank and Joseph (2006), direct and indirect effects of self-image congruence on brand loyalty. The study integrated the emerging construct of brand relationship quality into self-congruity theory. The model posits that self-image congruence positively affects brand loyalty directly and indirectly through functional congruity, product involvement and brand relationship quality. Dongdae and Ganesh (1999), on effects on partitioned country image in the context of brand image and familiarity. The study found out overall image and product specific image and three different types of familiarity product familiarity, brand familiarity and country familiarity. The study states that product specific image plays a mediating role between overall country image and consumer evaluation with product and brand familiarity moderate familiarity consumers utilize country of origin information less than low or high familiarity consumers. Myers Chris (2003) managing brand equity, based on its attributes. Brand equity continues to be one of the critical areas for marketing management. And this study explores some of the consequences attributes may have on brand equity such as the basis on consumer preferences. Attributes are examined from a tangible and intangible perspective and both are found to be important contributors to brand equity and brand choice. Rvi, Pascale and Ray (2005), consumer-based brand equity. The study found that brand awareness and brand associations were found to be two distinct dimensions of brand equity as conceptualized in the market literature Pamela and Robert (1999), strategies for building consumer brand preference. The study found that, the principles of market is typically to build a relationship with buyer. The relationship should be based on strong bond between the buyer and the brand. The choice of an individual strategy or combination depends mainly on the nature of the branded product or service. The success of the strategy depends heavily on the marketers understanding of the preference building and bonding process. Aaker Jennifer (2006), brands personality traits, personality psychology. He found that an understanding of the symbolic use of brands have been limited in the consumer behaviour literature. He identified five big dimensions of personality. And to measure it, a reliable, valid and generalizable measurement scale is created. Cheng and Zhen (2004), consumer ethnocentrism and willingness to buy domestic products in developing country setting. The results support the hypothesis that the impact of ethnocentrism on consumer willingness to buy domestic products trends to be weaker when consumers judge them as being of lower quality or when consumers hold higher values. Atilgan, Satak and Serkan (2001), determinants of the brand equity. The study concludes that brand loyalty is the most influential dimension of brand equity. Weak support is found for the brand awareness and perceived quality dimensions. Xuemei and Luiz (2011), role of brand image, product involvement and knowledge in explaining consumer purchase behaviour. This research is the first literature on counterfeits to establish that perceived brand personality plays a more dominant role in explaining consumer purchase intention based on profit and product attribute. Involvement and knowledge has no significant influence. Ravi, Pascale and Ray (2007), country image and consumer brand equity and relationship. The relationship between these two sets of constructs was found to be positive as well as product category. While the contribution of both country image dimensions was also product category specific. Neelam (2006), effect of country origin on foreign brand names in the Indian market. It was found that the quality of foreign brands was perceived to be generally higher and superior to local brands. Most consumers also associated greater accessibility of foreign brands in the Indian market with better quality at lower prices. Indian market evaluated them higher on technology, quality, status and self-esteem than Indian brands and attributed higher credibility.

OBJECTIVES

- To study the importance of consumer preference for branded products based on income.
- To find out how brand influences in consumer decision making.
- To find out the impact of price on purchase decision.

HYPOTHESIS

Null: There is no significant difference between consumer preference for branded products according to income.

Alternative: There is significant difference between consumer preference for branded products according to income.

METHODOLOGY

Type of Research

Descriptive, applied and conclusive research analysis based on correlation research approach and cross-sectional research analysis will be used for analysing and interpreting the data.

Sources of Data

This study will be based on both primary and secondary data. Primary data will be collected from the field through survey and secondary data will be collected from books, journals, and website.

Data Collection

This includes a cross-section survey to collect data from customers. Instrument Well-structured and designed questionnaire was prepared by the researcher to collect data from the selected samples.

Sampling Method

Simple random sampling method was used to collect the data.

Sample Size

Data was collected from a sample size of 53 peoples from different age group for the purpose of study and analysis.

Plan of the Analysis

Statistical Package for the Social Science (SPSS) was used for conducting various tests such as Frequency analysis, cross Table analysis, parametric test One way Anova for data analysis and interpretation.

Scope of the Study

This project helps in finding out the effect of brand image on consumer preference. The study focuses on various factors such as price, packaging of the product, customer satisfaction, and good will of the company, quality, customer service and brand name which affect the customer preference for the branded product and their purchasing decision.

Limitations

- The sample size is limited to 53 members; hence the result of the study cannot be taken as universal.
- Findings of the survey are based on the assumption that the respondents have given correct information.
- Since the respondents had to fill the questionnaire while busy with their hectic schedule, many people were reluctant to answer.
- The study was conducted only in K Narayanapura area and therefore, several other potential samples outside the city were neglected.

DATA ANALYSIS AND INTERPRETATION

This study was undertaken to analyst the effect of brand image on consumer preference on purchase branded products. The data was collected using questionnaire and analyzed. SPSS tools like Frequency test, Cross tabulation and One way Anova were used to evaluate the preference of the consumer on the branded products in their purchase decisions.

Table 1: Reasons for the Brand Preference

Reasons	Frequency	Percent
Product range	6	11.3
Product design	8	15.1
Product quality	25	47.2
Price range	12	22.6
Customer service	2	3.8
Total	53	100.0

Source: Primary data

INTERPRETATION

The Table 1 points out product quality as the main reason for the brand preference of the consumers, (47.2%), followed by price range (22.6%), product design (15.1%), and product range (11.3%). Only a small umer (3.8%) indicate customer service as the reason for their brand preference.

INFERENCE

Customers prefer products with high quality and reasonable price range over and above product design and product range.

Table 2: Attributes that affect the purchase decision

Attributes	Frequency	Percent
Brand name	14	26.4
Design	11	20.8
Easy availability	16	30.2
Price	6	11.3
Desire to purchase	6	11.3
Total	53	100.0

Source: Primary data

INTERPRETATION

The Table 2 indicate that easy availability of the product as the attribute that affect the purchase decision most (30.2%). Respondents also identify brand name (26.4%), and design (20.8%) as the attributes which affect their purchase decision. Only 11.3% find price and desire to purchase as the attributes which affect their purchase decision.

INFERENCE

Customers prefer to buy branded products because of their easy availability, brand name and product design.

Table 3: Impact of price with income group

Price impact	Income Group					Total
	Lower class	Middle class	Upper middle-class	Upper class	High income group	
Strongly disagree	1	0	2	2	0	5
	(20.0)	(0.0)	(40.0)	(40.0)	(0.0)	(100.0)
disagree	0	0	2	1	0	3
	(0.0)	(0.0)	(66.7)	(33.3)	(0.0)	(100.0)
Neutral	3	9	3	2	0	17
	(17.6)	(52.9)	(17.6)	(11.8)	(0.0)	(100.0)
Agree	1	10	6	2	4	23
	(4.3)	(43.5)	(26.1)	(8.7)	(17.4)	(100.0)
Strongly agree	0	2	2	1	0	5
	(0.0)	(40.0)	(40.0)	(20.0)	(0.0)	(100.0)
Total	5	21	15	8	4	53
	(9.4)	(39.6)	(28.3)	(15.1)	(7.5)	(100.0)

Source: Primary Data

Note: Figures in Brackets are Percentages to Total

INTERPRETATION

The result of the cross tabulation of impact of price with income group shows that 40% each of the upper middle class as well as upper class strongly disagree that price impact their buying decision. As against this, 20% of the lower class strongly disagree that price influence their buying decision. The data further indicate that 66.7% of the upper middle class and 33.3% of the upper class disagree that price has a significant impact on their buying decision. Nearly 43.5% of the middle class, 26.1% of the upper middle class, 17.4% of high income group, and 8.7% of the upper class agree that price of the product impact their buying decision. An equal number of middle and upper middle class (40% each) strongly agree that price impact their buying decision. Whereas, only 20% of the upper class strongly agree that price has an impact on their buying decision.

Inference

Price of the product is an important factor influencing the buying decision of the middle class, upper middle class, and the upper class. They look for the quality of the product in return for the amount they spent for the product.

Table 4: Attributes that affect the purchase decision

Attributes	Frequency	Percent
Brand name	14	26.4
Design	11	20.8
Easy availability	16	30.2
Price	6	11.3
Desire to purchase	6	11.3
Total	53	100.0

Source: Primary data

INTERPRETATION

The Table 4 indicate that easy availability of the product as the attribute that affect the purchase decision most (30.2%). Respondents also identify brand name (26.4%), and design (20.8%) as the attributes which affect their purchase decision. Only 11.3% find price and desire to purchase as the attributes which affect their purchase decision.

INFERENCE

Customers prefer to buy branded products because of their easy availability, brand name and product design.

One-Way ANOVA

Hypothesis

H0: There is no significant difference between consumer preference for branded products according to income.

H1: There is significant difference between consumer preference for branded products according to income.

Table 3: One-way Anova

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.140	4	1.535	1.349	.266
Within Groups	54.615	48	1.138		
Total	60.755	52			

Level of significance = 5 % (0.05)

One way Anova test was conducted to find out if there is any significant difference between consumer preferences for branded products according to income.

The test result shows that

F = 1.349, P value = 0.266

Since P value is > 0.05, the result is not significant.

Therefore, Ho: is accepted.

Therefore, there is no significant difference between consumer preferences for branded products according to income.

FINDINGS OF THE STUDY

- The survey was conducted to study the effect of brand image on consumer preference.

A questionnaire consisting of 20 questions were sent to 43 male and 10 female respondents and the data collected from all of them were analysed using different techniques.

- The respondents are comparatively young with 41.5% (22) of them belonging to the age group between 23-26, and 22.6% (12) between 18 to 22 years.

Majority of the respondents (43.4%) are either post-graduate or graduates (39.6%).

Majority of the respondents belongs either to middle class (39.6%), upper middle class (28.3%), or upper class 15.1%.

- With regard to the frequency of buying the branded products, 52.8% of the respondents buy the branded product only when quality is important as against 21.8% who always buys the branded products. Whereas, 18.9% rarely buys branded products as opposed to 7.5% who never buys branded products.
- With regards to the use of branded and unbranded products, 35.8% of the respondents have an equal proportion of 50:50.

- The findings of the study show product quality (47.2%), price range (22.6%), product design (15.1%), and product range (11.3%) as the reasons for the brand preference of the consumers. Customer service does not emerge the reason for their brand preference.
- Respondents receive information about the brands through TV ads, peers, point of sales and websites.
- Easy availability of the product (30.2%), brand name (26.4%), design (20.8%), and price and desire to purchase (11.3%) as the attributes which affect the purchase decision.
- The data indicate quality of the product as the main reason for the choice of the branded product (30.2%), followed by value added services (22.6%), status (20.8%), loyalty (15.1%), and luxury (11.3%).
- Customers' choice of the branded products depends mainly on the quality of the product and the value added services.
- The data indicate quality of the product as the main reason for the choice of the branded product (30.2%), followed by value added services (22.6%), status (20.8%), loyalty (15.1%), and luxury (11.3%).
- The good will of the company does not seem to influence the purchasing decision of the respondents from different education backgrounds as they have mixed response to the impact of the good will of the company on their purchasing decision.
- There is no significant difference between consumer preferences for branded products according to income.
- There is no significant influence of advertisements on purchasing decision.

CONCLUSIONS

- The middle class and the upper middle-class customers have a preferential option for the branded products may be due to their higher purchasing power as compared to the lower class.
- The economic and social -status of the high income group may also influence their purchasing decisions.
- Quality is an important factor that influences customers' preference for branded products and the frequency of buying.
- Consumers prefer to use branded and unbranded products in the equal proportion for factors such as price, quality and durability of the products.
- Customers prefer products with high quality and reasonable price range over and above product design and product range.
- Customers' choice of the branded products depends mainly on the quality of the product and the value-added services.
- Satisfaction seems to be the ultimate thing leading towards repeated purchase.
- Television advertisements play an important role in providing information about branded products more than peer, point of sales and website.
- There is no significant difference between consumer preferences for branded products according to income.
- There is no significant influence of advertisements on purchasing decision.

SUGGESTIONS

- More creative ways of advertising to create better awareness among the various segments of the society regarding the branded products.
- To focus more on the quality of the product and the brand image to enhances the sale of branded products.
- To ensure that the customers received true value for the amount they spent for their preferred item through various value-added services and additional benefits.
- To maintain a reasonable price range for the branded products to promote and enhance the sale of the products among the various income and age group.
- To ensure the easy availability of the branded products for the promotion of the sales.

REFERENCES

1. Jin, X., & Weber, K. (2013). Developing and Testing a Model of Exhibition Brand Preference: The Exhibitor's Perspective. *Tourism Management*, 38, 94-104. [http:// dx.doi.org/ 10.1016/ j.tourman. 2013. 02. 018](http://dx.doi.org/10.1016/j.tourman.2013.02.018)

2. Laczniak, R. N., & Palan, K. M. (2004). Under the influence. *Marketing Research*, 16(1), 34- 39.
3. Lammers, H. B. (1985). The Overkill Effect of Corrective Advertising: An Heiderian Perspective on the Influence of Corrective Advertisement Sponsorship on Cognitive Responses toward the Company. *Advances in Consumer Research*, 12(1), 426-431.
4. Minton, E. A. (2015). In Advertising We Trust: Religiosity's Influence on Marketplace and Relational Trust. *Journal of Advertising*, 44(4), 403-414.
5. Muehling, D. D., & Laczniak, R. N. (1988). Advertising's Immediate and Delayed Influence on Brand Attitudes: Considerations Across Message-Involvement Levels. *Journal of Advertising*, 17(4), 23-34.
6. Myers, J. R., & Sar, S. (2009). The Influence of Consumer Mood State on Mental Imagery Processing of Advertisement and Brand Evaluation. *Advances in Consumer Research*, 361052-1053.
7. Myers, J., & Sar, S. (2015). The influence of consumer mood state as a contextual factor on imagery-inducing advertisements and brand attitude. *Journal of Marketing Communications*, 21(4), 284-299.
8. Noriega, J., & Blair, E. (2008). Advertising to Bilinguals: Does the Language of Advertising Influence the Nature of Thoughts? *Journal of Marketing*, 72(5), 69-83.
9. *Open Journal of Business and Management*, (2015), 3, 58-62 Published Online January 2015 in SciRes. <http://www.scirp.org/journal/ojbm> <http://dx.doi.org/10.4236/ojbm.2015.31006>
10. Ching Chen and Ying Chang (2008) Airline brand equity, brand preference and purchase intention: *Journal of Air Transport Management*. Vol 14 (1), 40-42.
11. Whan Park and Bernard (1986). Strategic brand concept, image management: *Journal of Marketing*. Vol 50 (4), 135-145.
12. Jan Benedict and Batra Rajeev (2003). Brand global ness creates branch value: *Journal of International Business Studies*. Vol 34 (1), 53-65.
13. Rorth Ulrich and Malkewiz Keven (2008). Holistic package design and consumer brand impression: *Journal of Marketing*. Vol 72 (3), 64-81.
14. White Katherine and Darren (2006). Influence of dissociate reference group on consumer preference: *Journal of consumer Psychology*. Vol 16 (4).
15. K vessman frank and Sirgy Joseph (2009). Direct and indirect effects of self-image congruence on brand loyalty: *Journal of Business Research*. Vol 59 (9), 955-964.
16. Lee Dongdae and Ganesh Gopala (1999). Effect on partitioned country image in the context of brand image and familiarity: *International Marketing Review*. Vol 16 (1).
17. Myers Chris (2003). Managing brand equity: *Journal of Product and Brand management*. Vol 12 (1), 39-51.
18. Pappu Ravi and Pascale and Ray (2005). Consumer based brand equity: *Journal of Product and Brand Management*. Vol 14 (3), 143-154.
19. Pamela and Robert (1999). Strategies for building consumer brand presence: *Journal of Product and Brand Management*. Vol 8 (2), 130-144.
20. Aaker Janniefer (1997). Brands personality traits, personality psychology: *Journal of Marketing Research*. Vol.34 (3), 347-356.
21. Wang Lu Cheng and Chen Xing Zhen (2004). Consumer ethnocentrism and willingness to buy domestic products: *Journal of Customers Marketing*. Vol 21 (6), 391-400.
22. Eda Atilgan, Aksoy Satak and Akinci Serkan (2001). Determinants of the brand equity: *Journal of Marketing practice*. Vol 23 (3).
23. Xuemei Bian and Moutinho Luiz (2011). The role of brand image, product involvement and knowledge in explaining consumer purchase behaviour: *European Journal of Marketing*. Vol 45 (1/2), 191-216.
24. Pappu Ravi and Pascale and Ray (2007). Country image and consumer brand equity and relationship: *Journal of International Business Studies*. Vol 38 (5), 726-745.
25. Kinra Neelam (2006). Effect of country origin on foreign brands names in Indian market: *Journal of Marketing Practices*. Vol 24 (1), 15-30.

Unlocking Enigma for EDP Management for Sugar Factory in India Using Entity Model

Pratibha Deshmukh

Bharati Vidyapeeths Institute of Management and Information Technology, Navi Mumbai, Maharashtra, India

ABSTRACT

Today, there is a tremendous growth in Computer Technology and/or IT technology which results in increased turnover and reducing total cost of the organization. The use of technology is improved more day by day for accomplishing regular operations of organization. It is crucial to have the potential leaders to lead for more productivity and proper utilization of resources.

This paper studies and analyses various problems and prospects of EDP Managers or Electronic Data Processing Managers in co-operative Sugar Factories. It aims at the technology that optimises the production and management flow of Sugar Industry. EDP managers, here, are a need more than just a technologically advance system. It eases the workflow of system and simplifies it in various aspects as mentioned above. This paper also describes the role and responsibilities of EDP manager and their importance in Sugar factory.

Keywords: Computer Technology, IT technology, EDP Manager, Electronic Data Processing Managers, Sugar Factory, Workflow

1. INTRODUCCION

Sugar Factories in the food-processing industry comprise of specialized enterprises, in which is manufactures white granulated sugar from sugar beets, in refined sugar from granulated sugar. Sugarcane is the basis as raw material used in sugar processing in tropical and subtropical countries.

EDP means Electronic Data Processing. In all companies there is a department that looks after all the work of computers. All factories have IT Department in sugar industry. It uses the computers to manipulate, record, classify and to summarize data. If someone asks what is electronic data processing, then EPD meaning can be described as the processing of data using electronic means such as computers, calculators, servers and other similar electronic equipment.

Researchers carried out at initial discussion with EDP Managers of two sugar units who are implementing EDP solution and according to that discussion these units are facing some problems like exceeding the budget of the project, delays in implementation and EDP implementation planning mismatch etc. So the research problem is to study the present status and issues related with promoting as EDP manager for proper EDP implementation in sugar factory units. Because of availability of EDP manager in sugar factory leads to responses for success and failure of EDP operations in support with high level authority.

Common Departments Exists in Sugar Factory

- The list of common departments existing in Sugar Factory are as below:
- Administration
- IT Department/Computer
- Engineering Department
- Finished Goods/Store
- Agriculture
- Purchase Department
- Sales Department
- Harvesting & Distribution Department
- Accounting Department
- Manufacturing/Production Department
- Time Office, General Department
- Share Department
- Sugarcane Development Department
- Soil Laboratory Department

- Petrol pump
- Distillery
- Weigh bridge

Operations Handled by Inside Stakeholders of Sugar Factory

There are many day to day operations handled by all the stakeholders from various departments viz., Financial Accounting, Shares Accounting, Cane billing, By-product accounting, Fixed Deposit Billing, Sugar sale accounting, Store costing(purchase & costing), Petrol pump billing, Weigh Bridge, Harvesting & Transport Billing, Sugar Cane Development & Management, Soil Laboratory Analysis, Soil Laboratory Analysis, Plantation Registration, Harvesting schedule System, Vehicle Registration System, Fertilizer Billing System, Other weigh bridge, Store inventory, Godown Management, Shareholder registration, SMS (shareholder, admin, officer, Harvesting contractors, employees), Time Office, Molasses Sale, Agriculture centre, MIS, Online system, HR Management, Leave Management, Schedule Maintenance, Gate-pass, Machinery Schedule Maintenance, H/w, S/w, N/w Scheduled Maintenance, Email Management system, Cheques Management System, Multiple bank account management system, Bagasse & Presumed sale, Emergency alert system etc.

2. LITERATURE REVIEW

Researchers have collected primary data from various departments. On the basis of collected data analysis and interpretations have been made.

Table 1: shows details regarding Sugar Factories visited by researchers in terms, its year of establishment and capacity in TCD of each.

Sr. No.	Factory Name	Establishment Year	Capacity (TCD)
1	Baramati Agro	1988	4500
2	Shree Chatrapati co-op sah. Sugar Factory	1954	3500
3	Ajinkyatara co-op sah. Sugar Factory	1982	2500
4	Kisan Veer co-op sah. Sugar Factory	1968	4000
5	PratapGadh co-op sugar Factory	2002	2500
6	Khandala co-op sugar factory	2016	2500
7	Malegaon co-op sah. sugar factory	1958	4000
8	Shankarrao mohite patil co-op sah. Sugar Factory	1932	7200
9	SaswadMali co-op sah. Sugar, Solapur	1932	3500
10	Pandurang sahakari co-op sah. sugar factory	1992	4500
11	Green Power Sugar Factory	2006	3500
12	Sahyadri co-op sah. Sugar Factory	1969	7500
13	Someshwar co-op sah. Sugar Factory	1960	2500
14	Rajgad SSK Ltd Anantnager	1989	1250
15	Sharayu Agro Industries Ltd.	2011	5000
16	Cane Agro Pvt. Ltd.	2007	4000
17	Sonhira co-op sah. Sugar Factory	1999	2500
18	Udagiri Sugar and Power limited	2011	2500
19	Shahu co-op sah. Sugar Factory Ltd	1980	4500
20	Jaywant Sugars co-op sah. Ltd.	2006	2500
21	Krantiagrani shakari sakhar karkhana Ltd.	1997	2500
22	Shri Chh Rajaram Sah Sakhara Karkhana Ltd	1984	2500
23	Rajarambapu Sah. Sakhar Karkhana Ltd.	1969	2500
24	Shri Tatyasaheb Kore Warana Sah. Sakhar Karkhana Ltd.	1994	7000
25	Kumbhi Kasari Sah. Sakhar Karkhana Ltd.	1964	3000
26	Vishwasrao Naik co-op sah. Sugar Factory	1968	2500
27	Hutatma Sah. Sakhar Karkhana	1981	3500
28	Jawahar Shetkari sahakari Sakhar Karkhana Ltd. Hupari	1990	9000
29	Vikasratna vilasrao Deshmukh Shetkari Sah. Sakhar Karkhana Ltd. Latur	1995	3500
30	Jarandeshwar Sakhar Karkhana Pvt. Ltd.	2010	2500

Source: sugar.maharashtra.gov.in [100]

This section outlines all the significant data analysis, operations carried out on data, generating the data explanations or interpretations from the analysed tables, understanding of new knowledge about existing information and EDP used in Sugar factories of Western Maharashtra. It includes testing of hypotheses which are stated in chapter three. For this research following various components are considered to analyze the data viz; sugar factory and details, Technical support staff deals with the hardware, software and network problem, Availability of Electronic Data Processing (EDP) managers etc. The units of analysis in this research are the various factories in terms of small capacity, medium capacity and large capacity. The capacity of Sugar Factories is presented in terms of TCD i.e. Tons of Cane per Day. The capacities are categorised in three ranges of TCD viz; Small capacity of Sugar Factories having capacity 1250-2500 TCD, medium capacity of Sugar Factories having capacity 2501-4000 TCD, large capacity of Sugar Factories having capacity 4001-9000 TCD. The primary components considered to analyze the data are sugar factory details, user background, hardware, software, network, security, communication for this research shown as below:

The capacity of Sugar Factories is presented in terms of TCD that is Tons of Cane per Day. The capacities are categorised in three ranges of TCD which is Small capacity of Sugar Factories having capacity of 1250-2500 TCD, medium capacity of Sugar Factories having capacity of 2501-4000 TCD, large capacity of Sugar Factories having capacity of 4001-9000 TCD. The primary components considered to analyse data are sugar factory and details, user background, hardware, software, network, security, communication for this research as shown below:

Table 2: Technical support staff who deals with the hardware, software and network problem

Table 2		Capacity			Total
		1250-2500	2501-4000	4001-9000	
Yes	Count	45	38	43	126
	% within Capacity	100.0%	100.0%	95.6%	98.4%
No	Count	0	0	2	2
	% within Capacity	0.0%	0.0%	4.4%	1.6%
Total	Count	45	38	45	128
	% within Capacity	100.0%	100.0%	100.0%	100.0%

INTERPRETATION

The above statistics show that total 98.4% technical support staff is available in small capacity, medium capacity and large capacity to deal with hardware, software and network problem. In respect of this concern almost all Sugar Factories are having the same situation. It indicates that all Sugar Factories have appointed sufficient technical support staff.

Hypothesis H1: There is a correlation between sufficient and technically sound workforce available and capacity of sugar factories.

Chi-Square Tests			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.747 ^a	2	.154
Likelihood Ratio	4.240	2	.120
Linear-by-Linear Association	2.867	1	.090
N of Valid Cases	128		

A Pearson Chi-Square Tests shows that there is no significant difference between availability of technical support staff who deals with the hardware, software and network problems and Sugar Factories (Chi square = 3.747, df=2, P=.154). Therefore above said **hypothesis H1 is rejected**.

3. OBJECTIVES

1. To study Sugar Factories and their IT/EDP Department.
2. To identify need and importance of EDP manager in Sugar Factory.
3. To specify role of EDP manager in Sugar Industry Domain.
4. To suggest scope for improvements in Sugar Industry Domain with respect to EDP manager availability.

TABLE 3 Availability Of Electronic Data Processing (Edp) Managers

Table 3		Capacity			Total
		1250-2500	2501-4000	4001-9000	
Yes	Count	26	17	16	59
	% within Capacity	65.0%	45.9%	38.1%	49.6%
No	Count	14	20	26	60
	% within Capacity	35.0%	54.1%	61.9%	50.4%
Total	Count	40	37	42	119
	% within Capacity	100.0%	100.0%	100.0%	100.0%

INTERPRETATION

The above table shows the role of EDP manager existing in Sugar Factories of small capacity (65.0%), medium capacity (45.9%) and large capacity (38.1%). EDP managerial role exists more in small capacity (65.0%) as compared to large capacity (38.1%), and medium capacity (45.9%).

Hypothesis H2: There is a correlation between role of EDP Manager and capacity of sugar factories.

Chi-Square Test	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.216 ^a	2	.045
Likelihood Ratio	6.295	2	.043
Linear-by-Linear Association	5.847	1	.016
N of Valid Cases	119		

There is a significant difference between Sugar Factories and the role of EDP manager (Chi square = 6.216, df=2, P=.045). Therefore above stated **hypothesis H2 is accepted**.

EDP managerial role is available more in small capacity as compared to large capacity. Basically there is need of EDP manager in each Sugar Factory to deal with the responsibilities of monitoring, controlling ICT activities in Sugar factories. However there is need of motivation for IT/Computer department users from their higher authorities or higher management.

4. Role and Responsibilities of Edp Manager in Sugar Industry

In fact, there are multiple responsibilities handled by EDP Manager along with his technical support staff in IT department of Sugar Factory. List of day to day operations is described as below:

1. Deals with hardware, software and network problem
2. Internal Stakeholders support by providing available ICT facilities
3. Hardware architecture used in Sugar Factories
4. Use of Database Software in Sugar Factories
5. Use of Operating System in Sugar Factories
6. Assist regarding use of new Technologies in Sugar Factories
7. Regular use of internet software/application support
8. Tracking of Software/applications under process
9. In house application development in Sugar Factories
10. Monitoring outsource technical facilities
11. Use & support of operating environment
12. Computer software performance
13. Satisfaction regarding existing software/applications
14. Justifying the productivity improvement with current software implementation
15. Setting type of Network used in Sugar Factories
16. Network speed
17. Network topology used for Sugar Factories

18. Data transmission media used in Sugar Factories
19. Tracking and monitoring regular use of internet
20. Network speed and reliability of data network services available
21. Uses of firewall, antivirus or other security settings for the network
22. Maintaining security logs regularly
23. Alerts in case of unauthorized access
24. Setting up internal IT Security Policies
25. Use of methods of internal IT Security Policies
26. Regular backup
27. Tracking computerized system events, activities, invitation, meetings & work schedules
28. Improvement in existing ICT services etc.

5. CONCLUSION

Every stakeholder inside Sugar Factory has his role and responsibilities as is clear from smooth conduct of day to day operations. There must be well experienced & skilled IT support as EDP Manager to deal with the responsibilities of monitoring and controlling the ICT activities to increase total productivity. All stakeholders must be given sufficient and required resources so that they can perform more satisfactorily within stipulated time. Also they should be aware of proper utilization of resources so that it will not effect total cost and also make work more productive. It has also been observed that though there is sufficient staff in all capacity Sugar Factories to handle ICT, there is need to have some standard policies regarding staff and their working. When all stakeholders are provided with required resources and are clear about their role and responsibilities, they have positive influence on day to day activities. With able leadership and their guidance sugar factories easily improve productivity, quality of work and proper utilization of resources.

The results mentioned in literature survey show that majority small capacity factories have EDP managers as compared to large and medium scale sugar factories. However, each and every sugar factory should adopt EDP management irrespective of its capacity as it has such a wide variety of roles which ensure growth of factory in long term.

6. REFERENCES

1. Pratibha M. Deshmukh, "An ICT framework for sugar industries administration in western Maharashtra", Ph.D Thesis published in 2019, <http://hdl.handle.net/10603/337476>.
2. Pratibha M. Deshmukh and Pallavi P. Jamsandekar, "Transformation through Communication System the Step in Sugar Industries Domain", *International Journal of Advanced Research in Computer and Communication Engineering*, 2019, volume 8, 202-207.
3. S. Hartono, R. Tjahyadi and C. Cassandra, "Analysis of Employee and Manager Self Service Module on SAP Portal (A Case Study Approach)," 2021 International Conference on Information Management and Technology (ICIMTech), 2021, pp. 93-98, doi: 10.1109/ICIMTech53080.2021.9535090. [4] C.R.Kothari, "Research Methodology Methods & Techniques", Reprinted 2nd revised Edition, New Age International (P) Ltd., publishers, 2007.
4. M. Jagemar and G. Dodig-Crnkovic, "Cognitively Sustainable ICT with Ubiquitous Mobile Services - Challenges and Opportunities", 2015 IEEE/ACM 37th IEEE International Conference on Software Engineering, Florence, 2015, pp. 531-540.
5. A. Biswas and S. Prakash, "Farming technology for India agriculture based sensorics and indicative systems", *Technological Innovation in ICT for Agriculture and Rural Development (TIAR)*, 2015 IEEE, Chennai, 2015, pp. 72-78.
6. J. Doshi, ICT based solutions for education in rural India- A case study, *Global Humanitarian Technology Conference (GHTC)*, 2014 IEEE, San Jose, CA, 2014, pp. 302-306.
7. V. Deshpande, R. Bhujade, S. Amin, R. Agarwal and S. Untawale, "Development of Employee Performance Management System Using Web Based Application," 2021 International Conference on Intelligent Technologies (CONIT), 2021, pp. 1-5, doi: 10.1109/CONIT51480.2021.9498300.

8. Ferdianto, L. S. Sanjaya and Titan, "Design of Employee Management Application for Small Medium Enterprise," 2021 International Conference on Information Management and Technology (ICIMTech), 2021, pp. 696-701, doi: 10.1109/ICIMTech53080.2021.9534990.
9. S. Yang and M. He, "The Mechanism of the Abusive Management Perception of State-Owned Enterprise Personnel on Work Performance based on SPSS," 2021 International Conference on Management Science and Software Engineering (ICMSSE), 2021, pp. 140-144, doi: 10.1109/ICMSSE53595.2021.00038.
10. S. Koshy, S. Husain and K. Kumar, "Agricultural information delivery mechanism using ICT: A case study from Kerala, India", 2015 IEEE International Symposium on Technology and Society (ISTAS), Dublin, 2015, pp. 1-3.
11. A. Abraham and M. B. Santosh Kumar, "A study on using private-permissioned blockchain for securely sharing farmers data," 2020 Advanced Computing and Communication Technologies for High Performance Applications (ACCTHPA), 2020, pp. 103-106, doi: 10.1109/ACCTHPA49271.2020.9213237.

Business Sustainability and Technology Obsolescence

Vivek Nerurkar

GNVS Institute of Management, India

ABSTRACT

Conducting, Maintaining and Ensuring sustainable growth of a business in this Digital Age creates opportunity for launching new product with reduced lead time because of availability of concepts like Product Lifecycle Management software, Automation, Analytics, Database Solutions and Telecommunication. At the same time challenge of shorter technology life cycle remains!

At this paradoxical juncture, it becomes imperative for businesses to monitor and anticipate technology life cycle. Technology, on the other hand, has been having a limited shelf life and businesses have to either enhance the life of technology or to switch to another one, depending on environment of the business.

With this back drop, emergence of Industrial Internet of Things (IIOT), also called as Industry 4.0, completely based on technology, needs to monitor Technology Obsolescence (T.O.) with extreme minute and accuracy. As on date, tools like "Technology S-curve", "Technology Road Mapping" tracks T.O.

Technology giant General Electrics (G.E. - Digital) has already taken a stance to capitalise on the opportunity to grow sustainably, through IIOT. Considering case of G.E- Digital with respect to IIOT, I shall discuss about further need of technology life cycle tracking tools, to mitigate potential risk, posed to such giant efforts like IIOT, due to T.O.

Keywords: Technological Obsolescence, S- curve, Technology Road Mapping, IIOT

1 INTRODUCTION

1.1 Digital Age

Supermarkets compete with insurance providers, energy companies offer credit cards and retailers offer energy discounts. Google, is today in direct competition with social networking sites, they have also moved into the mobile handset market, and even the online fashion market, leaving organisations in other industries wondering, or perhaps fearing, what Google will do next? The battle to 'own' the digital customer has been thrown wide open.

Digital channels lower barriers to entry and increase globalisation, leading to a spiral of intensifying competition and commoditisation. Innovative organisations are taking the opportunity to diversify, bringing cross-industry convergence and blurring of the boundaries between industries. Previously physically distinct products and sectors now compete with one another, over less clearly defined customer bases.

This is the Strength of "Digital Age".

The digital age, also called the information age, is defined as the time period starting in the 1970s with the introduction of the personal computer with subsequent technology introduced providing the ability to transfer information freely and quickly.

1.2 Digitisation

Digitisation or Digitising is the representation of an object, image, sound, document or signal (Usually an analogue signal) by generating a series of numbers that describe a discrete set of its points or samples. The result is called digital representation or, more specifically, a digital image, for the object, and digital form, for the signal. In modern practice, the digitized data is in the form of binary numbers, which facilitate computer processing and other operations, but strictly speaking, digitising simply means the conversion of analogue source material into a numerical format; the decimal or any other number system can be used instead.

Digitisation is of crucial importance to data processing, storage and transmission, because it "allows information of all kinds in all formats to be carried with the same efficiency and also intermingled". Unlike analogue data, which typically suffers some loss of quality each time it is copied or transmitted, digital data can, in theory, be propagated indefinitely with absolutely no degradation. This is why it is a favoured way of preserving information for many organisations around the world.

1.3 Industrial Internet of Things (IIOT)

In today's ever-changing and volatile market, manufacturers seek a single version of the truth that will help them make the right decisions for improving profitability, while at the same time mitigating risk as much as

possible. They wish to grow their profits and their organization, while ensuring safety for employees, the general public and the environment.

To obtain all of this, they need increased visibility and better insights into the performance of their equipment and assets. They need increased asset performance management software, which can provide them with answers on what equipment is most important, how it should be maintained and how unexpected failures can be avoided.

The Industrial Internet provides just that – and more – by transforming the way of how people and machines interact by using data, technology and analytics in new ways to drive efficiency gains, accelerate productivity and achieve overall operational excellence. These technologies enable industries to analyse their data more intelligently, optimize their operations, boost their productivity, and their flexibility. Ultimately, the Industrial Internet allows to combine brilliant machines with best-in-class analytics to deliver valuable new insights that were never before possible. The results of these powerful analytic insights can be revolutionary for the business by transforming its technological infrastructure, helping reduce unplanned downtime and maximize profitability and efficiency.

1.4 Technological Obsolescence-

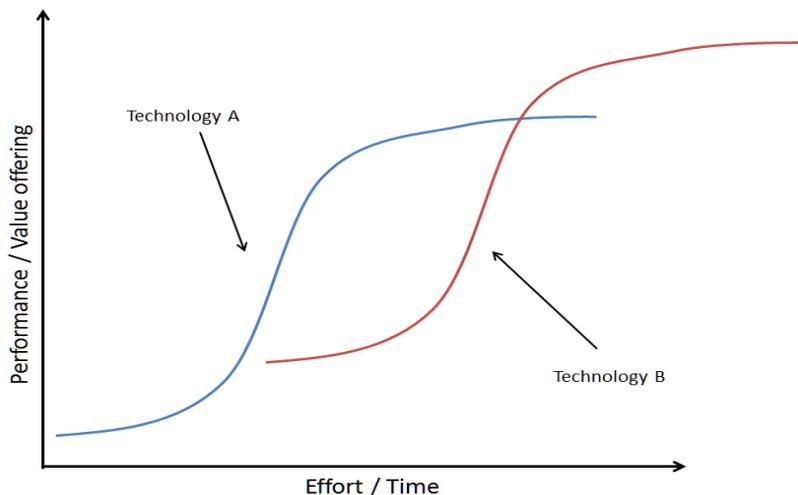
When a **technical** product or service is no longer needed or wanted, even though it could still be in working order. **Technological obsolescence** generally occurs when a new product has been created to replace an older version.

E.g. Even today, we can use cassette player to enjoy music, as against MP3 player. But issue arises when gadget is out of order. Maintaining the same cassette player i.e. required component, may not be available or required skill may be rare. This makes the out dated technology costlier.

1.5 Technology Obsolescence Mapping Tools

1.5(a) S- Curve:

The technology S-curve is a useful framework describing the substitution of new for old technologies at the industry level.



1.5(b) Technology Road Mapping:

Technology mapping is a form of Technology Planning. It provides information **to make better technology investment decisions** by identifying critical technologies and technology gaps and identifying ways to leverage R&D investments. Technology road mapping is an iterative process.

The technology road mapping process consists of three phases — preliminary activity, development of the technology roadmap, and follow-up activity

Preliminary activity includes: (1) Satisfy essential conditions. (2) Provide leadership/sponsorship. (3) Define the scope and boundaries for the technology roadmap

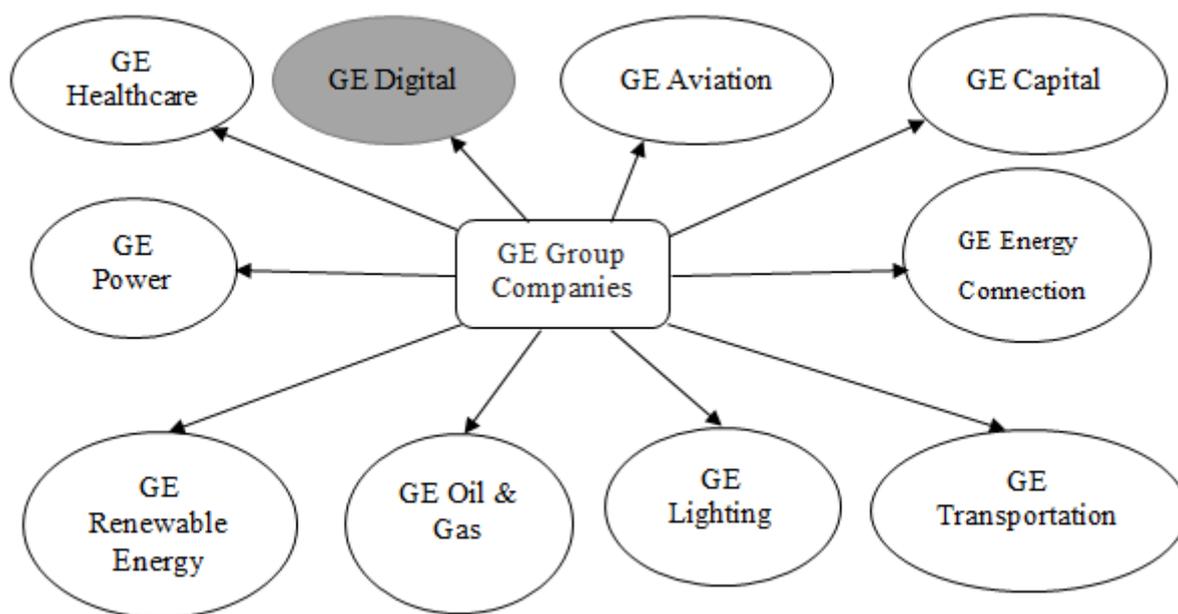
Development of the technology roadmap includes: (1) Identify the “product” that will be the focus of the roadmap. (2) Identify the critical system requirements and their targets. (3) Specify the major technology areas. (4) Specify the technology drivers and their targets. (5) Identify technology alternatives and their time lines. (6) Recommend the technology alternatives that should be pursued. (7) Create the technology roadmap report.

Follow-up activity includes: (1) Critique and validate the roadmap. (2) Develop an implementation plan. (3) Review and update.

2 ABOUT GENERAL ELECTRIC (GE):

GE is an American multinational conglomerate corporation incorporated in New York, and headquartered in Boston, Massachusetts. As of 2016, the company operates through the following segments: Power & Water, Oil and Gas, Aviation, Healthcare and Capital which cater to the needs of financial services, Medical devices, Sciences, Pharmaceutical, Automotive, Software Development and Engineering industries.

In 2011, GE ranked among the Fortune 500 as the 68th-largest firm in the U.S. by gross revenue, and the 14th most profitable. As of 2012, the company was listed the fourth-largest in the world among the Forbes Global 2000, further metrics being taken into account. The Nobel Prize has twice been awarded to employees of General Electric: Irving Langmuir in 1932 and Ivar Giaever in 1973.



G.E.Digital:

2.1 Brief about Company

GE Digital connects streams of machine data to powerful analytics and people, providing industrial companies with valuable insights to manage assets and operations more efficiently. World-class talent and software capabilities help drive digital industrial transformation for big gains in productivity, availability and longevity. The company do this by leveraging Predix, a cloud-based operating system, purpose built for the unique needs of industry.

2.2 Project IIOT by GE Digital



Based on the company's media blitz, its recent Minds & Machines event, and the mission of its leadership as driven and articulated by CEO Jeff Immelt, General Electric today has a singular focus. This is to use the Industrial Internet as a conduit to help manufacturers increase production efficiency, improve execution, and optimize their respective businesses through advanced analytics. The company's primary target appears to be to help industrial organizations solve two of the biggest challenges they face: improving overall asset performance and preventing or minimizing unscheduled downtime.

GE feels that the proof is in the success it has experienced in its own factories, where the company has applied advanced, real-time analytics to maximize manufacturing production performance. This involves leveraging the Industrial Internet of Things (IIOT) to collect, aggregate, and integrate data from design to service and leveraging analytics to support real-time decisions and actions. Many partnerships (with Cisco, IBM, and Microsoft) focus on reducing unscheduled downtime, deploying a framework of big Data, software, sensors, controllers, and robotics. This will ensure optimized industrial asset performance and availability.

E.g. GE's Digital Power Plant will enable the company's customers to harness information technologies to help optimize the underlying generation infrastructure and minimize environmental impact. GE anticipates savings of up to \$230 million for a new combined-cycle gas power plant and up to \$50 million for an existing combined-cycle gas-powered plant. As a major supplier of power generation equipment, GE has been able to combine a hardware and software solution to digitize complex power assets and systems. Once an entire power plant is digitized, it can deploy applications powered by the secure, cloud-based Predix industrial platform to help continuously improve assets and operations in the highly regulated power industry.

2.3 Indulgence of Technology

1. Big Data
2. Software
3. Sensors
4. Controllers
5. Robotics

3 ADVERSE IMPACT OF TECHNOLOGY OBSOLESCENCE (TO) FOR A COMPANY AND THE SECTOR, AT LARGE:

TO leads to

1. Higher costs of asset management
2. Legacy data conversion issues
3. Data Compatibility issues
4. Higher maintenance cost of electronic systems
5. System performance issues

In addition to these, small suppliers associated with big technology companies remain also at the risk of TO. Acquiring and adopting new technologies is a challenge, on one side, for small players. On the other side, to invest capital for compatible infrastructure for a certain technology poses a challenge for small businesses.

4 WAY OUT....

To understand, map and respond to technological obsolescence issues, as on date, we have very limited options available. Tools like Technology S-curve, Technology Road Mapping [discussed above 1.5 (a), (b)] are mainly adopted for the purpose. Within their limited scope, they are really benefiting the technology sector. But deep understanding of these tools, necessary skills to plot and derive a conclusion out of it, which will benefit the company and sector at large, commercially, is still uncertain.

Now, when many technology giants (G.E., IBM, Cisco, Tesla, and Google) are posed to capitalise upon the concepts like IIOT, which is hugely based on technology, the need to monitor and assess TO is felt with more intensity. The successes of these giants are equally contributed by small suppliers, associated with them.

Hence a need of more exhaustive and inclusive tool for mapping TO is felt, as technology lifecycle is getting shortened at faster rate than ever before [exhibit1]. This tool will help the businesses to predict technology life cycle, take corresponding action, and manage the life cycle, at proper juncture. Also it can project a seamless switching to new technology, in future, in a predictable and cost effective way.

5 CONCLUSIONS

An immense need is felt, after learning TO and special case of General Electric Digital with special focus on IIOT that, a tool is to be devised to monitor and predict TO. That will further help to decide whether to extend life of existing technology or to switch to new one, to remain competitive and make profit. It will further help small industry players to mitigate technology obsolescence cost.

6 BIBLIOGRAPHY

1. **Book:** Innovation Management by Maital, Seshadri, Sage Publication, 2007
2. <http://www.businessdictionary.com/definition/technological-obsolescence.html>
3. <http://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/strategic-principles-for-competing-in-the-digital-age>
4. <http://www.changefactory.com.au/our-thinking/articles/benefits-digitisation/>
5. <http://new.abb.com/about/technology/iotsp>
6. <https://en.wikipedia.org/wiki/Digitizing>
7. [https://www.ge.com/digital/sites/default/files/GE%20Industrial%20Internet%20of%20Things%20Journey%20\(1\).pdf](https://www.ge.com/digital/sites/default/files/GE%20Industrial%20Internet%20of%20Things%20Journey%20(1).pdf)
8. <https://www.ge.com/digital/content/meet-our-ecosystem>
9. <http://www.citylab.com/tech/2016/02/general-electric-cfl-led-light-bulb/459804/>

Exhibit1:

PRODUCT	Time from invention to commercialization
Electric motor	65 years
TV	52 years
Vacuum tube	33 years
Zip fastener	30 years
X- ray tube	18 years
Frozen foods	15 years
Nuclear reactors	10 years
RADAR	5 years
Solar batteries.	3 years
C.D.	12 years
USB flash drive	1 year

Covid-19 Machine Learning Based Data Analysis: A Literature Review

Manisha Shinde Pawar¹, Deepali Gala², Bhaskar Patil³ and Rajesh Kathe⁴

¹Institute of Management and Rural Development Administration, Bharati Vidyapeeth (Deemed to be University), Sangli, India

^{2,3,4}Institute of Management, Bharati Vidyapeeth (Deemed to be University), Kolhapur, India

ABSTRACT

Covid-19 triggered to researchers to come up with investigation for immediate solutions to address the pandemic problem and technical analysis could help strategic management and decision making for medicinal decisions also it need basis of domain strategies. This review of literature focuses literature investigation in systematic form to trace gap and to study framework. It explains mainly Research Motivation behind study, Literature Survey, Research Gap identified, Rationale of the study, and Significance of the study, Statement of the Problem, Objectives of said Research Work, also Orientation of the Research Work and explains different Software Used for Design and implementation of methods for COVID-19 Data Analysis.

Keywords: COVID-19 Data Analysis, Machine Learning, Medicinal Decisions, Review of Literature.

1. RESEARCH MOTIVATION

Amplified After studying all this situation of COVID-19, one can judge the future impact of such viral infections. Main challenge of Covid-19 is that the symptoms are changing from patient to patient as days passes so it's very difficult to set line of treatments. And also new trends are found in European countries.

So, there should be an ICT based model that will take patient data as an Input and after processing that data it should generate some results which could be useful for the doctors for deciding future line of treatment for patient based on the patients' health condition or severity of Infection.

So, The Researcher has identified some technical challenges for analysis of data through preliminary investigation and observation. To explore unfamiliar, exploration of new patterns and to scrutinize exceptions, incidents, cases by using strategic, structured and organized value mining to reach at sound decision is motivating potency for research in COVID 19.

To deal with vague data, fuzzy logic has played vital role in different domains. So, by considering the need of COVID research and treatment different analysis tools and algorithms for COVID can be focused to design in an action on existing data.

2. LITERATURE REVIEW

To understand the concept in depth, literature review is performed. Further the reviews are classified on the basis of its application and thus the following six categories were obtained.

- COVID 19
- Measures of Interestingness
- Fuzzy Based Analysis Algorithm COVID 19 treatment
- Machine Learning based analysis COVID 19 treatment
- PCA for COVID 19 treatment
- Analysis using R.

2.1 COVID-19

Authors have discussed about Chinese experience of dealing with COVID-19 cases for COVID-19 prevention and Management [R-6]. Enforcement of drastic quarantine measures were proactive measures to control the infection rate and delays resulted in death tolls. Researchers [R-1] explored the impact of **vital signs, chronic disease, preliminary clinical data, and demographic features** to predict mortality and survival. Grid search technique was applied for parameter optimization. Researchers suggested model needs improvement for multiple datasets. Authors suggested that, both population-wide and custom-made approaches should be developed as infectious diseases have **diverse infectivity, incubation time, transmission mode**, and will lead to different signs dependent on the host [R-11].

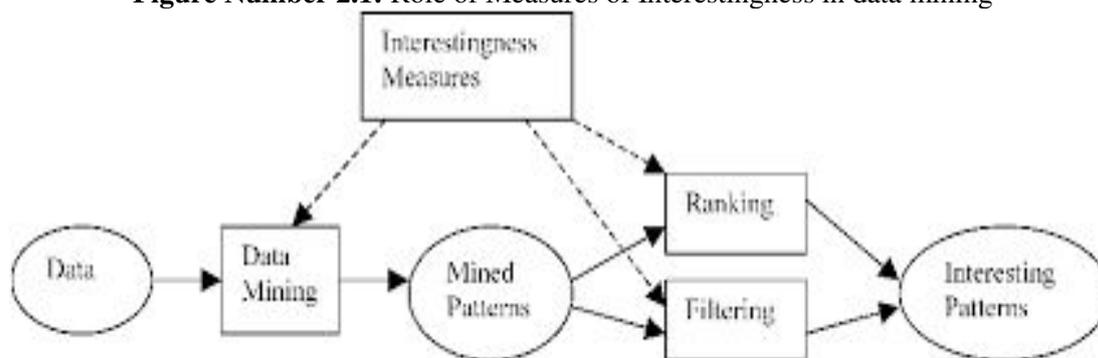
For future work authors suggested [R-22], if data sets can be gathered by researchers or WHO organization or based on personal efforts to include symptoms and other information of suspects of COVID-19, researcher can diagnose that new Coronavirus. Secondly, this classification can be further improved if other **symptoms like loss of taste and smell, a rash on the skin**, etc., are considered.

Authors revealed that [R-19] several studies are being conducted to overcome this lethal disease caused by Coronaviruses. These clinical specimens were subjected to **genetic, serological, and biochemical testing**. For further processing, several characteristics are collected from clinical samples, and also the **CT-lung screening** speeds up the process and aids in identifying people who have been infected with the coronavirus. Based on this, the COVID test is performed, the genuine **positive, negative, and false positive, negative** are separated, and the accuracy, precision, recall, and F1-factor are calculated.

Authors explained that, FL is a viable classifier that can be used for COVID-19 diagnosis because of the following reasons; (i) FL is **powerful, simple, flexible, fast, and appropriate** to the real world applications, (ii) FL can handle problems with **imprecise and incomplete data**, hence, it can make accurate predictions even with small amount of training data, (iii) FL is **less sensitive to missing data**, it is also resistive resistance to noisy data which avoids over-fitting the dataset, and (iv) when new data or rules are added to the system, there is **no need to re-train** the system, mainly just adding new rules (besides rule conflict check). Authors also suggested future work; the element of uncertainty is one of the biggest challenges in this field. **Studying the input uncertainty** simulation with input distributions that are based on real-world data.

2.2 Measures of Interestingness

Figure Number 2.1: Role of Measures of Interestingness in data mining



Source: [7]

Probability Based Objective Interestingness Measures for Rules [7], as depicted in figure number 2.2 Data mining process identifies interesting relationship with measures of interestingness to evaluate, rank and filter patterns of outcome obtained. Author suggested some key aspects to identify and apply suitable measures of interestingness based on probability, association or classification for data mining as shown in table number 1.

Table Number 2.1: measures of interestingness

Support	Leverage	Klogsen	J-Measure
Confidence/ Precision	Added Value/ Change of Support	Conviction	One-Way Support
Coverage	Relative Risk	Dependency	Two-Way Support
Prevalence	Jaccard	Collective Strength	Two-Way Support Variation
Recall	Certainty Factor	Laplace Correction	Loevinger
Specificity	Odds Ratio	Gini Index	Piatetsky-Shapiro
Accuracy	Yule's Q	Goodman and Kruskal	Cosine
Lift/Interest	Yule's Y	Normalized Mutual Information	Loevinger

This experiment [R-26] shows application of measures of interestingness and association rules for cluster analysis. Authors explained that, pruning of rules needs proper rules ranking, selection and association analysis for identifying representative rules as it is very complex process and can affect result. Author suggests pruning and efficiency classification for future work.

Author has studied [R-15] different 53 objective measures for associative rule classification. Number of rules may lead in repetitive result conditions so reducing rules can lead in improved result. The observation of

experiment shows that no standard single measure can be identified for classification and few set of measures have same impact and effectiveness, so one representative measure from resultant clustering of measures improves results. Author indicates that relevant feature or data set may direct right measure to apply.

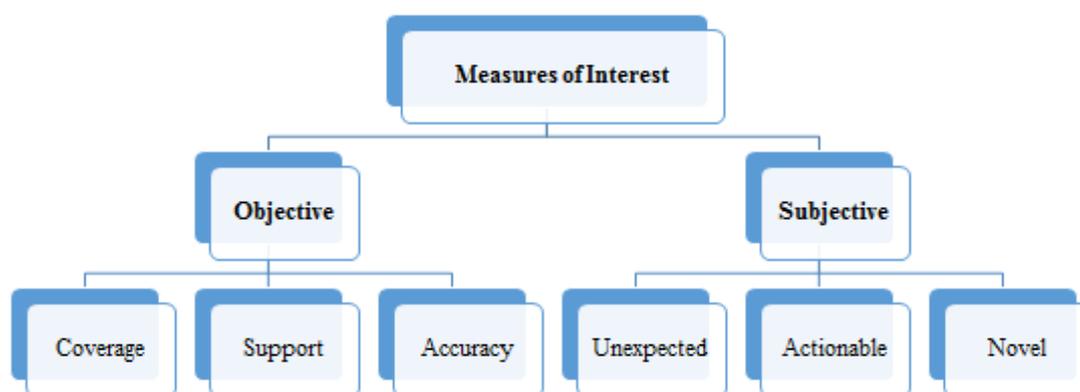
In this paper[R-6] authors have proposed a methodology for evaluating interestingness measures for closed itemset selection. The study gives comparative analysis of different measures of interestingness and evaluates to selection of suitable measure with ranking and classification techniques. Authors have mainly studied 3 measures as leverage, stability and difference measure. The study was performed to examine up to what extent measure evaluation matches to expert's evaluation for different datasets. Finally, author concluded with stability as better measure over other two leverage and difference.

According to author [R-37], there are different measures of interestingness for data mining real world applications, so part of author's work also focuses effectiveness of measures on real world application with web usage mining based application for information retrieval and management over internet, intranet and extranet. Author also analysed effectiveness of measures of interestingness with association rules, relationships among measures and rules and pruning of rules.

Ken defined about Pattern as: [R-24]

“Given a set of facts (data) F, a Language L, and some measure of certainty C, a pattern S is a statement S in L that describes relationships among a subset Fs of F with certainty C, such that S is simpler (in some sense) than the enumeration of all facts in Fs”

Figure 2.2: Taxonomy of Measures of Interest



Source: Compiled by Ken MCGarry (2005) [R-23]

“The interestingness (I) of a rule is defined by its support (S), confidence (C) and knowledge of common sense rules (κ) and is given by $I = f(S, C, \kappa)$. The relative entropy measure given by $D(p(x) || q(x))$ computes the differences in probability distributions when $q(x)$ is $p(x)$.”

According to author separation of subjective and objective measures can overcome knowledge acquisition problems with different aspects of evaluation. And if prior idea about patterns association is there then the prior knowledge about event can lead in better judgments and evaluation measures. Goal driven subjective measures approach only focuses to set assumption and ignores to unset and unforeseen patterns and relations. So the statistical measure can be combined with correlation measure to get improvement.

2.2 Fuzzy Based COVID-19 Treatment

[33] Fuzzy classification applied by authors and identified more refined multi-valued classes.

2.3 Machine Learning for COVID-19 Treatment

After carrying systematic review of 15 different papers authors [R-4] found that, the **use of an efficient machine learning based clinical decision support system for arboviral diseases can improve the quality of the entire clinical process, thus increasing the accuracy of the diagnosis and the associated treatment.** And **current research for clinical data is limited to the three most common infections—Dengue, Chikungunya and Zika.**

According to authors [R-7], the application of AI algorithms on covid-19 research is at its infancy and there is still much room for improvement and new areas that AI can be used in tackling the problem. There has been

some works that use evolutionary algorithms to solve them. Studying the fitness landscape of these problems can be helpful to better understand these problems and thus develop more successful algorithms. This pandemic will one day be over; however, its future impact on economy, global health, education, manufacturing, political relations, etc. will remain. It is important to know how the problems caused by the disease would look like in future to be able to plan strategies from now as they may be easier to cope with at their infancy. According to authors[R-15], world's critical situation in the current pandemic demands for more comprehensive and optimized ML approaches for medical treatment research, patient care, resource management and there is need of **Emergency ML** to support in the shocking consequences.

After Applying ML to number of clinical reports [R-17] [R-19], researchers could classify these reports into four classes and showed improved results of performance measures of interestingness as accuracy, precision, recall and f-score and suggested improvement for better version of ML models with focus on feature engineering and deep learning for future work. The recent publications about applications of ML approaches to COVID 19 suggested that advancement in Models can prevail most effective and accurate in managing and treating information, medical cost, and other parameters. Application of ML as intelligent systems can be advanced to mark independent decisions in pandemic to support medical practitioners [R-16].

[R-14]The study findings show that in view of the existence and dimension of the dataset, ES performs better in the current forecast domain. LR and LASSO have both been effective in estimating and verifying the death rate to some degree. The mortality rate will rise in the next few days and the survival rate will decline according to the effects of both models. In research study, predictor features obtained from patients first day of admission were divided into invasive laboratory tests and non-invasive demographic and clinical data. The framework of this study could be tested in other acute respiratory infectious diseases to investigate the feasibility of mortality prediction via ML modeling of non-invasive features. [R-12] After studying current ML applications for range of clinical outcomes, prediction, diagnosis and reporting performance, authors Suggested need of improvement in ML applications especially in diverse health settings, primary care and routine clinical care environments [R-13].

This study [R-3] aimed to assess the utility of machine-learning algorithms for predicting outcome of patients with non-critical COVID-19 based on clinical parameters on admission. We found clear difference between patients who developed later critical vs. non-critical COVID-19, mainly in **vital signs (respiratory rate and room-air oxygen saturation) and inflammation markers (blood WBC, neutrophil counts and CRP)** and in the APACHE II score that combines these makers. Authors assessed clinical, hematological and biochemical parameters at admission. [R-2] The prognosis of COVID-19 is largely dependent on various factors that include **the patient's age, the severity of illness at presentation, pre-existing conditions, how quickly treatment** can be implemented, and response to treatment.

Severity Level: Most of the datasets used to have two labels for the possible output classes (i.e., infected or not infected) [R-39]. Authors suggested need to have a dataset that is annotated to show the severity level of the illness to monitor patient healing progress. **Effect on different body organs:** Most of the studies rely on investigating lung or chest images to predict the infection with COVID-19. Other organs affected by the virus need to be investigated further as this may ease the virus detection and reduce the risk of being infected and not knowing that. Monitoring **Patient History, Vaccine status, Lifespan of virus, effect on body** these findings can help to identify and prevent patterns.

2.4 PCA for COVID 19 Treatments

In PCA Analysis of data populated [R-40], Authors identified largest cluster having around 53% data components of COVID patients with features insights as oldest age, less immunity, and less albumin levels, whereas very less only 9% data captured in group of third cluster represented data of patients who were having very young age and high immunity power features. Authors[R-9] compared different countries and spread rate in high risk countries also suggested classify COVID-19 data using factor analysis for other countries.

2.5 Analysis Using R.

The impetration of COVID-19 data research using R mentioned limitation of large corpus volume, which can be handled by using machine learning methods available in R[R-21].

LITERATURE SUMMARY

The Literature review presented in this chapter embodies mainly the framework of COVID-19 Data Analysis and application of soft computing techniques for pre-processing, standardisation process and methods that is to bring data to normal or regular form data contents such as symptoms, O₂ level, age, lab results, severity levels

and to analyse this data from the text obtained to support medical stakeholders with computerised decision-making abilities. COVID-19 Impact analysis process is studied with different categories of COVID-19 Impact as depicted in table no. 2.2. Different advanced techniques like machine learning based, cluster based and fuzzy based different approaches are discussed exploring strength and weakness of each method for classification, prediction and grouping study. So the researcher carved out that pattern detection, learning based prediction, hybrid or/and optimised techniques integrated with statistical methods can lead in improved COVID-19 Impact analysis approach.

3 RESEARCH GAP

After going through the preliminary research investigation, it seems as problem is very recent, very less work is addressed so more reliable and innovative machine learning- models can be developed. So, it is challenging to the world to come out with the solutions which is attracting academicians and researchers to address the problem with some immediate solutions. Existing Research shows, two possible classes infected and non-infected, but multiple classes can be formed to plan precise patterns of treatments. Severity level and recurrence of COVID-19 infection is needed to be addressed as parameters or determinants of infection. Amongst so many parameters dominant parameters need to be traced to focus separately.

4 STATEMENT OF THE PROBLEM

Since 2019 COVID has disturbed human life in entire world. People are facing problem to continue their routine life. Due to COVID-19 disease, healthcare sector also facing resource and management limitations while taking medical decisions for treatment and care. So, in order to cope up with the phase of viral disaster every related field research needs immediate research solutions to support medical stakeholders. In order to discover insights from available voluminous COVID-19 data of hospitals investigator proposed to study and provide improvement in technological solutions in form of application of machine learning to respiratory viral disease and focused to identify constraints of decisions in form of input parameter, fuzzy patterns, associations (relevance analysis), cluster and dominance groupings, and to predict future concerns in COVID-19 dataset studied. Investigator also planned to research blend of fuzzy genetic machine learning based to predict patient's data results.

5 TITLE OF THE RESEARCH WORK

The researcher aimed to address the algorithmic approaches to COVID-19 data analysis by proposing study titled, "**Application of Machine Learning to Respiratory Viral Infections diseases: Treatment and Decision making**"

6 CONCLUSIONS

The Researcher performed Review of Literature to track requirements of study, to track framework and challenges, which formed basis for researcher to enhance subject insights. The investigator has studied 4 books, 41 research articles from prominent papers, 4 thesis dissertations, 6 reports, 3 conference papers and workshop details and many website publications to review the field of problem. This literature investigation facilitated to avoid duplication of investigation problem and to come up with Original idea and problem specification.

The literature survey traced the research gap and procedural gap which doesn't considered application of evolutionary approach- fuzzy-genetic-machine learning algorithm which if applied with dynamic fuzzy range inputs membership according to data spread for iteration may lead in new technique leading in noteworthy for the application of machine learning to infectious diseases data for proper and timely patient's treatment and care. COVID-19 has drawn attention of all researchers towards the pandemic and viral disease control, treatment and care related research. So investigator can see the challenge in extracting knowledge to support medical decisions by processing huge data being generated of various types. Idea of voluminous, real-time, near-time data as a service makes ground rationalising intent of study in the area of application of machine learning to respiratory disease especially COVID-19 data.

This method also shortened analysis of efficacy using measures of interestingness and the challenges of voluminous heterogeneous data pre-processing using fuzzy and cluster formation whereas machine learning addresses to pattern learning, prediction of results and evolutionary fuzzy genetic machine learning logic application in genetic stage optimised fuzzification helps to categorise dynamic inputs and to determine fitness approximation comparing for proper decision base for different dynamically constructed ranges with training dataset and testing dataset for prediction.

Fuzzy approach gives simplification and improvement in processing logic and speed applied to Data analytics and testing of algorithm for different business purposes may be future research domain. Significant COVID-19

analytics can help to predict the future consequences to take enhanced self-ruled decisions, to recognise and design pattern in data spread to design strategic policies.

This review of literature is considered to fortify understandings, interpretation, result analysis and findings.

7. ACKNOWLEDGEMENT

The Research work (Principal Author Dr. Manisha Shinde-Pawar) was financially supported by Bharati Vidyapeeth (Deemed to be University), Pune, Institute of Management and Rural Development Administration, Sangli.

8. REFERENCES

1. Aljameel Sunayh, Khan Irfan, Aslam Nida, Aljabri Malak, Alsulmi , “Machine Learning Based Model to predict the disease Severity and Outcome in COVID 19 Patients, “Scientific Programming, Vol 2021
2. Assaf, D., Gutman, Y., Neuman, Y. et al. Utilization of machine-learning models to accurately predict the risk for critical COVID-19. *Intern Emerg Med* 15, 1435–1443 (2020). [https:// doi. org/ 10. 1007/ s11739-020-02475-0](https://doi.org/10.1007/s11739-020-02475-0)
3. Aydin N., Yurdakul G. Assessing countries’ performances against COVID-19 via WSIDEA and machine learning algorithms. *Appl. Soft Comput.* 2020; 97:1–18. Doi: 10.1016/ j.asoc. 2020. 10679. Elsevier.
4. Cascella, M., Rajnik, M., Aleem, A., Dulebohn, S. C., & Di Napoli, R. (2022). Features, evaluation, and treatment of coronavirus (COVID-19). *Statpearls* [internet].
5. Ayoubkhani D, Khunti K, Nafilyan V, Maddox T, Humberstone B, Diamond I et al. Post-covid syndrome in individuals admitted to hospital with covid-19: retrospective cohort study *BMJ* 2021; 372 : n693 doi: 10.1136/bmj.n693
6. Debnath, S., Barnaby, D.P., Coppa, K. et al. “Machine learning to assist clinical decision-making during the COVID-19 pandemic”. *Bioelectron Med* 6, 14 (2020). <https://doi.org/10.1186/s42234-020-00050-8>
7. Khanday, A.M.U.D., Rabani, S.T., Khan, Q.R. et al. (2020) “Machine learning based approaches for detecting COVID-19 using clinical text data”. *Int. j. inf. tecnol.* 12, 731–739 (2020). [https:// doi.org/ 10.1007/s41870-020-00495-9](https://doi.org/10.1007/s41870-020-00495-9)
8. Mohammad Sadeq Mottaqi, Fatemeh Mohammadipanah, Hedieh Sajedi (2021), “Contribution of machine learning approaches in response to SARS-CoV-2 infection, *Informatics in Medicine Unlocked*”, Volume 23, 2021, 100526, ISSN 2352-9148, [https:// doi.org/ 10.1016/ j.imu.2021.100526](https://doi.org/10.1016/j.imu.2021.100526). ([https:// www.sciencedirect.com/science/article/pii/S2352914821000162](https://www.sciencedirect.com/science/article/pii/S2352914821000162)).
9. Muhammad, L.J., Algehyne, E.A., Usman, S.S. et al.(2021) “Supervised Machine Learning Models for Prediction of COVID-19 Infection using Epidemiology Dataset”. *SN COMPUT. SCI.* 2, 11 (2021). <https://doi.org/10.1007/s42979-020-00394-7>
10. N. Peiffer-Smadja, T.M. Rawson, R. Ahmad, A. Buchard, P. Georgiou, F.-X. Lescure, G. Birgand, A.H. Holmes(2020), “Machine learning for clinical decision support in infectious diseases: a narrative review of current applications, *Clinical Microbiology and Infection*”, Volume 26, Issue 5, 2020, Pages 584-595, ISSN 1198-743X, [https:// doi.org/ 10.1016/ j.cmi. 2019.09. 009](https://doi.org/10.1016/j.cmi.2019.09.009). ([https:// www. sciencedirect. com/ science/article/pii/S1198743X1930494X](https://www.sciencedirect.com/science/article/pii/S1198743X1930494X))
11. Said Agrebi, Anis Larbi(2020), “Use of Artificial Intelligence in infectious diseases.”, *Artificial Intelligence in Precision Health*, Academic Press, 2020, Pages 415-438, ISBN 9780128171332, [https:// doi.org/ 10.1016/ B978-0-12-817133-2.00018-5](https://doi.org/10.1016/B978-0-12-817133-2.00018-5). ([https://www. sciencedirect.com/ science/ article/ pii/ B9780128171332000185](https://www.sciencedirect.com/science/article/pii/B9780128171332000185))<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7153335/>
12. <https://www.datarevenue.com/en-blog/machine-learning-covid-19>
13. Osaka University. "Sorting out viruses with machine learning." *ScienceDaily*, 11 November 2020. <https://www.sciencedaily.com/releases/2020/11/201111102641.htm>
14. <https://oig.hhs.gov/oei/reports/oei-06-20-00300.pdf>
15. <https://www.commonwealthfund.org/publications/2020/apr/impact-covid-19-outpatient-visits>

THESIS:

1. Christian Infante (2017), “Development of Machine Learning Algorithms for Screening of Pulmonary Disease”, MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

2. Filip Velickovski(2016), “Clinical Decision Support for screening, diagnosis and assessment of respiratory diseases: Chronic Obstructive Pulmonary Disease as a use case”, University of Girona
3. Manisha Shinde (2020),” Effectiveness Fuzzy based Sentiment Analysis in measuring impact of Social Media with special reference to Facebook and Twitter”, Bharati Vidyapeeth (Deemed to be University), Pune

Synthesis and Characterisation of Pb (II) Complexes with Some New Mixed Thia-Aza-Oxo-Macrocyclic Schiff Base Ligands

Arpit Srivastava*, Ashish Rajak, Subhash Chandra Shrivastava and Shekhar Srivastava

Synthetic Inorganic and Metallo-Organic Research Laboratory, Department of Chemistry, University of Allahabad, Prayagraj, UP- 211002, India

ABSTRACT

Thirty new complexes of Pb (II) of the type $[PbX_2L^{1-10}]$ (where X = Cl or Br or I and L^{1-10} = new mixed thia-aza-oxo-macrocyclic Schiff base ligands derived from condensation of thiodiglycolic acid and different aliphatic diammines in 2:2 molar ratio) have been synthesized and also characterized by elemental analysis, molar conductivity, infrared and XPS (X-Ray photoelectron spectra) data. An octahedral geometry was also established for them.

Keywords: Mixed thia-aza-oxo macrocyclic Schiff base ligands, Lead (II) Complexes, Infrared spectra, XPS (X-Ray photoelectron spectra).

INTRODUCTION

During last few decades, inorganic and bioinorganic chemists are interested in the macrocyclic, macroacyclic, compartmental macrocyclic ligands and their transition metal and lanthanides complexes due to their vast utilizations¹⁻⁷⁹. Very recently very few research paper on Pb (II) with macrocyclic ligands have been published⁸⁰⁻⁸⁹. Recently we have synthesized and characterized $[PbX_2L^{1-10}]$ complexes (where X= Cl/Br/ NO_3 and L = macrocyclic Schiff base ligands which are derived from trimestic acid or terephthalic acid or squaric acid and different aliphatic diammines⁹⁰. In the continuation of our this research paper, we synthesis and characterized of Pb (II) complexes with some new mixed thia-aza-oxo-macrocyclic Schiff base ligands.

EXPERIMENTAL

The chemicals thiodiglycolic acid (BDH); $NH_2(CH_2)_2NH_2$ (BDH); $NH_2(CH_2)_3NH_2$ (BDH); $NH_2(CH_2)_4NH_2$ (BDH); $NH_2(CH_2)_5NH_2$ (BDH); $NH_2(CH_2)_6NH_2$ (BDH); $NH_2(CH_2)_7NH_2$ (BDH); $NH_2(CH_2)_8NH_2$ (BDH); $NH_2(CH_2)_9NH_2$ (BDH); $NH_2(CH_2)_{10}NH_2$ (BDH); $NH_2(CH_2)_{12}NH_2$ (BDH) and methanol (BDH) were used after purification after that dried as given in literature⁹¹⁻⁹². Solvents were distilled and dried prior to use. Melting points (MP) were determined by digital melting point apparatus and were uncorrected. The elemental analysis for C, H, N and Pb were regulated on a semimicro scale at Central Drug Research Institute (CDRI), Lucknow (UP) India. Molar Conductance of all these compounds were computed at room temperature (RT) in DMF by Design Electronic Conductivity Bridge. Infrared spectra of all these compounds were recorded in KBr and CSI on Perkin- Elmer 457 spectrometer apparatus. The X-Ray photoelectron spectra (XPS) were recorded on Kratos analytical Axis Supra ESCA instrument equipped with monochromatized AlK_{α} (1486.6 eV) source. All these peaks were rectified for charging with reference to C1s peak 284.8 eV and fitted with Shirley background and a amalgamation of Gaussian and Lorentzian line- shape, using ESCApe software⁹³⁻⁹⁴.

Preparation of $[PbX_2L^{1-10}]$ Complexes: In thiodiglycolic acid (2 mmol) in 50ml dry methanol (MeOH) added different aliphatic diammines (2mmol) i.e., $NH_2(CH_2)_2NH_2$ or $NH_2(CH_2)_3NH_2$ or $NH_2(CH_2)_4NH_2$ or $NH_2(CH_2)_5NH_2$ or $NH_2(CH_2)_6NH_2$ or $NH_2(CH_2)_7NH_2$ or $NH_2(CH_2)_8NH_2$ or $NH_2(CH_2)_9NH_2$ or $NH_2(CH_2)_{10}NH_2$ or $NH_2(CH_2)_{12}NH_2$ and refluxed for 3hrs. The obtained precipitate was filtered and then recrystallized into benzene: pet-ether (9:1) and air- dried (Fig.-1).

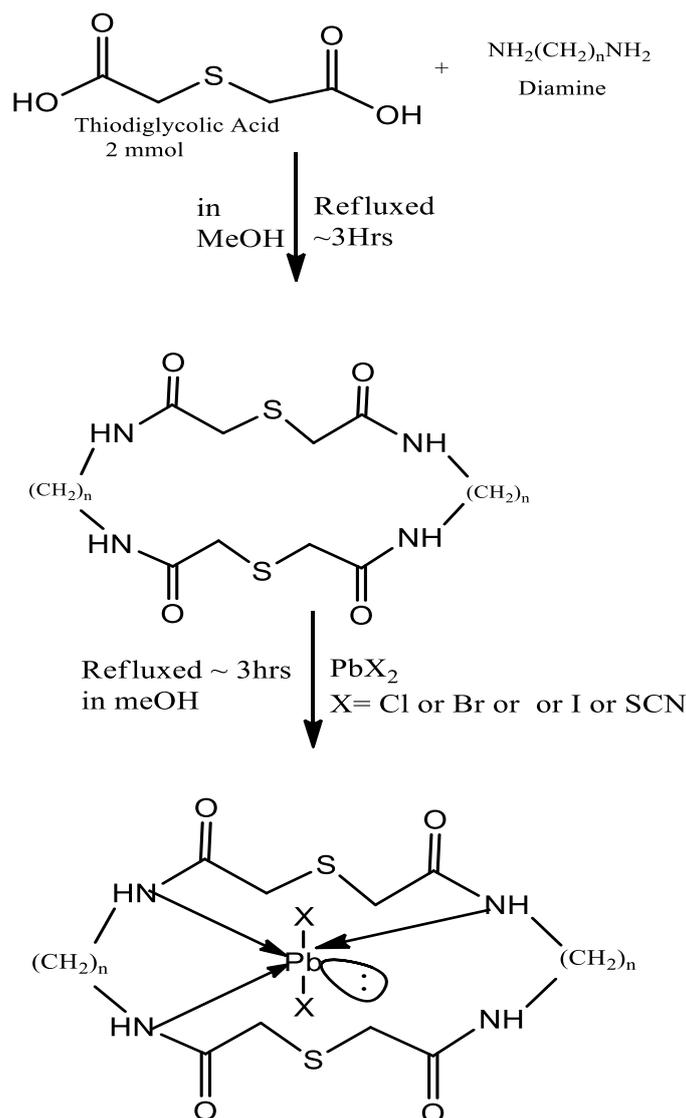


Fig.-1: Preparation of [PbX₂L] complexes (where n = 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 12)

RESULT AND DISCUSSION

All these prepared complexes [PbX₂L¹⁻¹⁰] (where X=Cl/Br/I and L¹⁻¹⁰ mixed thia-aza-oxo-macrocyclic Schiff base ligands i.e., L¹ or L² or L³ or L⁴ or L⁵ or L⁶ or L⁷ or L⁸ or L⁹ or L¹⁰) are white solids. The elemental analysis for C, H, N and X=Cl or Br or I were found within ±0.5%. The molar conductivity of all these prepared complexes were observed below than 20-40 ohm⁻¹cm²mol⁻¹ in DMF solution at room temperature concluded that all these prepared complexes are nonelectrolyte⁹⁵. The presence of sharp IR band in the range of 480-490 cm⁻¹ concluded the formation of ν_{Pb-X}⁹⁶⁻⁹⁹. Far-IR region at 430-470cm⁻¹ have shown a sharp IR band due to presence of ν_{Pb-N} vibration concluded the presence of the imine nitrogen to the lead metal ion¹⁰⁰. The binding energy (eV) of PbX₂ and [PbX₂L¹⁻¹⁰] metal complexes (where X=Cl/Br/I and L¹⁻¹⁰ i.e., mixed thia-aza-oxo-macrocyclic Schiff base ligands) for Pb3d_{3/2,5/2} and N1s photoelectron peaks are recorded in Table-1 and shown in Figs.-2 & 3. It was found that binding energies (eV) of Pb3d_{3/2,5/2} in starting material PbCl₂ or PbBr₂ or PbI₂ were ~587.8 eV – 587.4 eV and Pb3d_{5/2} ~ 485.8 – 485.4 eV: higher than in complexes [PbX₂L¹⁻¹⁰] Pb3d_{3/2} = 586.8- 586.4 eV and Pb3d_{5/2} = 484.8 - 484.4 eV. These XPS data concluded that the electron density in lead metal is more in complex [PbX₂L¹⁻¹⁰] than PbX₂ since coordination (Fig.-2) Table-1⁹³⁻⁹⁴. In all these [PbX₂L¹⁻¹⁰] complexes N1s photoelectron peaks in 1:3 intensity ratio, one weak intensity on same position as in each ligand and another higher intensity photoelectron peak with regard to higher binding energy side than ligand N1s photoelectron peak, concluded. One nitrogen atom is uncoordinated and rest three out of four nitrogen are coordinated to lead metal ion⁹³⁻⁹⁴. The S2p and O1s photoelectron peaks were observed at 166.2 eV and 531.2 eV respectively in each ligand which were present at same position in each metal complex [PbX₂L¹⁻¹⁰]; confirmed that there is no involvement of sulphur and oxygen atom in coordination within each [PbX₂L¹⁻¹⁰] complex⁹³⁻⁹⁴. In each [PbX₂L¹⁻¹⁰] complex, Pb3s photoelectron peak were observed symmetrical i.e., each complex has not shown multiple splitting, suggesting each complex is diamagnetic⁹³⁻⁹⁴.

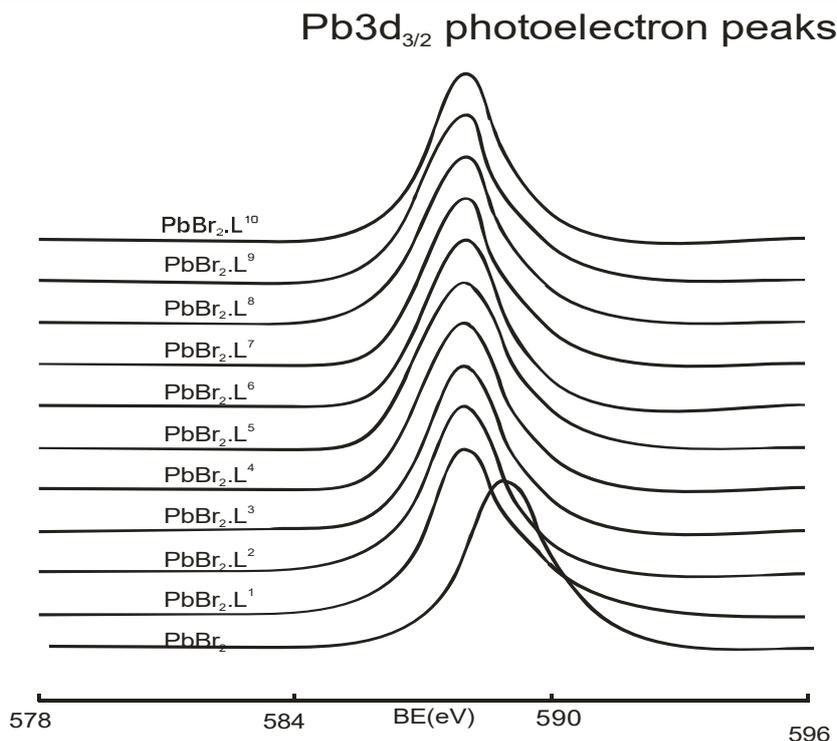


Fig.-2: Pd3d3/2 binding energies (eV) in PbBr₂ and [PbBr₂(L¹⁻¹⁰)] complexes

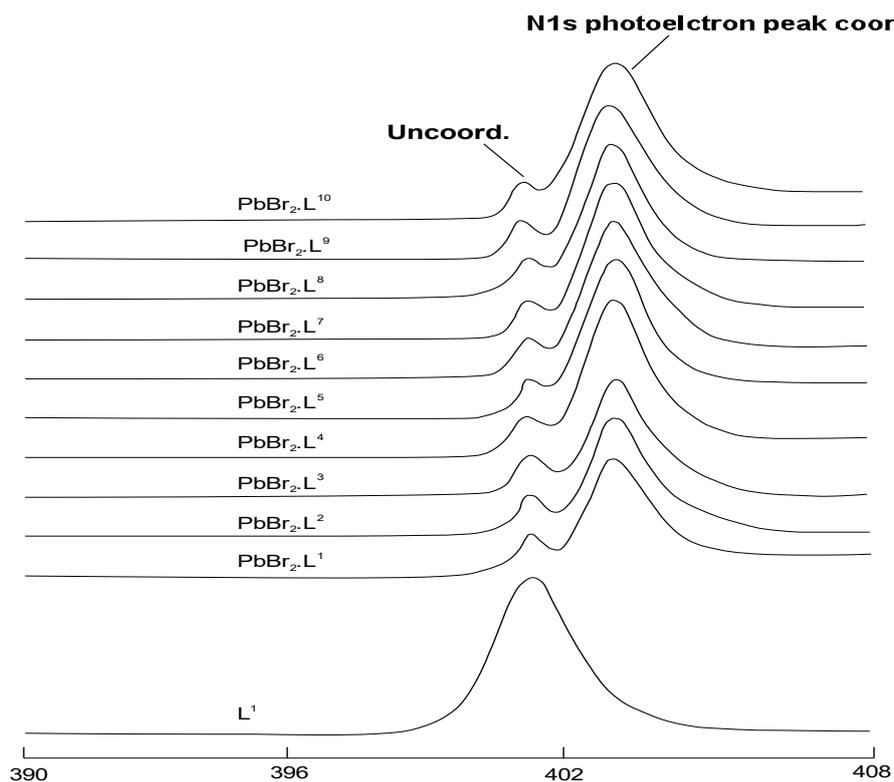


Fig.-3: N1s binding energies (eV) in L1 and [PbBr₂L¹⁻¹⁰] complexes

Table-1: Pb3d3/2,5/2, N1s, O1s and S2p binding energies (eV) in ligand, PbX₂ and [PbX₂L¹⁻¹⁰] complexes (where X= Cl/Br/I)

S. No.	Ligand & Complexes	Pb3d _{3/2, 5/2}		N1s		O1s	S2P _{1/2-3/2}
		Pb3d _{3/2}	Pb3d _{5/2}	Uncoord.	Coord.		
1	L ¹	-	-	400.8	-	-	-
2	L ²	-	-	400.8	-	531.2	166.2
3	L ³ ₁	-	-	400.8	-	531.2	166.2
4	L ⁴	-	-	400.8	-	531.2	166.2

5	L ⁵	-	-	400.8	-	531.2	166.2
6	L ⁶	-	-	400.8	-	531.2	166.2
7	L ⁷	-	-	400.8	-	531.2	166.2
8	L ⁸	-	-	400.8	-	531.2	166.2
9	L ⁹	-	-	400.8	-	531.2	166.2
10	L ¹⁰	-	-	400.8	-	531.2	166.2
11	PbCl ₂	587.8	485.8	-	-	-	-
12	PbCl ₂ .L ¹	586.8	484.8	400.8	402.6	531.2	166.2
13	PbCl ₂ .L ²	586.8	484.8	400.8	402.6	531.2	166.2
14	PbCl ₂ .L ³	586.8	484.8	400.8	402.6	531.2	166.2
15	PbCl ₂ .L ⁴	586.8	484.8	400.8	402.6	531.2	166.2
16	PbCl ₂ .L ⁵	586.8	484.8	400.8	402.6	531.2	166.2
17	PbCl ₂ .L ⁶	586.8	484.8	400.8	402.6	531.2	166.2
18	PbCl ₂ .L ⁷	586.8	484.8	400.8	402.6	531.2	166.2
19	PbCl ₂ .L ⁸	586.8	484.8	400.8	402.6	531.2	166.2
20	PbCl ₂ .L ⁹	586.8	484.8	400.8	402.6	531.2	166.2
21	PbCl ₂ .L ¹⁰	586.8	484.8	400.8	402.6	531.2	166.2
22	PbBr ₂	587.6	485.6	-	-	-	-
23	PbBr ₂ .L ¹	586.6	484.6	400.8	402.6	531.2	166.2
24	PbBr ₂ .L ²	586.6	484.6	400.8	402.6	531.2	166.2
25	PbBr ₂ .L ³	586.6	484.6	400.8	402.6	531.2	166.2
26	PbBr ₂ .L ⁴	586.6	484.6	400.8	402.6	531.2	166.2
27	PbBr ₂ .L ⁵	586.6	484.6	400.8	402.6	531.2	166.2
28	PbBr ₂ .L ⁶	586.6	484.6	400.8	402.6	531.2	166.2
29	PbBr ₂ .L ⁷	586.6	484.6	400.8	402.6	531.2	166.2
30	PbBr ₂ .L ⁸	586.6	484.6	400.8	402.6	531.2	166.2
31	PbBr ₂ .L ⁹	586.6	484.6	400.8	402.6	531.2	166.2
32	PbBr ₂ .L ¹⁰	586.6	484.6	400.8	402.6	531.2	166.2
33	PbI ₂	587.4	485.4	-	-	-	-
34	PbI ₂ .L ¹	586.4	484.4	400.8	402.6	531.2	166.2
35	PbI ₂ .L ²	586.4	484.4	400.8	402.6	531.2	166.2
36	PbI ₂ .L ³	586.4	484.4	400.8	402.6	531.2	166.2
37	PbI ₂ .L ⁴	586.4	484.4	400.8	402.6	531.2	166.2
38	PbI ₂ .L ⁵	586.4	484.4	400.8	402.6	531.2	166.2
39	PbI ₂ .L ⁶	586.4	484.4	400.8	402.6	531.2	166.2
40	PbI ₂ .L ⁷	586.4	484.4	400.8	402.6	531.2	166.2
41	PbI ₂ .L ⁸	586.4	484.4	400.8	402.6	531.2	166.2
42	PbI ₂ .L ⁹	586.4	484.4	400.8	402.6	531.2	166.2
43	PbI ₂ .L ¹⁰	586.4	484.4	400.8	402.6	531.2	166.2

CONCLUSION

On the basis of elemental analysis, molar conductivity, IR and XPS data it may be recommended the structure of each complex as communicated in Fig.-1 and an octahedral geometry may be established.

ACKNOWLEDGEMENT

The authors Arpit Srivastava and Ashish Rajak are thankful to Department of Chemistry, University of Allahabad, Prayagraj for instrumental facility, laboratory and financial support respectively.

REFERENCES

1. J.M. Lehn, Supramolecular Chemistry Concept and Perspectives, Wiley-VCH, Weinheim, Germany, 1st Edition, 1995.
2. R. Kanaoujiya, M. Singh, J. Singh and S. Srivastava, J. Sci. Res., 64 (01), 264 (2020). [http:// dx. doi. org/ 10.37398/JSR.2020.640150](http://dx.doi.org/10.37398/JSR.2020.640150)
3. B.K. tripuramallu, R. kishore and S.K. Das, Polyhedron, 29, 2985 (2010). [https:// doi.org/ 10.1016/ j.poly.2010.08.008](https://doi.org/10.1016/j.poly.2010.08.008)

4. R. Kanaoujiya and S. Srivastava, *Res. J. Chem. Environ.*, 25, 103 (2021). [https:// doi.org/ 10.25303/259rjce103106](https://doi.org/10.25303/259rjce103106)
5. R. Kanaoujiya and S. Shekhar, *Res. J. Chem. Environ.*, 25 (7), 177 (2021). [https:// doi.org/ 10.25303/257rjce17721](https://doi.org/10.25303/257rjce17721)
6. R. Kanaoujiya, M.A. Kumar, M.V. Kumar and S. Shekhar, *Res. J. Chem. Environ.*, 25 (4), 77 (2021).
7. J. Costamagna, G. Ferraudi and B. Matsuhiro, *Coord. Chem. Rev.*, 196(1), 125 (2000). [https:// doi.org/ 10.1016/ S0010-8545\(99\)00165-4](https://doi.org/10.1016/S0010-8545(99)00165-4)
8. S. Chandra and L.K. Gupta, *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 62, 307 (2005). <https://doi.org/10.1016/j.saa.2004.12.044>
9. D.S. Kumar and V. Alexander, *Polyhedron*, 18(11), 1561 (1999). <https://doi.org/10.1021/bc00014a004>
10. D.E. Fenton and A.G. Sykes, *Advances in Inorganic and Bioorganic Mechanisms Academic Press: London* 43, 187 (1983).
11. A.T. yordanov, D.M. Roundhill, *Coordination Chemistry Review*, 170(1), 93 (1998). [https://doi.org/10.1016/S0010-8545\(97\)00074-X](https://doi.org/10.1016/S0010-8545(97)00074-X)
12. D.E. Fenton U. Casellato, P.A. Vigato and M. Vidali, *Inorganica Chimica Acta*, 95(4), 187 (1984).
13. P. Guerriero, P.A. Vigato, D.E. Fenton. and P.C. Hellier, *Acta Chemica Scandinavica*, 46, 1025 (1992).
14. W. Radeeka-Paryzek, V. Patroniak and J. Lisowski, *Coordination Chemistry Review*, 249(21-22), 2156 (2005). <https://doi.org/10.1016/j.ccr.2005.02.021>
15. A.A. Khandar, S.A. Hosseini-Yazdi, M. Khatamian, P. McArdle and S.A. Zarei, *Polyhedron*, 26(1), 33 (2007). <https://doi.org/10.1016/j.poly.2006.07.022>
16. S. Tamburini, P.A. Vigato, M. Gatos, L. Bertolo and U. Casellato, *Inorganica Chimica Acta*, 359(1), 183 (2006). <https://doi.org/10.1016/j.ica.2005.09.052>
17. P. Guerriero, S. Tarnburini, P.A. Vigato, *Coordination Chemistry Review*, 139, 17 (1995). [https://doi.org/10.1016/0010-8545\(93\)01105-7](https://doi.org/10.1016/0010-8545(93)01105-7)
18. R.M. Izatt, J.S. Brandshaw, S.A. Neilsen, J.D Lamb. J.J. Christensen and D. Sen, *Chemical Review*, 85(4), 271 (1985). <https://doi.org/10.1021/cr00068a003>
19. G.A. Melson, *Coordination Chemistry of Macrocyclic Compounds*, Plenum Press, New York, 1979.
20. L.F. Lindoy, *The Chemistry of macrocyclic Ligand Complexes*, Cambridge University Press, Cambridge 1989.
21. E.C. Constable, P.J. Stotereau and M.G.B. Drew, *Polyhedron*, 8(23), 2749 (1989). [https:// doi. org/ 10.1016/ S0277-5387\(00\)80531-8](https://doi.org/10.1016/S0277-5387(00)80531-8)
22. S. M. Nelson, *Pure and Applied Chemistry*, 52(11), 2461 (1980). [http:// dx. doi.org/ 10.1351/ pac198052112461](http://dx.doi.org/10.1351/pac198052112461)
23. D.E. Fenton, *Pure and Applied Chemistry*, 58(11), 1437 (1986). [http:// dx.doi. org/ 10.1351/ pac198658111437](http://dx.doi.org/10.1351/pac198658111437)
24. E.C. Constable and J. Lewis, *Journal of Organometallic Chemistry*, 254(1), 105 (1983). [https:// doi.org/ 10.1016/0022-328X\(83\)85122-5](https://doi.org/10.1016/0022-328X(83)85122-5)
25. E.C. Constable, P.J. Stotereau and M.G.B. Drew, *Inorganica Chimica Acta*, 145, 3 (1988). [https://doi.org/10.1016/S0020-1693\(00\)81994-5](https://doi.org/10.1016/S0020-1693(00)81994-5)
26. P. Hambright, *Coordination Chemistry Review*, 6(2-3), 247 (1971). [https://doi.org/10.1016/S0010-8545\(00\)80041-7](https://doi.org/10.1016/S0010-8545(00)80041-7)
27. G.W. Gokel, W.M. Leevy and M.E. Weber, *Chemical Review*, 104(5), 2723 (2004). [https:// doi.org/ 10.1021/ cr00068a003](https://doi.org/10.1021/cr00068a003)

28. S. Khalil and K. Bashir, *Journal of Coordination Chemistry*, 55(6), 681 (2002). <https://doi.org/10.1080/00958970290027552>
29. A. Chaudhary, N. Bansal, A. Gajraj. and R.V. Singh, *Journal of Inorganic Biochemistry*, 96(2-3), 393 (2003). [http://dx.doi.org/10.1016/S0162-0134\(03\)00157-0](http://dx.doi.org/10.1016/S0162-0134(03)00157-0)
30. H.A. El-Boraey and O.A. El- Gammal, *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 138, 553 (2015). <https://doi.org/10.1016/j.saa.2014.11.015>
31. J.M. Lehn, *Angewandte Chemie International Edition in English*, 27, 89 (1988).
32. E.C. Constable, A.C. King, C.A. Palmer and P.R. Raithby, *Inorganica Chimica Acta*, 184(1), 43(1991). [https://doi.org/10.1016/S0020-1693\(00\)83043-1](https://doi.org/10.1016/S0020-1693(00)83043-1)
33. E.C. Constable, C.A. Palmer and D.A. Tocher, *Inorganica Chimica Acta*, 176(1), 57 (1990). [https://doi.org/10.1016/S0020-1693\(00\)85091-4](https://doi.org/10.1016/S0020-1693(00)85091-4)
34. K.B. Mertes, J.M. Lehn "Multidentate Macrocyclic and Macropolycyclic Ligands", *Comprehensive Coordination Chemistry*, vol. 2, p. 915, ed. Wilkinson, G., Pergamon Press, 1987.
35. E. Kimura, *Tetrahedron*, 48(30), 6175 (1992). [https://doi.org/10.1016/S0040-4020\(01\)88212-0](https://doi.org/10.1016/S0040-4020(01)88212-0)
36. I. Bertini, B.G. Harry, S.J. Lippard, and J.S. Valentine, *Bioinorganic chemistry*, University science books, 1994.
37. M. Ruppert, J. Draxler and R. Marr, *Separation Science and Technology*, 23(12-13), 1659 (1988). <https://doi.org/10.1080/01496398808075655>
38. K.R. Adam, M. Antolovich, D.S. Baldwin, P.A. Duckworth, A.J. Leong, L.F. Lindoy, M. McPartlin and P.A. Tasker, *Journal of the Chemical Society, Dalton Transactions*, 1013 (1993).
39. S. Weiss, V. Grigoriev and P. Muhl, *Journal of Membrane Science*, 12, 119 (1982). [https://doi.org/10.1016/0376-7388\(82\)80008-2](https://doi.org/10.1016/0376-7388(82)80008-2)
40. S Chandra, L.K. Gupta and Sangeetika, *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 62(1-3), 453 (2005). <https://doi.org/10.1016/j.saa.2005.01.015>
41. M. Tyagi, S. Chandra and D. Chand, *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 118, 1056 (2014). <https://doi.org/10.1016/j.saa.2013.09.124>
42. S. Verma, S. Chandra, U. Dev and N. Joshi, *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 74(2), 370 (2009). <https://doi.org/10.1016/j.saa.2009.06.029>
43. N.F. Curtis, *Coordination Chemistry of Macrocyclic Compounds*, edited by G.A. Melson, Plenum, New York 1979.
44. K.J. Lee and J.H. Suh, *Bioorganic Chemistry*, 22(1), 95 (1994). <https://doi.org/10.1006/bioo.1994.1007>
45. D.H. Busch, *Accounts of Chemical Research*, 11(10), 392 (1978).
46. X.X. Zhang, J.S. Bradshaw and R.M. Izatt, *Chemical Review*, 97(8), 3313 (1997). <https://doi.org/10.1021/cr960144p>
47. K.E. Krakowiak, J.S. Bradshaw and D.J. Zamecka-Krakowiak, *Chemical Review*, 89(4), 929 (1989). <https://doi.org/10.1021/cr00094a008>
48. J.S. Bradshaw, *Aza- Crown Macrocyclics*, Wiley, New York (1993).
49. M. Lopez-Dober, R. Bastida de la Calle, A. Macias. P. Perez-Lourido, A. Rodriguez and L. Valencia Matarranz, *Zeitschrift für anorganische und allgemeine Chemie*, 633(11-12), 1842 (2007).
50. E.C. Constable and P.R. Raithby, *Inorganica Chimica Acta*, 183(1), 21 (1991). [https://doi.org/10.1016/S0020-1693\(00\)82989-8](https://doi.org/10.1016/S0020-1693(00)82989-8)
51. R.E. Mewis and S.J. Archibald, *Coordination Chemistry Review*, 254, 1686 (2010). <https://doi.org/10.1016/j.ccr.2010.02.025>
52. S. Chandra, L.K. Gupta and Sangeetika, *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 62, 453 (2005). <https://doi.org/10.1016/j.saa.2005.01.015>

53. D.C. Buster, M.M.C. Castro, C.F. Geraldles, C.R. Malloy, A.D. Sherry and T.C. Siemers, *Magnetic Resonance in Medicine*, 15, 25 (1990). <https://doi.org/10.1002/mrm.1910150104>
54. S. Brandes, F. Denat, S. Lacour F. Rabiet, F. Barbette, P. Pullumbi and R. Guilard, *European Journal of Organic Chemistry*, 2349 (1998).
55. D. Dolphin, *Canadian Journal of Chemistry*, 72(4), 1005 (1994).
56. K. Sharma, S.C. Joshi and R.V. Singh, *Metal Based Drugs*, 7(5), 237 (2000).
57. R.V. Singh, R Dwivedi and S. C. Joshi, *Transition Metal Chemistry*, 29(1), 70 (2004). <https://doi.org/10.1023/B:TMCH.0000014487.86754.93>
58. N.R. Champness, C.S. Frampton, G. Geid and D.A. Toucher, *Journal of the Chemical Society, Dalton Transactions*, 20, 3031 (1994).
59. S. Amin, J.R. Morrow, C.R. Lake and M.R. Churchill, *Angewandte Chemie International edition in English*, 33(7), 773 (1994).
60. R. Bonnett, *Chemical Society Review*, 24(1), 19 (1995). <https://doi.org/10.1039/CS9952400019>
61. S. Verma, S. Chandra, U. Dev. and N. Joshi, *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 74(2), 370 (2009). <https://doi.org/10.1016/j.saa.2009.06.029>
62. J.L. Bousquet, S. Saini, D.D. Stark, P.F. Hahn, M. Nigam, J. Wittenberg and J. Ferrucci, *Journal of Radiology*, 166, 693 (1988). <https://doi.org/10.1148/radiology.166.3.3340763>
63. S. Blain, P. Appriou, H. Chaumeil and H. Handel, *Analytica Chimica Acta*, 232, 331 (1990). [https://doi.org/10.1016/S0003-2670\(00\)81250-7](https://doi.org/10.1016/S0003-2670(00)81250-7)
64. Q. Lu, A.E. Martell and R.J. Motekaitis, *Inorganica Chimica Acta*, 251(1-2), 365 (1996). [https://doi.org/10.1016/S0020-1693\(96\)05291-7](https://doi.org/10.1016/S0020-1693(96)05291-7)
65. J.P.L. Cox, K.J. Jankowski, R. Katakay, D. Parker, N.R.A. Beeley, B.A. Boyce, M.A.W. Eaton, K. Mllar, A.T. Millican, A. Harrison and C. Walker, *Journal of the Chemical Society, Chemical Communications*, 12, 797 (1989). <https://doi.org/10.1039/C39890000797>
66. J. Canales, J. Ramirez, G. Estiu and J. Costamagna, *Polyhedron*, 19(22-23), 2373 (2000). [https://doi.org/10.1016/S0277-5387\(00\)00574-X](https://doi.org/10.1016/S0277-5387(00)00574-X)
67. A. Bencini, A. Bianchi, C. Giorgi, P. Paoletti, B. Votancoli, V. Fusi, E. Garcia- Espana, J.M. Llinares and J.A. Ramirez, *Inorganic Chemistry*, 35(5), 1114 (1996). <http://doi.org/10.1021/Ic9506926>
68. M.S.T. Makki, R.M. Abdel-Rahman and M.S. El-Shahawi, *Comptes Rendus Chimie*, 15(7), 617 (2012).
69. M. Jain, S. Gaur, S.C. Diwedi, S.C. Joshi, R.V. Singh and A. Bansal, *Phosphorus, sulfur, Silicon and related Elements*, 179(8), 1517 (2004).
70. E.I. Ochiai, *Coordination Chemistry Review*, 254, 1812 (2010).
71. Bohdan Korybut-Daszkiwicz, Renata Bilewicz and Krzysztof Wozniak, *Coordination Chemistry Review*, 254, 1637 (2010).
72. L.F. Lindoy, G.V. Meehan, L.M. Vasilescu, Hyun Jee kim, Ji-Eun Lee and Shim Sung Lee, *Coordination Chemistry Review*, 254, 1713 (2010).
73. F. Marques, L. Gano, M.P. Campello, S. Lacerda, I. Santos, L.M.P. Lima, J. Costa, P. Antunes and R. Delgado, *Journal of Inorganic Biochemistry*, 100(2), 270 (2006).
74. E.G. Samsel, K. Srinivasan, and J.K. Kochi, *JACS - Journal of the American Chemical Society*, 107(25), 7606 (1985).
75. J. Cody Timmons and Timothy J. Hublin, *Coordination Chemistry Review*, 254(15-16), 1661 (2010).
76. A.A. Adel Emara, Azza A.A. Abou- Hussen, *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 64(4), 1010 (2006).
77. J.W. steed and J.L. Atwood, *Supramolecular Chemistry*, John Wiley & Sons, 2013.

78. T. Katsuki, *Coordination Chemistry Review*, 140, 189 (1995). [https://doi.org/10.1016/0010-8545\(94\)01124-T](https://doi.org/10.1016/0010-8545(94)01124-T)
79. E. Kent Barefield, *Coordination Chemistry Review*, 254(15-16), 1607 (2010). <https://doi.org/10.1016/j.ccr.2010.03.007>
80. Anil Bansal and R.V. Singh, *Indian Journal of Chemistry -Section A (IJC-A)*, 38, 1145 (1999).
81. Anil Bansal, Sudhir Kumar and R.V. Singh, *Synthesis and Reactivity in Inorganic and Metal- Organic Chemistry*, 31(6), 1085 (2007). <https://doi.org/10.1080/15533174.2015.1004423>
82. Salih Ilhan, Hamdi Temel, Ismail Yilmaz, Memet Sekerci, *Polyhedron*, 26(12), 2795 (2007). <https://doi.org/10.1016/j.poly.2007.01.015>
83. Salih Ilhan and Hamdi Temel, *Journal of Chemical Research*, 34(6), 304 (2010).
84. Nesrin Beynek, Guhergul Ulucam, Berrin Ayaz Tuylu, Hulya Zeytinoglu and Kadriye Benkli, *Drug and Chemical Toxicology*, 30(4), 399 (2007). <https://doi.org/10.1080/01480540701522601>
85. David Esteban, Fernando Auecilla, Carlos Platas-Iglesias, Jose Mahia, Andres de Blas and Teresa Rodriguez-Blas, *Inorganic Chemistry*, 41(17), 4337 (2002). <https://doi.org/10.1021/ic0255095>
86. Salih Ilhan Hamdi Temel, Salih Pasa, *Chinese Chemical Letters*, 20(3), 339 (2009). <https://doi.org/10.1016/j.ccllet.2008.12.008>
87. Bahram Ghanbari and Morteza Zarepour-Jevinani, *Journal of Coordination Chemistry*, 69(18), 2793 (2016). <https://doi.org/10.1080/00958972.2016.1217332>
88. Hassan Keypour, Majid Rezaeivala, Laura Valencia and Paulo Perez-Lourido, *Polyhedron*, 28(18), 4096 (2009). <http://dx.doi.org/10.1016/j.ica.2010.11.033>
89. Salih Ilhan, Hamdi Temel, Salih Pasa and Ibrahim Tegin, *Russian Journal of Inorganic Chemistry*, 55, 1402 (2010). <https://doi.org/10.1134/S0036023610090111>
90. P.M. Reddy, A.V. Prasad, R. Rohini and, V. Ravinder, *Catalytic reduction of pralidoxime in pharmaceuticals by macrocyclic Ni (II) compounds derived from orthophthalaldehyde*, *Spectrochim. Acta Part A: Mol. Biomol. Spect.*, 70(3), 704 (2008). <https://doi.org/10.1016/j.saa.2007.10.014>
91. A.I. Vogel, *A Text Book of Quantitative Inorganic Analysis*, Longmans Green, ELBS, London, 302 (1991).
92. A.I. Vogel, *A Text Book of Quantitative Inorganic Analysis*, Longmans Green ELBS, London 355 (1991).
93. S. Srivastava, *Applied Spectroscopy Reviews*, 22(4), 401 (1986). <https://doi.org/10.1080/05704928608060441>
94. Shekhar Srivastava, *Photoelectron spectroscopy and Metal Complexes*, Pravalika Publication, Allahabad-2014.
95. W.J. Geary, *Coordination Chemical Review*, 7(1), 81 (1971). [http://dx.doi.org/10.1016/S0010-8545\(00\)80009-0](http://dx.doi.org/10.1016/S0010-8545(00)80009-0)
96. C.P. Bhasin, G. Srivastava and R.C. Mehrotra, *Inorganica Chimica Acta*, 128(1), 69 (1987). [https://doi.org/10.1016/S0020-1693\(00\)84697-6](https://doi.org/10.1016/S0020-1693(00)84697-6)
97. C.P. Bhasin, G. Srivastava and R.C. Mehrotra, *Indian Journal of Chemistry -Section A (IJC-A)*, 26, 834 (1987).
98. K. Nakamota, *Infrared and Raman spectra of Inorganic and coordination compounds Part B: Application in Coordination organometallic and Bio inorganic chemistry*, 5th Ed., Wiley Intersciences, New York 65 (1997).
99. A. Kumari, J.P. Tondon, R.V. Singh, *Applied Organometallic Chemistry*, 7(8), 655 (1993). <https://doi.org/10.1002/aoc.5283>
100. B.K. Coltrain, S.C. Jackels, *Inorganic Chemistry*, 20(7), 2032 (1981). <https://doi.org/10.1021/ic50221a021>

Synthesis and Antifungal Study of Fe, Ru and Co Transition Metal Complexes

Amit Kumar

P G Department of Chemistry, Magadh University Bodh Gaya Bihar

ABSTRACT

Different organic molecules were used in the synthesis of the transition metal complexes of Fe, Ru, and Co. Basic research, conductivity measurements, infrared, electronic, and ESR spectroscopy were used to characterise the complexes. The coordination of the metal to the ligands in sulphonamide complexes occurs via the nitrogen of the pyrimidine group and by the nitrogen of the amine group, respectively. The complexes were tested for their antifungal efficacy against *Penicillium rubrum* and *Aspergillus niger*.

Keywords: Sulfonamides, synthesis, antifungal ligands, *Aspergillus niger* and *Penicillium rubrum*.

INTRODUCTION

Sulfa medications are used to treat bacterial infections such as those that cause eye disorders, the flu, meningitis, actinomycosis diseases, and urinary tract infections. They can also be used as model mixtures for irrational testing of drug activity.^{1,2} In the lengthy history of drug disclosure, a fascinating discovery has been made: mixtures with the same basic component show various organic activities. Sulfonamides, for instance, exhibit antibacterial, insulin-discharging antidiabetic, carbonic anhydrase inhibitory, high-roof diuretic, and antithyroid activities, among other properties.³ Recently, numerous papers have described various antitumor specialists having the fundamental properties of sulfonamide.^{4,5} It is noteworthy that sulfadiazine is a useful antibacterial drug with the standard sulfonamide structure.

The produced antimicrobial specialists known as sulpha medicines were made possible by 4-amino benzenesulphonamide. Their close structural similarity to the 4-aminobenzoic corrosive present in microbes for folic corrosive synthesis is assumed to be the source of their antibacterial activity.⁶ Significant interest is also being generated by agriculture and pharma's participation in the many biological functions of sulfonamides.⁷ Sulfonamides are the primary functional component of numerous pharmacological compounds, mostly due to their stability and human toleration.^{8,9} Sulfa medications are used to treat a variety of illnesses, including meningitis, bacillary dysentery, malaria, conjunctivitis, and urinary tract infections.¹⁰⁻¹² Numerous combinations of sulfonamide, pyrazinamide, and their subordinates are used to treat a variety of diseases, including tuberculosis, infection, and mental disorders. These compounds have been shown to have physiological activity.¹³ Sulfonamide and pyrazinamide mixtures have also been used as anticancer, insecticidal, antifungal, antibacterial, antipyretic, antiamoebic, and other drugs.¹⁴⁻¹⁹ Some of these mixtures are also known to cause sleepiness and have been shown to have captivating properties.²⁰

As a result, this work's objectives are:

1. To create more complexes, which are cutting-edge and powerful alternative medicines.
2. To analyse the metal drug complexes using IR, NMR, mass, and ESR spectrometry as well as conductivity, solubility, and melting point measurements.
3. To evaluate the synthesised metal complexes' effectiveness against fungus.

MATERIAL AND METHODS

The following are the various tools, procedures, glassware, solvents, reagents, and techniques utilised in the production of sulfonamide compounds:

- Bruker advance 300 MHz NMR
- Perkin Elmer 100 FT-IR spectrophotometer
- Agilent 1100 MCD trap-5C Mass spectrometer
- Digisun conductivity meter, DI 909 model
- Perkin Elmer UV-Vis spectrophotometer. U.V lamp

METHODOLOGY

Synthesis of the Complexes

4-(2-Hydroxybenzylidene) Amino) Benzenesulfonamide [HBABS]:

To an answer of 1.72 g (0.01 mol) of 4-aminobenzenesulfonamide (Merck) broke up in 100 ml of methanol in a 250 ml round base jar, 1.22 g (0.01 mol) of 2-hydroxy benzaldehyde (SD fine) was included and the substance were refluxed on a water shower for 2 hours. The arrangement, on cooling, gave a yellow hued compound, which was separated and recrystallized from ethanol. Yield (56%), MP: 180°C.^{21,22}

4-(Furan-2-Ylmethylene) Aminobenzenesul Fonamide [FMABS]

An answer of 1.72g (0.01mol) of 4-aminobenzenesulfonamide (Merck) broke down in 100 ml of methanol in a 250 ml round base cup, was included with 0.96g (0.01 mol) of furan-2-carbaldehyde (Fluka) . The arrangement was refluxed on a water shower for 3 hours. The compound isolated was separated and recrystallized from methanol to give a dark hued strong. Yield (62%), MP: 130°C.²³

4-(Thiophene-2-Ylmethylene) Aminobenzenesul Fonamide [TMABS]

To an answer of 1.72g (0.01mol) of 4-aminobenzenesulfonamide (Merck) disintegrated in 100 ml of methanol in a 250 ml round base cup, 1.22 g (0.01 mol) of thiophene-2-carbaldehyde (Fluka) was included. The arrangement was refluxed on a water shower for 3 hours. The compound isolated was separated and recrystallized from methanol to give a light yellow shaded strong. Yield(82%), MP: 140°C.^{24,25}

(Thiophen-2-Ylmethylidinene) Pyridine-4-Carbohydrazide [TMPCH]

To an answer of 1.23g (0.01m) of pyridine-4-carbohydrazide (Finar) disintegrated in 100 ml of methanol in a 250 ml round base cup, 1.22 g (0.01 mol) of thiophene - 2-carbaldehyde (Fluka) was included. The arrangement was refluxed on a water shower for 3 hours. The compound isolated was sifted and recrystallized from methanol to give a light yellow shaded strong. Yield (86%), MP: 130°C.²⁶

(Thiophen-2-Ylmethylidinene) Pyrazine-2-Carboxamide [TMPCA]

An answer containing 1.24 g of pyrazinamide (Hi media) in 100 ml of ethanol in a 250 ml round base carafe was included with 1.12 g (0.01 mol) of thiophene-2-carbaldehyde. The substance were refluxed on a water shower for 2 hours. The compound isolated was separated and recrystallized from methanol to give a light yellow shaded solid Yield (68%), MP: 178-180°C.²⁷

Arrangement of the Metal Complexes

The Fe (III), Ru (III), and Co (II) buildings with all the ligands were readied utilized.

Fe (III) Buildings

To an answer of anhydrous ferric chloride (BDH) in methanol, a hot methanolic arrangement of the ligand was included gradually with mixing. The blend was refluxed on a high temp water shower. It was concentrated constrained to two-third the first volume and cooled. The strong that isolated out was sifted, washed with water, hot methanol and ether and was vacuum dried over intertwined CaCl₂.

Ru (III) Edifices

Ruthenium trichloride trihydrate (SRL) (1.0g) was broken down in concentrated hydrochloric corrosive and weakened with water to 100 ml to give 0.1N arrangement concerning hydrochloric corrosive. An aliquot of this arrangement was treated with an equivalent volume of methanol and was included drop-wise, with a hot methanolic arrangement of the ligand with mixing. The blend was refluxed on a high temp water shower. It was concentrated constrained to two-third the first volume and cooled. The strong that isolated out was separated, washed with water, hot methanol and ether and was vacuum dried over combined CaCl₂.

Co (II) Buildings

To a methanolic arrangement of cobaltous chloride(CoCl₂.6H₂O), a hot methanolic arrangement of the ligand was included gradually with mixing. The blend was refluxed on a high temp water shower. It was concentrated constrained to two-third the first volume and cooled. The strong that isolated out was separated, washed with water, hot methanol and ether and was vacuum dried over melded CaCl₂.

Antifungal Movement: Preparation of Spore Suspension

From the new societies, spores were gathered and moved to a test tube containing sanitized refined water. The spore suspension subsequently acquired was utilized for testing the antifungal action of the mixes.

Antifungal Test

The antifungal test of the mixes was completed by agar well dispersion strategy as depicted by Magaldi et al²⁸. The way of life plates hatched with the test life forms were permitted to set and punched with a sterile stopper borer (5 mm distance across) to make open wells. The wells were loaded up with 100 μ l arrangement at a convergence of 5 mg/ml of the mixes at 30 °C. Following 72 hours, the restraint zones were estimated and

contrasted and those of the control DMSO and the standard flucanazole at a convergence of 5 mg/ml. On account of both antibacterial and antifungal measures, the tests were directed in triplicate and the outcomes communicated as mean.

RESULTS AND DISCUSSION

In the present study, 4-aminobenzenesulfonamide has been condensed with 2-hydroxybenzaldehyde, furan-2-carbaldehyde and thiophene-2-carbaldehyde; pyridine-4-carbohydrazide with thiophene-2-carbaldehyde and pyrazine-2-carboxamide with thiophene-2-carbaldehyde and the accompanying Schiff base ligands acquired and portrayed.

4-((2-Hydroxybenzylidene) amino) benzenesulfonamide (HBABS) (Fig. 1)

4-((Furan-2-ylmethylene) amino) benzenesulfonamide (FMABS) (Fig. 2)

4-((Thiophen-2-ylmethylene) amino) benzenesul fonamide (TMABS) (Fig. 3)

N'-(Thiophen-2-yl-methylidene)- pyridine-4-carbohydrazide (TMPCH) (Fig. 4)

N-(Thiophen-2-ylmethylidene)- pyrazine-2-carboxamide(TMPCA) (Fig. 5)

The Fe(III), Ru(III) and Co(II) edifices of these Schiff base ligands have been readied and basically portrayed based on basic investigation, conductance, warm, attractive and infrared, electronic and ESR ghostly information. Pertinent ends as for the geometry of the edifices have been drawn dependent on the information acquired.

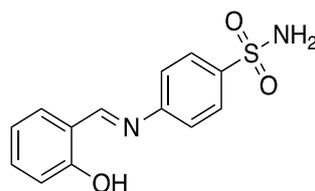


Fig. 1. 4-((2 Hydroxybenzylidene)amino)benzenesulfonamide (HBABS)

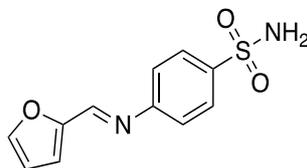


Fig. 2. 4-((Furan-2-ylmethylene)amino)benzenesulfonamide (FMABS)

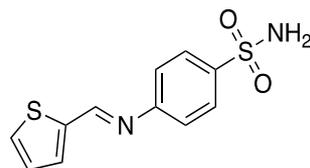


Fig. 3. 4-((Thiophen-2-ylmethylene)amino)benzenesulfonamide (TMABS)

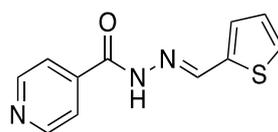


Fig. 4. N'-(Thiophen-2-yl-methylidene)- pyridine-4-carbohydrazide (TMPCH)

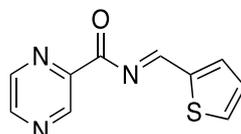


Fig. 5. N-(Thiophen-2-ylmethylidene)- pyrazine-2-carboxamide (TMPCA)

Due to the significance of this class of aggressors, the designer integrated and represented metal Schiff base structures made of sulfonamide, carbohydrazide, pyrazinamide, and other aldehydes. The ligands TMABS, TMPCH, and TMPCA as well as a fraction of their metal structures prepared for organic action have been screened in order to conduct the tests. In the current investigation, 4-aminobenzenesulfonamide was used to condense thiophene-2-carbaldehyde, pyridine-4-carbohydrazide, pyrazine-2-carboxamide, and the related Schiff base ligands. These responses were discovered and displayed in (figures 1-5). Fe(III), Ru(III), and Co(II) structures of these Schiff base ligands have been synthesised and essentially shown based on fundamental research, conductance, warm, attractive, and infrared, electronic, and ESR ghostly information. Relevant inferences about the geometry of the structures have been made in light of the knowledge acquired. At room temperature, all of the ligands are stable and non-hygroscopic. They are truly solvent in hot methanol and dimethylformamide, insoluble in water, and moderately soluble in methanol and (CH₃)₂CO. Mass, ¹H NMR, IR, and investigative data have been used to describe the ligands.

CONCLUSION

The structures of the five-compound complexes in Fe(III), Ru(III), and Co(II) have been depicted using various physico-substance data. Complexes of mixed ligands with the transition metals Fe, Ru, and Co have been created. The complexes are subjected to several forms of characterisation employing infrared spectroscopy, electric conductivity, melting point, and solubility. The complexes were tested for their antifungal efficacy against *Penicillium rubrum* and *Aspergillus niger*. Complex formation was confirmed by the combined results of the physical and spectroscopic examinations.

REFERENCES

1. Cutting, W.C., Handbook of pharmacology, Meridith, New York **1967**.
2. Sackheim G.I. and Schieltz, R.M., Chemistry for the Health Sciences, Macmillan, New York **1973**.
3. Maren, T.H., Annu. Rev. Pharmacol. Toxicol, 16, **1976** (309).
4. Toth, J.E. Grindey, G.B. Ehlhardt W.J., et al, J. Med. Chem, 40, **1997** (1018).
5. Owa, T. Yoshino, H. Okauchi. T. et al, J. Med. Chem, 42, **1999** (3789).
6. Laurance, D.R., Clinical pharmacology' p 765 English Language Book Society (ELBS) and Churchill, London **1973**.
7. Satoker, R.S., Pharmacology & Pharmacotherapeutics., Mumbai popular foundation. **2002**, (628).
8. Joel, G.H. & Lee, E.L., The Pharmacological Basis of Therapeutics. 10th Ed. McGraw Hill, **2001**, (1172).
9. Evans, B.E.; Rittle, K.E.; Bock, M.G.; DiPardo, R.M.; Freidinger, R.M.; Whitter, W.L.; Lundell, G.F.; Veber, D.F.; Anderson, P.S.; Chang, R.S.; Lotti, V.J.; Cerino, D.J.; Chen, T.B.; Kling, P.J.; Kunklerl, K.A.; Springer, J.P. & Hirshfield, J., J. Med. Chem., , 31, **1988** (2235).
10. Supuran, C.T.; Casini, A.; Mastrolorenzo, A. & Scozzafava, A., Mini Rev. Med. Chen., 4, **2004** (625).
11. Patel, H.S. & Mistry, H.J., Phosphorus, Sulfur, & Silicon Relat. Elem., 179, **2004**, (1085).
12. Selvam, P.; Smee, D.F.; Gowen, B.B.; Day, C.W.; Barnard, D.L. & Money, J. D., AntiviralRes., 74, **2007** (81).
13. Vander and Kark, G.J.M., 4th Proc. Brit. Insect. Fungi Conf., 2, **1967** (562).
14. Klosa, J., Ger. Pat. 1200307 (1965); Chem. Abstr., 63, **1965** (1811C).
15. Pluigena, C.W. and Sijpesteign, A.K., Amer. Appl. Biol., 57, **1968** (465).
16. Upender, S., Ph.D. Thesis, Regional Engineering College, Warangal **1988**.
17. Erdely, I., Leszkovsky and Trados, L., Acta Phys. Acad. Sci. Hung., **27** (1965), 85.
18. Merillus, W., J. Med. Chem., 11, **1968** (171).
19. Wojeiech Lehr and Splawiniski, Chem. Abstr., 55, **1961** (3602).
20. Vida, A. Julius, "Principles of Medicinal Chemistry" (Ed. Foye, O. William), Leas Febiger, Philadelphia **1974**.

21. Li, Y., Yang Z.S., Zhang, H., Cao, B.J. and Wang FD, Artemisinin Derivatives Bearing Mannich Base Group: Synthesis and Antimalarial Activity. *Bio org and Med Chem.* 11, **2003** (4363-4368).
22. Pandey, S.N., Lakshmi V.S. and Pandey, A. Biological activity of Mannich bases. *Indian J Pharm Sci.* **65**, **2003** (213).
23. Huang, J.L., Wang H.Y., and Tian X.Y., *Polym. J., Sci. Part A: Polym.Chem*, 34, **1933** (1996). 12. Huang J.L., Chen, .S, Tan L.S., and Wang H.Y., *Science in China (Series B)*, 41, **1998** (55).
24. Chen, S., Huang Z.H., and Huang, J.L., *Eur.J. Polym.* **36**, **2000** (1703).
25. Narang, K.K., and Vinod Synth, P., *React. Inorg. Met-Org. Chem.* **2**, **1996** (191).
26. Brown, D.J., *The Pyrazines.* J. Wiley. Sons, Inc., New York, **2002**.
27. Desta, B., *J. Ethnopharmacol.*, 100, **2005** (168).
28. Magaldi, S., Mata-Esayag, S., Capriles, C.H.D., Perez, C., Colellac, M., Olaizola and Ontiveros, Y., *Int. J. Infectious Diseases*, 8, **2004** (39).

The Antioxidant Profile of Two Traditionally Used Medicinal Liverworts, *Marchantia paleacea* and *Conocephalum conicum* Growing in District Kishtwar, Jammu and Kashmir

Mamta Verma¹, Parul Parihar¹ and Nitin Katoch²

¹Department of Botany, School of Bioengineering and Biosciences, Lovely Professional University

²Regional Institute of Management and Technology University

ABSTRACT

The present work is an effort to assess the potential of the antioxidant for two ethnobotanically important liverworts say., *Marchantia paleacea* and *Conocephalum conicum*. The antioxidant system comprising of enzymatic and non-enzymatic antioxidants have been evaluated. The values derived are close enough to the higher plants. For the *Marchantia paleacea*, the content of superoxide dismutase and soluble sugar are higher than *Conocephalum conicum*, whereas, the ascorbate activity and Guaiacol peroxidase for *Conocephalum conicum* are higher than *Marchantia paleacea*. All the other parameters including proline and MDA content are high in the case of *Conocephalum conicum*. However, parameters like total glutathione, chlorophyll a, Glycine betaine, Chlorophyll b are high in case of *Marchantia paleacea*.

Keywords: *Marchantia paleacea*, *Conocephalum conicum*, Antifungal, Antioxidant

INTRODUCTION

Many disorders are treated using medicinal plants since they have proved to have pharmacological activity [1]. Medical herbalism is becoming more and more popular because it is cheap, doesn't have side effects, and doesn't lead to drug resistance as often as standard synthetic medicines.

It is known that the bryophytes, which include liverworts, hornworts, and mosses, contain a number of secondary metabolites with a variety of bioactivities. These tiny, inconspicuous, non-vascular plants have been shown to have antibacterial, antioxidative, cytotoxic, and other properties [2]. It is known that bryophytes keep a wide range of secondary metabolites because they are always fighting off biotic and abiotic stressors.

The bryophytes have been one of the first terrestrial plants in the history of evolution. They have made a substantial addition to our perception of plant growth, physiology, stress-induced responses, and phylogenetics [3]. Additionally, their well-developed conduction systems, absence of significant cuticle or epidermis, and ability to absorb metals make them effective bioindicators, biomonitoring agents, and metal absorbers [4]. Although numerous compounds along with the secondary metabolites were identified from various liverworts [5], the conventional use of the species is based on the idea of signatures and is practiced among the indigenous communities to date, highlighting the importance of bryophytes in ethnomedicine. The bryophytes are employed in smaller amounts for the various needs of humans as compared to angiosperms, gymnosperms, and pteridophytes.

In India, approx. 22 bryophyte species with documented ethnobotanical applications are present, including one in the Nicobar Islands [6]. People from the tribe named Gaddi of the Kangra valley, state of Himachal Pradesh use a native species called "Patharshali", later found to be *P. appendiculatum*, to treat boils and blisters [7].

In North American, Chinese, Indian and European traditional medicine, a variety of chemical compounds were identified from the bryophytes and used to treat burns, tonsillitis, bronchitis, skin conditions, and illnesses of the skin [8]. Additionally, they have been shown to have cardiotoxic, cytotoxic, antitumor, antifungal, and antibacterial effects [9]. Most of the biological activity of bryophytes comes from chemical substances, especially secondary metabolites [10].

The body produces ROS, the species of reactive oxygen resulting from a variety of internal and external reactions, and antioxidants work to stop the damage the radicals do to healthy cells. Numerous studies have reported on the therapeutic potential of natural antioxidants. A lot of research [11,12,13] has been done on dietary sources of antioxidants, and it has been shown that certain foods have health benefits.

In the current years, the antioxidant titers of pteridophytes and angiosperms were evaluated [14,15,16]. However, very less data is present at present from the other plant groups say, bryophytes. Therefore, the recent study was basically designed to calculate the activity of antioxidants like (catalase, ascorbate peroxide, superoxide dismutase, Glutathione reductase, Guaiacol peroxidase), the non-enzymatic antioxidants (total

phenols, proline content, ascorbic acid, glutathione and glycine betaine), the photosynthesis pigments (the chlorophyll a and b) and also the protein content of *Conocephalum conicum* and *Marchantia paleacea*.

MATERIALS AND METHODS

Study Area

Jammu and Kashmir are a union territory of India, and Kishtwar district is one of its districts. It is Jammu and Kashmir's largest and least populated district as of 2011. 7,737 square kilometres make up the entire area of Kishtwar district (2,987 sq mi). In terms of location, Kishtwar is bounded by the districts of Anantnag and Doda to the west, Kargil to the east and north, Chamba to the south, and 33.5194° N latitude and 75.8999° E longitude. The conventional herbal medical system for treating humans and their livestock is well known to the locals of the Kishtwar district.



Map 1. Study area showing map of Kishtwar district in Jammu and Kashmir

Preparation of Plant Extract

In a pre-chilled pestle and mortar (in an ice box), 0.5 g of thallus tissue was homogenized in 3 ml of 0.1 M potassium phosphate buffer. The mixture was then centrifuged at 13,000 rpm for 20 minutes. Protein content and the activity of antioxidant enzymes were estimated using the supernatant.

Protein Estimation

The Lowry et al. 1951 [17] method was used to estimate the protein content. Approximately 0.1 ml of the extract was pipetted into various test tubes and then 1 ml of distilled water was added to make the volume larger. Each test tube was then filled with 5 ml of reagent C (Reagent A = 2% Sodium carbonate in 0.1 N Sodium chloride, Reagent B = 0.5% CuSO₄ in 1% Potassium sodium tartrate, and Reagent C = 50 ml of reagent A + 1 ml of reagent B), mixed thoroughly, and left to stand for 10 minutes. Next, 0.5 ml of the three-fold diluted Folin-Ciocalteu reagent was added. The reaction mixtures were blended and then let sit at room temperature in the dark for 30 minutes to develop their blue hue. This blue-colored complex was read spectrophotometrically at 660 nm using a UV/VIS absorption spectrophotometer.

Carbohydrate Estimation

The amount of carbohydrates was determined by using Yem, 1954 [18].

0.2 to 1 ml of working standard solution was taken in five different test tubes. Water was added to bring the volume to 1ml in each test tube and then 4 ml of anthrone reagent was added and the contents were mixed. Test tubes were covered with a bath for 10 minutes, then cooled to room temperature. Optical density was measured in a photoelectric colorimeter at 620 nm. Simultaneously, a blank with 1ml of distilled water and 4ml of anthrone reagent was prepared. A calibration curve was constructed on graph paper, by plotting the glucose concentration (10 to 100mg) on the X-axis and absorbance at 620nm on the Y-axis. The concentration of the sugar in the sample from the calibration curve was computed.

Calculation of Carbohydrate Amount

The Carbohydrate amount was calculated against the standard calibrating curve in excel using the equation:

$$Y = mx + b$$

Catalase Activity (CAT) (EC 1.11.1.6)

The catalase activity was estimated according to the method of Aebi, 1983 [19]. The reaction mixture consisted of 2 ml of potassium phosphate buffer (0.1M), 0.2ml of H₂O₂, and 0.1 ml of enzyme extract. The change in the absorbance was read at 240 nm in the test cuvette.

Unit activity (units/min/g tissue)	=	Change in the absorbance/min × total volume
		Extinction coefficient × Volume of the sample taken

Extinction Coefficient = $6.93 \times 10^{-3} \text{ ml}^{-1} \text{ cm}^{-1}$

Specific activity (UA/mg)	=	Unit activity
		Protein content

Guaiacol Peroxidase Activity (GPOX) (EC1.11.1.7) Using Putter's approach [20], the GPOX activity was approximated. 2.5 ml of phosphate buffer was present in the reaction mixture (0.1 M,) In a test cuvette, 0.50 ml of guaiacol solution, 0.1 ml of enzyme extract, and 0.50 ml of H₂O₂ solution were added. At 436 nm, the rate of production of the oxidized guaiacol product was quantified.

Unit activity (units/min/g tissue)	=	Change in the absorbance/min × total volume
		Extinction coefficient × Volume of sample taken

Extinction Coefficient = $25 \text{ Mm}^{-1} \text{ cm}^{-1}$

Specific activity (UA/mg)	=	Unit activity
		Protein content

Superoxide Dismutase Activity (SOD) (1.15.1.1) SOD activity was estimated using Kono's suggested methodology in 1978 [21]. 1.8 ml of sodium carbonate buffer, 750µl of nitrobluetetrazole (NBT-96 M), and 150 µl of triton-X-100 (0.6%) were used in the reaction mixture. After two minutes of incubation and the addition of 100 µl of enzyme extract, the reaction was started by adding 150µ l of hydroxylamine hydrochloride. This reaction mixture was placed in a test cuvette, and at 540 nm, inhibition in the rate of NBT reduction will be noted.

Unit activity (x)	=	Change in absorbance/min (Blank) – Change in absorbance/min (test)	×	100
		Change in absorbance/min (blank)		

X% of inhibition is produced by 0.1ml of enzyme extract. Therefore, 50% of inhibition is produced by

50×70	=	yµl of sample
X		

Specific activity (UA/mg)	=	Unit activity
		Protein content

Ascorbate Peroxidase Activity (APOX) (1.11.1.11). As per Nakano and Asada, APOX activity was assessed [22]. The reaction mixture contained 3 ml of potassium phosphate buffer, 100 mL of ethylenediaminetetraacetic acid (EDTA), 1.2 mL of ascorbic acid, 100 mL of H₂O₂, and 0.2 mL of enzyme extract. For 1 minute, the reduction in absorbance at 290 nm was monitored.

APOX activity was expressed as:

Unit activity (units/min/g tissue)	=	Change in the absorbance/min total volume
		Extinction coefficient × Volume of sample taken

Extinction Coefficient = 2.8 mM^{-1}

Specific activity (UA/mg)	=	Unit activity
		Protein content

Glutathione Reductase Activity (GR) (1.6.4.2)

Glutathione reductase activity was estimated according to the method of Nordhoff et al., 1993 [23].

The reaction mixture contained potassium phosphate buffer 0.1 ml, EDTA, 50µl, nicotinamide adenine dinucleotide phosphate 50µl, Glutathione 50µl and 50µl of enzyme extract.

Unit activity (units/min/g tissue)	=	Change in the absorbance/min × total volume
		Extinction coefficient × Volume of a sample taken

Extinction Coefficient = 6.2mM^{-1}

Specific activity (UA/mg)	=	Unit activity
		Protein content

Biochemical Estimation of Non-Enzymatic Antioxidants

Ascorbic Acid (ASA) The Cakmak and Marschners, 1992[24]. approach was used to assess ascorbic content. 10 cc of methanol were used to homogenize about 1 g of F.W. thalloid tissue. Then, 2.5 ml of 5% metaphosphoric acid was added to 0.5 ml of this extract, and the mixture was centrifuged at 10,000 rpm for 10 minutes. 0.3 ml of centrifuged supernatant, 0.7 ml of 150 mM phosphate buffer containing 5 mM EDTA, and 0.1 ml (10 mM) DDT made up the reaction mixture. The addition of 0.1 cc N- ethylmaleimide eliminated extra DDT. In the end, 0.5 ml of TCA, 0.2 ml of ferric chloride, 2, 2 bipyridine, and ethyl alcohol were added. 30 minutes of 45°C incubation of the reaction mixture preceded a 525 nm absorbance measurement. To ascertain the ascorbic acid concentration, ascorbic acid (0-100µg/ml) was utilised as a positive control

Calculations

Ascorbic acid was calculated against the standard calibration curve in excel using the equation:

$$Y = mx + b$$

Glutathione (GSH) The glutathione content was assessed according to the method of Sedlak and Lindsay, 1968 [25]. 0.5g F.W. of thalloid tissue was homogenized in 5ml of tris-buffer (0.2M). Then the homogenate was centrifuged at 13,000rpm at 10°C for 10 min. The reaction mixture consisting of 0.1 ml supernatant, distilled water, DTNB (0.001M), and methanol was taken in a test cuvette, a and reduction in absorbance will be observed at 412 nm. The concentration of GSH will be determined by using reduced glutathione as standard at a concentration range of 0-10 mg/ml.

Proline Content. The proline concentration was determined by using the method Bates et al., 1973[26].

Extract preparation: 0.5 g of thalloid tissue was homogenized in 10 ml of 3% aqueous sulphosalicylic test acid. Homogenate was filtered through Whatman No. 2 filter paper.

A test tube included 2 ml of filtrate, 2 ml of glacial acetic acid, and 2 ml of acid ninhydrin heated for one hour in a pot of boiling water. The cooled reaction mixture received 4 ml of toluene, which was thoroughly mixed for 30 seconds.

After being separated, the toluene layer was warmed to room temperature. At 520 nm, the intensity of the red color was measured. A standard curve was constructed by doing a series of tests with pure proline as the reference. The standard curve was used to estimate the proline content of the test sample.

Glycine-Betaine (GB) Glycine betaine content was determined according to the method of Greive and Grattan, 1983[27].

Extract Preparation: 0.5g of thalloid sample was homogenized in 5ml of ethanol. Extracts were filtered.

The filtered extract and 1ml of 2N HCL were well blended together. A test tube containing around 0.5 ml of this combination was filled with 0.1 ml of the samples, which were then stored on an ice bath for 90 minutes before being added together with 10 ml of 1,2-dichloromethane and vigorously shaken. Using a UV/VIS Specord M-40 spectrophotometer, the bottom organic layer was read spectrophotometrically at 365 nm. Using betaine as the standard, a standard curve was used to determine the concentration of betaine.

Calculation

Glycine betain was calculated against the standard calibrating curve in excel using the equation:

$$Y = mx + b$$

Total Phenol Content (TPC)

Total phenol content was determined by the method of Ragaazzi and Veronese, 1973[28]. About 0.5 g F.W of thalloid tissue was homogenized in 10 ml of distilled water. 1.5 ml this extract was mixed with 3 ml of

Folinciocalteau reagents and left undisturbed for 30 minutes in the dark followed by addition of 3 ml of sodium carbonate solution. The reading of blue colored solution was taken spectrophotometrically at 680 nm.

Malondialdehyde (MDA) content estimation MDA content was calculated using the technique of Heath and Packer, 1968 [29]. The supernatant from 0.5 g of thaloid tissue was transferred to a fresh tube after being centrifuged at 13,000 rpm for 10 minutes with 5 ml of Trichloroacetic Acid (TCA, 0.1%). The supernatant was stirred thoroughly before adding 3 ml of 20% TCA containing 0.5% Thiobarbituric Acid (TBA). The mixture was promptly cooled on ice after boiling at 95°C for 15 minutes. By using a spectrophotometer to measure the density of the resultant red compound at 532 and 699 nm, the amount of MDA was determined.

Calculations

Lipid peroxidation will be determined from the amount MDA formed and expressed as $\mu\text{mol/g F.W.}$

		Absorbance x total volume (ml)		
MDA ($\mu\text{mol/g F.W.}$)	=	Extinction coefficient x volume of sample (ml) x	x	1000
		weight of the tissue		

Extinction coefficient = 155^{-1} cm^{-1}

Photosynthetic Pigments 0.5 g of thallus before and after terminal water deficit was homogenized with ethanol (95%) (5ml) to make a slurry. The samples were centrifuged at 13000 rpm for 10 mins. To minimize the photo-oxidation, all the procedure was performed in dim light. The reading was taken spectrophotometrically at 664, 648, and 470 nm, for the estimation of Chl a, Chl b and carotenoids contents respectively using the equation of Lichtenthaler, 1987[30].

Chlorophyll a = $13.36A_{664} - 5.19A_{648}$ Chlorophyll b = $27.36A_{648} - 8.12A_{664}$

Total carotenoids = $1000A_{470} - 2.13Chla - 97.63chl b / 209$

Statistical Analyses

The experiments were performed four times. The mean values were expressed as mean \pm SE calculated by using SPSS 20 software.

RESULTS AND DISCUSSION

Protein Content and Antioxidant Enzymes

The ROS, Reactive oxygen species like the hydrogen peroxide, superoxide anion, and nitric oxide are naturally produced in plant tissues as a byproduct of metabolism. ROS are kept at safe levels in the healthy plants by using multilevel antioxidant system. This antioxidant system includes antioxidants which are non-enzymatic antioxidants including Ascorbic acid (ASA), Proline content, Glutathione (GSH), Glycine-betaine (GB), and Total Phenol content (TPC), along with the enzymatic antioxidants like SOD, CAT, GPOX, Ascorbate Peroxidase activity (APOX), Glutathione reductase activity (GR). This oxidative damage includes MDA. Three enzymes' unit activities, SOD, CAT, and GPOX, were calculated for the current study. *Marchantia paleacea* sp. had a protein level of 5.25 mg/g FW, compared to 4.43 mg/g FW for *Conocephalum conicum* sp (Fig. 1). Fig. 2 showed the Soluble sugar content for *Conocephalum conicum* sp. and *Marchantia paleacea* sp. Further, for *Conocephalum conicum* sp., superoxide dismutase (SOD) was found to have a value of 1.18 UA/mg Prot. g-1 FW for *Conocephalum conicum* sp. and for *Marchantia paleacea* sp., 1.42 UA/mg Prot. (Fig. 3). *Conocephalum conicum* sp. had the highest result for guaiacol peroxidase (1.94 UA/mg Prot.), while *Marchantia paleacea* sp. came 0.30 UA/mg Prot. (Fig. 4). However, results for catalase reported, where *Marchantia paleacea* sp. had a greater unit activity 64.45 UA/mg Prot. than *Conocephalum conicum* sp. 63.85 UA/mg Prot. (Fig. 5). For *Conocephalum conicum* sp., Ascorbate Peroxidase was found to have a value of 1.14 UA/mg Prot. for *Conocephalum conicum* and for *Marchantia paleacea* sp., 2.74 UA/mg Prot. (Fig. 6).

Antioxidants

The antioxidants are defined as an endogenous system unlike the ROS, utilized in medicinal and cosmetic applications. The antioxidants which are non-enzymatic: proline content, glutathione (GSH), glycine betadine (GB), ascorbic acid (ASA), total phenols (TPC) were evaluated too. The Glutathione Reductase content was calculated to be 1.08 UA/mg and 0.80 UA/mg for *Marchantia paleacea* sp. And *Conocephalum conicum* sp. Respectively (Fig 7). The Ascorbic acid ASA content was found to be 9.39 mg/g FW for *Conocephalum conicum* sp. and 4.59 mg/g FW for *Marchantia paleacea* sp. (Fig. 8). Total phenol in *Conocephalum conicum* sp. was calculated as 10.86 mg/g FW and 7.27 mg/g FW for *Marchantia paleacea* sp. (Fig. 9). Proline in *Conocephalum conicum* sp. was calculated as 3.38 mg/g FW and 4.77 mg/g FW for *Marchantia paleacea* sp. (Fig.10).

However, Glycine-betaine value was high in case of *Marchantia paleacea* sp. (3.86 mg/g FW) to that of *Conocephalum conicum* sp. (3.64 mg/g FW) (Fig. 11). MDA in *Conocephalum conicum* sp. was calculated as 0.83 mg/g FW and 0.61 mg/g FW for *Marchantia paleacea* sp. (Fig. 12). The value of total glutathione was high in case of *Marchantia paleacea* sp. (4.13 mg/g FW) to that of *Conocephalum conicum* sp. (3.08 mg/g FW) (Fig. 13).

The pigments of Photosynthetic and the Chlorophyll a and b for *Conocephalum conicum* sp. was calculated as 0.13 mg/g FW, and 0.45 mg/g FW resp. For *Marchantia paleacea* sp., values that were produced for the chlorophyll a as well as for chlorophyll b as 0.42 mg/g FW and 1.24 mg/g FW resp. (Figs. 14, 15).

DISCUSSION

The Bryophytes are a crucial part of the vegetation, mainly in the temperate biome. These are capable of growing diversity of habitats and also adapted to live on a surface with least amount of humus. The bryophytes fill in the gaps and also maintain moisture and therefore, plays a very important part in the ecosystem. In the recent study, *Conocephalum conicum* and two sp. *Marchantia paleacea* were explored and investigated for the antioxidant potential.

In the tissues of the plant, production of the ROS, the reactive oxygen species, say, the hydrogen peroxide, superoxide ion, and the nitric acid come naturally as an outcome of the side effects of the metabolism. For healthy plants, this multi-level system of antioxidants retains the safe levels for ROS [31]. The antioxidant system comprises the enzymatic antioxidants like: CAT, SOD, MDHAR, DHAR, and GPOX) and the antioxidants which are non-enzymatic (ASA, CAR, TPC, PL and GSH). During the current investigation, the unit activity for the three enzymes, GPOX of two liverworts, *Conocephalum conicum* sp. and *Marchantia paleacea* and CAT and SOD, have been assessed. They were evaluated for the determination of the antioxidant potential of bryophytes. The unit activity investigated for the liverwort was equivalent to the value of higher plants and was higher for *Marchantia paleacea* sp., in case of CAT, GPOX and SOD. However, the ascorbate peroxidase was high for the *Conocephalum conicum* sp. to that of *Marchantia paleacea* sp., which can be assigned to a certain task of antioxidant enzymes. According to Prasad et al., [32], the *Riccia* sp. to the Cd stress and assessed certain activity of the CAT and SOD under the normal as well as abnormal conditions. The antioxidants which are non-enzymatic such as., total phenols, ascorbic acid, and glutathione were also assessed. For medicinal applications and cosmetics, antioxidants are used which are an inland system against the ROS. The value of the ASA varies between 1.14 to 2.74 mg/g in the case of both taxa. Prasad et al. [32] perceived the content of ascorbic acid in *Riccia* sp. At a value of 15 mg/g FW which increases under the UV and Cd stress conditions. The GSH value varies from 0.80 mg/g FW upto 1.08 mg/g FW.

However, the increase in the antioxidants demand in the cosmetic and medicinal industry has guided us to a practical search for more resources and also additional analysis might also tell us the presence of huge number of antioxidants in the taxa [33].

Mahmud et al., 2017 [34] study looked into how MA affected the uptake of Cr and reduced Cr toxicity. In a medium of semi-hydroponic, we administered Cr (0.15 mM, 0.3 mM K₂CrO₄, 5 days) in conjunction with the MA (0.25 mM) to seedlings of Indian mustard that were 8 days old. MA supplementation increased the activity of non-enzymatic antioxidants (AsA ascorbate, glutathione, GSH); enzymatic antioxidants, monodehydroascorbate reductase (MDHAR), glutathione reductase (GR), dehydroascorbate reductase (DHAR), glutathione peroxidase (GPX), Their research found that MA might be used to improve phytoremediation, particularly Phyto stabilization, as well as act as the exogenous protector to increase Cr tolerance. [35] revealed in their experiments that the comparison to untreated plants demonstrated a significant decrease in disease activity and CMV development in treated plants with CHT and GB, either separately or together (challenge control). Growth indices, leaf chlorophyll content, phytohormones (such as indole acetic acid, salicylic acid, gibberellic acid, jasmonic acid), non-enzymatic antioxidants (such as ascorbic acid, phenols, glutathione), endogenous osmoprotectants (such as proline, glycine betaine and soluble sugars), and enzymatic antioxidants (superoxide malondialdehyde and abscisic acid) concentration, on the other hand, have dramatically decreased.

Table 1.

Biochemical estimations	<i>Conocephalum conicum</i>	<i>Marchantia paleacea</i>
Protein (mg/g F.W.)	4.43	5.25
Soluble sugar content (mg/g F.W.)	3.05	3.28
Superoxide Dismutase UA/mg protein	1.18	1.42
Guaiacol Peroxidase UA/mg protein	1.94	0.30

Catalase UA/mg protein	63.85	64.45
Ascorbate Peroxidase UA/mg protein	2.74	1.14
Glutathione Reductase UA/mg protein	0.80	1.08
Ascorbic acid Mg/gF.W.	9.39	4.59
Total Phenols Mg/gF.W.	10.86	17.27
Proline mg/gF.W.	3.38	4.77
Glycine-betaine mg/gF.W.	3.64	3.86
MDA content Umol g/ F.W.	0.83	0.61
Total glutathione mg/gF.W.	3.08	4.13
Chlorophyll a mg/gmF.W.	0.13	0.42
Chlorophyll b mg/gmF.W.	0.45	1.24

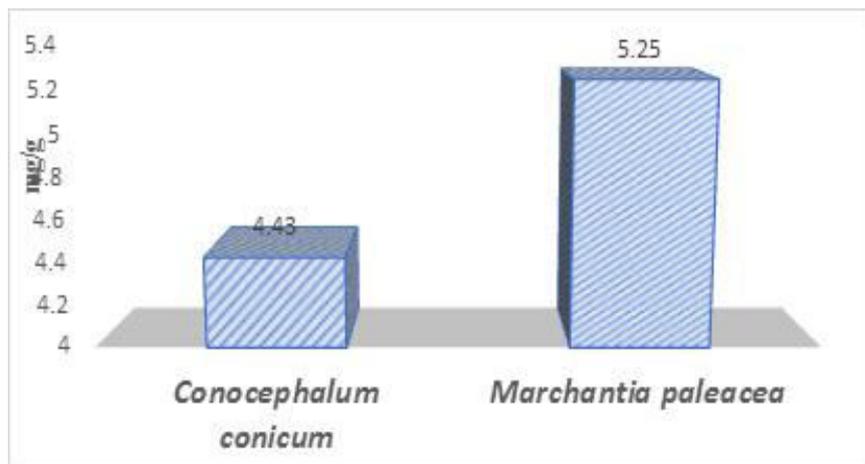


Fig 1 Unit activity of Protein (mg/g F.W.) in *Marchantia paleacea* and *Conocephalum conicum*

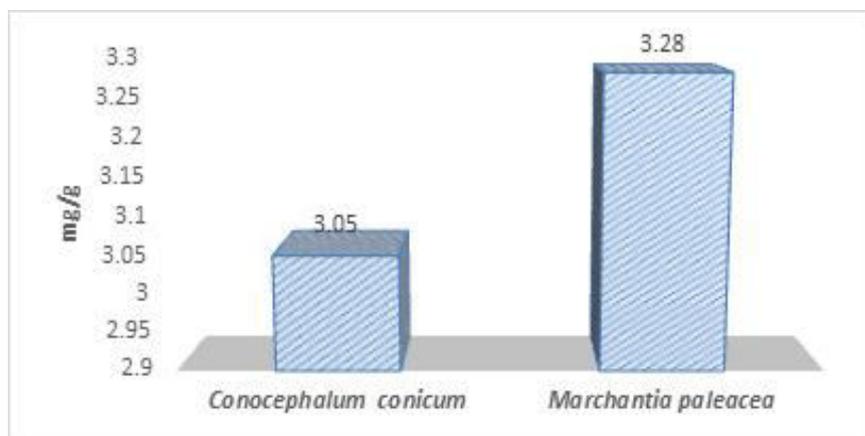


Fig 2 Unit activity of Soluble sugar content (mg/g F.W.) in *Marchantia paleacea* and *Conocephalum conicum*

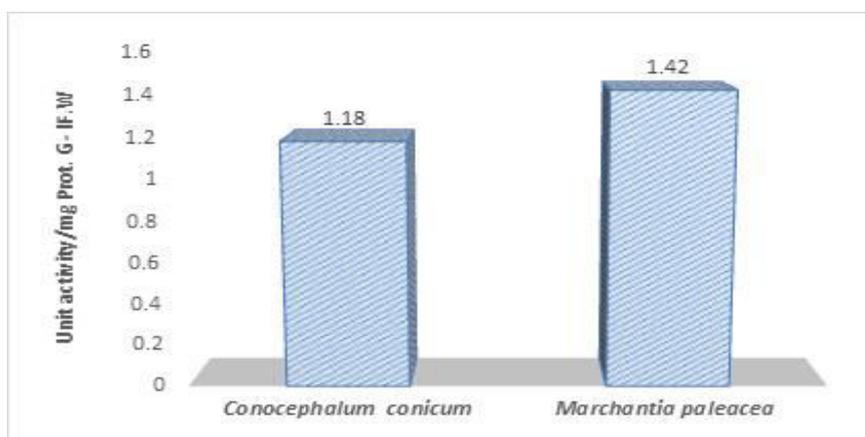


Fig 3 Unit activity of Superoxide Dismutase UA/mg protein in *Marchantia paleacea* and *Conocephalum conicum*

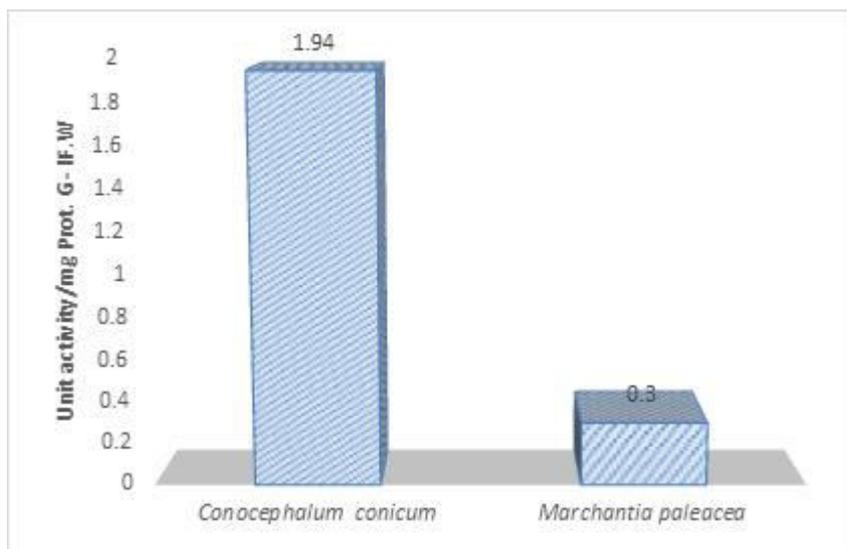


Fig 4 Unit activity of Guaiacol Peroxidase UA/mg protein in *Marchantia paleacea* and *Conocephalum conicum*

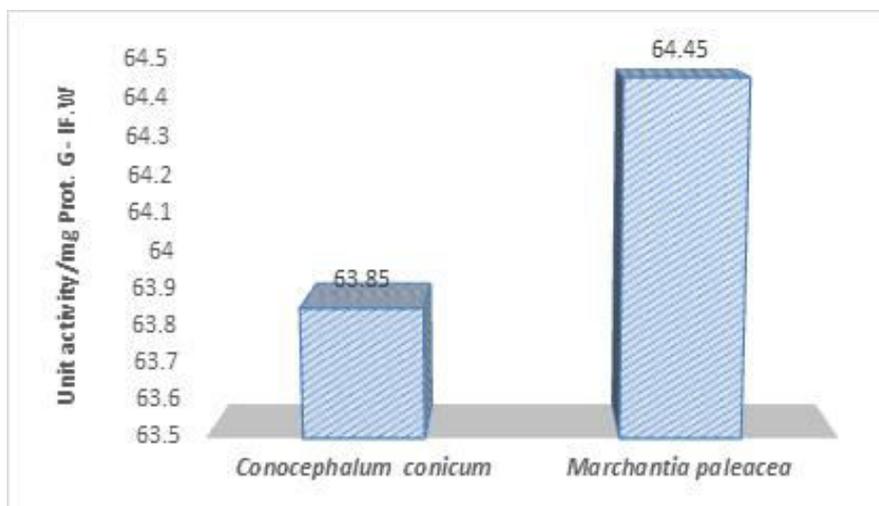


Fig 5 Unit activity of Catalase UA/mg protein in *Marchantia paleacea* and *Conocephalum conicum*

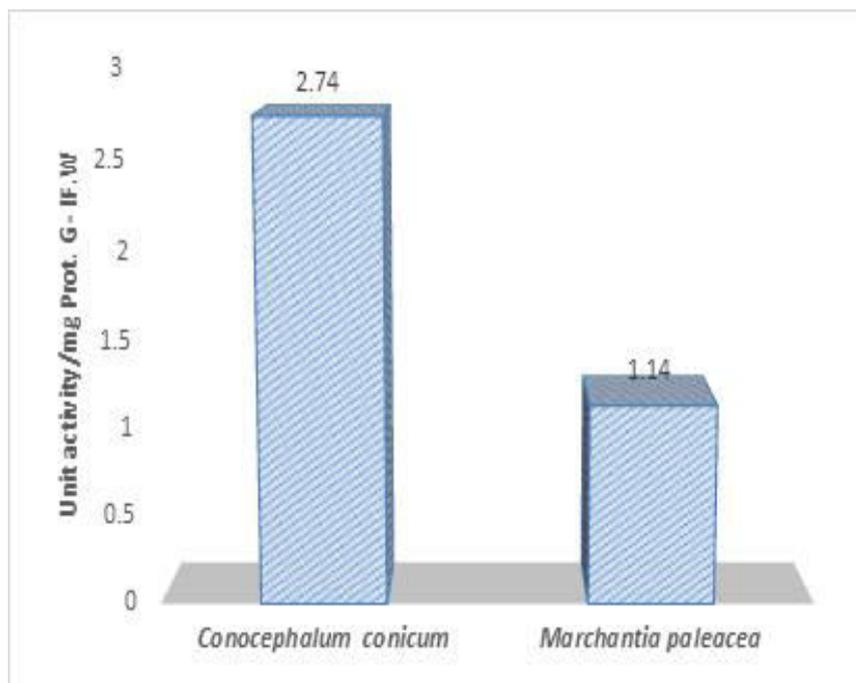


Fig 6 Unit activity of Ascorbate Peroxidase UA/mg protein in *Marchantia paleacea* and *Conocephalum conicum*

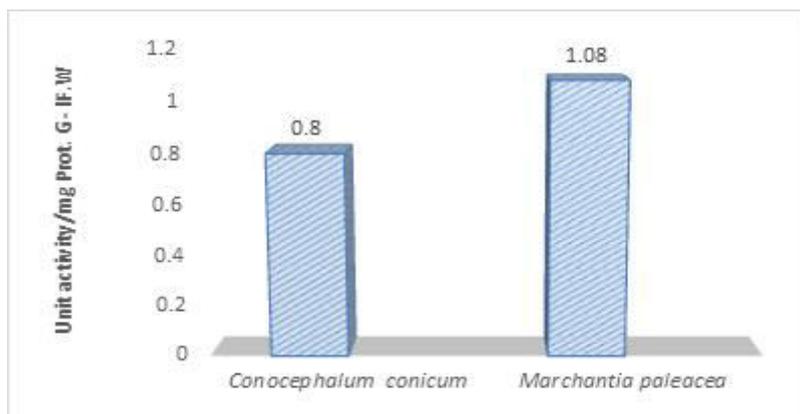


Fig 7 Unit activity of Glutathione Reductase UA/mg protein in Marchantia paleacea and Conocephalum conicum

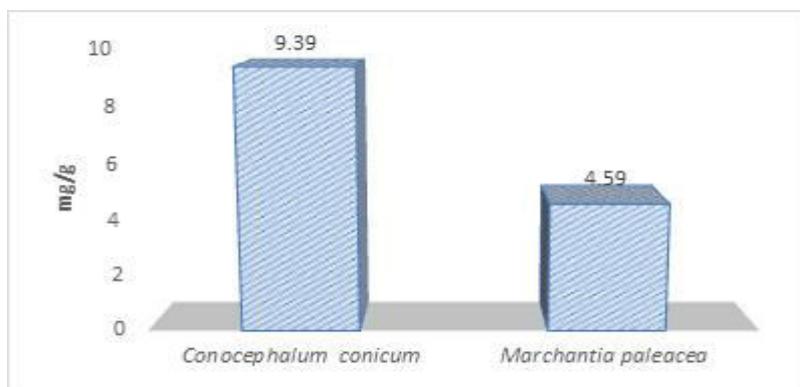


Fig 8 Unit activity of Ascorbic acid Mg/gF.W. in Marchantia paleacea and Conocephalum conicum

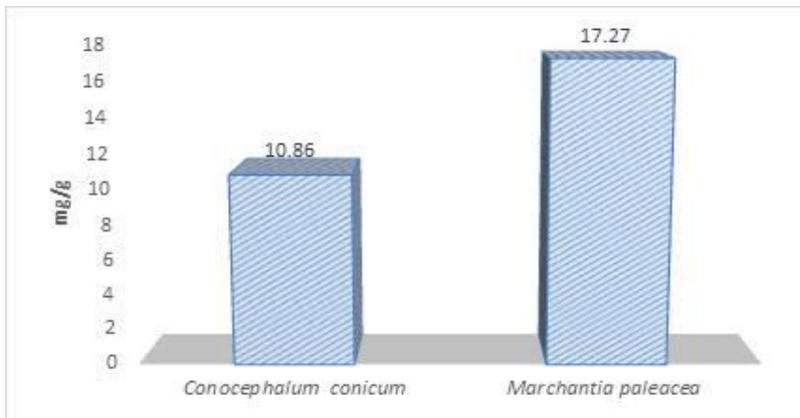


Fig 9 Unit activity of Total Phenols Mg/gF.W. in Marchantia paleacea and Conocephalum conicum

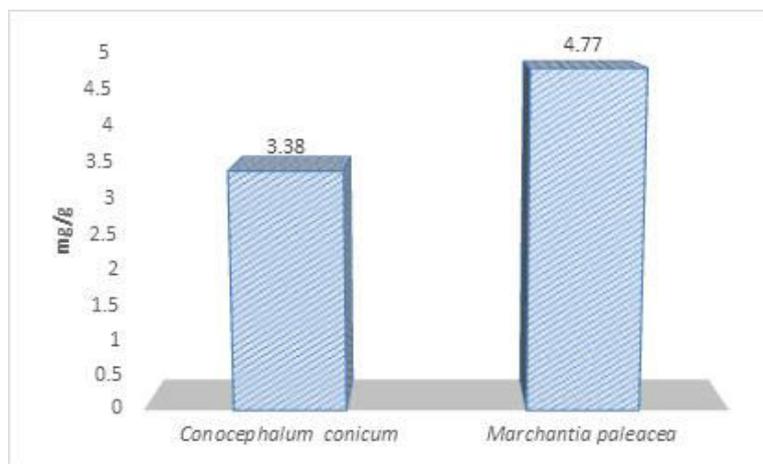


Fig 10. Unit activity of Proline mg/gF.W. In Marchantia paleacea and Conocephalum conicum

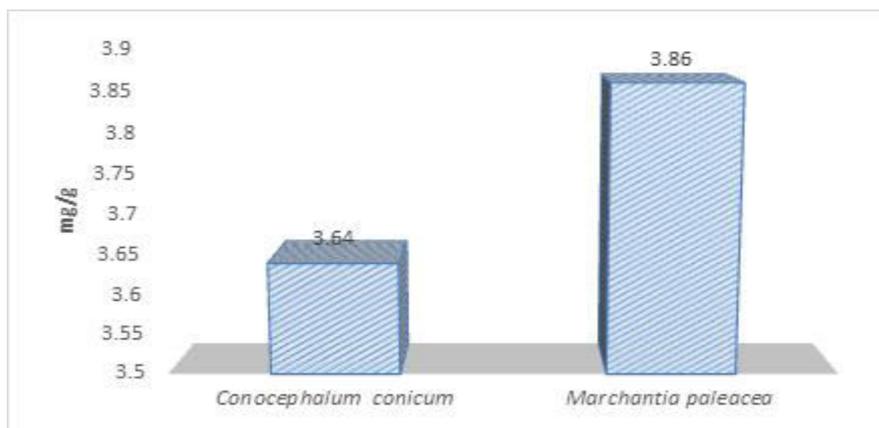


Fig 11. Unit activity of Glycine-betaine mg/gF.W. in Marchantia paleacea and Conocephalum conicum

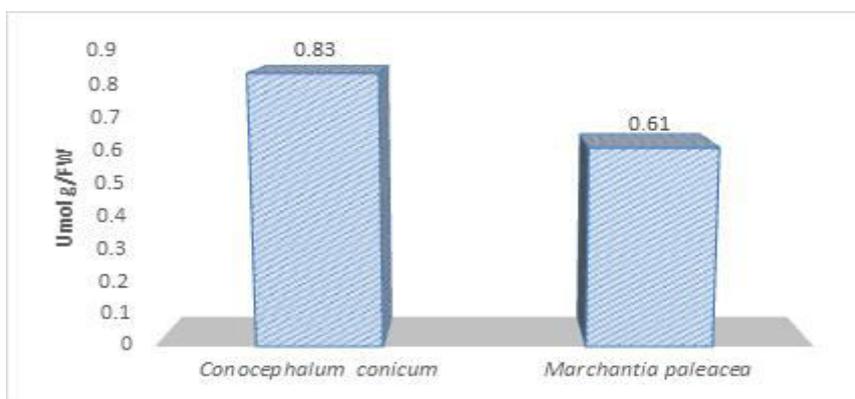


Fig 12 Unit activity of MDA content Umol g/ F.W.in Marchantia paleacea and Conocephalum conicum

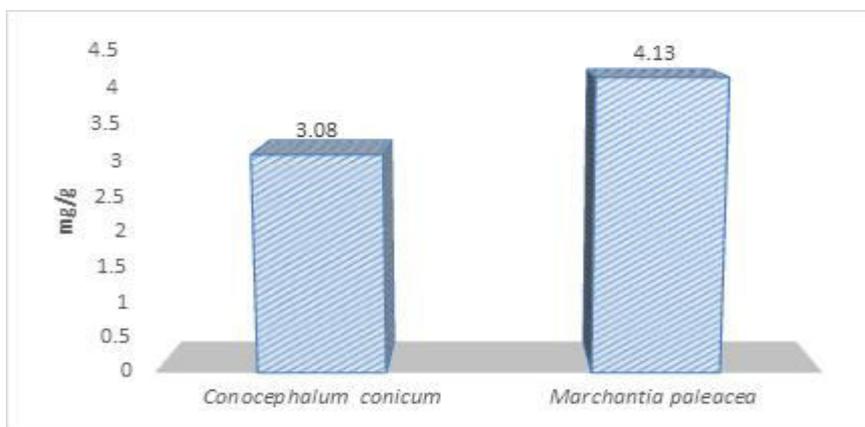


Fig 13 Unit activity of Total glutathione mg/gF.W.in Marchantia paleacea and Conocephalum conicum

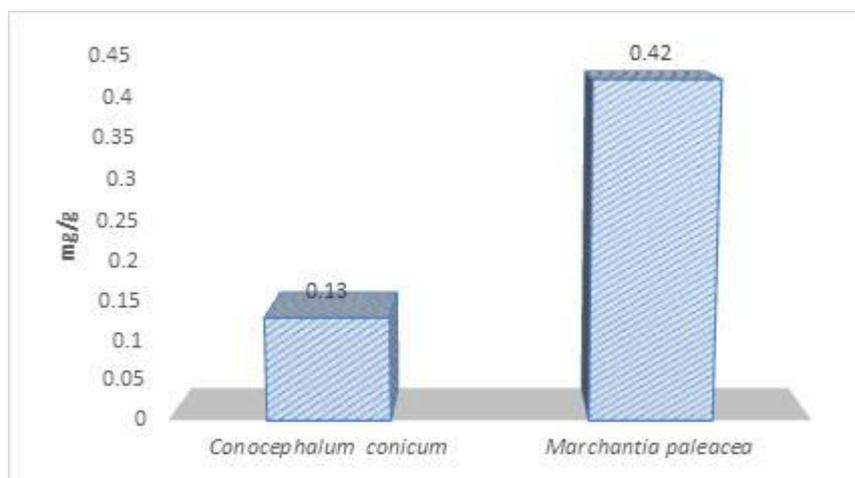


Fig 14 Chlorophyll amg/gmF.W. content in Marchantia paleacea and Conocephalum conicum

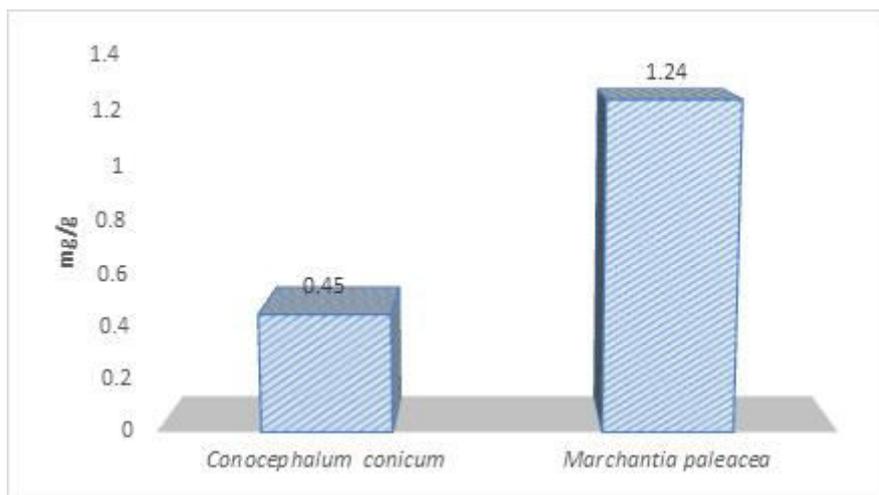


Fig 15 Chlorophyll bmg/gmF.W.content inMarchantia paleacea and Conocephalum conicum

CONCLUSION

According to the philosophy of signatures, bryophytes have been utilized by humans since the beginning of time. This led researchers to attempt a thorough analysis of the molecular components. Two liverworts, *Marchantia paleacea* and *Conocephalum conicum*, both had an effective biochemical titrant in their antioxidant systems. Both liverworts showed activity of the antioxidant system (enzymatic and non-enzymatic), particularly catalase, guaiacol peroxidase, glutathione reductase, superoxide dismutase, glutathione reductase, and biochemical estimation of ascorbic acid, ascorbate peroxidase, proline content, glutathione, glycine-betaine, and total phenol content. It takes pharmacological and phytochemical research to determine the antioxidant properties of these plants so that the noble medicines can be produced from them for everyday human consumption.

ACKNOWLEDGEMENT

I would like to express my deep and sincere gratitude to Professor Anima Langer, who introduced me to the world of bryophytes. I am extending my thanks to the Department of Botany, University of Jammu for providing me with lab space to conduct this research.

REFERENCE

1. Younis, W., Asif, H., Sharif, A., Riaz, H., Bukhari, I. A., & Assiri, A. M. (2018). Traditional medicinal plants used for respiratory disorders in Pakistan: a review of the ethno-medicinal and pharmacological evidence. *Chinese medicine*, 13(1), 1-29.
2. Atwood, J. J., & Buck, W. R. (2020). Recent literature on bryophytes—123 (3). *The Bryologist*, 123(3), 547-583.
3. Wang, C., Liu, Y., Li, S. S., & Han, G. Z. (2015). Insights into the origin and evolution of the plant hormone signaling machinery. *Plant physiology*, 167(3), 872-886.
4. Joshi, N., Joshi, A., & Bist, B. (2020). Phytomonitoring and mitigation of air pollution by plants. In *Sustainable Agriculture in the Era of Climate Change* (pp. 113-142). Springer, Cham.
5. Chen, F., Ludwiczuk, A., Wei, G., Chen, X., Crandall-Stotler, B., & Bowman, J. L. (2018). Terpenoid secondary metabolites in bryophytes: chemical diversity, biosynthesis and biological functions. *Critical Reviews in Plant Sciences*, 37(2-3), 210-231.
6. Sharma, A., Slathia, S., Gupta, D., Handa, N., Choudhary, S. P., Langer, A., & Bhardwaj, R. (2015). Antifungal and antioxidant profile of ethnomedicinally important liverworts (*Pellia endivaefolia* and *Plagiochasma appendiculatum*) used by indigenous tribes of district Reasi: North West Himalayas. *Proceedings of the National Academy of Sciences, India Section B: Biological Sciences*, 85(2), 571-579.
7. Ozturk, M., Gökler, İ., & Altay, V. (2018). Medicinal bryophytes distributed in Turkey. In *Plant and Human Health, Volume 1* (pp. 323-348). Springer, Cham.
8. Chandra, S., Chandra, D., Barh, A., Pandey, R. K., & Sharma, I. P. (2017). Bryophytes: Hoard of remedies, an ethno-medicinal review. *Journal of traditional and complementary medicine*, 7(1), 94-98.

9. Kamat, S., Dixit, R., & Kumari, M. (2022). Endophytic Microbiome in Bioactive Compound Production and Plant Disease Management. In *Microbial Biocontrol: Food Security and Post Harvest Management* (pp. 79-128). Springer, Cham.
10. Klavina, L., Springe, G., Nikolajeva, V., Martsinkevich, I., Nakurte, I., Dzabijeva, D., & Steinberga, I. (2015). Chemical composition analysis, antimicrobial activity and cytotoxicity screening of moss extracts (moss phytochemistry). *Molecules*, 20(9), 17221-17243.
11. Adwas, A. A., Elsayed, A., Azab, A. E., & Quwaydir, F. A. (2019). Oxidative stress and antioxidant mechanisms in human body. *J. Appl. Biotechnol. Bioeng*, 6(1), 43-47.
12. Ozougwu, J. C. (2016). The role of reactive oxygen species and antioxidants in oxidative stress. *International Journal of Research*, 1(8).
13. Gómez, X., Sanon, S., Zambrano, K., Asquel, S., Bassantes, M., Morales, J. E., ... & Caicedo, A. (2021). Key points for the development of antioxidant cocktails to prevent cellular stress and damage caused by reactive oxygen species (ROS) during manned space missions. *npj Microgravity*, 7(1), 1-19.
14. Sharma A, Slathia S, Choudhary SP, Sharma YP, Langer A (2013) Role of 24-epibrassinolide, putrescine and spermidine in salinity stressed *Adiantum capillis veneris* leaves. *Proc Natl Acad Sci* (in press)
15. Slathia S, Sharma A, Choudhary SP (2012) Influence of exogenously applied 24-epibrassinolide and putrescine on protein content, antioxidant enzymes and lipid peroxidation in *Lycopersicon esculentum* under salinity stress. *Am J Plant Sci* 3:714–720
16. Slathia S, Sharma A, Choudhary SP (2012) Co-application of 24-epibrassinolide and putrescine enhances salinity tolerance in *Solanum lycopersicum* via modulating stress indicators and antioxidant system. *Int J Pharma Biol Sci* 4:70–85
17. Lowry, OH, Rosebrough, NJ, Farr, AL and Randall, RJ (1951). Protein measurement with the Folin phenol reagent. *Journal of biological chemistry*, 193, pp.265-275.
18. Yemm, E.W. and Willis, A., 1954. The estimation of carbohydrates in plant extracts by anthrone. *Biochemical journal*, 57(3), pp.508-514.
19. Aebi, H., 1984. [13] Catalase in vitro. *Methods in enzymology*, 105, pp.121-126.
20. Pütter, J., 1974. Peroxidases. In *Methods of enzymatic analysis* (pp. 685-690). Academic Press.
21. Kono, Y., 1978. Generation of superoxide radical during autoxidation of hydroxylamine and an assay for superoxide dismutase. *Archives of biochemistry and biophysics*, 186(1), pp.189-195.
22. Nakano and Asada (1981). Nakano, Yoshiyuki, and Kozi Asada. "Hydrogen peroxide is scavenged by ascorbate-specific peroxidase in spinach chloroplasts." *Plant and cell physiology* 22.5 (1981): 867-880.
23. Nordhoff, A., Buecheler, U.S., Werner, D. and Schirmer, R.H., 1993. Folding of the four domains and dimerization are impaired by the Gly446. *fdarw. Glu exchange in human glutathione reductase. Implications for the design of antiparasitic drugs. Biochemistry*, 32(15), pp.4060-4066.
24. Cakmak, I. and Marschner, H., 1992. Magnesium deficiency and high light intensity enhance activities of superoxide dismutase, ascorbate peroxidase, and glutathione reductase in bean leaves. *Plant physiology*, 98(4), pp.1222-1227.
25. Sedlak, J. and Lindsay, R.H., 1968. Estimation of total, protein-bound, and nonprotein sulfhydryl groups in tissue with Ellman's reagent. *Analytical biochemistry*, 25, pp.192-205.
26. Bates et al., (1973). Bates, L.S., Waldren, R.P. and Teare, I.D., 1973. Rapid determination of free proline for water-stress studies. *Plant and soil*, 39(1), pp.205-207.
27. Greive, C.M. and Grattan, S.R., 1983. Rapid assay for determination of water-soluble quaternary amino compounds. *Plant Soil*, 70(2), pp.303-307.
28. Ragazzi, E. and Veronese, G., 1973. Quantitative analysis of phenolic compounds after thin-layer chromatographic separation. *Journal of Chromatography A*, 77(2), pp.369-375.
29. Heath, R.L. and Packer, L., 1968. Photoperoxidation in isolated chloroplasts: I. Kinetics and stoichiometry of fatty acid peroxidation. *Archives of biochemistry and biophysics*, 125(1), pp.189-198.

30. Lichtenthaler, H.K. and Buschmann, C., 2001. Chlorophylls and carotenoids: Measurement and characterization by UV-VIS spectroscopy. *Current protocols in food analytical chemistry*, 1(1), pp.F4-3.
31. Cortese-Krott, M. M., Koning, A., Kuhnle, G. G., Nagy, P., Bianco, C. L., Pasch, A., ... & Feelisch, M. (2017). The reactive species interactome: evolutionary emergence, biological significance, and opportunities for redox metabolomics and personalized medicine. *Antioxidants & redox signaling*, 27(10), 684-712.
32. Prasad SM, Dwivedi R, Zeeshan M, Singh R (2012) UV-B and cadmium induced changes in pigments, photosynthetic electron transport activity, antioxidant levels and antioxidative enzyme activities of *Riccia* sp. *Acta Physiol Plant* 26:423-430
33. Dey A, De A, Ghosh P, Souryadeep M (2013) Altitude and Tissue Type Influence Antioxidant Potential of *Pellia endiviifolia* from Darjeeling Himalaya. *Pak J Biol* 13:1-5
34. Al Mahmud, J., Hasanuzzaman, M., Nahar, K., Rahman, A., Hossain, M. S., & Fujita, M. (2017). Maleic acid assisted improvement of metal chelation and antioxidant metabolism confers chromium tolerance in *Brassica juncea* L. *Ecotoxicology and environmental safety*, 144, 216-226.
35. Sofy, A. R., Dawoud, R. A., Sofy, M. R., Mohamed, H. I., Hmed, A. A., & El-Dougdoug, N. K. (2020). Improving regulation of enzymatic and non-enzymatic antioxidants and stress-related gene stimulation in Cucumber mosaic cucumovirus-infected cucumber plants treated with glycine betaine, chitosan and combination. *Molecules*, 25(10), 2341.

Review of Different Types of Redox Reactions and their Mechanisms

Dipak Kumar Saha

Assistant Professor, Chemistry, Dinabandhu Mahavidyalaya, Bongaon, West Bengal, India

ABSTRACT

Objectives: Different types of redox reactions and their applications and importance in different field mainly, in biological system have been analyzed and presented in this review. Different examples and mechanisms of outer-sphere, inner-sphere and PCET (proton coupled electron transfer) redox reactions are also discussed. Distinguishing the factors that indicate if electron occurs by an outer or inner sphere mechanism. **Methods:** Many previously published research papers on this field are thoroughly investigated (literature surveying), books are studied on this topic.

Findings: Quantum mechanical tunneling of electron between different metal centers must be present in outer sphere mechanism. There is substitution for the formation of a bridge between oxidant and reductant and actual electron transferring process occurs in inner sphere reaction. Proton-coupled electron transfer (PCET) biologically important redox reaction and transfer of an electron and proton to or from a substrate is happened in a concerted manner in this case.

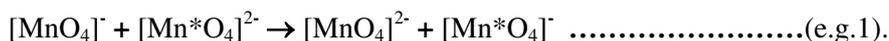
Novelty: This review article has highlighted the comprehensive overview of redox reactions and mechanism which creates a bridge for further research.

Keywords: Electron transfer, Redox, Outer-sphere, Inner-sphere, Proton transfer.

1. INTRODUCTION

After the basic researches by Jorgenson [1] and Werner [2] the huge advancement of knowledge on mechanism of various chemical reactions of d-block metal complexes had started. Lamb and Marden [3] had done the first quantitative study in 1911 on these complexes. Substitution and isomerisation reactions were chosen by these great scientists as their research interest. As time passes, researchers, followers paid more intense attention on redox reaction due to the importance of this type of reaction in the field of photosynthesis, respiration and differnt biological processes.

It is observed that redox reactions may proceed with or without a net chemical change. Most popularly known examples of redox reactions without a net chemical change are self exchange processes (e.g.1).



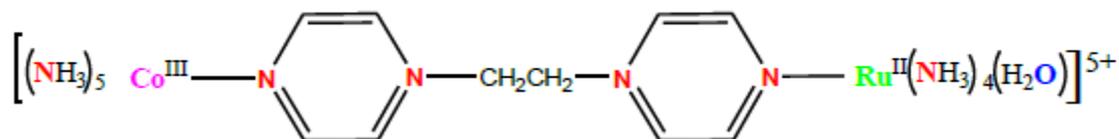
2. Types of Redox Reactions:

There are different types of redox reactions and they may be classified as follows:

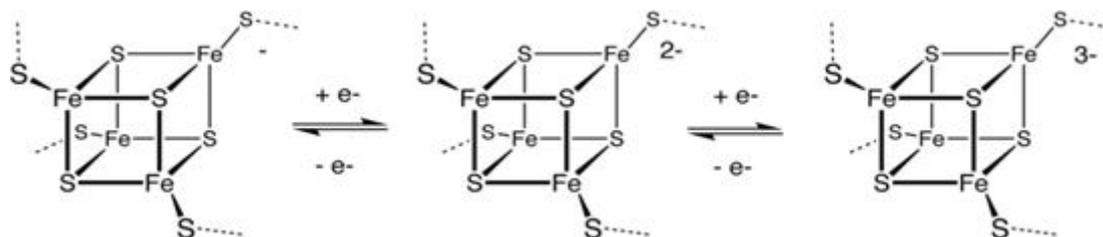
- A) The outer-sphere reactions
- B) The inner-sphere reactions
- C) The proton coupled electron transfer (PCET) reactions

2a. The Outer-Sphere Reactions

Outer sphere reactions refer to an electron transfer (ET) reaction that happens between chemical species. The chemical species remain separate and intact before and during as well as after the ET reaction [4]. On the contrary, the participating redox sites undergoing ET become connected by a chemical bridge for inner sphere electron transfer. The reason is that the ET in outer sphere electron transfer happens between the two non-connected species, the electron is forced to move through space from one redox centre to another redox centre. As there is very little electronic interactions between reagents in outer-sphere mechanism. If the bridge is insulated, a bridged intermediate may undergo outer sphere electron transfer, does not transmit electron and inhibits the inner sphere path. Electron transferring from Ru(II) to Co(III) in the bridged complexes in outer-sphere is shown in the following example [5].

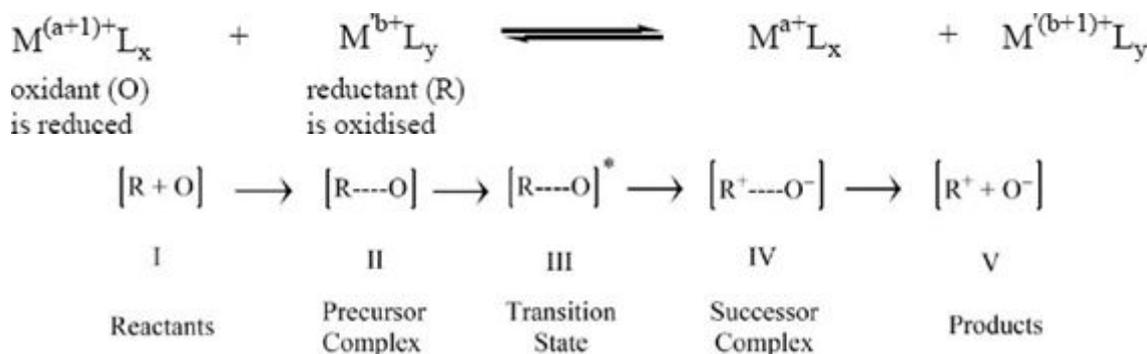


Outer sphere ET is the basis of the biological function of the iron-sulfur proteins. The Fe centers are typically further coordinated by cysteinyl ligands. The $[\text{Fe}_4\text{S}_4]$ electron-transfer proteins ($[\text{Fe}_4\text{S}_4]$ ferredoxins) may be further subdivided into low-potential (bacterial-type) and high-potential (HiPIP) ferredoxins. Low- and high-potential ferredoxins are related by the following redox scheme.



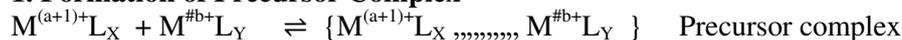
ET is rapid between these clusters as there are small structural differences between the individual redox states.

Mechanism

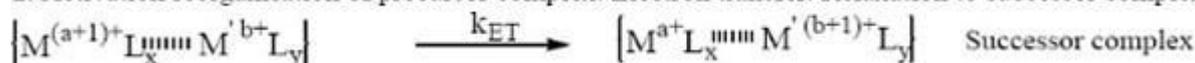


This is a common example of outer-sphere electron transfer reaction, where oxidant (O) is reduced and reductant (R) is oxidized. Oxidant (O) and reductant (R) come close in the first step to form a precursor complex $[\text{O}\cdots\text{R}]$, in 2nd step this complex is to be activated to form activated precursor complex $[\text{O}\cdots\text{R}]^*$ and electron transfer and relaxation to successor complex $[\text{O}^-\text{R}^+]$ happens. The successor complex dissociates to products in the last step.

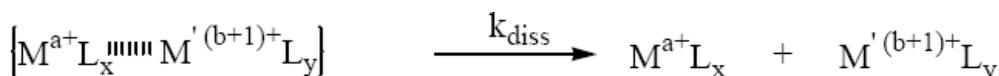
1. Formation of Precursor Complex



2. Activation/reorganisation of precursor complex. Electron transfer. Relaxation to successor complex



3. Dissociation of successor complex



Precursor complex formation and dissociation of successor complex are the fast step among these three steps. Electron transferring step is the slowest step i.e. rate determining step. The free energy vs. reaction coordinate graph is shown in figure 1.

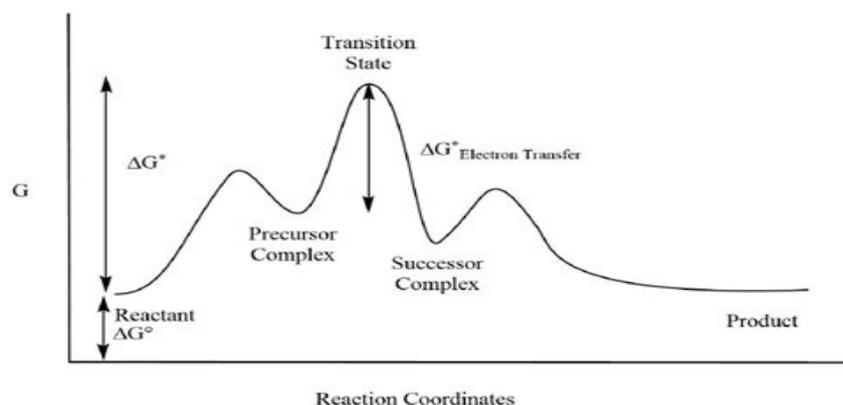


Figure 1: The free energy vs. reaction coordinate graph of outer-sphere reaction

$$\Delta G^\ddagger = \Delta G_t^\ddagger + \Delta G_o^\ddagger + \Delta G_i^\ddagger$$

energy to bring reactants together (including overcoming coulombic repulsion) energy needed for solvent reorganisation energy required for reorganisation of bond lengthening/compression to make interacting orbitals the same energy

The free energy related to activation of precursor complex is expressed as sum of three free energy terms:

$$\Delta G^\# = \Delta G_t^\# + \Delta G_o^\# + \Delta G_i^\#$$

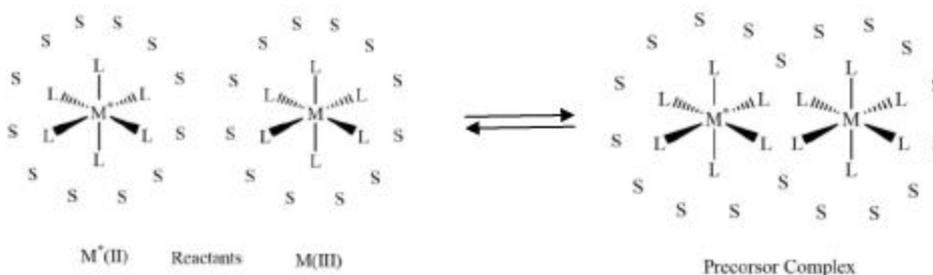


Figure 2: Solvent reorganization during the formation of precursor complex

2b. The Inner-Sphere Reactions

Inner sphere or bonded electron transfer [6] is a redox chemical reaction that goes through via a covalent linkage - a strong electronic interaction between the oxidant and the reductant. During the electron transfer event in Inner Sphere (IS) electron transfer (ET), a ligand bridges the two metal redox centres. Large ligands inhibit inner sphere processes, preventing the development of the essential bridging intermediate. IS ET is therefore uncommon in biological systems, because redox sites are generally shielded by bulky proteins. Inner sphere ET is commonly used to explain transition metal complex reactions. In the inner-sphere process [7], not only electrons are transferred, but also bonds are disrupted and formed. The electron is transported from the reductant to the oxidant via a bridging activated complex in this pathway. During the reaction, the bridging ligand shared by the precursor, successor, and activated complex may or may not be transferred. The bridging ligand must dissociate from one of the ligands in the octahedral complexes in order for the bridging ligand to play its role in producing an intimate contact between the reductant and the oxidant, allowing for electron transfer. Inner sphere reactions usually involve one labile reactant and one inert reactant. One of the complexes must be labile or co-ordinatively unsaturated. Inner sphere mechanism does not occur if both complexes are inactive.

The most important example [8] of inner sphere reaction mechanism is the reduction of $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$ by $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ as given below.



Where both metal centers (Co^{III} & Cr^{III}) are inert but both the Co^{II} & Cr^{II} are labile. The chloride anion, strongly bonded to inert Co^{III} ion can very fastly replace a H_2O molecule from labile Cr^{II} via a bridged intermediate, $[(\text{NH}_3)_5\text{Co}-\text{Cl}-\text{Cr}(\text{H}_2\text{O})_5]^{4+}$. After ET the intermediate leading to form reduced Co^{II} and oxidized Cr^{III} .

The entire reaction includes the production of a precursor complex, electron transfer, and the formation of a successor complex with the possibility of ligand transfer.

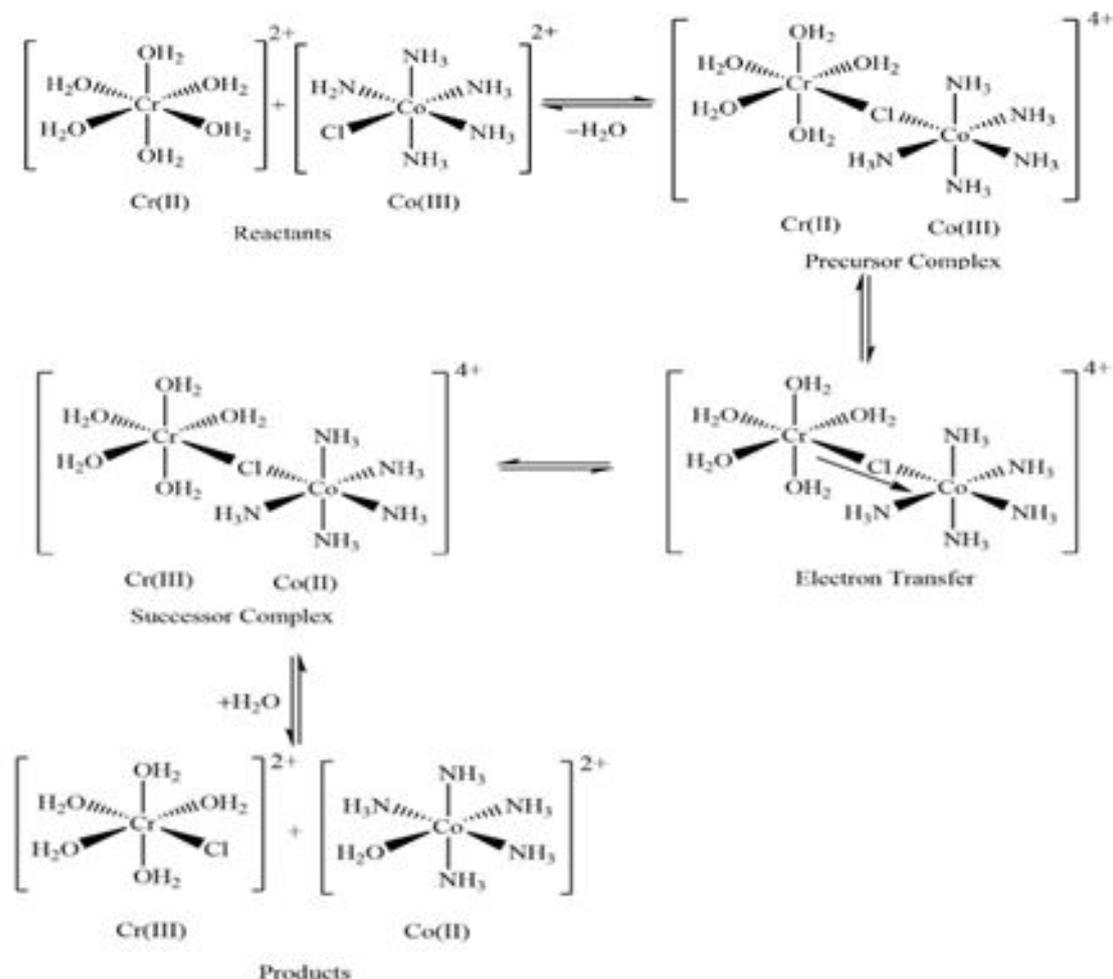


Figure 3: Different steps of inner sphere reaction

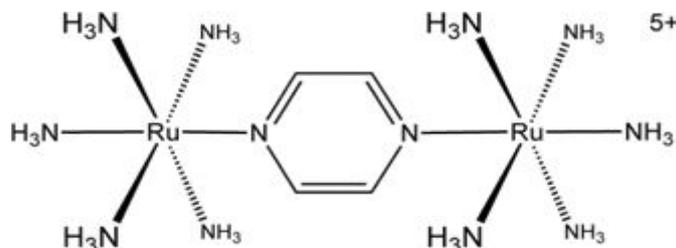


Figure 4: Structure of "Creutz Taube complex"

The presence of the chloride bridge is assumed from the product analysis in the prior example, although it was not observed. One complex which is taken as a model for the bridged intermediate is the "Creutz Taube complex" $[(\text{NH}_3)_5\text{RuNC}_4\text{H}_4\text{NRu}(\text{NH}_3)_5]^{5+}$. This species is named according to Carol Creutz, who prepared the ion in the laboratory during her Ph.D studies with Henry Taube. The heterocycle pyrazine, 1,4- $\text{C}_4\text{H}_4\text{N}_2$, is the bridging ligand. Ru has an average oxidation state of 2.5+ in the Creutz-Taube Ion. Spectroscopic measurements, on the other hand, reveal that the two Ru centres are equivalent, indicating that the electron hole can easily communicate between the two metals [9]. The Creutz-Taube ion is significant because of its simplicity, which makes theoretical analysis easier, and its high symmetry, which provides a high degree of delocalization. As molecules and polymeric materials, there are much more complex mixed valence species.

The bridging ligand could be virtually any entity that can donate electrons. Typically, ligand has more than one lone electron pair, such that it can act as an electron donor to both the reductant and the oxidant. Some common bridging ligands halides and the pseudohalides like hydroxide and thiocyanate, oxalate and malonate etc. Prior to ET, the bridged complex must form, and such processes are often highly reversible. Electron transfer proceeds through the bridge once it is established. In some cases, the stable bridged structure could exist within the ground state; in different cases, the bridged structure is also a transiently-formed intermediate, instead as a transition state throughout the reaction. Reaction coordinate diagram for inner sphere electron transfer mechanism has been shown in figure 5.

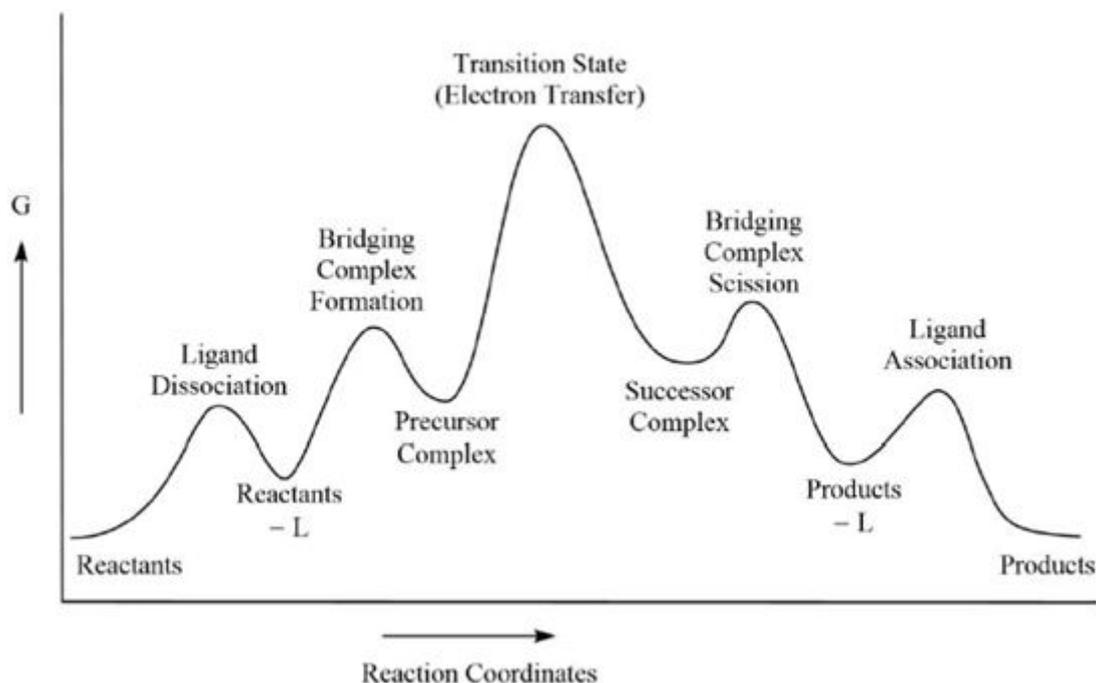
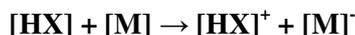


Figure 5: Reaction coordinate diagram for inner sphere electron transfer mechanism

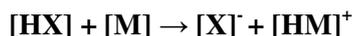
2c. The Proton Coupled Electron Transfer (Pcet) Reactions:

In the different energy conversion processes of chemistry and biochemistry electron transfer (ET) and proton transfer (PT) are most important processes of redox reactions. Proton-coupled electron transfer (PCET) is a type of redox reaction in which transfer of an electron and proton to or from a substrate is happened in the concerted way [10]. In PCET, the proton and the electron (i) start from different orbital and (ii) are transferred to different orbital. PCET contrast to step-wise mechanisms in which the electron and proton are transferred sequentially.

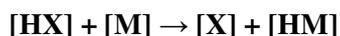
ET (electron transfer): Step-wise mechanism



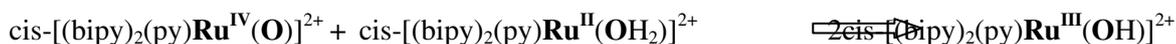
PT (proton transfer): Step-wise mechanism



PCET (proton coupled electron transfer): Concerted mechanism



In redox reactions that appear to be net hydrogenations and dehydrogenations, PCET is expected to be persistent. Water oxidation in photosynthesis, nitrogen fixation, and oxygen reduction in various respiration processes are all relevant examples. Simple reactions, such as the comproportionation of Ru(II) aquo and Ru(IV) oxo reactants, are frequently studied by inorganic chemists to evaluate this mechanism:



i.e.

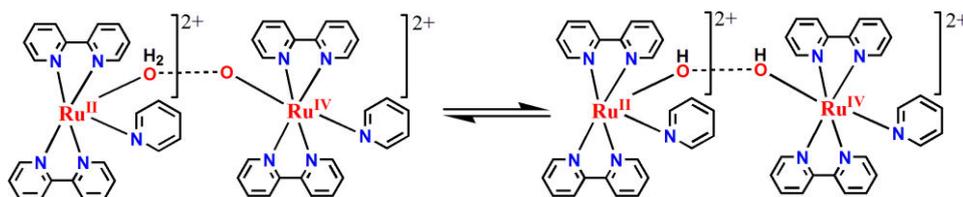


Figure 6: Comproportionation reaction of Ruthenium complexes

PCET is also frequently used in electrochemical reactions involving the coupling of reduction and protonation or oxidation and deprotonation [11].

Although it is very straight forward to show that the electron and proton begin and end in different orbitals, it is very hard to prove that they do not move in a sequential manner. The energy consumption of general sequential

pathways is lower than that of coordinated pathways. The fact that a number of reactions occur faster than expected for sequential routes is the most compelling proof that PCET occurs.

The initial redox event has a minimal thermodynamics barrier associated with the first step in the initial electron transfer (ET) mechanism. Similarly, the first proton transfer (PT) mechanism has a minimum barrier related with the initial p^{Ka} of the protons. Variations on these bare minimums are also taken into account. The interesting result is that there are a number of reactions that have rates that are higher than what these minimum barriers allow. This indicates a third mechanism lower in energy; the concerted PCET has been proposed as this third mechanism. The observation of extremely large kinetic isotope effects (KIE) has supported this. The individual ET and PT pathways operate at higher activation energy than the concerted pathway, which is a common approach for developing the PCET pathway [10]. The definition of PCET has been expanded in some literature to incorporate the sequential mechanisms outlined above. Because of the ambiguity in the concept of PCET, additional names such as electron transfer-proton transfer (ETPT), electron-proton transfer (EPT), and coordinated proton-electron transfer have been proposed (CPET).

3. CONCLUSION

Participating transition metal complexes in outer-sphere redox mechanism are generally kinetically inert. Quantum mechanical tunneling of electron between different metal centers must be present there. The most important and favorable factors for this mechanism are (i) for tunneling complexes come close together (ii) there are must be bond lengthening and shortening phenomenon (iii) Franck-Condon principle must be followed in this mechanism. On the other hand in case of inner-sphere redox reaction mechanism the most important factors are (i) there is substitution for the formation of a bridge between oxidant and reductant (ii) actual electron transferring process occurs here (iii) separation of the products (often with transfer of the bridging ligand) are observed in this mechanism. Proton-coupled electron transfer (PCET) is a common and biologically important redox reaction. In this mechanism transfer of an electron and proton to or from a substrate is happened in a concerted manner.

REFERENCES

1. Jorgenson S M. Zur Konstitution der Kobalt-, Chrom-, und Rhodiumbasen. X. Mitteilung. Z. Anorg. Chem. 1898;16: 184-197.
2. Werner A. Zur Kenntnis des asymmetrischen Kobaltatoms. Ber. Dtsch. Chem. Ges. 1912; 45: 3281-3287.
3. Lamb A B, Marden J N. J. Am. Chem. Soc. 1911; **11**: 1873.
4. McNaught A D, Wilkinson A. (Compiler) Outer-sphere electron transfer, IUPAC Gold book, Blackwell Scientific Publications, Oxford, 1997. Available from <https://doi.org/10.1351/goldbook>.
5. Campion R J, Purdie N, Sutin N. The kinetics of some related electron transfer reactions. Inorg. Chem. 1964; 3 (8): 1091-1094. Available from **doi:10.1021/ic50018a006**
6. Gold V. Inner-sphere electron transfer. Gold Book. 2006. 5th edition. Available from [doi:10.1351/goldbook.I03052](https://doi.org/10.1351/goldbook.I03052).
7. Haim A. Mechanism of electron transfer reactions: The bridged activated complex. Prog. Inorg. Chem. 1983; **30**: 273. Available from <https://doi.org/10.1002/9780470166314.ch6>
8. Taube H, Myers H, Rich R L. The Mechanism of Electron Transfer in Solution. J. Am. Chem. Soc. 1953; **75**: 4118-4119. Available from [doi:10.1021/ja01112a546](https://doi.org/10.1021/ja01112a546)
9. Richardson D E, Taube H. Mixed valence molecules: Electronic delocalization and stabilization. Coordination Chemistry Reviews. 1984; **60**: 107-129. Available from [https://doi.org/10.1016/0010-8545\(84\)85063-8](https://doi.org/10.1016/0010-8545(84)85063-8)
10. Huynh M H V, Meyer T J. Proton coupled electron transfer. Chemical Reviews. 2007; **107**: 5004. Available from <https://doi.org/10.1021/cr0500030>
11. Mayer J M. Proton coupled electron transfer: A reaction chemist's view. Ann. Rev. Phys. Chem. 2004; **55**: 363. Available at <https://doi.org/10.1146/annurev.physchem.55.091602.094446>

Synthesis and Antifungal Evaluation of Sulfonamide-Based Metal Drug Complexes

Amit Kumar

P G Department of Chemistry, Magadh University Bodh Gaya Bihar

ABSTRACT

The Fe, Pd, Zn, Hg and Ru complexes of mixed of sulphonamide were synthesized. The complexes were characterized using various techniques such as basic investigation, conductivity measurement, infrared, electronic and ESR spectroscopy. Sulphonamide complexes of coordination of the metal to the ligands is through the nitrogen of the pyrimidine group and coordination through the nitrogen of the amine group. The antifungal activity of the complexes was carried out against *Aspergillus niger* and *Penicillium rubrum*.

Keywords: Sulfonamides, synthesis, antifungal ligands, *Aspergillus niger* and *Penicillium rubrum*.

INTRODUCTION

Sulfa drugs are utilized for the treatment of bacterial contaminations, for example, eye diseases, flu, meningitis, actinomycetes diseases, and urinary tract contaminations. They can likewise be utilized as model mixes for unthinking examination of the activity of medications.^{1,2} Sulfapyridine was demonstrated to be successful against pneumonia in 1938. Sulfacetamide discovered profoundly fruitful use in battling urinary tract contaminations. Succinoyl sulfathiazole has been being used against gastrointestinal tract diseases since 1942. Sulfathiazole was utilized successfully during World War II to battle disease in fighters with fight wounds. Sulfanilamide itself, a strong anti-infection, never increased wide-spread use because of its more noteworthy human poisonousness versus its different subsidiaries.

In the long history of medication disclosure, a fascinating wonder has been noticed that mixes with the equivalent basic element show assorted organic exercises. For example, sulfonamides, with various subbed gatherings, show antibacterial, insulin-discharging antidiabetic, carbonic anhydrase inhibitory, high-roof diuretic, and antithyroid activities.³ As of late, numerous papers have detailed a few sorts of antitumor specialists having the basic highlights of sulfonamide.^{4,5} It is notable that sulfadiazine is a helpful antibacterial medication with the run of the mill sulfonamide structure. Sulpha drugs are the manufactured antimicrobial specialists coming about because of 4-amino benzenesulphonamide. Their antibacterial action is thought to emerge from closeness of their structures to the 4-aminobenzoic corrosive found in microbes for folic corrosive synthesis.⁶ The involvement of agriculture and pharma in enjoying various biological activities of sulfonamides is also producing significant attraction.⁷

Sulfonamides are the main functional portion of many structures of drugs principally because of its stability as well as tolerance in humans.^{8,9} Sulfa drugs are used for treatment of gut infections, conjunctivitis, urinary tract infections, in meningitis, eye lotions, bacillary dysentery, malaria.¹⁰⁻¹² Sulfonamide, pyrazinamide and their subordinates have been accounted for to be physiologically dynamic and huge numbers of these mixes discover application in the treatment of a few maladies, for example, tuberculosis, infection and mental disorders.¹³ Sulfonamide and pyrazinamide mixes have additionally been utilized as antifungal, antibacterial, antipyretic, antiamoebic, anticancer, insecticidal, and so on agents.¹⁴⁻¹⁹ A portion of these mixes are likewise known to prompt sedation and have demonstrated to have entrancing activity.²⁰

MATERIAL AND METHODS

The different instruments, techniques, glass wares, solvents, reagents and methods used in the synthesis of sulfonamide compounds are as follows:

The instruments utilized in the current examinations and the trial subtleties are introduced underneath.

Natural examination: The explanatory information (C, H, N) for the ligands and their metal buildings were gotten.

Conductance estimations: A Digisun conductivity meter, DI 909 model, with a cell aligned with 0.1M KCl arrangement was utilized to gauge conductance of the metal buildings in DMF at 10-3M focus.

Infrared spectra: The infrared spectra of the ligands and the metal edifices were recorded in KBr pellets in the range 4000 – 450cm⁻¹ on Perkin Elmer 100 FT-IR spectrophotometer.

Mass spectra: The mass spectra of the ligands were recorded utilizing Agilent 1100 MCD trap-5C Mass spectrometer.

¹H-NMR spectra: The ¹H-NMR spectra of the ligands were recorded in DMSO-d₆ arrangement utilizing Bruker avance 300 MHz.

Electronic spectra: The electronic spectra of the metal buildings in DMF were recorded on Perkin Elmer UV-Vis spectrophotometer.

ESR Spectra: WIN-EPR (BRUKER) ESR spectrometer working in the recurrence go 8.8 - 9.6 GHz was utilized in recording ESR spectra of the all the Cu(II) buildings in DMF at fluid nitrogen temperature.

Attractive weakness estimations: The attractive susceptibilities of the buildings were recorded on a Faraday balance (CAHN-7550-03) at room temperature utilizing Hg[Co(NCS)₄] as the norm.

Warm information: The TGA-DSC bends of the metal edifices were recorded on SDT Q600 V20.9 Build, at University.

METHODOLOGY

Synthesis of the Complexes.

4-(Furan-2-Ylmethylene) Aminobenzenesul Fonamide [Fmabs]:

An answer of 1.72g (0.01mol) of 4-aminobenzenesulfonamide (Merck) broke down in 100 ml of methanol in a 250 ml round base cup, was included with 0.96g (0.01 mol) of furan-2-carbaldehyde (Fluka) . The arrangement was refluxed on a water shower for 3 hours. The compound isolated was separated and recrystallized from methanol to give a dark hued strong. Yield (62%), MP:130°C.²¹

4-(Thiophene-2-Ylmethylene) Aminobenzenesul Fonamide [Tmabs]:

To an answer of 1.72g (0.01mol) of 4-aminobenzenesulfonamide (Merck) disintegrated in 100 ml of methanol in a 250 ml round base cup, 1.22 g (0.01 mol) of thiophene-2-carbaldehyde (Fluka) was included. The arrangement was refluxed on a water shower for 3 hours. The compound isolated was separated and recrystallized from methanol to give a light yellow shaded strong. Yield(82%), MP: 140°C.^{22,23}

4-(Thiophene-2-Ylmethylene) Aminobenzenesul Fonamide [Tmabs]:

To an answer of 1.72g (0.01mol) of 4-aminobenzenesulfonamide (Merck) disintegrated in 100 ml of methanol in a 250 ml round base cup, 1.22 g (0.01 mol) of thiophene-2-carbaldehyde (Fluka) was included. The arrangement was refluxed on a water shower for 3 hours. The compound isolated was separated and recrystallized from methanol to give a light yellow shaded strong. Yield (82%), MP: 140 °C.^{24,25}

Fungal Species: The following fungal species were used to assess the antifungal activity of the compounds.

Pencillum rubrum,

Aspergillus Niger

Antifungal movement: Preparation of spore suspension: From the new societies, spores were gathered and moved to a test tube containing sanitized refined water. The spore suspension subsequently acquired was utilized for testing the antifungal action of the mixes.

Antifungal Test

The antifungal test of the mixes was completed by agar well dispersion strategy as depicted by Magaldi et al.²⁶ The way of life plates hatched with the test life forms were permitted to set and punched with a sterile stopper borer (5 mm distance across) to make open wells. The wells were loaded up with 100 μ l arrangement at a convergence of 5 mg/ml of the mixes at 30 °C. Following 72 hours, the restraint zones were estimated and contrasted and those of the control DMSO and the standard flucnazole at a convergence of 5 mg/ml.

RESULTS AND DISCUSSIONS

Considering the significance related with this class of aggravates, the creator has taken to the combination and portrayal of metal buildings of Schiff bases got from a sulfonamide, carbohydrazide, pyrazinamide and various aldehydes. The examinations have been reached out by screening the ligands HBABS, FMABS and TMABS a portion of their metal edifices arranged for organic action. In the present study, 4-aminobenzenesulfonamide has been condensed with 2-hydroxybenzaldehyde, furan-2-carbaldehyde and thiophene-2-carbaldehyde; the accompanying Schiff base ligands acquired and portrayed.

4-((2-Hydroxybenzylidene) amino) benzenesul fonamide (HBABS) (Fig. 1)

4-((Furan-2-ylmethylene) amino) benzenesulfonamide (FMABS) (Fig. 2)

4-((Thiophen-2-ylmethylene) amino) benzenesulfonamide (TMABS) (Fig. 3)

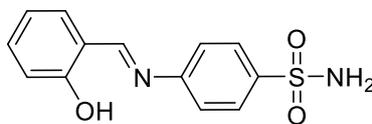


Fig. 1

4-((2-Hydroxybenzylidene)amino)benzenesulfonamide (HBABS)

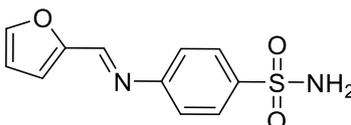


Fig. 2

4-((Furan-2-ylmethylene)amino)benzenesulfonamide (FMABS)

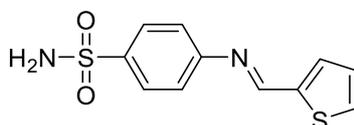


Fig. 3

4-((Thiophen-2-ylmethylene)amino)benzenesulfonamide (TMABS)

The Fe, Pd, Zn, Hg and Ru edifices of these Schiff base ligands have been readied and basically portrayed based on basic investigation, conductance, warm, attractive and infrared, electronic and ESR ghostly information. Pertinent ends as for the geometry of the edifices have been drawn dependent on the information acquired. The work typified in the theory likewise incorporates aftereffects of fundamental examinations of natural action of the ligands: HBABS, FMABS and TMABS with their Fe, Ru, Pd, Zn and Hg edifices against two contagious strains: *Aspergillus niger* and *Penicillium rubrum*.

All the ligands are steady at room temperature and are non-hygroscopic. They are insoluble in water, somewhat dissolvable in methanol and $(\text{CH}_3)_2\text{CO}$ and genuinely solvent in hot methanol and dimethylformamide. The ligands have been portrayed by investigative, mass, ^1H NMR and IR ghashly information.

CONCLUSION

The transition metal of Fe, Pd, Zn, Hg and Ru complexes of mixed ligands have been synthesized. The complexes undergo various characterization using solubility, electric conductivity, melting point, and infrared Spectroscopy. The ligands form a chelating complex. The new alternative drugs obtained, confirmed that they are more effective than their parent ligands. The antifungal activity of the complexes was carried out against *Aspergillus niger* and *Penicillium rubrum*. The combined result of the physical and spectroscopic studies confirmed formation of complexes.

REFERENCES

1. Cutting, W.C., Handbook of pharmacology, Meridith, New York **1967**.
2. Sackheim G.I. and Schieltz, R.M., Chemistry for the Health Sciences, Macmillan, New York **1973**.
3. Maren, T.H., Annu. Rev. Pharmacol. Toxicol, 16, **1976** (309).
4. Toth, J.E. Grindey, G.B. Ehlhardt W.J., et al, J. Med. Chem, 40, **1997** (1018).
5. Owa, T. Yoshino, H. Okauchi. T. et al, J. Med. Chem, 42, **1999** (3789).
6. Laurance, D.R., Clinical pharmacology' p 765 English Language Book Society (ELBS) and Churchill, London **1973**.
7. Satoker, R.S., Pharmacology & Pharmacotherapeutics., Mumbai popular foundation. **2002**, (628).
8. Joel, G.H. & Lee, E.L., The Pharmacological Basis of Therapeutics. 10th Ed. McGraw Hill, **2001**, (1172).

9. Evans, B.E.; Rittle, K.E.; Bock, M.G.; DiPardo, R.M.; Freidinger, R.M.; Whitter, W.L.; Lundell, G.F.; Veber, D.F.; Anderson, P.S.; Chang, R.S.; Lotti, V.J.; Cerino, D.J.; Chen, T.B.; Kling, P.J.; Kunkerl, K.A.; Springer, J.P. & Hirshfield, J., *J. Med. Chem.*, **31**, **1988** (2235).
10. Supuran, C.T.; Casini, A.; Mastrolorenzo, A. & Scozzafava, A., *Mini Rev. Med. Chem.*, **4**, **2004** (625).
11. Patel, H.S. & Mistry, H.J., *Phosphorus, Sulfur, & Silicon Relat. Elem.*, **179**, **2004**, (1085).
12. Selvam, P.; Smee, D.F.; Gowen, B.B.; Day, C.W.; Barnard, D.L. & Money, J. D., *AntiviralRes.*, **74**, **2007** (81).
13. Vander and Kark, G.J.M., *4th Proc. Brit. Insect. Fungi Conf.*, **2**, **1967** (562).
14. Klosa, J., *Ger. Pat. 1200307* (1965); *Chem. Abstr.*, **63**, **1965** (1811C).
15. Pluigena, C.W. and Sijpesteign, A.K., *Amer. Appl. Biol.*, **57**, **1968** (465).
16. Upender, S., Ph.D. Thesis, Regional Engineering College, Warangal **1988**.
17. Erdely, I., Leszkovsky and Trados, L., *Acta Phys. Acad. Sci. Hung.*, **27** (1965), 85.
18. Merillus, W., *J. Med. Chem.*, **11**, **1968** (171).
19. Wojeiech Lehr and Splawiniski, *Chem. Abstr.*, **55**, **1961** (3602).
20. Vida, A. Julius, "Principles of Medicinal Chemistry" (Ed. Foye, O. William), Leas Febiger, Philadelphia **1974**.
21. Huang, J.L., Wang H.Y., and Tian X.Y., *Polym. J., Sci. Part A: Polym.Chem*, **34**, **1933** (1996).
22. Huang J.L., Chen, .S, Tan L.S., and Wang H.Y., *Science in China (Series B)*, **41**, **1998** (55).
23. Chen, S., Huang Z.H., and Huang, J.L., *Eur.J. Polym.* **36**, **2000** (1703).
24. Huang J.L., Chen, .S, Tan L.S., and Wang H.Y., *Science in China (Series B)*, **41**, **1998** (55).
25. Chen, S., Huang Z.H., and Huang, J.L., *Eur.J. Polym.* **36**, **2000** (1703).
26. Magaldi, S., Mata-Esayag, S., Capriles, C.H.D., Perez, C., Colellac, M., Olaizola and Ontiveros, Y., *Int. J. Infectious Diseases*, **8**, **2004** (39).

Role of Angel Investors in Development of Small and Medium Enterprise

Kritika^{1*} and Aditi²

¹Department of Commerce, Chaudhary Bansi Lal University, Bhiwani, India

²Post Graduate, UGC JRF Qualified

ABSTRACT

Angel investors are crucial to the success of small and medium-sized businesses, the main reason behind this is that they provide more than just financial support. They are active investors who support the companies they invest in by their skills, knowledge, contacts, and expertise. Angel investors are the persons with lots of wealth and with extensive business backgrounds. They are eager to contribute money, resources & information to help startup owners and entrepreneurs to launch and expand business operations. The main feature of the angel investors is that they want to maintain their anonymity. Many ideas cannot be carried out as a result of this attribute. To get rid of this problem many countries in the world had established angel investor networks and syndicates (Group). The main advantage of doing this is that they facilitate the matching process of the angel investors and the entrepreneurs. So this research paper is about highlighting the role of angel investment in the development of small and medium enterprises.

Keywords: small and medium enterprise, Sources of finance, Angel investors, angel investment

INTRODUCTION

Financing is a very critical issue for the survival and development of small and medium sized enterprises (SMEs). Angel investors play a key role in financing small and medium sized enterprises, especially those which are innovative and with high growth potential. SMEs in their development pass through several stages.

For the small and medium-sized businesses to survive and grow, financing is an extremely important issue (SMEs). Angel investors are significant to the funding of small and medium-sized businesses, especially for those with strong growth potential and an innovative business model. SMEs go through a number of stages in the development process. The standard stages through which these businesses pass through are: Seed stage - Startup stage - Early stage. The seed stage starts with the some profitable business idea or concept of the entrepreneurs that needs to be proven and developed. The main sources of finance in this initial stage that can be used are finance from family members, friends and savings of the founder, these sources popularly known as 3F money. The next stage is startup stage: under this step the plan has been already formulated and needs only be commercialized. But startup stage lasts only for less than a year. The main source of finance under this stage that can be used is angel investors.

The next following stage is early stage: under this stage the manufacturing of goods and services starts takes place as well as their distribution. But this stage lasts more than a year that is up to 5 years and there are high chances of business being still unprofitable. Venture capital is main source of finance under this stage. Later stage: under the later stage business starts growing because it is already matured and profitable. The business can become famous and prestige with it's continuing high growth within a period from 6 month to 1 year. Main source of additional fund in this stage is initially public offering.

RESEARCH METHODOLOGY

Research methodology is a method for conducting the research work. For the present study qualitative research approach was used and the data were collected using secondary source of method of data collection. Secondary data includes immense review of various studies undertaken by the different authors.

ANGEL INVESTORS

An informal investor is sometimes referred to as business angel, an angel funder or angel. An angel investor is a person who contributes money to the startup of a company in return of ownership stock or convertible debt. The money provided by angel investors may come as a one-time investment or it may be used to maintain and sustain the business during its early stages. Angel investors typically invest in startups with strong growth potential, particularly in the technology sector. Additionally, they finance industries in the energy, healthcare, and other sectors. An angel investor must consider the company's growth possibilities.

a) Seed stage: the entrepreneur has an idea or concept for potential profitable business, which needs to be developed and proven. In this stage as financing sources can be used savings of founders, family and friends (also called as 3F Money);

b) Start-up stage: th

a) Seed stage: the entrepreneur has an idea or concept for potential profitable business, which needs to be developed and proven. In this stage as financing sources can be used savings of founders, family and friends (also called as 3F Money);

b) Start-up stage: th

a) Seed stage: the entrepreneur has an idea or concept for potential profitable business, which needs to be developed and proven. In this stage as financing sources can be used savings of founders, family and friends (also called as 3F Money);

b) Start-up stage: th

a) Seed stage: the entrepreneur has an idea or concept for potential profitable business, which needs to be developed and proven. In this stage as financing sources can be used savings of founders, family and friends (also called as 3F Money);

b) Start-up stage: th

Origin of Angel Investors

The term "angel investors" was first used in Broadway theatre, where rich patrons donated cash to support theatrical shows.

Business Angel Networks and Syndicates

Networks, private, or semi-public organizations that are typically function at the regional or national level are where business angels frequently operate. These networks essentially serve as a matchmaking service for entrepreneurs and investors; they do not really make any investments or investment decisions. By improving the flow of information, they address the informational imbalances that exist between investors and entrepreneurs. They have also become more involved in capacity building, which helps small businesses that are looking for funding become more investor-ready as well as (potential) business angel investors.

A syndicate is a group of at least three wealthy or knowledgeable investors who pool their investments. In a business angel network, syndication can take place on an as-needed, deal-by-deal basis when multiple investors are eager to invest in the same project. In such a situation, a lead investor is usually chosen to organize efforts and conduct negotiations on behalf of the syndicate. Alternatively, when the same group of people co-invests on a more regular basis, a more formal syndicate structure might be created. It is significant to remember that, each individual investor is in charge for its own investment choices.

The benefit of investing through a syndicate goes beyond risk-sharing and making it possible to invest in a diverse array of projects even with scarce resources. In order to benefit all members, syndicates also act as a repository where investors can combine their resources, expertise, contacts, and experience. The ability of organizations to provide adequate due diligence on behalf of its members—from early-stage business plan review through regulatory compliance—is particularly crucial in that regard. Syndicates typically collect a charge from each member to fund their expenses.

Role of Angel Investors in Development of Small and Medium Enterprise

1. Good Success Rate

The enterprises who receive their investment from the angel investors have the high chances of success with faster growth rate and better success rate as compared to those who use other mode of finance.

2. Funds Availability

Angel investors are the main source of finance for the small and medium enterprises in their initial stage. Firms can easily get the funds from these angle investors even when the financial institutions and the bank are unable to provide the loan.

3. Expertise Skills and Contacts

Angel investors are the experts of their own field. They not only provide the finance to the firms but also support them by their expertise. As well as angel investors have many contacts or a wide network with potential financial institutions & banks, traders and customers this will also be helpful for the startups.

4. No Need Regular Payment

There is no monthly repayment requirement when choosing an angel investment, unlike traditional lending companies. You are freed of your worry here, and you can reinvest your gains in your company. At the times of liquidity, the angel investors get compensated.

5. Assistance to Startups

Angel investor uses the best criteria for availing the funds to the startups. They are renowned for supplying the funding gaps left by conventional lenders. While the traditional companies have a large list of requirements, including things like profitability and well-known business models, they merely ask for a good and practical concept. These factors contribute to the excellent reputation of angel investment among owners of new businesses.

6. High Risk Bearing Capacity

Angel investors are quite risk-takers who believe in a new company's good idea and intentions. No matter how great your business idea is, a traditional lender will only give you a certain amount of money. Angel investors are truly new angels because they have no such limit on providing financial support to the startups. A decent concept and the commitment to work hard to achieve it are the only things that matter.

7. Increases The Credibility of a Business

Angel investors are frequently recognized authorities in their professions who have established reputations after launching numerous profitable enterprises. Founders of startups can benefit from this. Working with individuals who are well-known in a given field might work as a catalyst, greatly accelerating the growth of the startup.

CONCLUSION

In conclusion we can say that angel investment is the top most factors behind the growth and the development of small and medium enterprises. The appropriate relationship can help your company grow. Angel investors are adept at spotting businesses that have the potential for the growth they seek. Receiving funding from them in and of itself serves as confirmation that you are moving toward realizing your idea. Angel investors are repeatedly playing significant role in funding many new startups even though they financed only a small part of the fund required in the initial stage of firms' development. By considering all these benefits government should take necessary steps for the growth of the angel investors like providing them financial subsidies, tax relaxations and so on.

REFERENCES

1. V Ramadani (2012). The Importance of Angel Investors in Financing the Growth of Small And Medium Sized Enterprise, *International Journal of Academic Research in Business and Social Sciences*, July 2012, Vol. 2, No. 7 ISSN: 2222-6990
2. https://www.researchgate.net/publication/267842704_...
3. Olaore & Adetoye (2014). The Role of Business Angel in Financing Small Business,
4. *Journal of Poverty, Investment and Development - An Open Access International Journal* Vol.5 2014
5. <https://www.researchgate.net/publication/340846633>
6. The role of business angel investments in SME finance, *Financing SMEs and Entrepreneurs 2016* An OECD Scoreboard
7. https://www.oecd-ilibrary.org/fin_sme_ent-2016-6-en
8. March 22, 2022: Angel Investor
9. Angel investors are focused on helping startups take their first steps, rather than the possible profit they may get from the business. Essentially, angel... <https://www.investopedia.com/.../Private-Equity-VC-30-Oct-2019-Angel-Investors-Their-Role-and-Overall-Functions>
10. Angel Investor is an individual with considerable net worth who assists new and small startups or businesses by providing them required funding...
11. <http://www.nayanparikh.com/angel-investors-role-ove...09-Feb-2018>: An angel investor is an individual who provides capital for a business start-up, in exchange for convertible debt or ownership equity.
12. <https://www.goodreturns.in/classroom>
13. 21-Sept-2020 — 15 Advantages of Business Angel Funding – Vestbee <https://vestbee.com/blog/articles/15-advantages-of-...>

Potential Herbal Anti-Cancer Drug Formulations Using Modern Drug Delivery Methods

Chirag Goda^{1*}, Ashish Kandalkar², Manish Bhise³, Vinod Kumar Tiwari⁴, Sanjay Vasu⁵, Sunny Pahuja⁶, Sandip Hurpade⁷, Balaji Thakare⁸ and Satish Shelke⁹

¹IBN Sina National College for Medical Studies, Jeddah, Saudi Arabia

²Late Shri Ramraoji Gawande Institute of Pharmacy, Akola, India

^{3,5,6}SGSPS, Institute of Pharmacy, Akola, India

⁴Narayan Singh University, Jamuhar, Rohatas, Bihar, India

⁷Rajashri Shahu College of Pharmacy, Buldana, India

⁸MUP College of Pharmacy, Degaon, Taluka-Risod, Washim (MS), India

⁹Rajashri Shahu College of Pharmacy, Buldana, India

ABSTRACT

Objectives: The goal of the current effort is to create and assess chewing gum containing a potassium salt of curcumin extract for its ability to carry medication into the buccal cavity and fight cancer. It helps with the treatment of metabolic syndrome, arthritis, anxiety, and hyperlipidemia as well as oxidative and inflammatory diseases. Chewing gums containing curcumin were created to examine its anticancer properties.

Method: To increase the solubility of potassium Curcumin, a solid dispersion of the compound was created utilising cyclodextrin. For the purpose of improving solubility, the obtained solid dispersion of potassium curcumin was examined. Curcumin Sucrose, castor oil, chewing gum base, potassium curcumin, and other ingredients were then combined to create chewing gums. The prepared chewing gum was assessed for colour, flavour, hardness, and drug-excipient compatibility.

Results: The compatibility study's findings demonstrated that there was no interaction between the chosen medicine and excipients. When compared to curcumin and other common anticancer medications like 5-Fu, Mito-C, and Paclitaxel, potassium curcumin has greater anticancer activity: 85% against prostate cancer cells, 80% against liver cancer cells, and 92% on average against colon cancer cells. In-vivo studies of the chewing gums were optimised based on in-vitro drug release.

Conclusion: According to the results of this study, chewing gum containing the potassium salt of the cancer-fighting compound curcumin can be deemed a good delivery mechanism.

Keywords: Chewing gums, Cancer, Anticancer, Tumor, Normal cells, Curcumin.

INTRODUCTION

The oral route is arguably the one that both patients and doctors favour among the other administration methods. Drugs administered orally, however, have drawbacks such hepatic first pass metabolism and gastrointestinal enzymatic degradation that make oral administration of some medication types inappropriate.¹ The outermost layer of the oral mucosa is made up of stratum distendum, stratum filamentosum, stratum suprabasale, and stratum basale, all of which are stratified squamous epithelium and are mucous-covered. Lamina propria and submucosa cover the area beneath the basal lamina. The lamina propria serves as a mechanical support and also carries the blood vessels and nerves, whilst the epithelium acts as a mechanical barrier to protect underlying tissues. The oral mucosa contains keratinized areas.² In general, the oral mucosa is an intermediate layer of leaky epithelia between the epidermis and the intestinal mucosa. The buccal mucosa's permeability is thought to be 4–4000 times greater than that of skin. Because of the various forms and functions of various oral mucosae, there are significant variances in permeability between different parts of the oral cavity, as seen by the wide range in this reported value.³ In general, the oral mucosa is an intermediate layer of leaky epithelia between the epidermis and the intestinal mucosa. The buccal mucosa's permeability is thought to be 4–4000 times greater than that of skin. Because of the various forms and functions of various oral mucosae, there are significant variances in permeability between different parts of the oral cavity, as seen by the wide range in this reported value.⁴ In general, buccal mucosae are more permeable than sublingual, and buccal mucosae are more permeable than palatal.⁵ The sublingual mucosa is relatively thin and non-keratinized, the buccal mucosa is thicker and non-keratinized, and the palatal mucosa is intermediate in thickness but keratinized. These tissues are ranked according to their relative thickness and degree of keratinization.⁶ The paracellular and transcellular routes are the two penetration routes for passive drug transport over the oral mucosa. These two routes can be used simultaneously by permeants, although depending on the physiochemical characteristics of the diffusant, one is typically chosen over the other. Since the cytoplasm and intercellular gaps

have a hydrophilic nature, lipophilic substances would have poor solubilities in this setting.⁷ The pace and amount of drug absorption through the buccal mucosa are slowed down by barriers such as saliva, mucus, membrane coating granules, basement membrane, etc. Within the outermost quarter to a third of the epithelium, there lies the major penetration barrier.⁸ The buildup of lipids and cytokeratins in the keratinocytes is less obvious and the change in morphology is much less pronounced in non-keratinized epithelia than in keratinized epithelia. The cytokeratins do not consolidate to form bundles of filaments as seen in keratinizing epithelia, and the mature cells in the outer region of non-keratinized epithelia grow big and flat and retain their nuclei and other organelles.⁹ Although the basement membrane is also a factor in controlling connective tissue, the oral epithelium's superficial layers still serve as the main barrier to the entry of substances from the outside. The opposing direction appears to be controlled by a comparable process. Lipophilic substances that can reasonably easily cross the superficial epithelial barrier may have their rate of penetration slowed down by the charge on the basal lamina's constituents.¹⁰ The buccal mucosa's epithelial cells are encircled by mucus, an intercellular ground substance that can range in thickness from 40 m to 300 m. Even though the small salivary glands and sublingual glands together only provide around 10% of all saliva, they create the majority of mucus and are essential for preserving the mucin layer over the oral mucosa.¹¹ A salivary layer that is unstirred and is thought to be 70 m thick covers the mucosal surface. High molecular weight mucin, found in saliva, can bind to the surface of the oral mucosa to prevent drying out, lubricate, concentrate protective chemicals like secretory immunoglobulins, and prevent microbial adhesion.¹² Buccal delivery is the process of administering a medicine to the systemic circulation through the buccal mucosa. The buccal mucosa is substantially more permeable than skin and has additional benefits over other delivery methods, although being significantly less permeable than the sublingual mucosa and typically not able to enable quick drug absorption or adequate bioavailability.¹³ A different option is for the medicine released from chewing gum to be eaten and delivered into the stomach in a dissolved or dispersed form in saliva if it is not absorbed through the oral cavity membrane. As a result, the medicine would be available for absorption by the gastro intestinal tract.¹⁴ As an alternative, medication released from medical chewing gum and lozenges can be ingested and received into the stomach in a dissolved or dispersed form by saliva if it is not absorbed through the oral cavity barrier. As a result, the medicine would be available for absorption by the gastro intestinal tract.¹⁵ The gender factor may affect how frequently a certain cancer occurs. For both sexes, skin cancer is the most prevalent kind of malignancy, followed by breast cancer in women and prostate cancer in men. Its frequency is not a direct indicator of cancer mortality. Skin malignancies can frequently be cured. The main cause of death for both men and women is lung cancer.¹⁶

MATERIALS AND METHOD

Materials

Potassium di Hydrogen Orthophosphate was obtained from Qualigens Fine Chemicals, Sodium Hydroxide was gotten from Qualigens Fine Chemicals, Liquid Glucose from Laxmi Confectionaries Ltd, Akola, and Curcumin from CHR-Hansen Pvt Ltd, Mumbai

Drug Profile

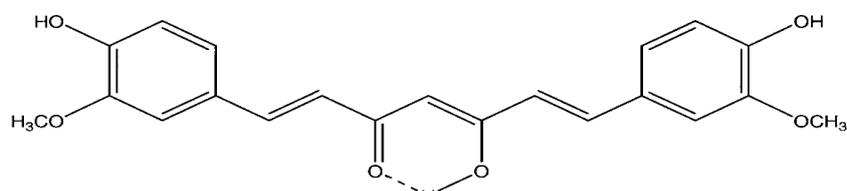


Figure-1 Curcumin chemical structure

Synonym: Diferuloyl Methane

Molecular Weight: 368.37

Description:

Curcumin occurs as orange yellowish powder. It is practically insoluble in Water¹⁷

METHOD

Preparation of Potassium Curcumin Salt:¹⁸

Curcumin diferuloyl methane is insoluble in water. It is considered worthwhile to prepare water soluble alkali phenates of curcumin which might possess enhanced activity compared to curcumin.

The procedure followed to prepare alkali salt of the curcumin is as follows:

Curcumin was added to alcoholic potassium hydroxide (1:2 moles respectively) and stirred to homogeneous thin paste which soon liquefied to a deep red solution. After adding an excess of about 5% curcumin and thorough stirring, the liquid was dried in a current of air at 400 C. The dried mass was then dissolved in minimum quantity of cold water and filtered under reduced pressure. The filtrate containing the potassium phenates were evaporated to dryness as above and finally in vacuum desiccators to constant weights.

Solid dispersion of potassium curcumin ate was prepared using β -cyclodextrin to enhance the solubility of potassium Curcumin ate.

Cell Lines and Cell Culture Preparation¹⁹

PC-3, HEP-2, A-549, 502713, HCT-15 and SW-620 cell lines were obtained from Indian Institute of Integrated Medicine, Jammu. cells were cultured in 2-3 ml of 0.05% trypsin-EDTA. And addition of 10 ml of 5% serum containing RPMI 1640 medium.

In Vitro Dissolution Studies for Potassium Curcumin ate²⁰

The vessel was filled with 200 ml phosphate buffer (6.4) and the gum was placed in the inner perforated vessel. The metal bob was attached to the rod, the height of rod and bob was previously adjusted so that the bob completely touches the bottom of the perforated vessel.

The apparatus was switched on and the bob was allowed to impact on the chewing gum.

This process was continued for 2 hours. 5 ml sample of the buffer solution was withdrawn at a regular interval of 10 min and every time it was replaced with equal amount of phosphate buffer, thus the samples were collected at 10, 20, 30 up-to 120 minutes

Formulation of Chewing Gum²¹

The chewing gums with chewing gum base and drug and glucose were prepared by the method described below.

Numbers of trials were extensively carried out to arrive at the correct concentration of each ingredient in order to have a desirable consistency as well as non-adhering properties.

In case of the chewing gums various plasticizers such as soyabean oil cottonseed oil, castor oil, diethyl phthalate, dibutyl phthalate were tried. The optimum concentration was decided for each plasticizer and two of them which showed good result, were selected. The two selected plasticizer castor oil and dibutyl phthalate were used subsequently bees wax was often incorporated in the gum bases in order to improve the chewability that is to give desired consistency to product prepared from the gum bases.

The chewing gum formulation is always sweetened. This is obvious as the product is used for the chewing and hence the taste of the product must be considered. In this study the model drug selected has bitter taste and hence large quantities of sucrose is added to mask the taste.

Talc was employed in the gum base as an anti-sticking agent. The purpose is to avoid adhering of the gum to dental surfaces. The concentration of talc was fixed to 5 to 10 % of total gum base composition.

Table-1 Formulation of Chewing Gum

Potassium curcumin ate	100 mg
Chewing Gum Base	800 mg
Sucrose	150 mg
Castor oil	0.5 ml

Evaluation of Chewing Gums:²²

Stability Testing:

The purpose of this testing is to determine the physical and chemical stabilities of medicament, flavour, candy base and colour both under accelerated temperature and humidity conditions and at ambient storage conditions. This testing will enable the formulator to predict the acceptable shelf life of the product in a relatively short period of time and make changes as required to eliminate any incompatibilities that may influence product stability.

Elevated Temperature and Elevated Humidity Testing

Elevated temperature and elevated humidity testing is initiated as soon as product is manufactured. Product should be tested at elevated temperatures and elevated humidity conditions. Testing conditions generally utilized by the product development laboratory include 25°C at 80% relative humidity for 6-12 months, 37°C at 80% humidity for 3 months, and 25°C at 70% relative humidity for 6-12 months. The elevated humidity studies are carried out both at constant humidity and in humidity cabinets with day and night cycling. Elevated humidity tests are vital for ascertaining medicament stability and candy stickiness including surface graining characteristics

Physical Stability

Concurrent with the chemical stability evaluation, a physical stability study is carried out on the product in order to determine what factors will detract from organoleptic appeal of the product and how long these changes will take place to occur. A routine physical stability evaluation includes:

Colour:

Chewing gums are checked for the colour stability by keeping them in direct sunlight and at elevated temperatures to determine if the colours are light fast, also changes occurring due to presence of medicaments are to be evaluated. Table no. 2

Odour:

Changes in the odour of flavours at elevated temperature are evaluated by sealing the Chewing gums in glass bottles and determining if any odour is there.

Taste:

The product is tasted and compared to production controls in order to determine if any flavour change has occurred. Many small flavour changes that cannot be detected via gas-liquid chromatography can be ascertained when lozenge is tasted. Any change in the surface texture is also evaluated during the taste evaluation. Result mentioned in table no.2

Table-2 Study for stability of potassium curcuminat Chewing gums

Parameters	Appearance		Colour		Dissolution	
First day 4°C	--	--	--	--	--	--
Room Temp	--	--	--	--	--	--
37° C	--	--	--	--	--	--
50° C	--	--	--	--	--	--
1 st Month 4° C	--	--	--	--	--	--
Room Temp	--	--	--	--	--	--
37° C	--	--	--	--	--	--
50° C	--	--	--	--	+	--
2 nd Month 4° C	--	--	--	--	--	--
Room Temp	--	--	--	--	--	--
37° C	--	--	--	--	--	--
50° C	--	--	--	--	+	--
3 rd Month 4° C	--	--	--	--	--	--
Room Temp	--	--	--	--	--	--
37° C	--	--	--	--	--	--
50° C	--	--	--	--	+	--

-- No Change + Slight change

Weight Variation Test:

Twenty Chewing gum were taken and their weight was decided exclusively and all things considered on a computerized weighing balance. The typical load of one not set in stone from the system weight. The weight variety test would be a agreeable strategy for deciding the medication content consistency. The percent deviation was determined utilizing the accompanying equation. The outcomes are introduced in

% Deviation =

(Individual weight – Average weight /

Average weight) × 100

Hardness:

Compressed tablet Chewing gum are tested for proper hardness using Pfizer hardness tester. The force required to penetrate the lozenge is used as measure of chewiness, surface harness and stability. Results are mentioned in table no. 3

Chewing Gum Thickness:

Chewing gum thickness is a significant trademark in repeating appearance. Twenty chewing gum were taken and their thickness was recorded utilizing Digital Micrometer. The typical thickness for Chewing gum was determined and given standard deviation. The outcomes are introduced in Table no-3

Friability:

It is a proportion of mechanical strength of Chewing gum. Roche friabilator was utilized to decide the friability by following method. Pre weighed Chewing gum (20) were put in the friabilator. The Chewing gums were turned at 25 rpm for 4 minutes (100 revolutions). Toward the finish of test, the Chewing gums were re-gauged, misfortune in the heaviness of capsules is the proportion of friability and is communicated in Table no.3

$$\% \text{ Friability} = [(W1 - W2) / W1] \times 100$$

Where,

W1 = Initial weight of 20 chewing gums

W2 = Weight of the 20 chewing gum after testing

Table- 3 Evaluation of Chewing gum

Parameters	Potassium Curcuminat
Weight variation (mg)	2804±2.16
Thickness (mm)	3.23±0.08
Hardness (kg/cm ²)	1.40±0.45
Friability (%)	0.11
Content uniformity	95.21

*All information is offered in Mean ± SD, n=3, SD = standard deviation

Preparation of Standard Solution:

Estimation of Potassium Curcuminat in 6.4 pH phosphate buffer.

100 mg of potassium curcuminat was dissolved in 100 ml of 6.4 pH phosphate buffer; the resulting solution was subsequently diluted with 6.4 pH phosphate buffer to obtain series of diluted concentrations i.e. 50, to 500 mcg/ml the absorbance of above diluted concentrations was measured at 464 nm using 6.4 pH buffer as blank.

Estimation of Potassium Curcuminat in 6.4 Ph Phosphate Buffer.

100 mg of potassium curcuminat was dissolved in 100 ml of 6.4 pH phosphate buffer; the resulting solution was subsequently diluted with 6.4 pH phosphate buffer to obtain series of diluted concentrations i.e. 50, to 350 mcg/ml the absorbance of above diluted concentrations was measured at 272 nm using 6.4 pH buffer as blank. Standard curve data reading are shown in table no.4

Table-4 Standard curve data for potassium curcuminat by UV-Visible spectrophotometer

Serial No	Concentration in µg/ml	Average Absorbance (n=3)
1	50	0.079±0.004
2	100	0.156±0.007
3	150	0.235±0.008
4	200	0.316±0.011
5	250	0.393±0.007
6	300	0.465±0.008
7	350	0.549±0.007
8	400	0.625±0.008

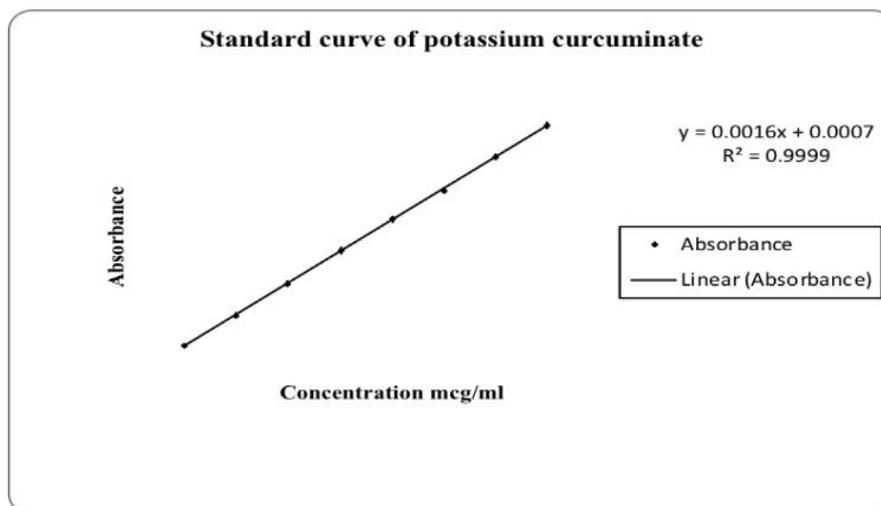


Figure-2 Standard Curve of Potassium Curcuminat

Dissolution Studies:¹⁴

In Vitro Dissolution Studies for Potassium Curcuminat

The vessel was filled with 200 ml phosphate buffer (6.4) and the Chewing gums was placed in the inner perforated vessel. The metal bob was attached to the rod, the height of rod and bob was previously adjusted so that the bob completely touches the bottom of the perforated vessel.

The apparatus was switched on and the bob was allowed to impact on the Chewing gums.

This process was continued for 2 hours. 5 ml sample of the buffer solution was withdrawn at a regular interval of 10 min and every time it was replaced with equal amount of phosphate buffer, thus the samples were collected at 10, 20, 30 upto 60 minutes. Results are shown in table-5

Table-5: In vitro dissolution profile of potassium curcuminat

Time in Minutes	Average Percent Drug Release
5	4.733±0.681
10	12.400±0.529
15	14.833±0.289
20	24.500±0.500
25	36.000±1.000
30	39.667±0.577
35	49.667±1.528
40	64.000±1.732
45	71.000±2.646
50	82.000±3.000
55	92.833±1.041
60	92.833±0.764

*All information is offered in Mean ± SD, n=3, SD = standard deviation

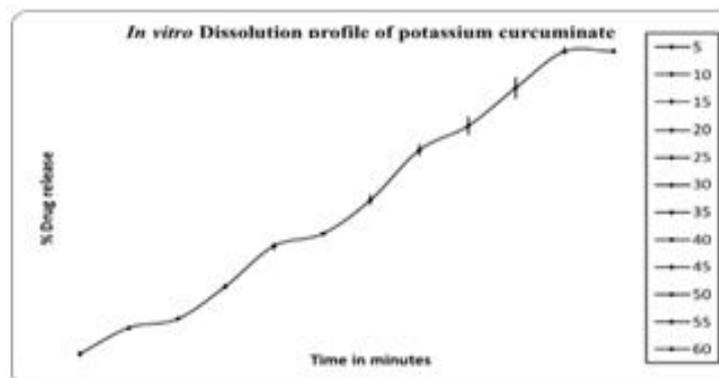


Figure-3 Drug release from potassium curcuminat

Drug Release Kinetics

The mechanism of drug release from Chewing gums was determined by fitting the in vitro release profiles of optimized batches with zero order, first order, Hixson, Higuchi and Korsmeyer models. The obtained correlation coefficient values are given in the Table-6 & figure4-8

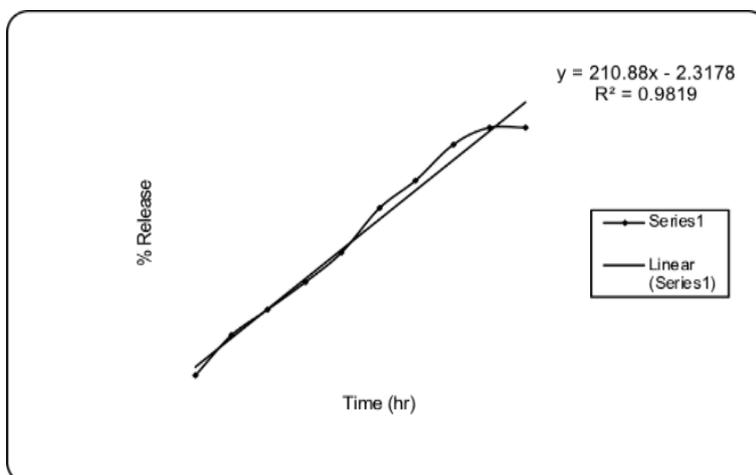


Figure -4 Zero order model for drug release from potassium curcumin chewing gums

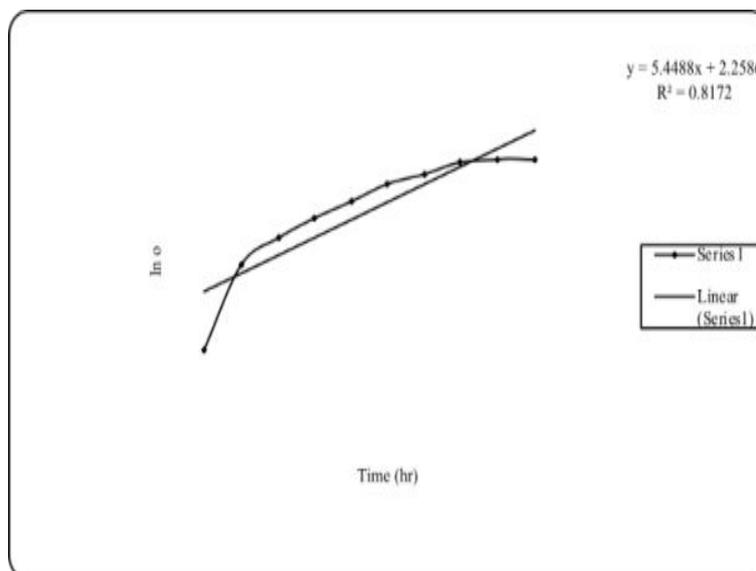


Figure-5 First order model for drug release from potassium curcumin chewing gums

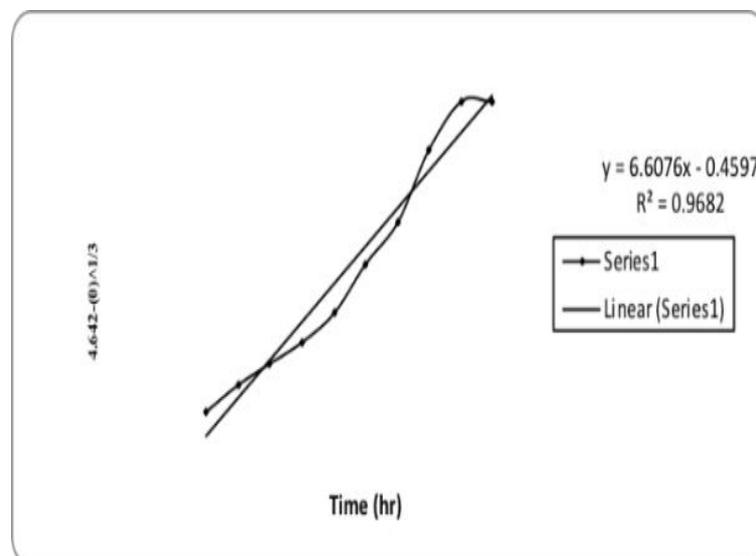


Figure-6 Hixson-Crowmell model for drug release from potassium curcumin chewing gum

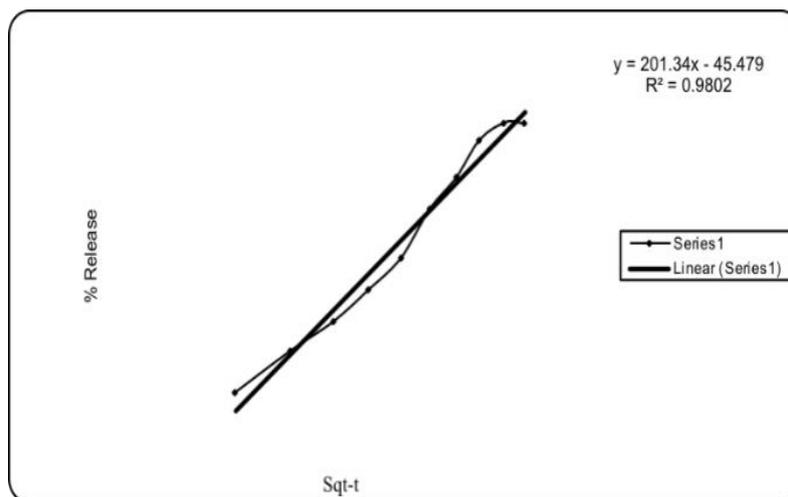


Figure-7 Higuchi square root model for drug release from potassium curcumin chewing gum

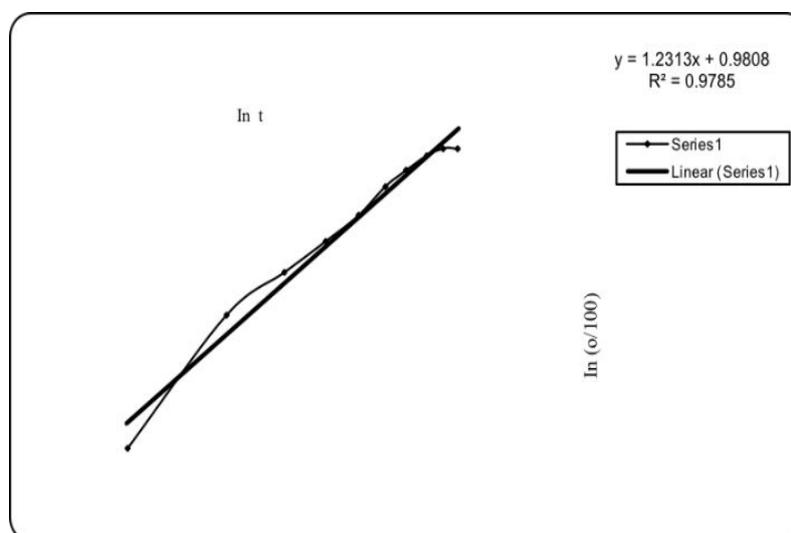


Figure-8 Korsmeyer model for drug release from potassium curcumin chewing gum

Table-6 Comparative study of drug release from different models for potassium curcumin chewing gum

Time	Observed % rel.	ZERO		FIRST		HIGUCHI		HIXSON		KORSMEYER	
		Calculated % rel. (Q)	RS	Calculated % rel. (Q)	RS	Calculated % rel. (Q)	RS	Calculated % rel. (Q)	RS	Calculated % rel. (Q)	RS
0.050	5.233	8.226	8.957	12.567	53.776	-0.458	32.391	-8.621	191.955	6.668	2.058
0.100	19.167	18.770	0.157	16.502	7.101	18.190	0.953	12.416	45.571	15.655	12.331
0.150	28.667	29.314	0.419	21.670	48.956	32.500	14.692	30.545	3.528	25.792	8.266
0.200	38.667	39.858	1.420	28.456	104.257	44.563	34.767	45.982	53.516	36.755	3.655
0.250	49.333	50.402	1.142	37.367	143.182	55.191	34.312	58.944	92.356	48.377	0.914
0.300	65.000	60.946	16.433	49.070	253.777	64.799	0.040	69.646	21.582	60.553	19.776
0.350	75.333	71.490	14.770	64.436	118.741	73.635	2.883	78.305	8.829	73.209	4.511
0.400	88.000	82.034	35.591	84.616	11.453	81.860	37.705	85.137	8.195	86.292	2.916
0.450	93.667	92.578	1.185	111.114	304.422	89.584	16.668	90.360	10.935	99.760	37.129
0.500	93.667	103.122	89.407	145.911	2729.518	96.890	10.389	94.188	0.272	113.579	396.498
SSR			169.482		3775.185		184.801		436.740		488.056
SSR/R ²			172.606		4619.659		188.534		451.085		498.780

ZERO $Q = 210.88t - 2.3178$ $R^2 = 0.9819$

FIRST $\ln Q = 5.4488T + 2.2586$ $R^2 = 0.8172$

HIXSON $4.642 - (Q)/3 = 0.3106t - 0.3225$ $R^2 = 0.9493$

HIGUCHI $Q = 201.34 t^{1/2} - 45.479$ $R^2 = 0.9802$

KORSMEYER $\ln(Q/100) = 1.2313\ln t + 0.9808$ $R^2 = 0.9785$

Procedure for in Vitro Analysis of Anti-Cancer Activity²³

The criteria for selection of a cell line for use in the interim panel were as follows.

- a) Adaptability to growth on a single medium (RPMI-1640 plus 5% fetal bovine serum and 2mM glutamine):
- b) A negative test for mycoplasma and mouse antibody production.
- c) Isoenzyme and karyotype profiles verifying the human origin of cells.
- d) Mass doubling that allows for harnessing of approximately 3×10^7 cells twice a week: and
- e) Suitability for use with microculture assays.

Once a line had been established as suitable, the number of cells was massively expanded in minimal number of passages and the cells were cryopreserved in a large repository of ampoules each containing 1×10^6 cells to provide a consistent frozen stock for future use. Once the growth in the in the new stock is established at the second or third passage, the older passage line is replaced with the new stock established at the second or third passage, the older passage line is replaced with the new stock for use in the screening laboratory.

Cell Line Maintenance

Cells are maintained in multiple of T150 tissue culture flasks. Cells for each inoculation day are maintained separately (no common reagents) and passaged on separate days to prevent catastrophic loss of growing cell line stocks to microbial contamination. Additional backup flasks of cells are also maintained. For each cell line, the seeding density per flask is determined for production of healthy culture of 70% to 90% after 7 days for continued routine maintenance. These seeding densities than utilized twice a week to maintain sufficient cells for anti-cancer drug screening.

Preparation and Inoculation of Cells

All of the adherent cell lines are detached from the culture flasks by addition of 2-3 ml of 0.05% trypsin-EDTA. Thereafter trypsin is inactivated by addition of 10 ml of 5% serum containing RPMI 1640 medium. Cells are separated into single cell suspension by gentle pipetting action then counted using trypan blue exclusion on a hemacytometer or by Coulter counter which is used when viability as determined by trypan- blue exclusion routinely greater than 97%. After counting dilutions were made to give the appropriate cell densities for inoculation onto the micrometer plate. Cells were inoculated in a volume of 100 μ l per well at densities between 5000 and 40000 cells per well. Cells were counted diluted and inoculated onto microculture plates within 4 hours period on 2 days each week. The micrometer plates containing the cells are preincubated for approximately 24 hours at 37 $^{\circ}$ C to allow stabilization prior to addition of drug.

Solubilization and Dilution of Samples

For the initial screening of pure compounds each agent is routinely tested at five 10 fold dilutions starting from a maximum concentration of 10 4 M. Alternatively a maximum of 10 M can be selected if solubility permits. All samples are initially solubilized in dimethyl sulfoxide (DMSO) or water at 400 times the desired final maximum test concentration. Drug stocks are not filtered or sterilized, but microbial contamination is controlled by addition of gentamicin to the drug diluent. Multiple aliquots are stored at frozen at -70 $^{\circ}$ C to provide uniform samples for initial for tests as well as retests, if required just prior to preparation of the drug dilutions in cell-culture medium. These frozen concentrates are thawed at room temperature for 5 minutes. The concentrates are then diluted with complete medium containing 50 μ g/ml gentamicin to twice the desire final concentrations.

Drug Incubation

Immediately after preparation of these intermediate dilutions 100 μ L aliquots of each dilution were added to the appropriate microtiter plate wells according to the format. As the microtiter wells already contain the cells in 100 μ L of medium, the final drug concentration tested is 50% of that in the intermediate dilutions. Agents are than added immediately to the cultures in the microtiter plates. During development of these procedures, drug incubation time was 1, 2, 3, 4 or 6 days at 37 $^{\circ}$ C in an atmosphere of 5% CO₂ and 100% relative humidity. The plates were been assayed for the cellular growth and viability by microculture assay by tetrazolium assay or by SRB assay. In the current screening procedure, the cultures were incubated with test agents for 2 days and the end point is measured by the SRB assay.

Microculture Tetrazolium Assay

The MTT assay is based on metabolic reduction of 3-(4, 5- dimethyl thiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT). A 50 μ l aliquot of MTT solution (1mg/ml) in RPMI-1640 medium, with no serum or glutamine, is added directly to all the appropriate microtiter plate wells containing cells complete growth medium and test agents. The culture is then incubated for 4 hrs to allow for MTT metabolism to formazan. After this time the supernatant is aspired and 150 μ l of Dimithyl sulfoxide is added to dissolve the formazan. Plates are agitated on

plate shaker to ensure a homogenous solution, and the optical densities are read on an automated spectrophotometric plate reader.

Sulforhodamine Bio Assay

Adherent cell cultures were fixed in situ by adding 50 µl of cold 50 % (wt/vol) trichloroacetic acid (TCA) and incubating for 60 minutes at 40C. The supernatant is then discarded and the plates were washed five times with deionized water and dried. One hundred microliters of SRB solution (0.4% wt/vol in acetic acid) is added to each microtiter well and the culture is incubated for 10 minutes at room temperature. Unbound SRB is removed by washing five times with 1 % acetic acid. Then the plates are air dried. Bound stain is solubilized with Tris buffer and the optical densities are read.

Data Calculations

Unprocessed optical density data from each microtiter plate are automatically transferred from the plate reader to a microcomputer, where the background optical density (OD) measurements (i.e. complete medium plus stain minus cells) are subtracted from the appropriate control well values and where the appropriate drug- blank measurements (i.e. complete medium plus test compound dilution plus stain, minus cells) are subtracted from appropriate test well values. The values for mean + SD of data from replicate wells were calculated. Data are expressed in terms of % T/C [(OD of treated cells/ OD of control cells) x 100] as measure of cells viability and survival in the presence of test materials. Calculations are also made for the concentration of test agents giving a T/C value of 50% or 50% growth inhibition (IC50) and a T/C value of 10% or 90% growth inhibition (IC90).

With the SRB assay, a measure is also made of the cells population density at time (the time at which drugs are added) from two extra reference plates of inoculated cells fixed with TCA just prior to drug addition to the test plates. Thus we have three measurements controls optical density (C), test optical density (T) and optical density at tie zero (T0).

Using these measurements, cellular responses can be calculated for growth stimulations for no drug effect and for growth inhibition. If T is greater than or equal to T0, the calculation is $100 \times [(T-T_0)/(C-T_0)]$. If T is less than T0, cell killing has occurred and can be calculated from $100 \times [(T-T_0)/T_0]$. Growth inhibition of 50% (GI50) was calculated from $100 \times [(T-T_0)/(C-T_0)] = 50$, which is the drug concentration causing a 50% reduction in the net protein increase in control cells during the drug incubation. The drug concentration resulting in total growth inhibition (TGI) was calculated from $T = T_0$. Where the amount of protein at the end of drug incubation is equal to the amount of protein at the end of drug incubation is equal to the amount at the beginning. The final calculation, LC50, is the concentration of drug causing a 50% reduction in the measured protein at the end of the drug incubation, compared with that at the beginning. Indicating a net loss of cells following drug treatment. LC50 is calculated from $100 \times [(T-T_0)/T_0] = -50$. Results are shown in table no. 7

Table-7 Comparative in vitro cytotoxicity evaluation against human cancer cell lines with fixed concentration

Name of Drug	Conc. (µg/ml)	PC-3	HEP-2	A-549	502713	HCT-15	SW-620
		Prostate	Liver	Lung	Colon		
Green tea extract	100	46%	4%	28%	94%	83%	9%
Potassium curcumin	100	85%	80%	52%	92%	89%	95%
Curcumin	100	58%	32%	36%	74%	82%	51%
5-Fu	1x10-4M	51%	24%	32%	65%	44%	40%
Mito-C	1x10-5M	60%	69%	24%	85%	66%	62%
Paclitaxel	1x10-6M	26%	-	37%	71%	73%	-

RESULTS

potassium curcumin exhibits targeted anticancer effect against Prostate, Liver, Lungs and colon cancer cell line Anticancer effect of potassium curcumin was estimated by MTT assay and morphological studies. The results of the MTT assay, Sulforhodamine bio assay revealed wide anticancer activity of the potassium curcumin towards Prostate, Liver, Lungs and Colon cancer cells. Potassium curcumin greatest anticancer activity 85% towards prostate cancer cell, 80% towards liver cancer cell, and average of 92% towards colon cancer cell compared to curcumin and standard anticancer drugs like 5-Fu, Mito-C and Paclitaxel.

CONCLUSION

Chewing gum show many benefits over the other dose type of these are; direct simple to geriatric and pediatric populace, has great taste, it draws out the time of medication in the oral cavity to deliver a particular impact, arranged effectively and no need water consumption for organization, this study planned to form potassium

curcumin as Chewing gum to further develop conveyance to treat oral thrush. The pre-arranged definitions were exposed to different physical and Chemical tests like assay, weight variation in-vitro drug release. Finally, it was concluded that the potassium salt of Curcumin Chewing gum can be considered as a suitable delivery system for the treatment variety of Cancer.

REFERENCES

1. Rathbone M, Drummond B, and tucker I. 1994. Oral Cavity as a site for systemic drug delivery. *Adv. Drug. Del. Rev.* 13; 1-22 pp.
2. Shojaei H.A. 1998. Buccal mucosa as route for systemic drug delivery: A review. *Journal of Pharmaceutical Sciences.* 1; 1: 15-30 pp.
3. Devrajan V.P, Adani H.M, Oral Transmucosal drug delivery, New delhi, 1997. 65 pp.
4. Squier C.A. 1991. The permeability of oral mucosa. *Crit Rev Oral Biol. Med.* 2; 13-32 pp.
5. de Vries M. E, Bodde H. E, Verhoef J. C, Junginger H. E, 1991. Developments in buccal drug delivery. *Crit. Rev. Ther Drug Carr. Sys.* 8; 271- 303 pp.
6. Kurosaki Y., Hisaichi S., Hamada C., Nakayama T. and Kimura T. 1988. Effects of surfactants on the absorption of salicylic acid from hamster cheek pouch as a model of keratinized oral mucosa. *Int. J. Pharm.* 47; 13-19 pp.
7. Gennaro R.A, Remington: The Sciences and Practice of Pharmacy, 1995, Mack Publishing Company, 710 pp.
8. YajamanSudhakar, KetousetuoKuotsu, A.K.Bandyopadhyay. 2006. Buccal bioadhesive drug delivery. A promising option for orally less efficient drugs. *Journal of Controlled Release* 114 15-40
9. R.B.Gandhi, J.R. Robinson. 1988. Bioadhesion in drug delivery. *Ind. J.PharmSci* 50 (3) 145-152.
10. C.A. Squier, J. *Ultrastruct.* 1977. Res 60 212-220.
11. K.Wolf, H.J.Honigsmann, J.*Ultrastruct* 1971. Res36 176-190.
12. F.S.Rosen, B.J.Bailey, Anatomy and physiology of salivary glands, Grand Rounds presentation, UTMB, Department of Otolaryngology.
13. Rathbone M. J and Hadgraft J. 1991. Absorption of drugs from the human oral cavity. *Int J Pharm* 79; 9-24 pp
14. Morjaria Y, Irwin WJ, Barnett PX, Chan RS and Conway BR: 2004 In vitro Release of Nicotine From Chewing Gum Formulations. *Dissolution Technologies*, 12-15.
15. Cohen Lee M, Britt Dana M, Collins Fank L. 2001. Multimodal assessment of the effect of chewing gum on nicotine withdrawal. *Addictive Behaviors.* 26; 289-295 pp.
16. Yamanaka N, Oda O, Nagao S. 1997. Pro-oxidant activity of caffeic acid, dietary non-flavonoid phenolic acid, on Cu²⁺-induced low density lipoprotein oxidation. *FEBS Lett.* 405:186-90
17. Gupta S, Saha B, Giri A.K. 2002. Comparative antimutagenic and anticlastogenic effects of green tea and black tea: a review. *Reviews in Mutation Research.* 512; 37-65 pp.
18. Tonnesen H.H., Masson M., Loftsson, T. 2002. Studies of curcumin and curcuminoids. XXVII. Cyclodextrin complexation: solubility, chemical and photochemical stability. *Int. J. Pharm.* 244; 127-135 pp.
19. Monks Anne, et.al.1991. Feasibility of high flux anticancer drug screen using a diverse panel of cultured human tumor cell lines. *J Natl Cancer Inst.* 11; 5. 757-766 pp.
20. Morjaria Y, Irwin WJ, Barnett PX, Chan RS and Conway BR: 2004 In vitro Release of Nicotine from Chewing Gum Formulations. *Dissolution Technologies*, 12-15.
21. Buschang P.H, Hayasaki H, Throckmorton G.S. 2000. Quantification of human chewing cycle kinematics. *Arch of Oral Biology.* 45; 461-474 pp.
22. Tonnesen H.H., Krlsen J. 1985. Studies on curcumin and curcuminoids. VI. Kinetics of curcumin degradation in aqueous solution. *Z. Lebensm. Unters. Forsch.* 180; 402-404 pp.
23. Monks Anne, et.al.1991. Feasibility of high flux anticancer drug screen using a diverse panel of cultured human tumor cell lines. *J Natl Cancer Inst.* 11; 5. 757-766 pp..

Development and Validation of High Performance Thin Layer Chromatographic Method for Estimation of Favipiravir API and Its Tablet Dosage Form Using Quality by Design Approach

Jyoti Shinde^{1*}, Pankaj Kumar Sharma², Jaya Sharma³, Monika Dandwate⁴ and Madhuri Shelar⁵

^{1,2,3,4}Department of Pharmaceutical Science, Apex University, Jaipur, Rajasthan, India

⁵Department of QAT, Alard College of Pharmacy, Marunji, Pune-411057, Maharashtra, India

ABSTRACT

The Purpose of the Current research was to apply Quality by Design approach for development of more accurate, precise, specific and robust HPTLC method for estimation of Favipiravir in its tablet dosage form. About seven variables were screened out by Taguchi OA design on Rf and peak area. Out of seven variables, two critical method variables (mobile phase ratio and Front solvent) were found significant. These two factors were subjected to 3² factorial designs. Once response surface methodology, method operable design space was obtained by optimization of model, on the basis of that control strategy was developed. The chromatographic separation was carried out by using Methanol: Toluene: Ethyl acetate (2:5:3 v/v/v) as mobile phase and pre-coated silica gel aluminum plate 60F254 as stationary phase at wavelength of 242 nm. Developed method was validated as per ICH Q2(R1) guideline. The estimation of favipiravir in its tablet dosage form was performed by applying developed method and results were found accurate and precise.

Keywords: favipiravir, High Performance Thin Layer Chromatography, Quality by Design, Taguchi OA Design, 3² factorial design, Validation.

INTRODUCTION

Favipiravir is an antiviral drug of pyrazine carboxamide derivative and chemically 5-fluoro-2-oxo-1H-pyrazine-3-carboxamide (Figure 1), The mechanism of its actions is thought to be related to the selective inhibition of viral RNA-dependent RNA polymerase.^[8] Favipiravir is a prodrug that is metabolized to its active form, favipiravir-ribofuranosyl-5'-triphosphate (favipiravir-RTP), available in both oral and intravenous formulations.^{[9][10]} In 2014, favipiravir was approved in Japan for stockpiling against influenza pandemics and recently in Covid-19 it's given as first line drug for reducing the infection.^[1,2]

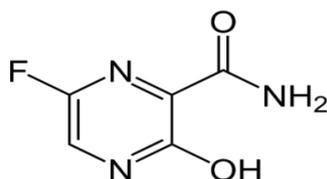


Figure 1: Structure of Favipiravir

The survey of literature revealed HPLC method for estimation of favipiravir related substance and favipiravir^[3] so far HPTLC method by Quality by Design (QbD) approach has not reported.^[4-22] The use of HPTLC is used due to its high accuracy, less evaluation time and QbD for systematic evaluation of interaction effect and individual effect.

ICH Q8, Q9 and Q10 guidelines proposed by International Conference on Harmonization for elaborating QbD. Quality by design is new concept for developing and analyzing the API & pharmaceutical products. It is useful in development and analysis of pharmaceutical product and API with quality attributes.^[24] The concept of QbD helps in finding the design points, which are able to produce results as per requirements and set all conditions with possibilities of reproducibility, accuracy and repeatability.^[25]

The objective of the present study was to determine the significance of QbD approach in the development of HPTLC method for estimation of Favipiravir in marketed formulation.

MATERIALS AND METHODS

Material

Favipiravir, pure drug substances was obtained from Yarrow chemical Products from Mumbai. Methanol, Toluene, Formic acid and Ethyl Acetate used were of analytical grade and purchased from Oswal scientific, Pune (india). The FAPVIRTM tablet (Abbott Healthcare Pvt. Ltd) containing 200 mg of favipiravir was procured from local market.

Instrumentation:

HPTLC method development of favipiravir was carried out using a Camag HPTLC equipped with Linomat V semiautomatic sample applicator and Camag thin layer chromatography (TLC) Scanner III. The sample was applied using Linomate syringe (100 μ l). Chromatographic separation was achieved on pre-coated silica gel aluminum plate 60F254, (10 \times 10 cm: Merck KGaA 64271, Darmstadt, Germany) using Camag twin-trough TLC developing chamber. Densitometric analysis was carried out using TLC scanner III with Camag win-CATS software and data analysis was performed by using trial version of Design Expert software.

Preparation of Mobile Phase and Stock Solution:

Stock solutions were prepared by weighing 20 mg each of favipiravir. The weighed drugs were transferred to 10 ml volumetric flask. Volumes were made up to the mark with methanol to obtain a solution containing 2000 μ g/ml (2000ppm) of favipiravir.

Selection of Quality Target Analytical Profile, Potential Method Variables and Potential Quality Attributes

As per available literature and scientific knowledge, there are seven method variable were identified as potential i.e. Mobile phase ratio, retention factor, peak area of FAP were selected as potential quality attributes.

Table 1: Taguchi Oa Design Of Factors and Their Levels

Factor NO.	Factor	Unit	Level	
			-1	+1
1	Mobile phase ratio: (Methanol : Toluene : Ethyl acetate)	-	30 : 50 : 2	50 : 30 : 2
2	Volume of modifier	ml	0.1	0.2
3	Front Solvent	mm	80	90
4	Saturation time	min	10	15
5	Band length	mm	6	8
6	Detection wavelength	nm	242	326
7	Plate size	nm X nm	10X10	20X10

Screening of Potential Method Variables and Method Attributes by Taguchi OA design : Taguchi OA design was used for screening of Eight trial version potential method variables each with two levels using design expert software. Eight run for seven factors were suggested in design matrix (Table 2). All runs were performed in three replicates. TLC plates were dried and then scanned under Camag scanner III. All results were reported by using CAT Win software and analyzed all variable effect on response.

Table 2: Taghuchi Oa Design Matrix

RUN	FACTOR							RESPONSE	
	1	2	3	4	5	6	7	Rf of FAP	Peak area
1	30	0.2	90	15	8	242	10X10	0.81	2726
2	50	0.1	90	15	6	326	10X10	0.725	2687
3	50	0.2	80	10	8	326	10X10	0.73	2204.1
4	50	0.1	90	10	8	242	20X10	0.699	2713.7
5	30	0.1	80	15	8	326	20X10	0.823	2298
6	30	0.2	90	10	6	326	20X10	0.85	2907.9
7	50	0.2	80	15	6	242	20X10	0.71	2324
8	50	0.1	80	10	6	242	10X10	0.72	2311

Response Surface Modeling by 3² Factorial Design

Mobile Phase and Front Solvent were found critical affecting method variables from Pareto chart analysis and ANOVA screening. Response surface modeling by 3³ factorial design was applied to study relationship between critical method variable and retention factor, peak area, tailing of FAP using design expert software 8 versions.

Table 3: Factors and Their Levels for 3² Factorial Design

Factor No	Factors	Unit	Level		
			-1	0	+1
1	Mobile Phase	ml	30	40	50
2	Solvent Front	mm	80	85	90

Nine experimental runs were suggested by design metrics for three levels for two factors (Table 4). All experimental runs were performed in triplicate and Retention factor and Peak area of FAP for each run was recorded. All responses were entered against respective experimental run and analyzed for relationship between critical method attribute and variables. Response surface model was used for optimization of response.

TABLE 4: 3² FACTORIAL DESIGN METRICS

Run	Factor		Rf	Peak area
	Mobile Phase	Front Solvent		
1	40	85	0.761	2564
2	30	85	0.81	2564
3	50	80	0.72	2311
4	50	90	0.71	2947
5	40	90	0.758	2897
6	30	80	0.79	2298
7	50	85	0.723	2601
8	40	80	0.758	2375
9	30	90	0.78	2841

Validation of Response Surface Model

The developed model was validated by comparing practical value of response to predicted value.

Optimized Chromatographic Conditions

Chromatographic separation was performed on 10 × 10 cm pre-coated silica gel aluminum plate 60F254. The TLC plates were pre-washed with methanol and then dried in hot air oven at 120°C for 20 min. Samples were spotted on TLC plate at 15 mm from the bottom edge by Linomate syringe (100 µl) using following parameters: band length 6 mm, application rate, 0.6 µL/s. The TLC plate was developed in twin trough chamber using in Methanol: Toluene: Ethyl acetate (2:5:3 v/v/v) as mobile phase at temperature 25 ± 2 °C; relative humidity 35±5 %; migration distance 80 mm and chamber saturation time 10 min. The TLC plate was scanned at 242 nm and analysed by TLC Scanner III and WinCATS software using following parameters: scanning speed 20 mm/sec, slit dimension 6 × 0.40 mm.

Selection of Wavelength for Detection

The working standard solution of 0.6 µl of FAP were spotted on the TLC plate then plate was developed as per optimized chromatographic conditions. After drying, developed TLC plate was scanned between 200 to 800 nm under Camag scanner III for detection of wavelength.

Preparation of Calibration Curve

From the working standard solution (2000 µg/ml) of FAP 0.2, 0.4, 0.6, 0.8, 1.0, and 1.2 µL were spotted to get concentration of 400, 800, 1200, 1600, 2000 and 2400 ng/band of drugs. According to optimized chromatographic condition, the plate was developed, dried and analyzed. The calibration curve was drawn by plotting peak area versus respective concentration of drug.

Method Validation ^[26]

The optimized method was validated as per the ICH ^[26] guidelines included parameters like Linearity, Precision, accuracy, Recovery, Specificity etc.

Analysis of Marketed Formulation

Twenty tablets of favipiravir (FAPVIRTM tablet) were weighed and powdered. The equivalent weight of 20 mg of FAP powder weighted accurately and transferred to 10 ml volumetric flask. The flask was filled to about 85% with methanol, sonicated for 15 minutes and diluted to mark with methanol to get concentration of 2000 µg/ml and 0.6 µl of marketed formulation solution was spotted on TLC plate and analyzed.

RESULTS AND DISCUSSION

Result of Screening by Taguchi OA Design

On the basis of ANOVA (Table 5) and Pareto charts (Figure 2 to 3) analysis, the mobile phase ratio and migration distance were considered as critical method variables for optimization of chromatographic condition

Table 5: Anova Table for Taguchi Oa for Response

Responses	Source	Sum of Square	Degree of Freedom	Mean Square	F-Value	P-Value	
Rf of FAP	Model	0.023	2	0.012	40.19	0.0008	Significant
	Residual	1.434E-003	5	2.869E-004			
	Total	0.024	7				
Peak area of FAP	Model	4.598E+005	2	2.299E+005	38.70	0.0009	Significant
	Residual	29699.03	5	5939.81			
	Total	4.895E+005	7				

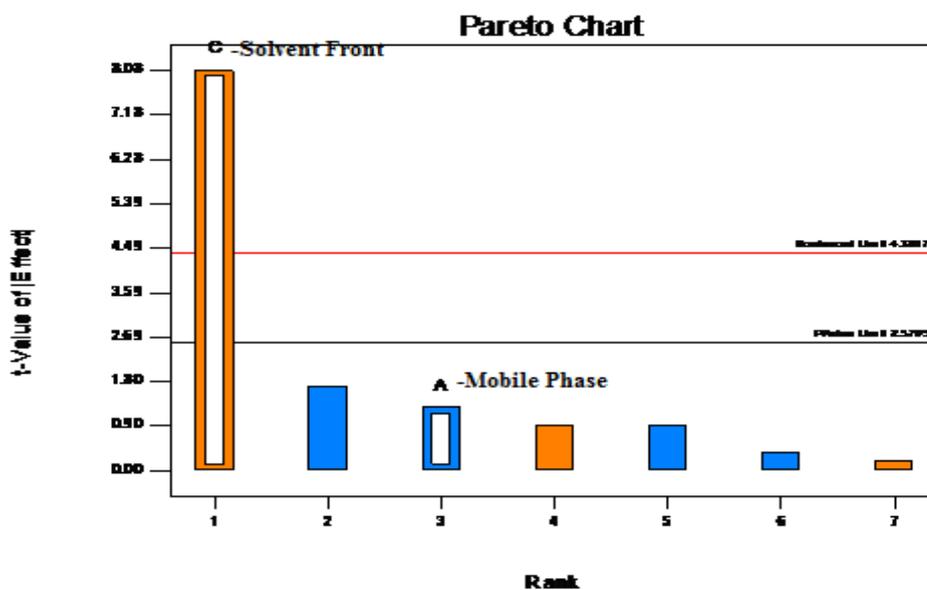


Figure 2: Pareto Chart for screening design- R_f of FAP

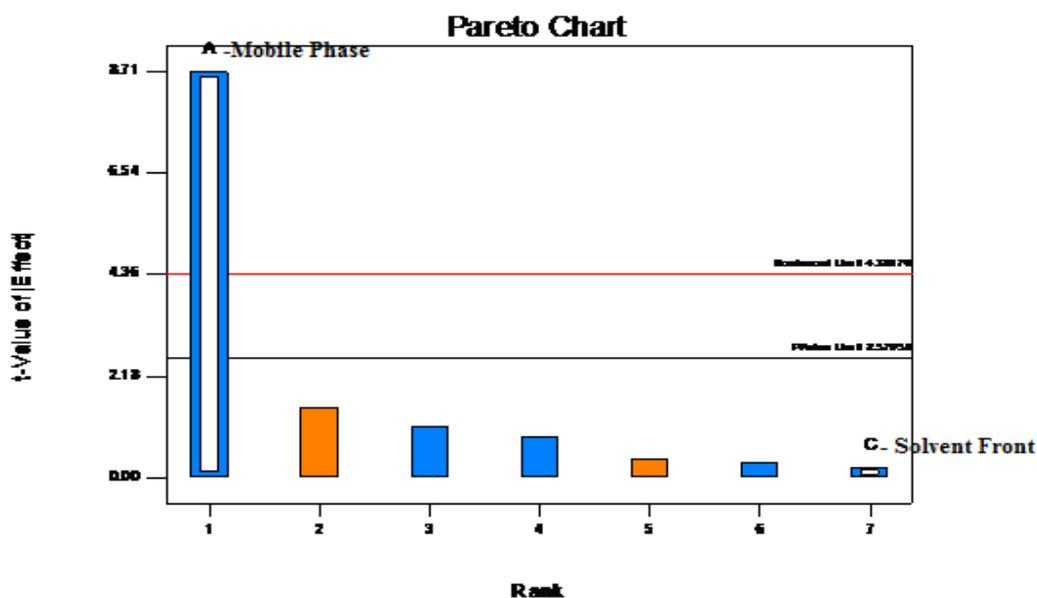


Figure 3: Pareto Chart for screening design- Peak area of FAP

Response Surface Modeling by 3² Factorial Design

From ANNOVA, F values for model were found 49.63 and 174.67 to be for R_f and peak area of FAP respectively. According to those values, models were indicated significant. The mathematical models obtained from response surface model and contour plots analysis were used for optimization of R_f and Peak area.

$$R_f \text{ of FAP} = 0.76 - 0.038 * A - 3.333E-003 * B$$

$$\text{Peak Area} = 2599.78 + 26.00 * A + 283.50 * B$$

Table 6: Anova Table for 3² Factorial Design for Response

Response	Source	Sum of Square	Degree of Freedom	Mean Square	F-Value	P-Value	
Rf of FAP	Model	8.655E-003	2	4.327E-003	49.63	0.0002	Significant
	Residual	5.232E-004	6	8.719E-005			
	Total	9.178E-003	8				
PEAK AREA	Model	4.863E+005	2	2.431E+005	174.67	0.0001	Significant
	Residual	8352.06	6	1392.01			
	Total	4.946E+005	8				

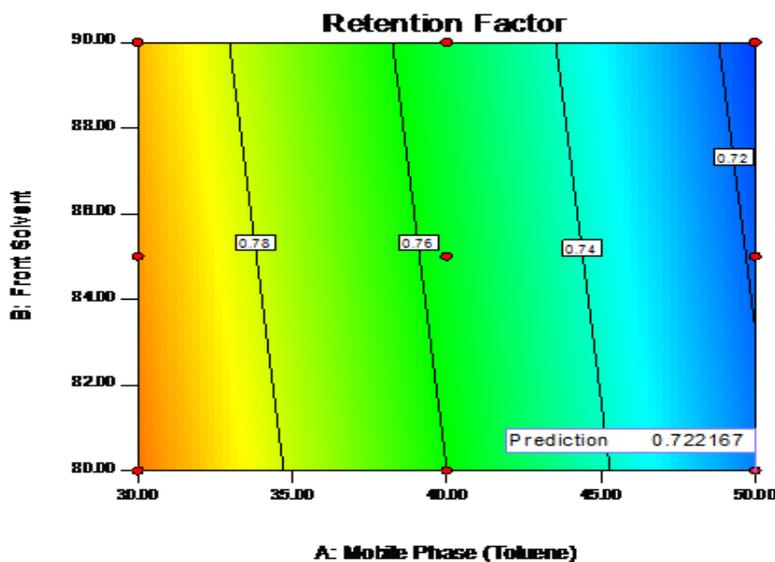


Figure 4: Contour plot for Rf of FAP

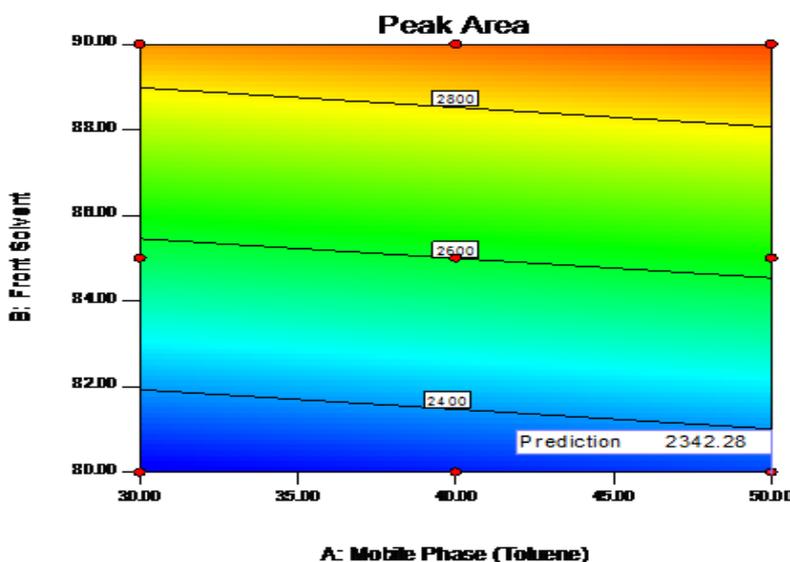


Figure 5: Contour plot for Peak area

Validation of Response Surface Model

The peak area and Rf of FAP were noted by doing small variations in the factors within the design space, which was similar to that of predicted values. The greater correlation between predicted and experimental values was found.

Design Space and Control Strategy

The following control strategy was applied for development of analytical method (Table 7) according design space (Figure 6)

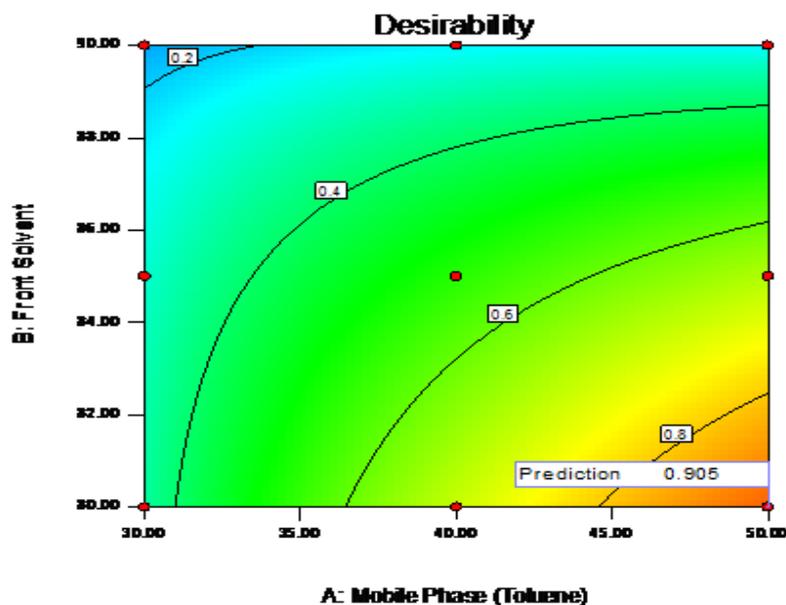


Table 7: Control Strategy

Method Variables	Levels	Control Strategy
Mobile phase ratio: (Methanol : Toluene : Ethyl acetate)	3:5:2 – 5:3:2	3.5.2
Volume of modifier	0.1 – 0.2ml	0.1 ml
Front Solvent	80–90 mm	80 mm
Saturation time	10 – 15 min	10 min
Band length	6–8 mm	6mm
Detection wavelength	242 – 326 nm	242 nm
Plate size	10X10-20X10 cm	10X10 cm

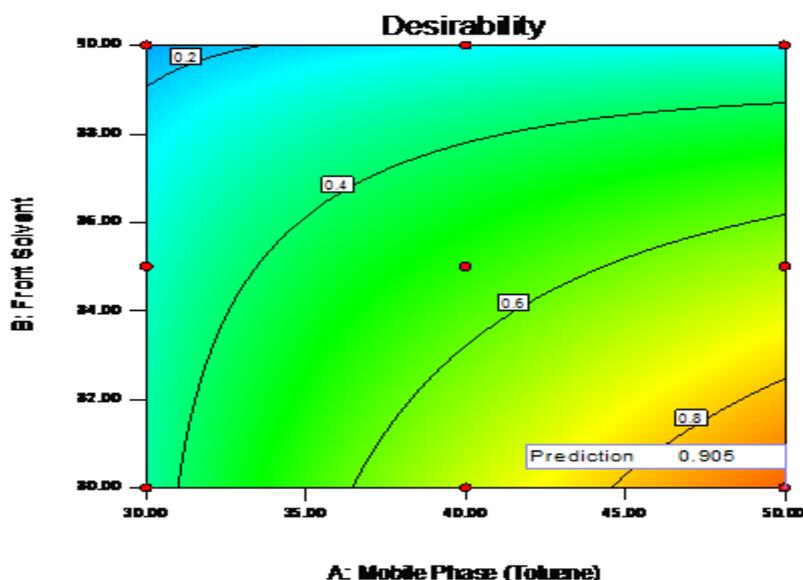


Figure 6: Overlay plot Figure 6 design space

Selection of Detection Wavelength

Standard UV spectrum of FAP showed maximum absorbance at 242 nm. Hence, 242 nm was selected for further analysis.

METHOD VALIDATION

The mobile phase containing combination of Methanol: Toluene : Ethyl Acetate: formic acid (2:5:3:0.1,v/v/v/v) given sharp peaks having $R_f 0.72 \pm 0.02$ for FAP. The calibration curve for FAP was found linear over the range of 400-2400 ng/band. The data of calibration curves is mentioned in Table 8.

Table 8: Calibration Curve Data for Fap

Sr. No	Concentration (ng/band)	Peak Area (AU) (Mean \pm SD : n=5)	SD	%RSD
1	400	955.6	8.366	0.851
2	800	1600	11.713	0.728
3	1200	2327.6	17.827	0.766
4	1600	3046.4	18.474	0.606
5	2000	3848	4.472	0.116
6	2400	4477.6	10.286	0.229

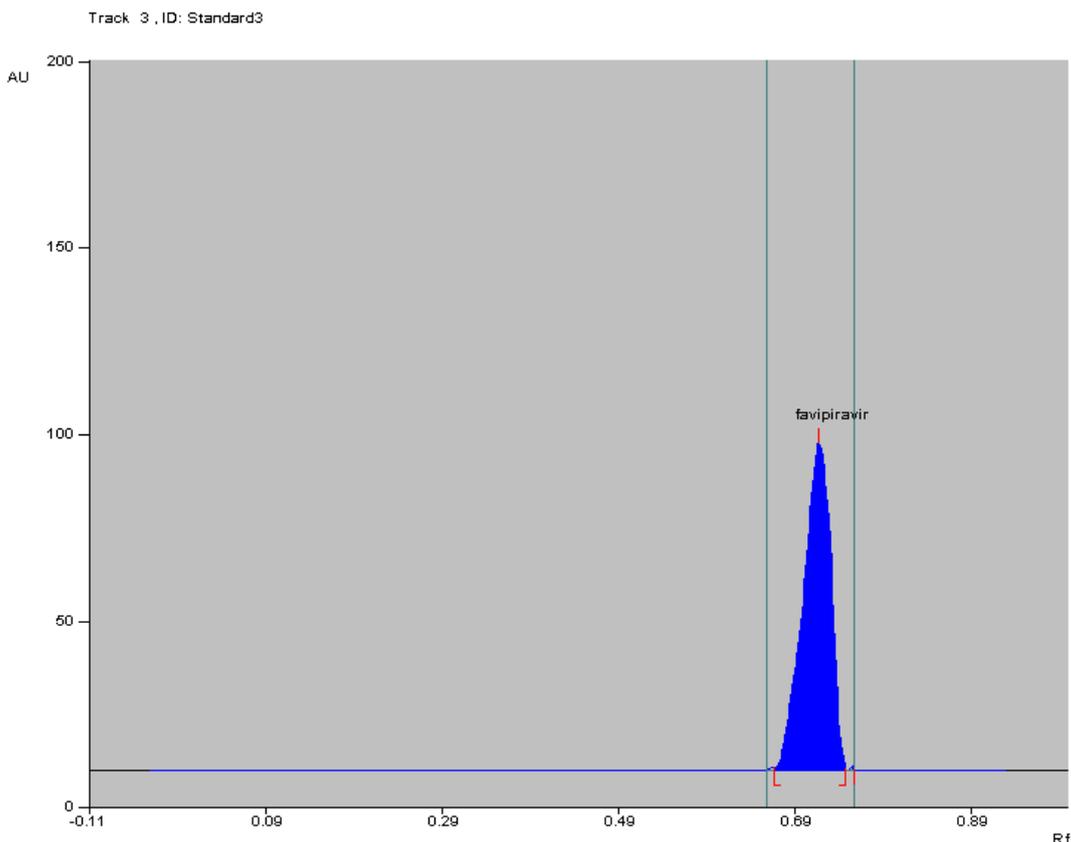


Figure7: Graph densitogram for standard FAP

% RSD for inter-day and intra-day precision for FAP were found 3.167 & 2.407 respectively (Table 09)

TABLE 9: INTERMEDIATE PRECISION DATA FOR FAP

Sr. NO	Concentration (Ng/Band)	Intraday Precision	Interday Precision
		Peak area (AU)	Peak area (AU)
1	1200	2353.6	2353.6
2	1200	2362.4	2312.8
3	1200	2350.8	2345.5
4	1200	2375.9	2353.6
5	1200	2335.6	2311.6
6	1200	2311.1	2304.1
Average		2348.233	2330.20
Standard Deviation		20.57512	23.061396
RSD%		0.87	0.99

The LOD and LOQ for FAP were found to be 85.49 ng/band and 259.06 ng/band respectively. The accuracy for FAP were found to be 103.8-105.7 (Table 10).

Table 10: Recovery Data for FAP

Level	Amount of tablet powder equivalent to drug amount (mg)	Amount of drug spiked (mg)	Peak Area (AU) (Mean \pm SD; n=3)	% Recovery
0%	26.8	0	2331	-
80%	26.8	16	4304	105.7
100%	26.8	20	4771	104.6
120%	26.8	24	5237	103.8

The results for validation are summarized in Table 11.

Table 11: Summary of Validation Parameters

Sr. NO	Parameters	Result
1	Linearity Range (ng/band)	400-2400
2	Regression Equation	$y=1.779x+224.76$
3	Correlation Coefficient	0.9989
	Precision (%RSD)	
	Intraday Precision	0.87
	Interday Precision	0.99
5	% Recovery	103.8-105.7
6	LOD	85.49 ng/band
7	LOQ	259.06 ng/band

Assay of Marketed Formulation

The content of Favipiravir in marketed formulation (FAPVIRTM Tablet) was found to be 104.6 % effective (Table 12). The chromatogram showed peak area of FAP was shown 2331, with no additional excipients showing interference in FAP estimation.

Table 12: Analysis of Marketed Formulation

Drugs	Label Claim (mg)	Amount found(mg)	Assay (%) (Mean \pm SD) (n=3)
FAP	200	209	104.6%

CONCLUSION

QbD approach was applied for the analytical HPTLC method development for determination of favipiravir. QbD approach help to study the potential factor affecting on HPTLC. About seven factors were screened by Taguchi OA Design, out of which two factors namely Mobile Phase & front solvent were found potential. The experimental design showed mobile phase & front solvent more affecting factors on the response. These two critical factors were analysed by using 3² factorial design in conjugation with response surface methodology. The sinterrelation between HPTLC parameters and response was investigated. Experimental developed method was found less time consuming, optimum migration distance, satisfactory accuracy & precision. The optimized method was successfully validated as per ICH guidelines. QbD approach was successfully used to develop HPTLC method of favipiravir and its marketed formulation.

ACKNOWLEDGEMENT

We are thankful to Yarrow Chem products, Mumbai for providing the API of Favipiravir and Oswal Scientific Pune for providing chemicals.

REFERENCES

1. Favipiravir - Wikipedia n.d. <https://en.wikipedia.org/wiki/Favipiravir> (accessed December 17, 2021).
2. Favipiravir: Uses, Interactions, Mechanism of Action | DrugBank Online n.d. [https:// go.drugbank. com/d rugs/ DB12466](https://go.drugbank.com/drugs/DB12466) (accessed December 17, 2021).
3. BULDUK I. HPLC-UV method for quantification of favipiravir in pharmaceutical formulations. <https://EnWikipediaOrg/Wiki/Favipiravir2021;33:209-15>. <https://doi.org/10.1556/1326.2020.00828>.
4. Saber-Ayad M, Saleh MA, Abu-Gharbieh E. pharmaceuticals The Rationale for Potential Pharmacotherapy of COVID-19 n.d. <https://doi.org/10.3390/ph13050096>.
5. Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, et al. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). *Int J Surg* 2020;76:71-6.

<https://doi.org/10.1016/J.IJSU.2020.02.034>.

6. Zhu R, Gao Y, Robert S-H, Gao J, Yang S, Zhu C. Systematic review of the registered clinical trials for coronavirus disease 2019 (COVID-19). *J Transl Med* 2020;18:274. <https://doi.org/10.1186/s12967-020-02442-5>.
7. Dong L, Hu S, Gao J. Discovering drugs to treat coronavirus disease 2019 (COVID-19). *Drug Discov Ther* 2020;14:58–60. <https://doi.org/10.5582/ddt.2020.01012>.
8. De Clercq E. New Nucleoside Analogues for the Treatment of Hemorrhagic Fever Virus Infections. *Chem - An Asian J* 2019;14:3962–8. <https://doi.org/10.1002/asia.201900841>.
9. Delang L, Abdelnabi R, Neyts J. Favipiravir as a potential countermeasure against neglected and emerging RNA viruses. *Antiviral Res* 2018;153:85–94. <https://doi.org/10.1016/j.antiviral.2018.03.003>.
10. Dawes BE, Kalveram B, Ikegami T, Juelich T, Smith JK, Zhang L, et al. Favipiravir (T-705) protects against Nipah virus infection in the hamster model /631/326/22/1295 /631/326/596/1296 /13/106 /14/35 /38/77 /82/51 /96/63 article. <https://EnWikipediaOrg/Wiki/Favipiravir> 2018;8:1–11. <https://doi.org/10.1038/s41598-018-25780-3>.
11. Mendenhall M, Russell A, Juelich T, Messina EL, Smee DF, Freiberg AN, et al. T-705 (favipiravir) inhibition of arenavirus replication in cell culture. <https://EnWikipediaOrg/Wiki/Favipiravir> 2011;55:782–7. <https://doi.org/10.1128/AAC.01219-10>.
12. Bocan TM, Basuli F, Stafford RG, Brown JL, Zhang X, Duplantier AJ, et al. Synthesis of [18 F]Favipiravir and Biodistribution in C3H/HeN Mice as Assessed by Positron Emission Tomography. <https://EnWikipediaOrg/Wiki/Favipiravir> 2019;9:1–10. <https://doi.org/10.1038/s41598-018-37866-z>.
13. Naydenova K, Muir KW, Wu LF, Zhang Z, Coscia F, Peet MJ, et al. Structure of the SARS-CoV-2 RNA-dependent RNA polymerase in the presence of favipiravir-RTP. <https://EnWikipediaOrg/Wiki/Favipiravir> 2021;118:2–7. <https://doi.org/10.1073/pnas.2021946118>.
14. Nguyen THT, Guedj J, Anglaret X, Laouénan C, Madelain V, Taburet AM, et al. Favipiravir pharmacokinetics in Ebola-Infected patients of the JIKI trial reveals concentrations lower than targeted. <https://EnWikipediaOrg/Wiki/Favipiravir> 2017;11:1–18. <https://doi.org/10.1371/journal.pntd.0005389>.
15. Baranovich T, Wong S-S, Armstrong J, Marjuki H, Webby RJ, Webster RG, et al. T-705 (Favipiravir) Induces Lethal Mutagenesis in Influenza A H1N1 Viruses In Vitro. <https://EnWikipediaOrg/Wiki/Favipiravir> 2013;87:3741–51. <https://doi.org/10.1128/jvi.02346-12>.
16. Prajapat M, Sarma P, Shekhar N, Avti P, Sinha S, Kaur H, et al. Drug targets for corona virus: A systematic review. *Indian J Pharmacol* 2020;52:56–65. https://doi.org/10.4103/IJP.IJP_115_20.
17. Eryavuz Onmaz D, Abusoglu S, Onmaz M, Yerlikaya FH, Unlu A. Development and validation of a sensitive, fast and simple LC-MS / MS method for the quantitation of favipiravir in human serum. *J Chromatogr B* 2021;1176:122768. <https://doi.org/10.1016/J.JCHROMB.2021.122768>.
18. Nazifa S, Ali S, Mobina L, Mehfuza M, Seema P, Ahmed A, et al. Analytical Method Development and Validation and Forced Degradation Stability-Indicating Studies of Favipiravir by RP-HPLC and UV in Bulk and Pharmaceutical Dosage Form. *J Pharm Res Int* 2021;33:254–71. <https://doi.org/10.9734/JPRI/2021/v33i48B33283>.
19. V. Duse P, G. Baheti K. Bioanalytical Method Development and Validation for the Determination of Favipiravir in Spiked Human Plasma by using RP-HPLC. *J Pharm Res Int* 2021;33:275–81. <https://doi.org/10.9734/JPRI/2021/v33i47A33014>.
20. Gökce S, Höl A, Bulduk I. Development and Validation of UPLC-MS / MS Method for Obtaining Favipiravir Tablet Dosage form and Evaluation of its Behavior Under forced Conditions. *J Pharm Res Int* 2021;33:130–40. <https://doi.org/10.9734/JPRI/2021/v33i56A33895>.
21. Morsy MI, Nouman EG, Abdallah YM, Zainelabdeen MA, Darwish MM, Hassan AY, et al. A novel LC-MS/MS method for determination of the potential antiviral candidate favipiravir for the emergency treatment of SARS-CoV-2 virus in human plasma: Application to a bioequivalence study in Egyptian human volunteers. *J Pharm Biomed Anal* 2021;199. <https://doi.org/10.1016/J.JPBA.2021.114057>.

22. Jitta SR, Salwa , Kumar L, Gangurde PK, Verma R. Development and Validation of High-Performance Liquid Chromatography Method for the Quantification of Remdesivir in Intravenous Dosage Form. *Assay Drug Dev Technol* 2021;19:475–83. <https://doi.org/10.1089/ADT.2021.074>.
23. Rezk MR, Badr KA, Abdel-Naby NS, Ayyad MM. A novel, rapid and simple UPLC-MS/MS method for quantification of favipiravir in human plasma: Application to a bioequivalence study. *Biomed Chromatogr* 2021;35. <https://doi.org/10.1002/BMC.5098>.
24. Patil AS, Pethe AM. Quality by design (QbD): A new concept for development of quality pharmaceuticals. <https://en.wikipedia.org/wiki/Favipiravir> 2013;4:13–9.
25. Vogt FG, Kord AS. Development of quality-by-design analytical methods. *J Pharm Sci* 2011;100:797–812. <https://doi.org/10.1002/JPS.22325>.
26. Harron DWG. Technical Requirements for Registration of Pharmaceuticals for Human Use: The ICH Process. <https://en.wikipedia.org/wiki/Favipiravir> 2013;1994:447–60. <https://doi.org/10.1002/9781118532331.ch23>.

Synthesis of a New Series of Dyes from O-(3-Chloro 4-Hydroxy Benzoyl) Benzoic Acid

Sharat Srivastava¹, Harsh Kumar Garg² and Umesh Chandra Mishra^{3*}

^{1,2}Department of Chemistry, D.V College, Orai, India

³Department of Chemistry, B.N. P.G College, Rath, India

ABSTRACT

In this paper a new series of phthal-as-ein dyes derived from o-(3-chloro 4-hydroxy benzoyl) Benzoic acid. These dyes synthesized from γ -keto acid and characterised on the basis of IR spectra, NMR spectra. The analytic data are given in percentage.

Keywords: IR Spectra, NMR Spectra, phthal-as-ein dyes

INTRODUCTION

Dyes are used for the coloration of several materials such as textile fibers, paper, cosmetics, tannery leather, food, pharmaceutical products etc.^{1,2}

Before 1856, dyes were derived from natural sources only. The increasing demand and costs of natural dye extraction engendered the discovery of the first synthetic dye aniline in 1856 by Perkin.³

According to literature these are over 10000 different dyes and pigment available which are used in industry and around 7×10^4 tons of synthetic dyes that are produced globally throughout the year^{4,5}.

One of the historical theories involving development in dyestuff chemistry was given by Witt which was applied to azo and anthraquinonoid dyes. This theory provided a base to understand the link between color and the molecule structure. The theory states that a dye molecule consists of three constituents- one or more fused benzene connected to a chromophore and a basic auxochrome group.

METHODS

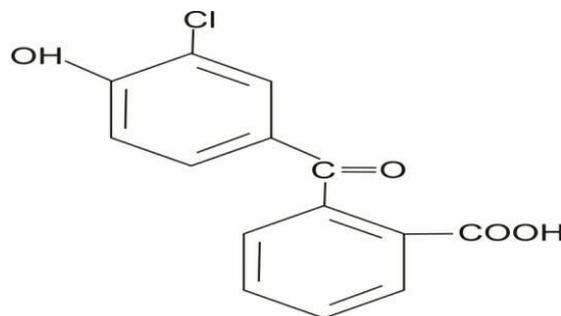
IR spectra were recorded by using Perkin-Flamen Infracard (KBr) and NMR was recorded on varian A-60 T.M.S. as internal reference and solvent CDCl_3 were used and the chemical shift have been given in (τ) values.

The purity of a dye was checked by TLC or paper chromatography. In case of TLC methanol has been used as solvent and in case of paper Chromatography butanol saturated with ammonia has been used as the mobile phase and 1% KOH solution as developing agent

The analytical data were given in percentage.

Experiment-

(1) Preparation of o-(3-Chloro 4-Hydroxy Benzoyl) Benzoic Acid:



The acid¹ was prepared by carrying out Friedel-Crafts reaction between 2-Chloro phenol (dry AR, 120 ml) and phthalic anhydride (14.8 g, 0.1 mole) in presence of anhydrous aluminium chloride (23.0 g, 0.2 mole) in a similar manner as o-(2-amino 4-methyl benzoyl) benzoic acid. The acid was crystallized from acetone/petroleum ether in the form of white crystalline solid m.p. 180-182°C. the acid is soluble in ethanol, ether yield (19.3 g) 70%.

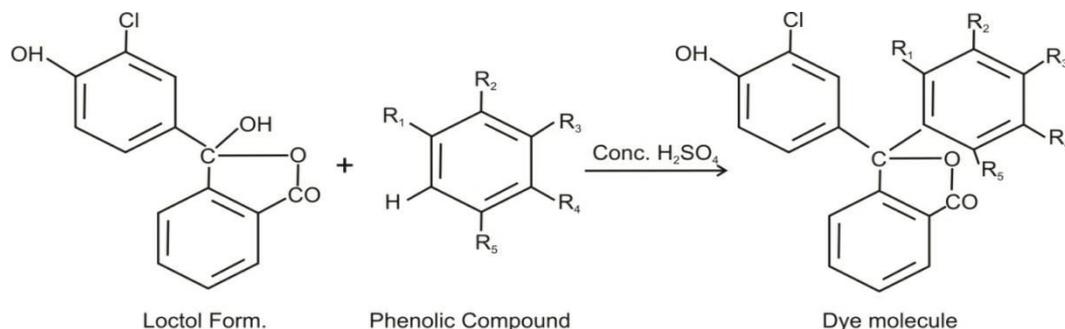
PREPARATION OF ACETYL DERIVATIVE OF THE ACID

The acetyl derivative of the acid was prepared by taking (1.0 g) acid, (3.0 g) of fused sodium acetate and 15 ml of acetic anhydride in a similar manner as the preparation of acetyl derivative of o-(2-amino 4-methyl benzoyl)

benzoic acid. The coloured acetyl derivative was decolourised by treating with animal charcoal and finally recrystallised by acetone. The yield of acetyl derivative was 0.70 g, m.p. 116-118^o. It is soluble in ethanol and acetic acid.

Synthesis of Dye-

The dyes prepared from the acid may be represented by the following general formula:



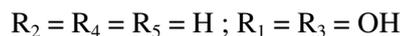
Dye-1

(3-Chloro 4-hydroxy phenyl) Phenol Phthal-as-ein :



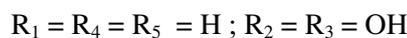
Dye-2

(3-Chloro 4-hydroxy phenyl) Resorcinol Phthal-as-ein :



Dye-3

(3-Chloro 4-hydroxy phenyl) catchol Phthal-as-ein :



Dye-1

(3-Chloro 4-hydroxy phenyl) phenol phthal-as-ein:

The dye was prepared by condensing the acid (2.5 g) and phenol (1.0 g) in presence of 4-5 drops of concentrated sulphuric acid. the heating was carried out for four hours at 170-180^oC, till brittle mass was obtained on cooling. Excess of phenol was removed by steam distillation. The mass left in the flask was powdered and extracted with 2% sodium hydroxide solution. It was filtered and the dye was precipitated from coloured filtrate by the gradual addition of dilute hydrochloric acid with constant stirring. It was purified by repeated crystallization from rectified spirit and dried in vacuum desiccators, yield 1.85 g.

The dye is Blackish-brown, m.p. 129-131^oC, its ethanolic solution is yellowish-brown in colour, which turns into pink on adding a drop of alkali. With strong alkali it gives Pinkish-red colour.

Dye-2

(3-Chloro 4-hydroxy phenyl) resorcinol phthal-as-ein:

The dye was prepared by condensing the acid (5 g) and resorcinol (2.5 g) by using 4-6 drops of concentrated sulphuric acid as condensing agent. Heating was continued for four hours at 130-140^oC, till brittle mass was obtained on cooling. The solid mass left in the flask was extracted with 2% sodium hydroxide solution. It was filtered and the dye was precipitated from coloured filtrate by the gradual addition of dilute hydrochloric acid with constant stirring. It was purified by repeated crystallization from rectified spirit and dried in vacuum desiccators, yield 4.5 g.

The reddish micro crystalline dye has m.p. 274-276^oC, its ethanolic solution is yellowish-red in colour, which turns into yellowish-orange with green fluorescence on adding of a drop of alkali. In strong basic medium it gives yellowish-orange colour with intensified green fluorescence.

Dye-3

(3-Chloro 4-hydroxy phenyl) catechol phthal-as-ein:

The dye was prepared by condensing the acid (3.0 g) and catechol (1.5 g) in presence of concentrated sulphuric acid (4-6) drops, at a temperature 120-135^o for three hours till the molten mass of the tube become hard brittle

on cooling. The solid mass left in the flask was powdered and extracted with 2% sodium hydroxide solution. It was filtered and the dye was precipitated from coloured filtrate by the gradual addition of dilute hydrochloric acid with constant stirring. It was purified by ethanol, yield 2.5 g.

The dye is black in colour, m.p. $>360^{\circ}$. Its ethanolic solution is brown in colour which turns into blue on addition of alkali.

RESULT AND DISCUSSION

A series of new phthal-as-ein dyes derived from *o*-(3-chloro 4-hydroxy benzoyl) Benzoic acid⁶. These dyes synthesized from γ -keto acid and characterised on the basis of IR spectra, NMR spectra, paper chromatography. The analytic data are given in percentage.

IR spectral examination of these acid clearly reveals their existence as a mixture of ring and chain tautomers.

The open chain substituted or unsubstituted γ -keto acids possess a characteristic structural requirement due to which they are capable of existing in cyclic tautomeric form also. The formation of ring tautomer (lactol form) takes place due to electrophilic ring-chain tautomerism where the electrophile is proton (hydrogen). Amount of the lactol depends on the extent of this prototropic change. Generally it has been observed that γ -keto acids exist chiefly as lactol or equilibrium mixture of ring and chain tautomers^{7,8}. The lactols give well crystalline acetyl derivatives, still retaining their cyclic structures. Therefore, it is obvious that the cyclic tautomer is comparably more stable form than the chain tautomer⁹⁻¹².

There are notable peaks showing the presence of diaryl ketonic $\text{C}=\text{O}$ ($1675\text{-}1700\text{ cm}^{-1}$) and aryl ketonic $\text{C}-\text{CH}_2-\text{C}-\text{Ar}$
 $\begin{array}{c} \text{O} \\ \parallel \\ \text{C} \end{array}$ ($1660\text{-}1670\text{ cm}^{-1}$).

Carboxyl $> \text{C}=\text{O}$ ($1695\text{-}1710\text{ cm}^{-1}$), Lactonic $> \text{C}=\text{O}$ ($1735\text{-}1790\text{ cm}^{-1}$),

Carboxyl $-\text{OH}$ ($2600\text{-}2700\text{ cm}^{-1}$) and lactol $-\text{OH}$ ($3100\text{-}3500\text{ cm}^{-1}$).

IR spectra of the acetyl derivatives of the acids were also studied. It shows notable peaks of $> \text{C}=\text{O}$ in acetate (new peaks $1000\text{-}1250\text{ cm}^{-1}$ and $1735\text{-}1760\text{ cm}^{-1}$) and lactonic $> \text{C}=\text{O}$ ($1735\text{-}1790\text{ cm}^{-1}$). The peaks, due to diaryl ketonic $> \text{C}=\text{O}$ ($1675\text{-}1700\text{ cm}^{-1}$), aryl ketonic $> \text{C}=\text{O}$ ($1660\text{ to }1670\text{ cm}^{-1}$), Carboxyl $> \text{C}=\text{O}$ ($1695\text{-}1710\text{ cm}^{-1}$), Carboxyl $-\text{OH}$ ($2600\text{-}2700\text{ cm}^{-1}$) and lactol $-\text{OH}$ ($3100\text{-}3550\text{ cm}^{-1}$), which were present originally in acids, were found absent in acetyl derivatives of the acids.

NMR SPECTRA OF γ -KETO ACIDS (1-15) AND THEIR DERIVATIVES:

Chemical shifts recorded in NMR spectra of acids and their derivatives further confirm the presence of lactol tautomer in each case ($\tau = 4.2 - 4.35$) which disappears in the case of their acetyl derivatives and a new chemical shift of OCOCH_3 ($\tau = 7.65 - 7.85$) was observed. Thus it is amply clear that the γ -keto acids exist in keto as well as lactol forms which makes it possible to condense these acids with different phenolic compounds giving unsymmetrical phthaleins and Succinins. In addition to the above characteristic chemical shift others were mostly of aromatic protons ($\tau = 1.8\text{-}3.50$) depending on the chemical environment in the aromatic rings. However, chemical shift of COOH in the keto form could not be recorded as NMR spectra were recorded on varian A-60. The Phenolic $-\text{OH}$ proton chemical shift has been observed at about ($\tau = 4.45$).

The melting point, shade colour in different mediums and λ -max of dyes *o*-(3-chloro 4-hydroxy benzoyl) Benzoic acid is in form of table 3 & Elemental analysis is in table 4.

REFERENCES

1. Celia, M.P.; Suruthi, S. Textile Dye Degradation Using Bacterial Strains Isolated from Textile Mill Effluent. *Int. J. Appl. Res.* **2016**, *2*, 337–341.
2. Shindhal, T.; Rakholiya, P.; Varjani, S.; Pandey, A.; Ngo, H.H.; Guo, W.; Ng, H.Y.; Taherzadeh, M.J. A Critical Review on Advances in the Practices and Perspectives for the Treatment of Dye Industry Wastewater. *Bioengineered* **2021**, *12*, 70–87. [CrossRef] [PubMed]
3. Druding, S.C. (Ed.) *Dye History from 2600 BC to the 20th Century*. 1982. Available online: <http://www.straw.com/sig/dyehist.html> (accessed on 1 June 2021).
4. Gurses, A., Acikyildiz, M., Gunes, K. and Gurses, M.S. (1016), *Dyes and pigments: their structure and properties*. *Dyes and Pigments*, pp. 13-29.

- Chequer, F.D., de Oliverira, G.A.R., Ferraz, E.A., Cardoso, J.C., Zanoni, M.B., and de Oliveira, D.P. (2013), Textile dyes : dyeing process and environmental impact. Eco-friendly textile dyeing and finishing, 6, pp. 151-176.
- Umesh Chandra Mishra, Ph.D. thesis 1991, Colour and Constitution of mixed phthaleins, succiniens and their synthesis. Page. 133-135.
- P.R. Jones, Chem, Rev., (1963), 63. 465.
- K. Von. Answers and Heinge, Ber., (1919), 52, 584.
- I. Heilbron and H.M. Bundury, Dictionary of Organic Compounds, (1953), Vol. 3, P. 178; Oxford Univ. Press, New York.
- P.R. Jones and S.L. Congdon, J. Amer. Chem. Soc., (1959), 81, 4291.
- Victor, Von Richter, 'Chemistry of Carbon Compounds', Vol. I, P. 478.
- B. Blendermann, 24, 4077; Beilstein Organische Chemic (Organic Series), 10. P. 697.

Table-1: IR SPECTRA OF γ -KETO ACIDS AND THEIR ACETYL DERIVATIVES, λ -max(KBr)

S.N.	Acids and their Acetyl derivatives	Diaryl Ketonic C=O	Aryl Ketonic	Carboxyl >C=O	Lactonic >C=O	Carboxyl =OH	Lactol =OH	Easter Group
1	O-(3-chloro 4-hydroxy benzoyl) Benzoic Acid Acetyl Derivative	1690	-	1700	1740 1790	2660(Weak)	3460	- 1750, 1235 1230, 1010

Table-2: NMR SPECTRA OF γ -KETO ACIDS AND THEIR ACETYL DERIVATIVES

S.N.	Acids & their Acetyl Derivatives	Solvent	Chemical Shift (τ)
1	O-(3-chloro 4-hydroxy benzoyl) Benzoic Acid Acetyl Derivative	DMSO DMSO	2.55-3.4 (m; 7 unsymmetrical aromatic protons); 4.30 (br. S; lactol proton); 4.55 (S; 1-Phenolic -OH Protons) 2.35-3.2 (m; 7 unsymmetrical aromatic protons); 7.65 (S; 6-OOCCH ₃ Protons)s

Table-3: DYES DERIVED FROM O-(3-chloro 4-hydroxy benzoyl) BENZOIC ACID

Phenols	Shade of dye	M.P.	Colour in ethanol		Colour with 25 NaOH	λ -max (nm)		
			Neutrel	Alkaline		pH	Medium	
Phenol	Blackish-Brown	129-131 ⁰ C	Yellowish-Brown	Pink	Pink	510 530	6.5 9.6	Neu. Alk.
Resorcinol	Red	274-276 ⁰ C	Yellowish-Red	Yellowish-orange (G.F.)	Yellowish-orange (G.F.)	465 510	6.4 9.0	Neu. Alk.
Catechol	Black	>360 ⁰ C	Brown	Blue	Blue	- -	- -	Neu. Alk.

Table-4

Anal. for	Mol. wt	Calculated %			Found %		
		C	H	Cl	C	H	Cl
C ₁₄ H ₉ ClO ₄	276.5	60.75	3.25	12.83	60.71	3.21	12.76
C ₁₈ H ₁₃ ClO ₆ or C ₁₄ H ₇ ClO ₄ (COCH ₃) ₂	360.5	59.91	3.60	9.84	59.81	3.56	9.82
C ₂₀ H ₁₃ ClO ₄	352.5	68.08	3.68	10.07	68.04	3.62	10.06
C ₂₀ H ₁₃ ClO ₅	368.5	65.12	3.52	9.63	65.10	3.50	9.61
C ₂₀ H ₁₃ ClO ₅	368.5	65.12	3.52	9.63	65.08	3.50	9.61

Critical Analysis of Legislative Framework of Women Empowerment in India

Priti Sandesh Sodaye, Mrityunjai Pandey and Amin Kumar Singh
Chattrapati Shivaji Maharaj University, New Panvel, Maharashtra, India

ABSTRACT

The constitution of India not only grants the gender equality but also grants some of the privileges to the women. Within the framework of democratic policy, our laws, development policies, planes and programs have aimed at women advancement in different sphere. Fundamental rights16- Article 14- the state shall not deny to any person equality before law and equal protection so laws within the territory of India, and prohibits any discrimination on the basis of sex. Article 15(3) - the state is empowered to make any special provisions for women. Article 16(20)- no citizen shall be discriminating against or be ineligible for any employment or office under the state on the ground of sex Directive principle of state policy17- Article 39(d) - the state to direct an equal pay for equal work both men and women. Article 39(A) - to promote justice on the basic of equal opportunities and to provide free legal aid by sustainable legislation to ensure that opportunities for securing justice are not denied to any citizen by reason of economic or other disabilities. Article 42- the state makes provisions for securing just and human conditions of work and for maternity relief. Article 46- the state to promote with special care the education and economic interest of the weaker sections of the people and to promote them from social injustice and all forms of the exploitations.

INTRODUCTION

Indian society which had undergone a drastic change since the Vedic ages and when we compare Indian culture to other cultures, we realize that Indian culture worship women as Laxmi Maa- Goodness of women, Saraswati maa- wisdom, Dura Mea- power and strength. Nirmala Sitharaman, quoting the Swami Vivekananda in her union Budget Speech on “Need of Empowering Women” Times of India, July 5, 2019. Indian values, nationalism and culture heritage were glorified through the symbolic of ‘Mother India’. Now a days this will limit to Vedas and purans only crime against women are increasing day by day. The empowerment of women in practical reality is debatable issue in all over India and India is not exception to that. Over a past few years the status of women undergoing lot a positive and negative changes. The Government of India is been engaged in a continuous endeavor drawing the strength from the constitutional commitments, translating all the rights, commitments and safe from de jure to de facto status.

What is Mean Women Empowerment?

Women Empowerment implies the ability in women to take decision with regards to their life and work and giving equal rights to them in all sphere like: personal, social, economic, political, right and so on. We are living in an age of women empowerment where women are working shoulder to shoulder with men. A woman also manages to balance between their commitment to their professional as well as their home and family. They are playing multiple roles at homes as a mother, daughter, sister and wife and at working places as professionals with remarkable simplicity and complexity. According to United Nations, A women empowerment mainly has five components-

- Generating women sense of self-worth
- Women right to have and determine their choice
- Women right to have access to equal opportunities and all kind of resources.
- Women right to have a power to regulates and control their lives, within and outside the home.
- Women ability to contribute in creating a more just social and economic order.

Thus, women empowerment is nothing but reorganization of women basic rights and creating an environment where they are treated equal as men and the expansion in people’s ability to make strategic life choice in a context where this ability previously denied to them.

Historical Perspective

From history to present 21th century women condition not remain the static. Socially, economically, politically it goes on changing. In ancient time women was treated equal to men. In Vedic period they are very educated and they are reference as Maitreyan in some of ancient texts. Not after the famous treaty of Manu that is Manuscript the status of women relegated subordinate so as men is concern. Empowerment occurs within sociological, psychological and economic sphere and at various levels such as individual, group and community and challenges our assumptions about the status quo asymmetrical power relationship and social dynamics.

After that period all discretionary practices was performed against the women like child marriage, Sati, Devadashpratha etc and the social position of women curtained. During the medieval period the condition of women got worsened with the advent of Muslim rules & during the British regime. But rule also brought western ideas into country. The patrician mindset of the medieval Indian society can be understood from the couplets of the famous Hindi poet Tulsidas who describes the status of women, in his writing, 'dhor, gangwar, shudra aur nari, ye sab taadan ke adhikari' which means animals, illiterate, untouchables and females deserves to be punished. Period where the India fought for the Independence, Indian congress supported the first women delegation which met the secretary of state demand women politician rights in 1917, The Child Marriage Restrain Act in 1929 was passed due to effort of Mohammad Ali jinha; Mahatma Gandhi called upon the young men to marry the child widows and urged people to boycott the child marriage.

International Commitments and Conventions

India has ratified various international conventions and human rights instruments committing to secure equal rights of women. Key among them is the ratify cation of the Convention on Elimination of All Forms of Discrimination Against Women (CEDAW) in 1993. India has ratified the convention with two declaratory statements and one reservation both the declarations relate to marriage. We have declared that the provisions on marriage and family relations in its article 16(1) would be ensured in conformity with our policy of non-interference in the personal affairs of any community without its initiative and consent and that while agreeing to the principle of compulsory registration of marriages, failure to get the marriage registered at the same time will not invalidate the marriage. We did not agree to Article 29(1) of the Convention, which establishes compulsory arbitration or adjudication by the International Court of Justice of disputes concerning interpretation. The Mexico Plan of Action (1975), the Nairobi Forward Looking Strategies (1985), the Beijing Declaration as well as the Platform for Action (1995) and the Outcome Document adopted by the UNGA Session on Gender Equality and Development & Peace for the 21st century, titled "Further actions and initiatives to implement the Beijing Declaration and the Platform for Action"¹² have been unreservedly endorsed by India for appropriate follow up. The Beijing Platform for Action lays down critical areas of concern for the women, and assures through its statement of Kofi Annan, United Nations Secretary General as below, "The commitments made by governments in Beijing reflect the understanding that women's equality must be a central component of any attempt to solve the world's social, economic and political problems. Thus, where once women fought to put gender equality on the international agenda, gender equality is now one of the primary factors shaping that agenda. The commitments made in the international conventions are as far as possible reflected in the Plan documents and the National Policy for the Empowerment of Women. Millennium Development Goals (MDGs) have been established in the Millennium Declaration at the General Assembly of the United Nations in the year 2000. These include promoting gender equality and empowerment of women and improving maternal health where we can see the enormous growth that many more girls are now in school when compared to 15 years ago, 41% of women are paid workers outside the agricultural sector and 90% of women have gained parliamentary representation of 174 countries with data over 20 years¹⁴. Along with the goal of, gender equality which is at the core of achievement of MDGs is also striving to achieve its different goals such as improving health and fighting disease, reducing poverty and mitigating hunger, expanding education and lowering child mortality, increasing access to safe water, and ensuring environmental sustainability.

Constitutional Privileges to Women

The constitution of India not only grants the gender equality but also grants some of the privileges to the women. Within the framework of democratic policy, our laws, development policies, planes and programs have aimed at women advancement in different sphere. Fundamental rights¹⁶- Article 14- the state shall not deny to any person equality before law and equal protection so laws within the territory of India, and prohibits any discrimination on the basis of sex. Article 15(3) - the state is empowered to make any special provisions for women. Article 16(20)- no citizen shall be discriminating against or be ineligible for any employment or office under the state on the ground of sex Directive principle of state policy¹⁷- Article 39(d) - the state to direct an equal pay for equal work both men and women. Article 39(A) - to promote justice on the basic of equal opportunities and to provide free legal aid by sustainable legislation to ensure that opportunities for securing justice are not denied to any citizen by reason of economic or other disabilities. Article 42- the state makes provisions for securing just and human conditions of work and for maternity relief. Article 46- the state to promote with special care the education and economic interest of the weaker sections of the people and to promote them from social injustice and all forms of the exploitations. Article 47- the state to raise the level of nutrition and standard of living of the people. Fundamental duties¹⁸- Article 51A e – to promote harmony sand the spirit of brotherhood amongst all the people of India and to renounce practice derogatory to the dignity of

the women.73rd and 74th Amendment of constitution19- Article 243 D 3- not less than one third of the total number of seats to be filled by the direct election in every panchayat to be reserved for women and such seats to be allotted by rotation to different constitutes in panchayats. Article 243D (4) - not less than one third of the total number of offices of chairperson in the panchayats at each level to be reserved for women Article 243T (3) - not less than one third of the total number of the seats to be filled by direct election in every municipality to be reserved for women and such seats to be allotted by rotation to different constitutes in municipality. Article 243T (4)- reservation of offices of chairperson in municipalities for the schedules casts the schedules tribes and women in such manner as the legislation of state may be law provide. Although constitutionally the women have been empowered with equal opportunity but it is still at a nascent stage because at the grass root level the women are only for the name's sake as it is dominated by male in decision making and are highly exploited.

Government Initiatives for Women

1. National Commission for Women²¹- in January 1992, the government set-ups the statutory body with a specific mandate to study and monitor all matters relating to the constitutional and legal safeguard provided for women, review the existing legislation to suggest amendment whatever necessary etc.
2. Reservation for Women in Local Self Government²²- the 73th constitutional amendment acts passes 1992 by parliament ensure one third of the total status for women in all elected officers in local bodies whether in rural areas or urban areas.
3. The National Plan of Action for the Girl Child (1991-2000) ²³- the law of action I to ensure survival, protection and development of the girl child with the ultimate objective of building up a better future for the girl child.
4. National Policy for the Empowerment of Women, 2001²⁴- the Department of Women and Child Development in the ministry of Human Development has prepared a National Policy for the empowerment of Women in the year 2001. The goal of the policy is to bring about the advancement development and empowerment of women.
5. National Policy for Women, 2016²⁵ - to create an effective framework to enable the process of developing policies, programmers' and practices which all ensure equal rights and opportunities for women in the family, community, workplace and in governance.
6. Various Other Women Empowerment Schemes- the various empowerment schemes introduced by the government of India time to time to secure the women from all the social evils, all these schemes are like helping hand throughout her life.

These schemes are as follows:

- Beti Bachao Beti Padhao Scheme
- One Stop Centre Scheme
- Women helpline Scheme
- UJJAWALA Scheme for prevention of trafficking and rescue victims
- Working Women Hostel
- Ministry approves new projects under Ujjwal scheme and continuous existing projects
- SWADHAR Great – a scheme for women who are in difficult circumstance
- Support to training and employment programmers for women (STEP)
- Nari Shakti Parashar
- Awardees of Street Shakti Purusha, 2014
- Awardees of Nari Shakti Puskar, 2014
- Awardees of Rajya Mahala Samman and Zila Mahala Samman
- Mahala Police Volunteers
- Mahila Shakti Kendras (MSK)
- NIRBHAYA

Growth of Legislation Related to Safeguard of Women

Though a large number of women related legislation are in place, it is seen that the efficacy of these laws is not satisfactory primarily on account of poor implementation. A major reason for this is the lack of adequate knowledge regarding these special legislations and also absence of gender sensitivity on part of the

functionaries such as law enforcement, police, prosecution, medical profession, judiciary etc. The eleventh plan needs to give a very high priority to training and capacity building of these stakeholders not only to educate them about the nuances of the laws but also to inculcate gender sensitivity in the system. The women themselves need to be made aware of the special legislations that are available for their protection and rights. For this purpose, awareness generation and dissemination of information on a sustained basis will need to take up with special modules based on the region and group targets. Indian Penal code, 1860- the code defines various provisions of crime against women such as Rape- section 376, Kidnapping and abduction for different purpose-Section 363 to 373, Homicide for Dowry, Dowry Death or attempts- Section 302/304, Torture, both mental and physical- Section 498A, Molestation- Section 509, Sexual Harassment- Section 509, Importation of girl- Section 366 B of IPC.

1. Code of Criminal Procedure Code, 1973- has certain safeguard for women like obligation of a person to maintain his wife, arrest women by female police etc.
2. Dowry Prohibition Act, 1961- prohibits the giving or taking of dowry at or before or any time after the marriage.
3. Commission of Sati Act, 1987- provides for more effective prevention of commission of sati and its glorification on women.
4. Indecent Representation of Women (Prohibition) Act, 1986-prohibits indecent representation of women through advertisement or in publication, writing, paintings, or any other manner.
5. Immoral Traffic (Prevention) Act, 1956- it prevents trafficking in women and girl for the purpose of prostitution.

Recent Developments

Social evils like child marriages, dowry, rape, practice of Sati etc. The recently notified Prevention of Domestic Violence Act is a landmark law in acting as a deterrent as well as providing legal recourse to the women who are victims of any form of domestic violence. Apart from these, there are a number of laws which may not be gender specific but still have ramifications on women.

- Criminal Law Amendment Act, 2013²⁶, they insert new sections in the IPC with regard to sexual offence. Some of the new offences recognized as stalking, acid attack, disrobing etc.
- Sexual Harassment of Women at Workplace Act, 2013²⁷, this was the first legislation adopted by India who deals with the issues of workplace sexual harassment, prevention, prohibition and redressable.
- Maternity Benefits (Amendment) Act, 2017²⁸, this year experience on of the bold amendment by amending Maternity Benefits Act, 1961 The act provides adoption of child, maternity leave right takes leave before and after pregnancy.
- Decriminalizing of Adultery²⁹- on September 27, 2018 a five-bench judge struck down another colonial era law, section 497 of IPC that prescribed a maximum imprisonment of five years to men. That 157 years old law struck down by judiciary.
- Triple Talaq³⁰- it is Islamic practice that allows men to divorce their wife by uttering word talaq three times. After much argument, discussion practicing such practice was against the human value and the sane need to be quashed.
- Sharmala issue³¹- the Supreme Court on September 28, 2019 delivered an awaiting judgment in this case. Justice Nariman held that the customs and usages of serial temple must yield to the fundamental right of women to workshop in the temple.

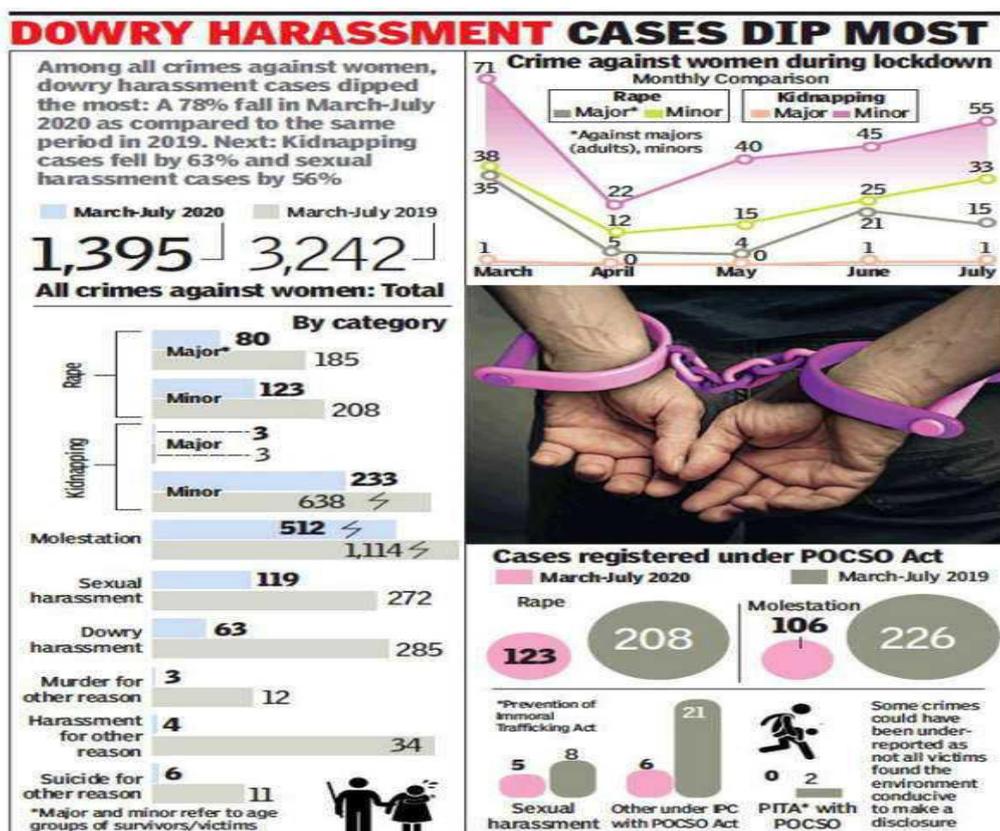
Role of Judiciary

Gender justice is not only problem there at India but all over the world. We have seen the constitutional protection, legislature safeguard but still we can't ignore the fact that women still treated badly in society. Women are victims of ill-treatment from long back history. Judiciary has performed well to active the goal of women justice and women empowerment. According to analytical jurisprudence a court merely found the law or merely interprets the law. Judges are applying the disciplinary power to provide better justice to women in the new context of the socio-economic conditions. Judiciary has played an active role in enforcing and strengthens the constitutional goals towards protection rights of the land. The Supreme Court in Muhammad vs. Union of India³³ and Air India vs. Nagesh Mirza³⁴ struck down discriminatory service conditions female employers to obtain government permission before marriage and denying married and pregnant women the right to be employed. Vishaka vs. State of Rajasthan³⁵, Bhanwari Devi, a social worker from Rajasthan was brutally

ganged raped by five men for preventing a child marriage. Determine to seek justice; she decided to go on the court. In a shocking decision, the trial court acquitted to all five accused. Vishaka, a group of women education and research, took up the cause of victim. They joined the forcer with four other organizations, and filed the petition before the supreme court of India on the issue of sexual harassment at workplace. The court take into consideration all the fact and circumstance and give the guideline which is of the great step at the time of 1977, and that guideline followed further for safe working environment for women. Mary Roy vs. State of Kerala³⁶, Women from Syrian christen community in Kerala were prevented from inhering property due to patriarchal tradition. The decree was challenged by the Mary a woman right activist and educator. She filed the case against her brother, who denied giving equal share in father property. In 1986, the Supreme Court delivered a landmark judgment that grants of women the right to seek an equal share in their father property. Centre for enquiry into health and Allied Themes vs. Union of India³⁷, with the advent of pre-natal diagnostic that could determine the sex of foetus, the growing trend of aborting girl foetuses was observed. The government issue PNDT Act, 1996. However, the government not properly implements this act. The petition was filed to challenge this act; the court held that all advertisement relating to pre-natal sex determination should be banned with that government need to enact provisions of the existing act. Laxmi vs. Union of India³⁸, in 2006 Laxmi an acid attack victim filed the petition seeking measures to regulates the sale of acid and provide the adequate compensation to victims. Taking into consideration the high number of acid attack cases Supreme Court imposed stringent regulations of the sale of acid in 2013.

Current Crime Rate against Women

The worldwide survey was conducted by Thomson Reuters said that India is the fourth most unsafe country in the world for women to live in amongst G20 countries. In India there is harassment and stalking at work place and educational organizations, outrage trafficking and forced prostitution. 12 million girls were aborted over the last 3 decades in India- an estimate. According to UN population fund, there were 50,000 maternal deaths which are highest in the world in 2013. As per National Crime Record, a total number of 3,09,546 incidents of crime against women (both under SLL AND IPC) were reported during the year 2013 as compared to 2,44,270 in the year 2012 in India, showing a raise of 26.4% in the year 2013. In last five years these crimes have increased rapidly³⁹. Over the years there have been efforts made to socially, economically and politically empower women but as a result of the lack of synergy or coordination between these activities, the outcomes could never be completely satisfactory and it is also pertinent to note that there are number of laws to protect but yet there is significant increase in crime rates and is due to delayed legal procedure and presence of several loopholes in functioning of judicial system.



SUGGESTIONS AND RECOMMENDATIONS TO ACHIEVE WOMEN EMPOWERMENT

With technological advancement, there has been incidence of frauds. Misuse of information uploaded on the cyberspace and hence there is need to developing protective measures for citizens keeping in view that victims of such frauds are largely women. Judiciary and local authorities need to be more vigilant in protecting the rights of women. The existing legislation affecting relating to women will be reviewed to enhance their effectiveness and additional legislation measures or amendment to be taken up based on the emerging needs. Education plays the most crucial role in empowering women; education helps to develop both mental and psychological growth to stand for them. Action Plans for Women's Empowerment at national and State levels should be drawn up in consultation with civil society including women's groups, lawyers, activists, women's studies centres etc. Give encouragement to women to develop the quality of entrepreneurship, so that gives attainable strength to women and remove gender inequality. Certain existing laws have been amended and modified according to need of time by creating penal sanction against certain type of behaviour, which deprive or derogate the dignity of women. State needs to give much attention to nutrition and health of the women. And that too such programmes need to arrange at rural level to monthly check-up and take of health status. Policy should ensure women friendly accessible, free, comprehensive primary health care accessible to all, specially marginalized groups with full preventive, primitive and curative care. Make efforts to render woman victims quick, speedy and effective justice true to its meaning. Place women as leaders and give them decision making roles. Provide training, sensitization and capacity building of Protection Officers, Service Providers, members of the judiciary, police, medical professionals, 135 counsellors, lawyers, etc on the issue of domestic violence and the use of law (PWDVA and other criminal and civil laws) to redress the same. The legal framework to ensure that wherever the reservation is granted to women they must have a fair decision-making powers and mobility.

CONCLUSION

As we heard quote quoted by Ms. Leela Seth that "we all know that women are half the world and hold up half the sky but where are they when it comes to equality". The concept of gender equality has roots in long back to history. To resolve the discussion on gender equality the concept women empowerment grows. The present condition of women depends upon and ancient time, British rule and social culture of India. Judiciary time to time playing an important role when the circumstances arise When we look into 21st century we can see women are doing great in each and every filed. Empowering women is to make them independent in all aspects from mind, thought, rights, decisions etc by leaving all the social and family limitations. It is also brought equality in the society for both male and female in all areas. Women empowerment is very necessary to make the bright future of the family, society and country. Still its long route to see its men is equal to women in society. It's not enough to enact a number of legislations, laws, regulation there is need to accomplished social, economic, educations, social status of women. Lastly, we have a long way to go, but we will get there one day as "The moment we empower a woman, we empower our family."

Social Media and Youth: A Study of Uses and Impacts

Jinal Mehta and Sanjay G. Mishra
JJT University, Rajasthan, India

ABSTRACT

Virtual entertainment's effect on youth is setting out extra difficulties and open doors. Person to person communication destinations give a stage to conversation on consuming issues that has been ignored in the present situation. The effect of person-to-person communication destinations in the evolving attitude of the young. It was review type exploration and information was gathered through the poll. 300 examined youth fill the survey; non-irregular inspecting method was applied to choose test units. The principal goals were as (1) To dissect the impact of virtual entertainment on youth public activity (2) To survey the advantageous and favoured type of web-based entertainment for youth (3) To assess the disposition of youth towards online entertainment and measure the investing energy in virtual entertainment (4) To suggest some action for legitimate utilization of online entertainment in right course to illuminate and teach individuals. Gathered information was examined in term of recurrence, rate, and mean score of articulations. Following were principal discoveries Majority of the respondents shows the concurrences with these impacts of web-based entertainment. Respondents believe Facebook as their number one virtual entertainment structure, and afterward the like Skype as second famous type of web-based entertainment, the essential spot for them, 46% answered interface virtual entertainment in instructive establishment PC labs, standard answered as enlightening connections share, respondents Face principal issue during utilization of social are undesirable messages, online entertainment is useful for youth in the field of schooling, virtual entertainment disintegrating accepted practices, virtual entertainment is influencing adversely on investigation of youth. Online entertainment advances untrustworthy pictures, video clasps and pictures among youth, hostile to strict post and connections make scorn among people groups of various networks, Negative utilization of virtual entertainment is weakening the relationship among the nations, web-based entertainment is assuming a vital part to make political mindfulness among youth.

Keywords: Virtual entertainment, youth, person to person communication, Facebook, twitter, YouTube

INTRODUCTION

Virtual entertainment is latest type of media and having many highlights and attributes. It has numerous offices on same channel like as imparting, messaging, pictures sharing, sound and video sharing, quick distributing, connecting with all over world, direct interfacing. it is additionally least expensive quick admittance to the world so it is vital for all period of people groups. Its utilization is expanding step by step with high rate in everywhere. Greater part of youth is moving rapidly from electronic media like as watchers at home and radio audience members to the virtual entertainment among all period of gathering. Youth rate is specially to moving into virtual entertainment so its persuasions are a lot of on youth. This frenzy of virtual entertainment has prompted a large group of inquiry with respect to its effect on society, while it is concurred that the web-based entertainment influences individuals' living styles and it is a continuous cycle to recognize the idea of these impact in each general public and country exceptionally on youth .this concentrate likewise engaged the impacts of online entertainment on youth and their way of life, patterns, instructive and political mindfulness, proactive tasks, public activity, their advancing, etc. Web-based entertainment is a bunch of webs put together application that develops with respect to the philosophical and innovative underpinning of marry and that license the plan and trade of client produced content. Online entertainment, for example, Facebook, Skype, Twitter, YouTube and My Space might have been newly advertised as extraordinary leveller as social affair in what partitions of races, classes, and nationality. Online entertainment is method for associations among individuals in which they make, offer, and trade data and thoughts in virtual networks and organizations. There are some recognizable and most utilizing types of virtual entertainment with their starting points and element presentation uniquely involving in Pakistan at large scale and its utilizing rate expanding step by step in Pakistan and utilization of web-based entertainment is at first stage in Pakistan and a few natural kinds of online entertainment are here which are utilizing.

IMPACT OF SOCIAL MEDIA ON YOUTH

Virtual entertainment differently affecting youth's life in the two closures some time influences are in the blessing of youth's public activity and once in a while propositions influence are negative to its client. Virtual Entertainment may be in some cases seemed like simply another arrangement of cool devices for affecting youngsters. Once in a while you might utilize it all over alright there are a few pretty cool new devices around

yet the development of online entertainment possibly has a greater effect than that. It influences upon youngsters who are experiencing childhood during a time where media isn't about communicated content from the TV, yet is about intelligence, sight and sound and performing multiple tasks. What's more, it influences upon associations who need to stay pertinent to another age, and who find their own work and designs being changed by changing specialized devices and examples of interchanges. Web-based entertainment influence on youth on the two finishes great and terrible virtual entertainment is one of most impacts affecting source all through the world including Pakistan individuals in all actuality do have these impacts of web-based entertainment which has improved the openness of individuals and make more mindfulness among youth. Youth is exceptionally associated with virtual entertainment. Virtual entertainment devices are woven into numerous youngsters' everyday lives. Youngsters are in discussion and correspondence with their friend bunches utilizing a wide range of media and media gadgets consistently. quite a while back, youngsters might have possibly been in contact with companions and friend bunches while hanging out at school, or meeting up in the neighbourhood. Presently youngsters can be contact through texting, interpersonal organizations, internet games and numerous different instruments. Youngsters are experiencing childhood in a continually associated society.

STATEMENT OF THE PROBLEM

The review was plan to dissected the effect of virtual entertainment on youth, what web-based entertainment is meaning for on youth in various parts of public activity, political mindfulness, strict practices, instructive learning, patterns embracing, sports exercises, etc.

SIGNIFICANCE OF THE STUDY

This study is expedient to apply social media in right direction for youth and create cognizance among youth that proper use of social media become a solid tool to educate, inform and groomed the mentality level of youth social media refine their living style of public especially for youth it is also create a responsiveness that how it is effecting the social life the deteriorate social norm, society standards and ethics of society and create awareness among youth the aspect of social media. This study is practical to apply online entertainment in right course for youth and make discernment among youth that legitimate utilization of web-based entertainment become a strong device to teach, illuminate and prepared the mindset level of youth virtual entertainment refine their living style of public particularly for youth it is likewise make a responsiveness that the way things are affecting the public activity the decay accepted practice, society norms and morals of society and make mindfulness among youth the part of virtual entertainment.

HYPOTHESIS OF THE STUDY

- It is probably going to say that social media is making mindfulness for youth in better living style.
- It is probably going to say that social media is quick wellspring of data and diversion for youth's advantage.
- It is probably going to say that social media is extraordinary facilitator for youth in the field of schooling.
- It is probably going to say that young are using virtual entertainment in sure manner.

OBJECTIVES OF THE STUDY

The objectives of the study were as following:

1. To break down the impact of virtual entertainment on youth public activity
2. To assess bearing of youth to using online entertainment.
3. To evaluate the advantageous and favoured type of online entertainment for youth.
4. To assess the demeanour of youth towards web-based entertainment and measure the investing energy in virtual entertainment.
5. To dissect the reliance of youth via web-based entertainment and it's debilitating in life schedule.
6. To suggest some action for appropriate utilization of virtual entertainment in right course to illuminate and teach individuals.

METHODOLOGY OF THE STUDY

The expressive technique was utilized to convey this review. Furthermore, review type research was led, through the poll general assessment and discernment was segregate about the effect of virtual entertainment on youth and proclamations was created connected with the different part of youth's life and society. There are

numerous hypotheses that may be amazing to help our concentrate however generally appropriate and as per the idea of study that are uses and satisfaction hypothesis and media impact examination and hypothesis.

DESIGN OF THE STUDY

The spellbinding examination was directed by utilizing the technique review strategy that is a kind of system in sociologies studies.

POPULATIONS

The number of inhabitants in the review contains on young people of Bahawalpur City.

SAMPLE

From the above populace of Bahawalpur youth an example of 300 young people was chosen and none irregular examining technique was utilized to choose the example from everywhere populace among youth remembering male and female for Bahawalpur City.

Implementation of the Research Tool

The survey was conveyed among the example by moving toward them actually. A duplicate of survey was conveyed among each example unit and furthermore give adequate opportunity to fill the poll, as it is 300 duplicates of polls were dispersed among the examples and after culmination was gathered. The pace of return stays up to 97 percent that is appears to be acceptable conduct and premium of youth in research.

Statistical Analysis

Factual Package for the Social Sciences (SPSS) was utilized for the information investigation and deciphered. All gathered information was placed at SPSS sheet to dissect the information, to division the discoveries and portrayal the information in fitting structure, to draw the graphs and tables.

Formulas Used to Find Average and Percentage

$$\bar{X} = \frac{((fSA * 5) + (fA * 4) + (fUnc * 3) + (fDA * 2) + (fSDA * 1))}{fTotal}$$

Data Analysis and Interpretation

The portrayal of information that was placed in unique bundles for sociologies programming and all information was examine as table and diagram and made all rate, frequencies, mean score by applying factual equations.

Table No. 1.1 Social Status of respondents

	Social status	F	%	Valid %	Cumulative %
Valid	Employee	2	.7	.7	.7
	Student	281	96.9	99.3	100.0
	Total	283	97.6	100.0	
Missing	System	7	2.4		
Total		290	100.0		

Table No. 1.1 shows that among the respondents 0.7% were employees, 96.9% respondents were students while 2.4% respondents did not respond for the statement

Table No. 1.2 Degree or qualification level of respondent's separation

	degree level of respondents	F	%	Valid %	Cumulative %
Valid	BS	135	46.6	48.9	48.9
	Master	132	45.5	47.8	96.7
	M.Phil	9	3.1	3.3	100.0
	Total	276	95.2	100.0	
Missing	System	14	4.8		
Total		290	100.0		

Table No. 1.2 shows that 46.6% responded for BS Degree, 45.5% responded for Master's Degree, 3.1% responded for M. Phil while 4.8% of the population did not respond for the statement.

Table No. 1.3 Gender of respondents

	Gender	F	%	Valid %	Cumulative %
Valid	Male	101	34.8	35.6	35.6
	Female	183	63.1	64.4	100.0
	Total	284	97.9	100.0	
Missing	System	6	2.1		
Total		290	100.0		

Table No. 5.3 shows that 34.8% among respondents were male, 63.1% among them were female while 2.1% respondents did not respond for the statement.

Table No. 1.4 Residence of respondents

	Region	F	%	Valid %	Cumulative %
Valid	Rural	155	53.4	55.2	55.2
	Urban	126	43.4	44.8	100.0
	Total	281	96.9	100.0	
Missing	System	9	3.1		
Total		290	100.0		

Table No. 1.4 shows that among population 53.4% respondents were from rural residency, 43.4% respondents were from urban while 3.1 % respondents did not respond for the statement.

Table No. 1.5 Age wise division of respondents

	Age wise	f	%	Valid %	Cumulative %
Valid	15-20	85	29.3	30.4	30.4
	21-25	164	56.6	58.6	88.9
	26-30	31	10.7	11.1	100.0
	Total	280	96.6	100.0	
Missing	System	10	3.4		
Total		290	100.0		

Table No. 1.5 shows the division of the population into age groups. Among them 29.3% responded for age group 15-20years, 56.6% responded for age group 21-25, while 10.7 % responded for age group 26-30 years, while 3.4% did not responded for the statement.

Table No. 1.6 Your favourite form of social media.

	Forms of social media	F	%	Valid %	Cumulative %
Valid	Facebook	143	49.3	50.2	50.2
	Skype	112	38.6	39.3	89.5
	Twitter	25	8.6	8.8	98.2
	YouTube	4	1.4	1.4	99.6
	MySpace	1	.3	.4	100.0
	Total	285	98.3	100.0	
Missing	System	5	1.7		
Total		290	100.0		

Table No. 1.6 shows the statement that your favourite form of social media. 49.3% responded for Facebook, 38.6% responded for Skype, 8.6% responded for twitter, 1.4% responded for YouTube, 0.3% responded for MySpace while 1.7% respondents did not respond for the statement.

Table No. 1.7 Which place you are using for social media connecting

	User Connectivity places	F	%	Valid %	Cumulative %
Valid	Home network	98	33.8	34.3	34.3
	Computer Lab	134	46.2	46.9	81.1
	Cellular Services	37	12.8	12.9	94.1
	Private Internet Café	11	3.8	3.8	97.9
	any other	6	2.1	2.1	100.0
	Total	286	98.6	100.0	
Missing	System	4	1.4		
Total		290	100.0		

Table No. 1.7 shows that which place you are using for social media connecting. Where 33.8% responded for home network, 46.2% responded for computer lab, 12.8% responded for cellular services, 3.8% responded for private internet cafe, 2.1% responded for any other while 1.4% respondents did not respond for the statement.

Table No. 1.8 Daily duration that you spend on social media

	Usage Time duration	F	%	Valid %	Cumulative %
Valid	30 Minutes	111	38.3	38.5	38.5
	30-60 Minutes	143	49.3	49.7	88.2
	1-2 hours	21	7.2	7.3	95.5
	3-5 hours	13	4.5	4.5	100.0
	Total	288	99.3	100.0	
Missing	System	2	.7		
Total		290	100.0		

Table No. 1.8 shows that the Daily duration that you spend on social media. Where 38.3% responded for 30 minutes, 49.3% responded for 30-60 minutes, 7.2% responded for 1-2 hours, 4.5% responded for 3-5 hours while .7% respondents did not respond for the statement.

Table No. 1.9 The internet package you are using

	User packages	F	%	Valid %	Cumulative %
Valid	IUB package	88	30.3	30.6	30.6
	Monthly Package	140	48.3	48.6	79.2
	Weekly Package	34	11.7	11.8	91.0
	Private Café	18	6.2	6.3	97.2
	Others	8	2.8	2.8	100.0
	Total	288	99.3	100.0	
Missing	System	2	.7		
Total		290	100.0		

Table No. 1.9 shows that the internet package you are using. Where 30.3% responded for IUB package, 48.3% responded for monthly package, 11.7% responded for weekly package, 6.2% responded for private internet cafe, 2.8% responded for others while .7% respondents did not respond for the statement.

Table No. 1.10 Which form of social media is important for you

	Preferred facility of users	F	%	Valid %	Cumulative %
Valid	SMS	126	43.4	43.8	43.8
	Movie Clip	80	27.6	27.8	71.5
	Shared Links	43	14.8	14.9	86.5
	Liked Links	20	6.9	6.9	93.4

	Comment	9	3.1	3.1	96.5
	Others	10	3.4	3.5	100.0
	Total	288	99.3	100.0	
Missing	System	2	.7		
Total		290	100.0		

The Table No. 1.10 shows the Which form of social media is important for you 43.4% responded for SMS, 27.6% responded for movie clip, 14.8% responded for shared links, 6.9% responded for liked links, 3.1% responded for comments, 3.4% responded for others usage while .7% respondents did not respond for the statement.

Table No. 1.11 You mostly share which links for your contact or friends.

		F	%	Valid %	Cumulative %
Valid	Islamic	74	25.5	25.6	25.6
	Informative	144	49.7	49.8	75.4
	Entertainment	18	6.2	6.2	81.7
	Political	30	10.3	10.4	92.0
	Sports	5	1.7	1.7	93.8
	All	18	6.2	6.2	100.0
	Total	289	99.7	100.0	
Missing	System	1	.3		
Total		290	100.0		

The Table No. 1.11 shows the mostly shared links from contact or friends. 25.5% responded for Islamic, 49.7% responded for informative, 6.2% responded for entertainment, 10.3% responded for political, 1.7% responded for sports, 6.2% responded for all while .3% respondents did not respond for the statement.

Table No. 1.12 You use social media for entertainment through.

		F	%	Valid %	Cumulative %
Valid	Chatting	128	44.1	44.3	44.3
	Commenting	113	39.0	39.1	83.4
	video clips	23	7.9	8.0	91.3
	funny links	7	2.4	2.4	93.8
	group chatting	18	6.2	6.2	100.0
	Total	289	99.7	100.0	
Missing	System	1	0.345		
Total		290	100		

Table No. 1.12 shows the use of social media for entertainment. where 44.1% respondents get entertainment through chatting, 39.0% responded for commenting, 7.9% responded for video clips, 2.4% responded for funny links, 6.2% responded for group chatting while .3% respondents did not respond for the statement.

Table No. 1.13 You mostly face problem in using social media.

		f	%	Valid %	Cumulative %
Valid	Unwanted friend request	84	28.97	29.0	28.96
	unwanted messages	129	44.5	44.5	73.4
	political links	38	13.1	13.1	86.6
	unethical links	34	11.7	11.7	98.3
	Defamation of personalities	1	0.3	0.3	98.6
	Fake Ids	4	1.4	1.4	100.0
Missing	System	0	100.0	100.0	28.96
Total		290	100.0		

Table No. 1.13 shows that users mostly faced problems in using social media. Whereas 28.97% unwanted friend request 44.5% responded for unwanted messages, 13.1% responded for political links, 11.7% responded for unethical links, 0.3% responded for defamation of personalities, 1.4% responded for fake's ids.

Table No. 1.14 Social media is beneficial for youth in the field of education

Sr.	Statement	Response	f	%	Valid %	Cum.%	Mean
14	Social media is beneficial for youth in the field of education	Strongly Disagree	5	1.7	1.8	1.8	4.12
		Disagree	10	3.4	3.5	5.3	
		Uncertain	37	12.8	13.0	18.3	
		Agree	126	43.45	44.4	62.7	
		Strongly Agree	106	36.65	37.3	100.0	
		Total Response	284	97.9	100.0		
		Missing	6	2.1			
		Total	290	100.0			

Table No. 1.14 shows that students were asked social media is beneficial for youth in the field of education, where 43.45% of the respondents agree, and 36.65% of the respondent responded strongly agree. While 12.8% of respondents was uncertain about the statement. 3.4% disagreed and 1.7% was strongly disagreed with the statement. The mean score 4.12 supported the statement while 2.1% of the respondents did not respond for this statement.

Table No. 1.15 Upon social media chatting, calling, sharing links, liking links is the wastage of time for youth.

Sr.	Statement	Response	F	%	Val. %	Cum.%	Mean
15	Upon social media chatting, calling, sharing links, liking links is the wastage of time for youth.	Strongly Disagree	6	2.1	2.1	2.1	3.75
		Disagree	33	11.4	11.7	13.8	
		Undecided	55	19.0	19.5	33.3	
		Agree	119	41.0	42.2	75.5	
		Strongly Agree	69	23.8	24.5	100.0	
		Total Response	282	97.2	100.0		
		Missing	8	2.8			
		Total	290	100.0			

In the Table No. 1.15 students were asked if upon social media chatting, calling, sharing links, liking links is the wastage of time for youth., where 41.0% of the respondents agree, 23.8% of the respondent responded strongly agree while 19.0% of respondents was uncertain about the statement. 11.4% disagreed and 2.1% respondents were strongly disagreed with the statement the mean score 3.75 supported the statement. So, the majority 41.03% of respondents supported the statement while 2.8% of the respondents did not respond for this statement.

FINDINGS AND CONCLUSION

FINDINGS

As indicated by the investigation of gathered information by research review which is drawn from the assessment and reaction of youth about the use and effect of web-based entertainment on youth that 90 is portrayed as follows. The poll which is utilized in this study, containing 31 close finished and two are unassuming inquiries. The example was being finished by 290 respondents up of complete 300 examples. The pace of return is 96.66 percent. As per the discoveries by economic wellbeing greater part of the respondents were understudies while a little rate were representatives in various government and confidential areas associations and divisions among the populace. As per the discoveries by capability level of respondents results greater part of respondents were concentrating on in BS praises and expert degree programs while some expand were in M. Phil Programmers which contained 0.7 percent from test populace of the review. As per the discoveries, most of the respondents in the poll study have a place with female populace with which contained 63.1 percent. The proportion of female and male proportion is around determined as 2:1. This proportion shows that the male respondents were less keen on filling the poll than the female respondents who have purposely obliged this examination. The exploration shows that among populace 53.4% respondents were from rustic residency which demonstrate their more tendency in presenting their reaction to these surveys while the

metropolitan respondents with, 43.4% result show shows the examination have variedly empowers the returning reaction from the provincial respondents while the excess 3.1 % respondents didn't answer for the assertion. It likewise depicts that among the all-out returning of the reactions, 50 % respondents think Facebook as their #1 web-based entertainment structure, 39% answered for Skype, while the leftover 11% respondents favour the other virtual entertainment structures like Twitter, YouTube and MySpace. The exploration demonstrates that most of the respondents use Facebook as their essential looking for the online entertainment organizing. The Skype comes next all together, Twitter at number three, trailed by YouTube and MySpace. The examination explains in light of the inquiry that which place you are utilizing for online entertainment associating. Around 34% answered as home organization associations as the essential spot for them, 46.2% answered as instructive PC labs, 12.8% answered as cell administrations, 3.8% answered as confidential web bistro, 2.1% answered as some other while 1.4% respondents didn't answer for the assertion. The outcomes show that larger part of the testing populace utilize instructive PC labs as their essential hotspot for interpersonal interaction. At the point when gotten some information about the pace of everyday time utilization on the web-based entertainment which you spend length that you burn through, 38% answered as 30 minutes, 49% answered as 30-an hour while the leftover 13.3 percent answered between 1-2 hours, 3-or above, while 0.7 percent didn't address to this inquiry. The estimation shows that the pace of day-to-day time utilization is over the 30 minutes in their everyday use. At the point when gotten some information about the web bundle which a respondent using, 48.3% answered as month-to-month bundle, 30 % answered as IUB bundle, 11.7% answered as week after week bundle, 6.2% answered as confidential web bistro, 2.8% answered for others while .7% respondents didn't answer for the assertion. The computation finds that just about 50% examined populace utilize their month to month home informal communication bundles followed by the college month to month bundle. At the point when gotten some information about that Which component of virtual entertainment is significant for you, around 43% answered as Short Message Services (SMS), 27.6% answered as film cut, 14.8% answered as shared joins, 6.9% answered as preferred joins, 3.1% answered as 'remarks', 3.4% answered as 'others use, while .7% respondents didn't answer for the assertion. The outcomes find that in excess of 40% tested populace use SMS as their #1 element followed by film cuts while 'remarks' highlight got the lowest pay permitted by law in the respondents replying. At the point when gotten some information about the for the most part shared joins for contact or companions; 26% answered as Islamic, half answered as enlightening, 6% answered for diversion, 10% answered as political, 1.7% answered for sports and 6.2% answered for 'all' while .3% respondents didn't answer for the assertion. Most of the tested populace share joins connected with the instructive issues followed by the religion-related posts and connections. The political connections change at number three in the discoveries. At the point when gotten some information about the spot for utilizing of online entertainment for diversion; Approximately 44% respondents help amusement through visiting, 30% answered for remarking, 8% answered for video cuts, 2% answered for interesting connections and remaining answered for bunch talking while .3% respondents didn't answer for the assertion. The outcomes show that greater part of the respondents help diversion through SMS talking followed by interface remarking. At the point when gotten some information about the clients generally dealt with issues in utilizing virtual entertainment; 29% undesirable companion demand 45% answered for undesirable messages, 13% answered for political connections and the excess 12% answered for untrustworthy connections and 0.3% answered for slander of characters, 0.7% answered for phony's ids. The outcomes show that most of the respondents experienced undesirable messages as their key issue. When asked from the understudies were asked web-based entertainment is advantageous for youth in the field of training; 44% of the respondents concur, and 37% of the respondent answered emphatically concur. While 13% of respondents was unsure about the articulation. 3% differ and remaining was unequivocally couldn't help contradicting the assertion. The mean score 4.12 upheld the assertion while 2.1% of the respondents didn't answer for this assertion. At the point when understudies were inquired as to whether upon online entertainment visiting, calling, sharing connections, enjoying joins is the wastage of time for youth; around 41% of the respondents concur, 24% of the respondent answered unequivocally concur while 19% of respondents was dubious about the articulation.

CONCLUSION

The exploration manages a study on the use of the web-based entertainment organizing in the space of youth. The web-based entertainment referring to which is utilized in the exploration apparatus are Face book, Skype, YouTube, Twitter and MySpace. The survey comprises of 31 close finished inquiries while two inquiries are opening finished. The review was being approach by this specialist to 300 youths. Every one of the members effectively answer this survey. The return normal of the poll was significantly high with 97%. The typical interest of the female respondents is more prominent than the male respondents with 66%. The degree of capability of the respondents shifts from Bachelors to M. Phil projects and them were has a place with various

instructive organizations in Bahawalpur. Greater part of the respondents has a place with rustic regions. This shows that the virtual entertainment is broadly utilized by the provincial youth living in the metropolitan populace while the metropolitan populace used this with underestimated interests as per this example overview. The typical age bunches which are being reached by this scientist were between 1530 years. Most of the respondents were understudies while a more modest extent were individuals having a place with various worker gatherings. This shows that the utilization of virtual entertainment is generally utilized by every one of the divided young people of the general public in Pakistan. The eventual outcomes of the study shows that very nearly 50% clients like face book as their essential and most loved virtual entertainment structure followed by Skype 39% and the 11% clients utilize different types of web-based entertainment like Twitter and MySpace. This exploration finds that the unreasonable clients in the instructive PC labs utilize the web-based entertainment structures for remarks, talking, picture and video sharing and messaging and so on. These normal contacts the close to half of the tested populace. This shows that they overlook their essential spotlight on their review and exploration related exercises while using the office of web in associating with their companions on the virtual entertainment organizing discussions with their typical used time between 30 to an hour. However, the genuine outcomes might cross this most extreme time span while using the online entertainment structures as 13% answered that they use it over 2 hours in a solitary day. Their significant highlights while utilizing online entertainment are SMS, video cuts sharing connections and remarks. The instructive connections and the Islamic connections are generally shared by the example populace of this study for the individual clients. The clients for the most part deal with issues, for example, undesirable messages, undesirable companions demand and dubious political connections and untrustworthy pictures and connections, unessential strict and hostile to strict messages and futile data. Regardless of concur with the contention that web-based entertainment is influencing the existence of the adolescent, the tested youth populace is constantly utilizing the virtual entertainment structures in all the Pakistan remembering for country regions where the web office is accessible. It has intentionally impacted the physical and sports exercises which is being supplanted by virtual entertainment. The negative pictures, messages, video joins, voice messages are making adverse impact in the general public and gatherings at the minor level to enter to weaken the between state concordance in the worldwide relations. The new web-based entertainment uses in Egypt, Libya, Tunisia, Lebanon and a few other Asian, African and Latin American states have undermined the interior as well as outer relations of the states. The online entertainment crusade is making further division in the general public, social and political gatherings, ethnic networks, racial substances and social gatherings. The utilizations of the web-based entertainment are underway since the early long stretches of the 21st hundred years in Pakistan. The virtual entertainment is used by the populace having a place with various age bunches yet the young populace is at the front in the online entertainment destinations in all around the world and particularly in Pakistan. The old impression of the socio-political advancement of the general public in Pakistan through customary elites and the family bunches has fundamentally changed into the new peculiarities of person-to-person communication and web-based conferencing through the online entertainment. The normal practices of the general public have debilitated in the time of online entertainment organization and impact from individual to aggregate collective endeavours and movement. Most of the inspected populace of this exploration concurs with this contention. Greater part of the tested populace is concurred with this contention that the positive utilization of web-based entertainment structures can brought socio-political mindfulness, upgrade the various abilities like increment language capability, foster web-based relational abilities, make more extensive visionary power and network. It is likewise valuable for promoting, position hunting entryways, distributing research articles and different methods and so on.

BIBLIOGRAPHY

1. Aamoth. D. (2011) Brief History of Skype, USA: Oxford University Press.
2. Ahn, J. (2012). Teenager and social network sites do of line inequalities predict their on-line social networks. USA: University of Maryland.
3. Alexa, G. (2008). Facebook Overtakes MySpace. USA.
4. Balousha, H. (2013). Palestian Youth on social media. Gaza Publications.
5. Barneys, S. (2012). Effects of social media on employees, New York: Tag Archive.
6. Beattie, A. (2013). Social media and its effects on our emotional wellbeing. Canada: INSIGHT Planner at Metro and Freelance Film Journalist.

7. Berkman, S. (2007). Why youth hearts social network sites, Berkman Centre for Internet and Society, Harvard University, USA.
8. Chmielewski et al., (2009). How MySpace fell off the pace, USA: Los Angeles Times.

Effect of Social Media on Youngster's Food Choices

Palwinder Singh Bhatia¹ and Ashima Sahni²

¹Department Mass Communication, Guru Nanak Dev University, Amritsar, Punjab, India

²Department Political Science, Kanya MahaVidyalaya, (Autonomous College), Jalandhar, Punjab, India

ABSTRACT

Social media provides a platform for communication, interaction, and sharing of ideas and information through videos, images, and messages building a virtual networking community. Facebook, Twitter, Snapchat, and Instagram are a few of the social media sites that are commonly used by the younger population. The influence of social media on individuals and the norm for beauty standards have led to the development of dieting resulting in changes in eating behaviour. In order to improve the health status of youngsters, studies are needed to illuminate the essence of their general and dietary lifestyle. Thus, this study verifies meaningful relationships between youngsters' usage of social media (USM), which plays an important role in their life, their food consumption behavior (FCB), and their dietary satisfaction. The purpose of this study was to find out how social media affects eating behaviour of youth. Hence, the aim was to understand the possible effects of social media on eating behaviour in youngsters and how this behaviour leads to positive and negative effects on their health. To find out the real facts and causes behind eating behaviour a review of the literature of articles published from journal inception to 2019 was performed by searching PubMed (i.e., MEDLINE), Embase, CINAHL, PsycINFO, Web of Science, and other databases. The review was conducted in three steps: (1) identification of the research question and clarification of criteria using the population, intervention, comparison, and outcome (PICO) framework; (2) selection of articles from the literature using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines; and (3) charting and summarizing information from selected articles. PubMed's Medical Subject Headings (MeSH) and Embase's Emtree subject headings were reviewed along with specific keywords to construct a comprehensive search strategy.

Keywords: food consumer, eating behaviour, youth health, food consumption pattern, sound eating, convenience food

INTRODUCTION

Eating behaviour is a broad term that encompasses food choices and motives, feeding practices, dieting and eating-related problems such as obesity, eating disorders and feeding disorders¹. With growing technology, life has become easier and better for all people. The advancement in technology day by day and excessive use of social media has both positive and negative effects. Social media has become famous nowadays and no one can stay away from it. All around the world in every 60 seconds 156 million emails are sent, 3.8 million search requests are made from Google and 2 million minutes of calls are made via Skype. The study has shown that 70% of 17–22-year old youngsters have a profile on social media, while the OECD (Organisation for Economic Co-operation and Development) reported in 2015 has shown that 94.8% of 17-year-old children in the UK used social media.²

Social media has been defined as any social networking site that enables interactive, user-generated content that allows sharing of images, ideas, videos, music, or commentary on internet forums (e.g., Facebook), blogs and microblogs (e.g., Twitter), and photograph- or video-hosting platforms (e.g., Instagram, YouTube, or TikTok)³. Individuals or groups of people can communicate, collaborate, and connect in real time via text, video, or phone anywhere that Wi-Fi is available. Social media channels, such as Facebook or YouTube, were initiated in the year early 2000. However, the first website recognized as being the first social media platform was called *Six Degrees*—short for Six Degrees of Separation—and it launched in 1997. In 2018, YouTube, Instagram, and Snapchat were identified as the most popular online platforms utilized even by teens 13 to 17 years of age⁴. User-generated content on these channels may allow for autonomy, identity, and interpersonal peer relationship development, a hallmark of youngsters⁵. Social media is an effective channel for engaging youngsters, a target population that has been hard to engage in public health practice. It can be used to influence, inform, and persuade. Social media mobile apps have global reach, use, and engagement⁶. In an earlier global report, approximately 85% of youngsters between the ages of 17 and 24 years across Europe, Latin America, the United States, and South Korea reported using a social media website⁶. Among a sample of 4460 high school students from Turkey in 2019, 88% owned a smartphone and 100% had a social media account⁸. Out of this sample 75% of students influenced by the food-related content through advertisements, blogs and articles in different social networking sites. All the junk food items like pizza, burger, pasta, cakes, chocolate and burger

got popular with the help of online media only. Studies have seen tremendous change in the eating habits of youngsters in the last four years.⁹

Contagion effect—the rapid communication of an idea that has gone *virial* among peers on social media platforms—has been recognized as an effective way to promote health behaviors¹⁰. Behavior intent, increased knowledge, and increased awareness are positive attributes of healthful food posts on social media that influence users¹¹. Extensive social media use, along with other entertainment media use, has been associated with consumption of unhealthy foods, mostly due to snacking behaviors. In a recent report, Chau et al concluded that social media was a promising channel for increasing obesity in youngsters and young adults¹². More recent research has revealed that 95% of 17- to 25-year-olds own a smartphone, 51% use Facebook, 69% use Snapchat, 72% use Instagram, and With 85% using YouTube, an examination of peer influence, via social media channels, confirmed eating behavior. A social network analysis of adult, in-person peer relationship influences indicated that maladaptive eating behaviors (i.e., eating disorders) may be influenced by friendships on online channels¹³. Social norms, as well as real and perceived social support, may also be used to underpin peer influences related to the practice of eating. Peer groups and the type and degree of peer influence may shape one's relationship with food. Peer influence on eating behaviors may extend from in-person influence to social media influence. Findings from a US nationally representative sample of young adults, 19 to 32 years of age, revealed an association between a high volume and frequency of social media platform engagement (i.e., Facebook, Twitter, Google, YouTube, LinkedIn, Instagram, Pinterest, Tumblr, Vine, Snapchat, and Reddit) and eating concerns¹⁴. However, some of the most popular social media channels have been noted to influence maladaptive (i.e., nonpathological) eating disorders as well as adaptive (i.e., pathological) healthy eating. Social media platforms (i.e., Facebook and YouTube) and mobile gaming nutrition-intervention apps (e.g., Food Hero) demonstrate utility among young adult populations to raise awareness, increase knowledge, influence intrinsic beliefs, and motivate attitudes¹⁴. Social media channels, including Facebook, YouTube, and Snapchat, have been recognized by youngsters for providing peer-to-peer support in healthy eating through sharing information and offering social support¹³.

METHODOLOGY

This study examined a social media apps and their impact on youngsters eating behaviour. Study has a qualitative and observation design. The study examined eating behaviour of youngsters in a social media environment. Social media platforms included Facebook and Facebook Messenger, YouTube, Instagram, Twitter, self-made blogs, school websites, and health sponsored different forums were part of the online consumption of health information. Each study examined how youth utilized such social media platforms to communicate ideas regarding food and diet. To find out the real facts and causes behind changes in eating behaviour a review of the literature of articles published from journal inception to 2019 was performed by searching PubMed (i.e., MEDLINE), Embase, CINAHL, PsycINFO, Web of Science, and other databases.

FINDINGS

Social media has become one of the platforms for the youngsters to communicate, share photos and videos, share information, ideas. Social media has many positive and negative effects on youngsters' life. The positive effects of social media on youngsters lives are developing social skills, increasing social connections with the people from all around the world, reading and writing skills, sharing creative works with friends and other people, assessing online health information and able to get counselling support, advice from the people who are suffering from mental health problems. On the other hand, the negative effects of social media on youngsters are distorted body image, cyberbullied, increase in obesity, getting a negative source of information from strangers, getting low grades. Social media and the internet are a source of gathering important information, advice and support for youngsters with mental health illness.

Both positive and negative influences were found in eating behavior content among youngsters. Holmberg et al were the researchers to leverage a contemporary social media platform (i.e., Instagram) and identify positive eating behaviors promoted among youngsters. Their study is a leading example of the utility of social media to influence eating behaviors in a positive way. Their engagement strategy with youngsters could be leveraged for future studies that evaluate actual eating behavior change¹⁷. Food safety behaviors were the other positive aspect of healthy eating promoted via social media, as identified by Quick et al¹⁸. Kendal et al¹⁹ described self-made blogs help to prevent of eating disorders. Fast food advertising, as identified by Thaichon and Quach²⁰, and self-harming anorexic eating behavior content, as identified by Castro and Osório²¹, had negative influences on youngsters eating behavior. Instagram and Facebook were among the most popular social media platforms that influenced healthful eating behaviors (i.e., fruit and vegetable intake) as well as unhealthful eating behaviors related to fast food advertising. Online forums served as accessible channels for eating disorder relapse

prevention among youth. However, self-made blogs also promoted content about self-harming behavior in support of the eating disorder²².

Thematically, results of the studies included in the scoping review revealed several core themes related to engagement and dissemination of food-related content in a social media environment among young users across countries. Social media influence converged around four central themes: (1) visual appeal, (2) content dissemination, (3) socialized digital connections, and (4) youngsters *marketer* influencers. Social media not only served as a communication channel to a target cohort but also allowed for interaction through a platform that allowed for user autonomy on a specific topic.

First, communicating eye-catching visual imagery of food, fitness, and body ideals among young peers played a primary role of influence in several modalities. Videos and pictures allow for creative design feature elements that may increase engagement. Entertaining videos with appealing graphics, relatable scenarios, and music were employed effectively in food safety videos. These videos increased food safety practices (i.e., handwashing) among 332 young peer groups in an experimental design¹⁸. Similarly, researcher observed that shared images of food in social media may reflect a lifestyle that youngsters admire or want to promote. Positive framing of fruits and vegetables that were colorful and aesthetically pleasing may be indicative of a certain status worth sharing¹⁸.

Second, posting images and videos with friends allows for quick dissemination of health-related ideas, products, and practices. Social media has the ability to be circulated worldwide instantly. Rapid dissemination allows for contagion *virality* or *viral marketing* of a topic faster than a formal broadcasting channel, indicating the speed of dissemination by sharing unique, entertaining messages on one's pre-existing social network¹⁸. Quick communication uptakes may bypass mainstream media channel dissemination and speed. The emotion conveyed behind *viral* messages may influence person-to-person well-being. The researcher found that social media dissemination of harmful ideas may have negative consequences on mental health of youth, thereby influencing eating disorders. Social media contagion passed between individuals may have mental health implications contributing to unique social norms that affect anxiety levels due to *viral* messaging of negative eating behaviors¹⁹.

Third, digital platforms facilitate peer-to-peer interactions in ways that are quicker and more convenient than traditional in-person support networks, potentially influencing peer social norms. Social media interactions occur at a speed, engagement, and influence level beyond in-person communication. Their reach and scale could effectively influence youngsters beliefs, attitudes, and norms around eating behaviors at a broad scale. Digital communities have been leveraged by the food industry as a marketing tool to advertise directly to consumers. Thaichon and Quach¹⁷ reported that food advertising to young consumers associated a company's product with community and socialization. The researcher found that fast food advertising on social media influenced youngsters' views toward fast food, eating habits, and purchasing likelihood.

Images shared by young population with one another may be more influential than commercial advertising. young user-generated food content on social media was presented and received differently than food advertisements, but still mimicked that of food advertisers. Holmberg et al²⁰ examined how youngsters presented the food they posted online, analyzing trends in food and drink items and how they were described. The authors found most of the food images (68%) depicted high-calorie, nutrient-poor foods, and only 22% of images included fruits and vegetables. Topic engagement allows for peers to relate to each other through common interest and language. Online relationship building is fostered regardless of differences. There are more than 1.7 billion recipe pins on Pinterest app. BuzzFeed's Tasty, a food oriented page on Facebook, has over 3.5 million followers. The University of Pittsburgh School of Medicine conducted a study and found a few disturbing trends. Study participants who spent the most time on social media each day were 2.2 times more likely to report that they had issues with body image and eating. Participants who spent less time on social media did not report those concerns with the same frequency. On the other hand, There are qualified nutritionists, dieticians, chefs and wellness brands like Vape Genie using social media as a platform to share solid diet advice on healthy eating, nutrition, alcohol detox, weight loss and other topics²¹. People are being exposed to proteins, fruits and vegetables that they may not have experienced before. Then there are the new herbs, spices and plants like CBD to explore for health benefits. This can lead to a more varied diet and that's almost always healthier⁴.

DISCUSSION

Holmberg and colleagues²⁰ reported positive portrayals of healthy eating promoted for youngsters. Fruit and vegetable images that are zoomed-in on and focused on for a picture may place emphasis on the food depicted, due to visual appeal and positive attributes. Poelman et al stats that It's nearly impossible to scroll through any

social media feed without seeing pictures of food, recipes, food-related videos, or simply posts from friends and family discussing what they have or will eat. All of this exposure to food on social impacts eating habits among youth²². Many studies that indicate that looking at pictures and videos of food can trigger behavioral and physiological responses that lead to excess hunger. This of course can lead to unhealthy eating habits and weight gain²³. Social media has also opened up many channels for youngsters. Instead of going to the traditional healthcare providers for advice and insights on diet and wellness, youngsters are turning to social media more and more often, for practical advice they can use right away²⁴.

In addition to helping people access great dietary and wellness advice, social media is also widening our food horizons in a cultural sense as well. Blogs and social media channels are leading people to be exposed to cuisines that they may have never seen before. People who may have never done so otherwise are making their way to restaurants to try authentic ramen, curries, soul food, street tacos, injera, bibimbap and a variety of other foods. Not only this, but they're buying the ingredients and making these recipes at home as well. Inevitably, as people learn about new cuisines, they become exposed to the people and cultures behind those cuisines²¹. Healthy eating posts may reflect an aspirational lifestyle change among people in the contemplation phase toward healthy eating. Kinard and Holmberg et al²⁰ found that obese and overweight adolescents and adults were more likely to engage with healthy food posts than with unhealthy *junk food* posts on Instagram and Facebook²⁵. Similarly, Holmberg et al²⁶ commented that fruits and vegetables were portrayed in a favorable way that connoted palatability. Health promotion marketing of healthy foods may aid to inspire healthful behavior change as users are drawn to the visual appeal. It's true that social media can lead to some negative thoughts and behaviors related to food, there is more good news than bad. Social media can be a wealth of helpful advice on diet and wellness. It can also expose to new foods and new cultures. This can lead to better understanding and communication between cultures⁴.

CONCLUSION

Social media offers the potential of a hand-held change agent. Social media use on cell phones has become a global mainstay in contemporary culture, particularly for youngsters. Youth can serve as digital beacons of influence on health topics, including eating behaviors. Drawing from influencer marketing strategies in the digital landscape, tailored for culture and audience, youth could have a significant influence on the health behaviors of their peers. Health promotion initiatives to influence youth should consider the integration of social media channels.

REFERENCES

1. Sharps M., Robinson E. (2017) Perceived eating norms and children's eating behaviour: An informational social influence account. *Appetite*. 01;113:41–50. doi: 10.1016/j.appet. 2017. 02.015. [https:// linkinghub .elsevier.com/retrieve/pii/S0195-6663\(17\)30212-X](https://linkinghub.elsevier.com/retrieve/pii/S0195-6663(17)30212-X). [PMC free article] [PubMed] [CrossRef] [Google Scholar]
2. Kininmonth AR., Jamil N., Almatrouk N., Evans CEL. (2017) Quality assessment of nutrition coverage in the media: A 6-week survey of five popular UK newspapers. *27;7(12):e014633*. doi: 10.1136/bmjopen-2016-014633. <https://bmjopen.bmj.com/lookup/pmidlookup?view=long&pmid=29284712>. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
3. Ventola C. (2014) Social media and health care professionals: Benefits, risks, and best practices;39(7): 491–520. [http:// europepmc.org/ abstract/MED/25083128](http://europepmc.org/abstract/MED/25083128). [PMC free article] [PubMed] [Google Scholar]
4. Anderson M., Jiang J. (2018) Pew Research Center. Washington, DC: Pew Research Center; <https://www.pewresearch.org/internet/2018/05/31/teens-social-media-technology-2018/> [Google Scholar]
5. Spies Shapiro LA, Margolin G. (2014) Growing up wired: Social networking sites and adolescent psychosocial development. *Clin Child Fam Psychol*:1–18. doi: 10.1007/s10567-013-0135-1. <http://europepmc.org/abstract/MED/23645343>. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
6. Meshi, D., Tamir, D. (2015) Heekeren HR. The emerging neuroscience of social media. *Trends Cogn Sci*. 19(12):771–782. doi: 10.1016/j.tics.2015.09.004. [PubMed] [CrossRef] [Google Scholar]
7. Hur, J., Gupta, M. (2013) Growing up in the web of social networking: Adolescent development and social media. *Adolesc Psychia*;3(3):233–244. doi: 10.2174/2210676611303030004. [CrossRef] [Google Scholar]

8. Coskun S., Karayagız Muslu G. (2019) Investigation of problematic mobile phones use and fear of missing out (FoMO) level in adolescents. *Community Ment Health J.* (6):1004–1014. doi: 10.1007/s10597-019-00422-8. [PubMed] [CrossRef] [Google Scholar]
9. Taggart T, Grewe ME, Conserve DF, Gliwa C, Roman Isler M. (2015) Social media and HIV: A systematic review of uses of social media in HIV communication. *J Med Internet;*17(11):e248. doi: 10.2196/jmir.4387. [https:// www.jmir.org/ 2015/11/e248/](https://www.jmir.org/2015/11/e248/) [PMC free article] [PubMed] [CrossRef] [Google Scholar]
10. Barragan NC, Noller AJ, Robles B, Gase LN, Leighs MS, Bogert S, Simon PA, Kuo T. (2014) The "sugar pack" health marketing campaign in Los Angeles County, 2011-2012. *Health Promot Pract.* 15(2):208–216. doi: 10.1177/1524839913507280. [PubMed] [CrossRef] [Google Scholar]
11. Chau M, Burgermaster M, Mamykina L. (2018) The use of social media in nutrition interventions for adolescents and young adults-A systematic review. *Int J Med Inform.* doi: 10.1016/j.ijmedinf.2018.10.001. <http://europepmc.org/abstract/MED/30409348>. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
12. Forney KJ, Schwendler T, Ward RM. (2019) Examining similarities in eating pathology, negative affect, and perfectionism among peers: A social network analysis. *Appetite;*137:236–243. doi: 10.1016/j.appet.2019.03.013. <http://europepmc.org/abstract/MED/30872142>. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
13. Sidani JE, Shensa A, Hoffman B, Hanmer J, Primack BA. (2016) The association between social media use and eating concerns among US young adults. *J Acad Nutr Diet;*116(9):1465–1472. doi: 10.1016/j.jand.2016.03.021. [http:// europepmc.org/ abstract/MED/27161027](http://europepmc.org/abstract/MED/27161027). [PMC free article] [PubMed] [CrossRef] [Google Scholar]
14. Norman CD, Yip AL. (2012) eHealth promotion and social innovation with youth: Using social and visual media to engage diverse communities. *Stud Health Technol Inform;*172:54–70. [PubMed] [Google Scholar]
15. Quick V. (2015) Short food safety videos promote peer networking and behavior change. *Br Food J.;*117(1):78–93. doi: 10.1108/bfj-09-2013-0270. [CrossRef] [Google Scholar]
16. Kendal S, Kirk S, Elvey R, Catchpole R, Prymachuk S.(2017) How a moderated online discussion forum facilitates support for young people with eating disorders. *Health Expect;*20(1):98–111. doi: 10.1111/hex.12439. <http://europepmc.org/abstract/MED/26725547>. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
17. Thaichon P, Quach TN. (2019) Online marketing communications and childhood's intention to consume unhealthy food. *Australas Mark J.;* 24(1):79–86. doi: 10.1016/j.ausmj.2016.01.007. [CrossRef] [Google Scholar]
18. Castro TS, Osório AJ. (2013) “I love my bones!” – Self-harm and dangerous eating youth behaviours in Portuguese written blogs. *Young Consum;*14(4):321–330. doi: 10.1108/yc-03-2013-00351. [CrossRef] [Google Scholar]
19. Kulik NL, Fisher EB, Ward DS, Ennett ST, Bowling JM, Tate DF. (2014) Peer support enhanced social support in adolescent females during weight loss. *Am J Health Behav.;*38(5):789–800. doi: 10.5993/ajhb.38.5.16. [PubMed] [CrossRef] [Google Scholar]
20. Holmberg C, Chaplin JE, Hillman T, Berg C. (2016) Adolescents' presentation of food in social media: An explorative study. *Appetite;*99:121–129. doi: 10.1016/j.appet.2016.01.009. [PubMed] [CrossRef] [Google Scholar]
21. Montgomery KC, Chester J. (2019) Interactive food and beverage marketing: Targeting adolescents in the digital age. *J Adolesc Health.* (3 Suppl):S18–S29. doi: 10.1016/j.jadohealth.2009.04.006. [PubMed] [CrossRef] [Google Scholar]

22. Poelman MP, van Lenthe FJ, Scheider S, Kamphuis CB. (2019) A smartphone app combining global positioning system data and ecological momentary assessment to track individual food environment exposure, food purchases, and food consumption: Protocol for the observational Foodtrack study. *JMIR Res Protoc.*;9(1):e15283. doi: 10.2196/15283. <https://www.researchprotocols.org/2020/1/e15283/> [PMC free article] [PubMed] [CrossRef] [Google Scholar]
23. Pisano S, Adams M, Koester K, Bruening M. (2019) Acceptability of fruit and vegetable marketing materials for schools among adolescents. *Proceedings of Nutrition*; [https:// www.eventscribe.com/2019/ASN/ajaxcalls/PosterInfo.asp?efp=UURQVExBSVA3OTU5&PosterID=203256&rnd=0.6161305](https://www.eventscribe.com/2019/ASN/ajaxcalls/PosterInfo.asp?efp=UURQVExBSVA3OTU5&PosterID=203256&rnd=0.6161305). [CrossRef] [Google Scholar]
24. Murphy G, Corcoran C, Tatlow-Golden M, Boyland E, Rooney B. (2019) See, like, share, remember: Adolescents' responses to unhealthy-, healthy- and non-food advertising in social media. *Int J Environ Res Public Health.* ;17(7):2181. doi: 10.3390/ ijerph17072181. <https:// www.mdpi.com/ resolver?pii=ijerph17072181>. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
25. Kinard BR. (2016) Insta-grams: The effect of consumer weight on reactions to healthy food posts. *Cyberpsychol Behav Soc Netw.*;19(8):481–486. doi: 10.1089/cyber.2016.0085. [PubMed] [CrossRef] [Google Scholar]
26. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PeC, Ioannidis JPA, Clarke M, Devereaux PJ, Kleijnen J, Moher D.(2009) The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *Ann Intern Med.*;151(4):W65–W94. doi: 10.7326/0003-4819-151-4-200908180-00136. [PubMed] [CrossRef] [Google Scholar]

Consumer's Preference towards Online Shopping: A Case Study on College Students of Tinsukia Town

Lipika Jyoti Dowarah

Women's College, Tinsukia, Assam, India

ABSTRACT

Online shopping in the form of electronic commerce has been increasing continuously among the consumers at an increasing rate in the present century. In India revenue earned from e-commerce market is of worth USD\$ 63 billion in 2021. Online shopping in India has become common among all sections of the society especially among the college students. In the present research study an attempt has been made to study the online shopping behavior among college students of Tinsukia town based on primary data. Findings of the study reveal that the overall preference towards shopping among college students of Tinsukia town is high.

Keywords: consumer, high, online shopping, revenue

INTRODUCTION

Technology in the present era is considered as one of the effective methods in conducting almost all the activities of the human being in the personal as well as professional front (Magotha et al., 2015). Technology used for buying and selling goods and services without any physical market is called as online shopping. In other words, online shopping is a form of electronic commerce which facilitates buying and selling of goods and services among buyers and sellers with the help of modern technology such as smart phones, laptops, desktops etc. (Hila Ludin & Cheng 2014). In 1979 online shopping was invented for the first time by Michael Aldrich in United Kingdom, since then online shopping has become common across the globe. Online shopping is one of the fastest growing channels for commercial transaction in India. In recent years it has become common among all sections of the society belonging to different age groups, especially among the young generation. As per estimates India's e-commerce market is expected to grow from US\$48.5 billion in 2018 to US\$200 billion in 2021. In 2021 India is the 8th largest e-commerce market with revenue of US\$63 billion.

OBJECTIVE

3. To study the demographic profile of the sample respondents
4. To have an idea on the overall preference towards online shopping among the college students of Tinsukia town

REVIEW OF LITERATURE

Author	Findings
Armstrong & Kotler (2000)	A consumer's online shopping behavior is influenced by psychological factors such as perception, motivation, attitude, learning and beliefs
Forsythe et. al. (2002)	Their study showed a positive and highly significant relationship between online shopping, frequency of shopping and expenditure on online shopping.
Shang et. al. (2005)	Consumers prefer online shopping usually because of extrinsic as well as intrinsic benefits. Extrinsic benefits are competitive price, wide selection of products, easy access and low search cost while the intrinsic benefits mainly include different designs, color, quality etc.
Delafrooz, N., Laily, H. P., et. al. (2009)	The study attempted by them reveals that utilitarian orientations, convenience, price and wider selection of commodities are the important determinants of online shopping attitudes of the consumers. The study also suggests that online retailers should be provided more convenience, competitive price and more variety products so that consumers are more attracted towards online shopping.
Choudhury & Dey (2014)	In their research study on the online shopping behavior among the students of Assam university the researcher found a significant relationship of online shopping and with gender, internet literacy, and price of online products.
Vaghela (2017)	A study conducted on the factors affecting online shopping in the Surat city, the researcher identified six variables responsible for online shopping among the people of the region. These six variables include perceived usefulness, website design, ease of use, vendors characteristic, perceived risk and trust.

Rose, J. G. (2018)	Findings of the researcher reveal that students expenditure on online shopping is above Rs. 10000 compared with other respondents. Also the study highlights that the attitudes of the students and problems in online shopping are independent variable in predicting the preference towards shopping online.
--------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

METHODOLOGY

Sampling Framework

Present study is designed to know the online shopping behavior among the college students of Tinsukia town. A self-structured questionnaire having 20 statements in 5 likert scale ranging from very good (as 1) to very bad (as 5) has been distributed randomly among 150 college students of Tinsukia town. For the study data has been collected between November – December 2020.

Sampling Unit

A total of 150 samples have been randomly selected from the colleges of Tinsukia town.

Data Analysis

For the study the collected raw data are analyzed in MS Excel with the help of percentage method. To analyze the preference of the college students towards online shopping Impact Index method was applied.

$$\text{Impact Index} = \sum WiRi / M_i \times 100$$

Where, $\sum WiRi$ – Weighted Score

M_i – Maximum range

For the analysis of the index following ranges were taken

0-20% = Very Low, 20%-40% = Low, 40%-60% = Moderate, 60% - 80% = High, 80%-100% = Very High

Limitation:

The study is based on only 150 samples randomly selected randomly from different colleges of Tinsukia town.

RESULTS & DISCUSSION

1.1 Demographic Profile

Demographic profile of the sample respondents (age, gender, educational qualification, income of the households) is summarized in the help of the table 1 below

Table 1: Demographic Profile of the respondents

Variables	Participants (N= 150)	%
Age		
>17	25	16.67
17 – 20	48	32
20 – 22	63	42
< 22	14	9.34
Gender		
Male	70	46.67
Female	80	53.34
Educational Qualification		
HS	46	30.67
Under Graduate	69	46.00
Post Graduate	20	13.34
Diploma	15	10
Income of the household		
>10000	45	30
10000 - > 20000	47	31.34
20000 - > 40000	38	25.34
< 40000	20	13.34

Source: Primary data

The table 1 above shows that female students (53.34%) mainly prefer online shopping compared to the male students (46.67%). Also the frequency of online shopping is more among the undergraduate college students i.e. 46%

2. Consumer's Perception Towards Online Shopping

To study the consumer's perception towards online shopping indicators such as frequency on online purchase, expenditure made on online shopping, mode of payment and risk faced in online shopping are taken into account.

2.1 Product Purchase and Frequency

Table 2 and table 3 represents the survey results of the essential products purchased.

Table 2: Product purchased by the consumer

Products	Participants (N=150)	%
Electronics	19	12.67
Food & beverage	10	6.67
Books	32	21.34
Clothing & accessory	51	34.00
Tickets (Movie/ Railway/ Bus/ Flight)	26	17.34
Others	12	8.00

Source: Primary data

Table 2 above shows that 34% of the sample mainly purchases clothing and accessories online. 21.34% sample students prefer books, 17.34% prefer booking online tickets, 12.67% purchases electronics, and 6.67% prefer food and beverages.

Table3: Frequency on online purchase of the consumer

Variables	Participants (N=150)	%
Weekly	8	5.34
Monthly	20	13.34
Quarterly	49	32.67
Half yearly	58	38.67
Yearly	15	10.00

Source: Primary data

From the table 3 it is understood that maximum students (38.67%) quarterly prefer for shopping online and only 5% responded that their frequency of purchasing commodities online is weekly.

2.2 Expenditure and Mode of Payment on Online Shopping

Another important indicator to study the online shopping behavior of college students is the expenditure (quarterly) on online shopping and the mode of its payment.

Table4: Expenditure on online shopping

Expenditure (quarterly)	Participants (N=150)	%
>1000	30	20.00
1000 - > 2500	59	39.34
2500 - > 5000	41	27.34
< 5000	20	13.34

Source: Primary data

Table 4 above shows the expenditure made by sample respondents on online shopping. 39.34% samples quarterly send Rs.1000 to Rs2500 on purchasing commodities online. 27.34% spends Rs2500 to Rs5000, 20% spends less than Rs1000 and 13.34% spends more than Rs5000 quarterly on online shopping.

Table 5: Mode of payment used by sample respondents

Mode of Payment	Participants (N=150)	%
UPI	46	30.67
Credit/ Debit / ATM card	25	16.67
Net Banking	11	7.34
Cash on Delivery (COD)	59	39.34
Others	9	6.00

Source: Primary data

Preferred mode of payment for online shopping of the college students is shown with the help of the table above. From the table it is understood that 39.34% students mainly prefer COD as mode of payment, 30.67% prefer UPI (i.e. GPay, Paytm etc.) and 16.67% prefer Credit/ Debit / ATM card for online shopping.

2.3 Factors affecting Online Shopping

Table 6: Factors affecting online purchase

Variables	Response					Total
	R1	R2	R3	R4	R5	
Time saving	61	33	26	19	11	150
Convenient	33	49	18	28	22	150
Wider Selection	27	42	50	11	20	150
Mode of Payment	11	16	33	47	43	150
Others	18	10	23	45	54	150

Source: Field Survey

Note: R1, R2, R3, R4 and R5 are Rank 1, Rank 2, Rank 3, Rank4 and Rank5

In the table above probable factors affecting online shopping among the sample college students were analyzed. Students were asked to rank the factors (i.e. time saving, wider selection, convenient, mode of payment and others) affecting online shopping. Table highlights that 61 respondents has ranked time saving as Rank 1, followed by 49 sample for convenient as Rank 2, wider selection as rank 3 by 50 respondents, mode of payment as Rank 4 by 47 respondents and others are ranked by 54 respondents.

Table 7: Frequently used online shopping sites

Online shopping sites	Response					Total
	R1	R2	R3	R4	R5	
Amazon	14	26	10	64	36	150
Flipkart	61	22	35	11	21	150
Myntra	18	21	61	26	24	150
Meesho	22	68	30	25	05	150
Snapdeal	35	13	14	24	64	150

Source: Field survey

Note: R1, R2, R3, R4 and R5 are Rank 1, Rank 2, Rank 3, Rank4 and Rank5

Table 7 above shows the frequently used shopping sites by the sample college students of Tinsukia town. From the table it is understood that 61respondents has ranked Flipkart as Rank1, Meesho as Rank 2 by 68 respondents, Myntra as Rank 3 by 61samples followed by Amazon as Rank 4 and Snapdeal as Rank 5. Thus, Flipkart is mostly preferred online shopping site by the sample respondents.

Table 8: Risk faced on online shopping

Risk	Participants (N=150)	%
Payment Risk	29	19.34
Product Risk	36	24.00
No Risk	85	56.67

Source: Field survey

Table 8 above shows the risk faced by the sample respondents during online shopping. 56.67% respondents responded that they do not face any risk during shopping online. 24% respondent for product risk and 19.34% responded for risk during payment.

Table 9: Overall consumer's preference towards online shopping

Response	Very high	High	Moderate	Low	Very low	Total
W_i	5	4	3	2	1	
R_i	60	41	26	14	09	150
$\sum W_i R_i$	300	164	78	28	09	579

Source: Authors own computation

Maximum Weight (M_i) = Maximum Score \times Total number of respondents

$$= 5 \times 150$$

$$M_i = 750$$

$$\text{Impact Index} = \sum WiRi / M_i \times 100$$

$$= 579 / 750 \times 100$$

$$= 77.2\%$$

Impact Index calculated from the above study is 77.2% which lies in the fourth category (60% -80%). Therefore, we can conclude from the study that the overall preference for online shopping among the college students among Tinsukia town is high.

CONCLUSION

In the present day online shopping has played an important role in changing the aspects of human lives. Shopping online has increasingly becoming popular among the college students. Study reveals that online shopping is time saving and convenient and it is mostly common among female students compared with the male counterparts. Also the risk of online shopping is minimum and it is user friendly. Flipkart followed by Meesho and Myantra are the most frequently used online shopping sites among the students. Findings reveal that the overall preference for online shopping among college students of Tinsukia town is high i.e. 77.2%.

REFERENCE

1. Armstrong, G., Kotler, P., (2000) "Marketing an Introduction", Paper presented at the 5th ed., Prentice-Hall, Englewood cliffs. Pp-153-154
2. Bakos, J. Y., et. al., "Bundling Information Goods: Pricing, Profit and Efficiency", Management science, Vol.45, No. 12, pp-1613-1630
3. Bhatt, A. (2014), "Consumes Attitude towards Oline shopping in selected region of Gujrat" Journal of Marketing Management, Vol. 2, No. 2, pp-29-56
4. Choudhury and Dey, (2014), "Online shopping attitude among youth: A study on university students" International journal of entrepreneurship od development studies, Vol 2(1) pp:23-32
5. Delafrooz, N., Laily, H. P., et. al. (2009), "Factors affecting students attitude towards online shopping" African Journal of Business Management, Vol.3, pp:200-2009
6. Forsythe, S., Petee T., Kim J.O, (2002), "Modeling consumer behavior in Online environment" Scale development: National textile center: Annual Report
7. Rose, J. G. (2018), "A study on online shopping towards college students with special reference to Kanyakumari district" Recent trend in Marketing technology, Vol.6, pp:74-83
8. Shang, R. A., Chen. Y. C., Shen, L., (2005), "Extrinsic versus intrinsic motivation for consumer to shop online" Inf. Manag. 42 pp:410-413
9. Sreekanth, K., et. al. (2020), "A study on Online shopping Behaviour of college students in Hyderbad region" AEGAEUM journal, Vol.8, issue 4
10. Vaghela, (2017), "Factors affecting online shopping behavior in Surat city" Researchgate

Antimicrobial Activity and Phytochemical Analysis of Lagerstroemia Microcarpa against Bacterial Pathogens

Gunasekaran T*, Akilan P, Chandrasekaran V and Kannan A

Department of Chemistry, Government Arts College (Autonomous), Salem -7, India

ABSTRACT

Globally, it can be said that the majority of traditional medical practises frequently use medicinal plants to treat both acute and chronic wounds. In light of this, numerous plants from tropical and subtropical climates have been examined for their capacity to heal wounds. Due to their bioactive components, medicinal plants are known to harbour potential entophytic bacteria. This involved the acetone and methanol extraction of the *L.microcarpa*. Preliminary phytochemical constituents of *L.microcarpa* were examined. The extract was carried out in two solvents methanol and acetone. The methanol extracts show the presence of alkaloids, flavonoids, steroids, Terpenoids, phenols, tannin and carbohydrates. The agar disc diffusion method was then used to determine the antimicrobial activity of the *L.microcarpa* methanolic extract against reference strains (*Escherichia coli*, *Bacillus subtilis*, *Staphylococcus aureus*, *Salmonella typhi*, *Bacillus cereus*, *Candida albicans*, *Aspergillus niger*, *Trichophyton rubrum*, *Aspergillus fumigatus* and *Microsporum gypseum*). In antibacterial activity *S. typhi* shows better inhibition when compared to other organisms, whereas in antifungal activity *C.albicans*, *A.niger* and *M.gypseum* have similar inhibition activity. This inhibition can be seen when using the individual extracts and when using ineffective antibiotics with them at lesser quantities. With antibiotic-susceptible and -resistant bacteria, the antimicrobial activity of plant extracts and phytochemicals were assessed. Additionally, these plants contain bioactive phytochemicals that have potential medical benefits for the treatment of a variety of infections. Therefore, especially in traditional medical procedures, these herbs may be useful in the treatment of acute and chronic wounds.

Keywords: *L.microcarpa*, Medicinal plant, Antimicrobial activity, Phytochemical Analysis

INTRODUCTION

Medicinal plants are those which contain compounds that can be utilised to treat ailments in one or more of their constituent components. Plant-based medicines are well known for their efficacy, accessibility, and affordability (Westh et al., 2004). The importance of medicinal herbs to both individual and group health is greater. These plants' medical usefulness comes from their bioactive phytochemical components, which have defined physiological effects on the human body. Although medicinal plants are found all across the world, tropical nations are particularly rich in them. 25% of modern medication is said to be derived directly or indirectly from high plants (Crag et al., 2001). One could classify herbal medications as "diluted pharmaceuticals." In order to receive the desired benefits from herbal medications, an individual must take a suitable dosage for a predetermined amount of time. Each plant part contains a variety of active substances, some of which may be hazardous; however, as these substances are not powerful, toxicity cannot be produced at low doses. Additionally, compared to the medications, their side effects are quite infrequent (WHO, 2005).

Plants often play a significant part in medicinal characteristics for both therapeutic and preventative purposes. Due to their numerous uses, phytochemicals, compounds derived from plants, have recently attracted a lot of attention. They serve medicinal purposes as well. These medicinal properties of plants are due to a chemical compound that has a specific physiological effect on people (Karunyadevi et al., 2009). Many different bioactive chemicals can be produced by plants. Fruits and vegetables contain significant amounts of phytochemicals, which may offer protection against free radical damage. Plants with advantageous phytochemicals may act as natural antioxidants to supplement the body's requirements (Boots et al., 2008). Numerous studies have demonstrated the abundance of antioxidants in numerous plants. For instance, plant-derived phenolic chemicals including flavonoids, tannins, and lignins, as well as vitamins A, C and E, all function as antioxidants (Suffredini et al., 2004).

Antibiotics have been essential in the treatment of microbiological infections (particularly bacterial infections) since their discovery and have contributed to an increase in the average life expectancy (Aslam et al., 2018). Antibiotics have significantly improved human health worldwide, particularly in developing nations with inadequate public health infrastructure, by lowering rates of morbidity and mortality caused on by bacterial infections (Rossolini et al., 2014). However, antibiotics have been abused and mishandled by the general public, leading to an increase in the prevalence of antibiotic resistance in a number of microorganisms. Antibiotic resistance is now understood to represent a significant danger to world health. In order to combat the threat of

antibiotic resistance, efforts have been made while also looking into alternate sources of antimicrobial compounds, such as medicinal plants (Anand et al., 2019).

Microorganisms can easily access food during harvest, slaughter, processing, and packing since they are naturally present in the environment (Hatab et al., 2016). Because of the substantial consumer concern over the potential harm from utilising synthetic additions to human health, the usage of these chemicals in food preservation has decreased (Gyawali and Ibrahim, 2014; Caleja et al., 2016). In order to prevent the formation of dangerous germs and extend the shelf life of food products without the use of chemical preservatives, new environmentally friendly approaches are needed. Recently, numerous experts looked into the possibility of using some plant extracts as efficient all-natural preservatives (Fernandez Lopez et al., 2005; Clarke et al., 2017).

An indigenous to India flowering tree is named Lagerstroemia microcarpa. It is indigenous to India's southwest, specifically the Western Ghats mountain range. A native of the wet forests of the Western Ghats, benteak is a deciduous tree that can reach heights of 10 to 15 metres. The ash-colour bark flakes off in strips. The stalks of the oppositely oriented, elliptic-lance shaped leaves are 1 cm long and 6–10 cm long. Large compound panicles that are 20–30 cm long bear flowers. Flowers are tiny, white, 1 cm in diameter, and have 6 oblong petals that are 6 mm long, 1-2 cm long, ellipsoid capsule. The potential use of species from the Lythraceae family in conjunction with nanotechnology for a variety of biomedical applications is highlighted in this study.

MATERIALS AND METHODS

Collection of Plant Materials

The fresh samples of *L. microcarpa* were randomly gathered in Tamil Nadu's Yercaud Hills. Sample components were cleaned with running water, allowed to air dry, and then homogenised into a fine powder and stored in airtight containers in the refrigerator.

Preparation of Extracts

Soxhlet extraction technique was used to create the crude sample extract. A uniformly distributed 20gm of powdered sample material was placed in a thimble before being extracted with 250ml of acetone and methanol separately. The extraction procedure must be continued for 24 hours or until the solvent in the extractor's syphon tube becomes colourless. The extract was then placed in a beaker and cooked on a hot plate at 30 to 40 degrees Celsius until the solvent had evaporated. Until use, dried extract was kept in a refrigerator at 4°C.

Phytochemical Screening

According to accepted procedures outlined by Brain and Turner, 1975 and Evans, 1996, preliminary phytochemical analysis was performed on *L. microcarpa* acetone and methanol extracts.

QUANTITATIVE PHYTOCHEMICAL ANALYSIS

Estimation of Alkaloids

Using the Harborne (1973) approach, determine alkaloids. A 250 ml beaker was filled with 5 ml of the methanolic extract of the *L. microcarpa* sample, 200 ml of 10% acetic acid in ethanol, and then the mixture was capped and allowed to stand for 4 hours. After filtering, the extract was concentrated to a quarter of its original volume on a water bath. Until the precipitation was finished, concentrated ammonium hydroxide was applied drop by drop to the extract. After allowing the entire solution to settle, the precipitated material was collected, cleaned with diluted ammonium hydroxide, and then filtered. The alkaloid, which was dried and weighed, is the residual.

Estimation of Flavonoids

100ml of 80% aqueous methanol were regularly used to extract five millilitres of *L. microcarpa* methanolic extract at room temperature. The liquid was then funnelled through a filter into a 250 ml beaker that had been previously weighed. The filtrate was put into a water bath, allowed to dry completely, and then weighed. By comparing weight differences, the percentage flavonoid content was estimated (Krishnaiah et al., 2009).

Determination of Total phenols

The phenolic component was extracted from the fat-free sample by boiling it in 50 cc of ether for 15 minutes. A 50 ml flask was filled with 5 ml of the methanolic extract of *L. microcarpa* and 10 ml of distilled water. Additionally, 5 ml of concentrated amyl alcohol and 2 ml of ammonium hydroxide solutions were added. The *L. microcarpa* samples were prepared according to specification and allowed to react for 30 min to acquire colour. 505 nm was used to measure it (Siddhuraju and Decker, 2003).

Screening of Antimicrobial Activity

The disc diffusion method was used to screen the antibacterial activity (Bauer et al., 1966). In vitro antibacterial activity was evaluated using Muller Hinton Agar (MHA), which was acquired from Hi-media (Mumbai). The MHA plates were created by adding 15 ml of molten medium to sterile petri dishes. Just five minutes after the plates had hardened, the 0.1% inoculum suspension was equally swabbed onto the plates. The inoculums were then left to dry for five minutes. The extracts were administered at a concentration of 40 mg/disc on a 6 mm sterile disc. The plates were incubated at 37°C for a 24-hour incubation period just after loaded disc was placed on the medium's surface, the extract was given five minutes to diffuse, and the procedure was completed.

RESULT AND DISCUSSION

A crucial step in identifying different bioactive secondary metabolites of plants that play a crucial role in favourable physiological and therapeutic activities like antioxidant, antidiabetic, and anticancer properties is preliminary screening of phytochemicals (Savithamma et al., 2011).

Table 1: Phytochemical Analysis in Methanol and Acetone Extract of *L.microcarpa*

Phytochemicals	Observations	Methanol Extract	Acetone Extract
Alkaloids Mayer's test	Cream colour	+-	-
Flavonoids H ₂ SO ₄ test	Reddish brown / Orange colour precipitate	+	+
Steroids Liebermann-Burchard test	Violet to blue or Green colour formation	+	+
Terpenoids Salkowski test	Reddish brown precipitate	+	+
Arthroquinone Borntrager's test	Pink colour	-	-
Phenols Ferric chloride test	Deep blue to Black colour formation	+-	+-
Saponin	Stable persistent	-	-
Tannin	Brownish green / Blue black	+	+
Carbohydrates	Yellow / brownish / blue / green colour	+	+
Oils & Resins	Filter paper method	-	-

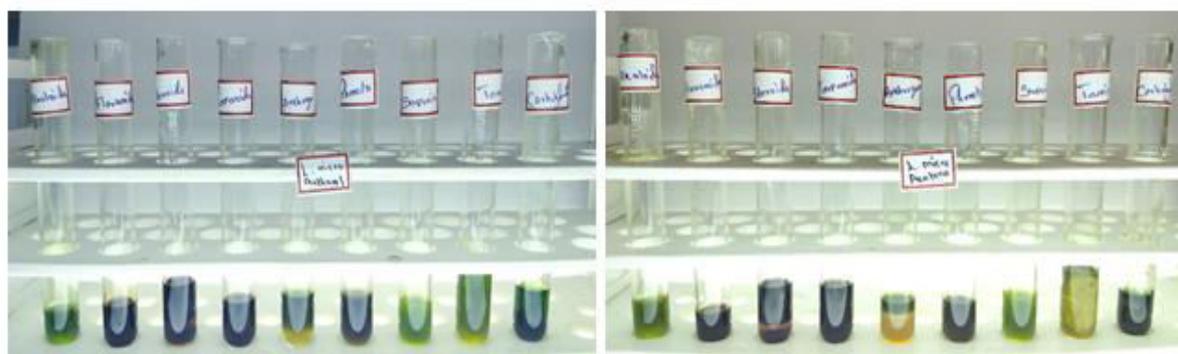


Figure: Phytochemical Analysis in Methanol & Acetone Extract of *L.Microcarpa*

The study found bioactive substances in both plants, including flavonoids, alkaloids, phenols, tannins, and saponins. These findings are consistent with those reported in another study (Shirwaikar et al., 2007; Akacha et al., 2016). Because they contain hydroxyl groups, phenolic substances have strong antioxidant properties by scavenging free radicals. Therefore, determining the quantitative phenolic content gives a thorough understanding of the biological activities and antioxidant capacity of plants. Antioxidant action is carried on by plant-derived free radical scavengers such flavonoids and phenolic substances (Amiri, 2012).

Methanol and acetone were used as two solvents throughout the extraction process of *L.microcarpa*. Alkaloids, flavonoids, steroids, Terpenoids, phenols, tannin, and carbohydrates are all identified in the methanol extracts. Flavonoids, steroids, Terpenoids, phenols, tannin, and carbohydrates all are detected in acetone extract. Methanolic extracts were found to have better activity than acetone extracts. Many natural active substances

found in plants, such as flavonoids, polyphenols, saponins, steroids, tannins, terpenoids, and alkaloids, are used as nutrients and nutritional supplements as well as to cure a variety of ailments (Sanjoaquin et al., 2004; Topping and Clifton, 2001).

Polyphenols, which represent the majority of flavonoids, can enhance an antibiotic's ability to fight bacteria (Sato et al., 2004). The flavonoids are crucial and potent antibacterial chemicals that interact with the protein and extracellular components of bacterial cell walls to form complexes (Cushnie and Lamb, 2005). Terpenoids are engaged in membranous tissue disintegration and damaged microbial cell walls (Hernandez et al., 2000). Enzyme and protein leakage from the cell is caused by the interaction of saponins with bacteria. Antimicrobial steroid causes liposome leakage from the lipid bilayer membrane (Epand et al., 2007).

Quantitative Phytochemical Analysis

Natural product chemists are also a term for phytochemists. Using the proper collection, identification, and cleaning procedures, these phytochemists make crude extracts from the selected plant materials, subject these crude extracts to biological screening of their desired assays, and begin the process of isolating and characterization of the active chemical compound (s). Bioassay-guided fractionation is the term used to describe the entire procedure. As antioxidant components of plant materials (hydrolysable tannins, phenolic acid, and flavonoids) that can protect against coronary heart disease, cancer, and have anti-carcinogenic and anti-mutagenic properties, phytochemicals have the potential to have significant pharmacological and biological effects (Loliger, 1991).

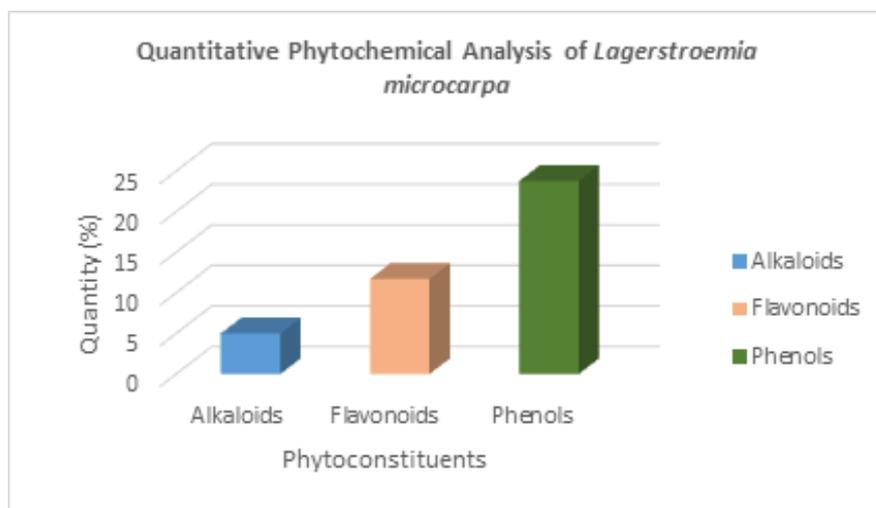


Figure: Quantitative Phytochemical Analysis of L.microcarpa in Methanol Extract

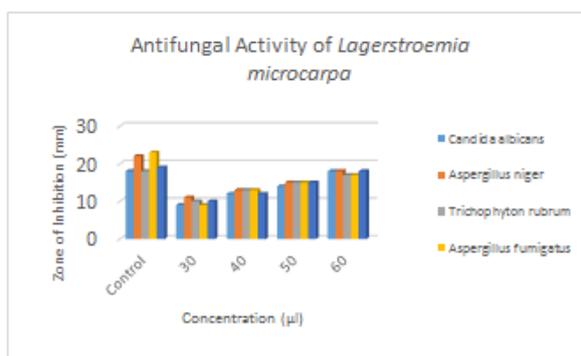
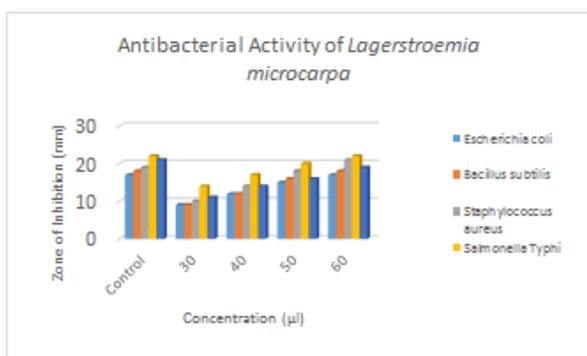
The quantitative phytochemical analysis were carried out for L.microcarpa methanolic extract for alkaloid, flavonoids and phenols. The percentage obtained in the phytoconstituents were alkaloids (5%), flavonoids (11.72%) and phenols (23.78%). It is well known that phenolics have the ability to scavenge free radicals. The primary cause of phenolics' antioxidant activity is their redox characteristics, which enable them to function as reducing agents and hydrogen donors. Phenolics are especially common in the tissues that produce flowers, in leaves, and in woody components like stems and bark. Alkaloids are substances found in medicinal plants that are utilised as anaesthetics (Herouart et al., 1988). The plant's bioactive phytochemical components, which have a variety of physiological impacts on the human body, are which it its medicinal significance. Therefore, one may identify a number of significant molecules that might be the basis for modern medications to treat a variety of ailments using phytochemical screening. Due to the existence of phytochemical components, medicinal plants can be used to cure or even treat human ailments (Nostro et al., 2000).

Antimicrobial Activity

One of the most potent and effective contributions of modern science and technology to the management of infectious diseases is the discovery and development of antibiotics. However, there has been alarming increase in the rate of pathogenic microorganism resistance to commonly used antimicrobial medicines (Ge et al., 2002; Nair and Chanda, 2005; Neogi et al., 2008). Numerous phytochemicals found in medicinal plants, including flavonoids, alkaloids, tannins, and terpenoids, have antibacterial and antioxidant activities (Talib and Mahasneh, 2010). Antibiotic resistance is a subject that continues to provide difficulties for the healthcare industry in both developed and developing nations all over the world. The existing antibiotic therapy is significantly threatened by the emergence and spread of multidrug resistant organisms.

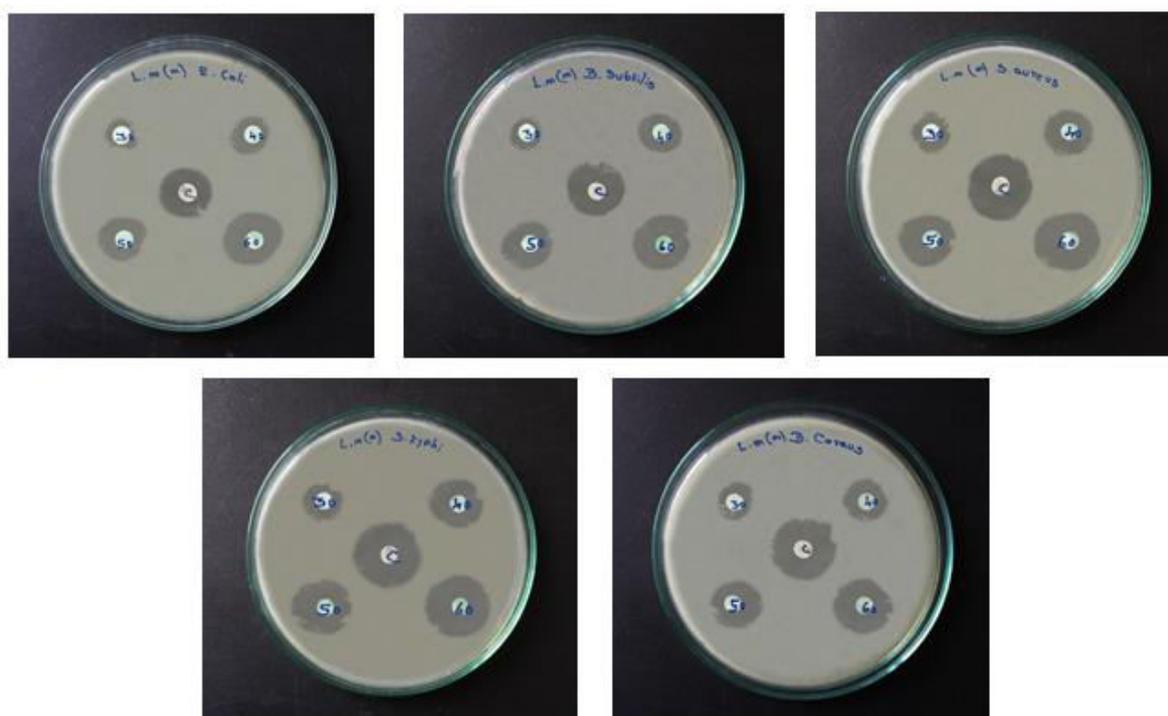
Table: Antimicrobial Activity of *L.microcarpa* in Methanol Extract

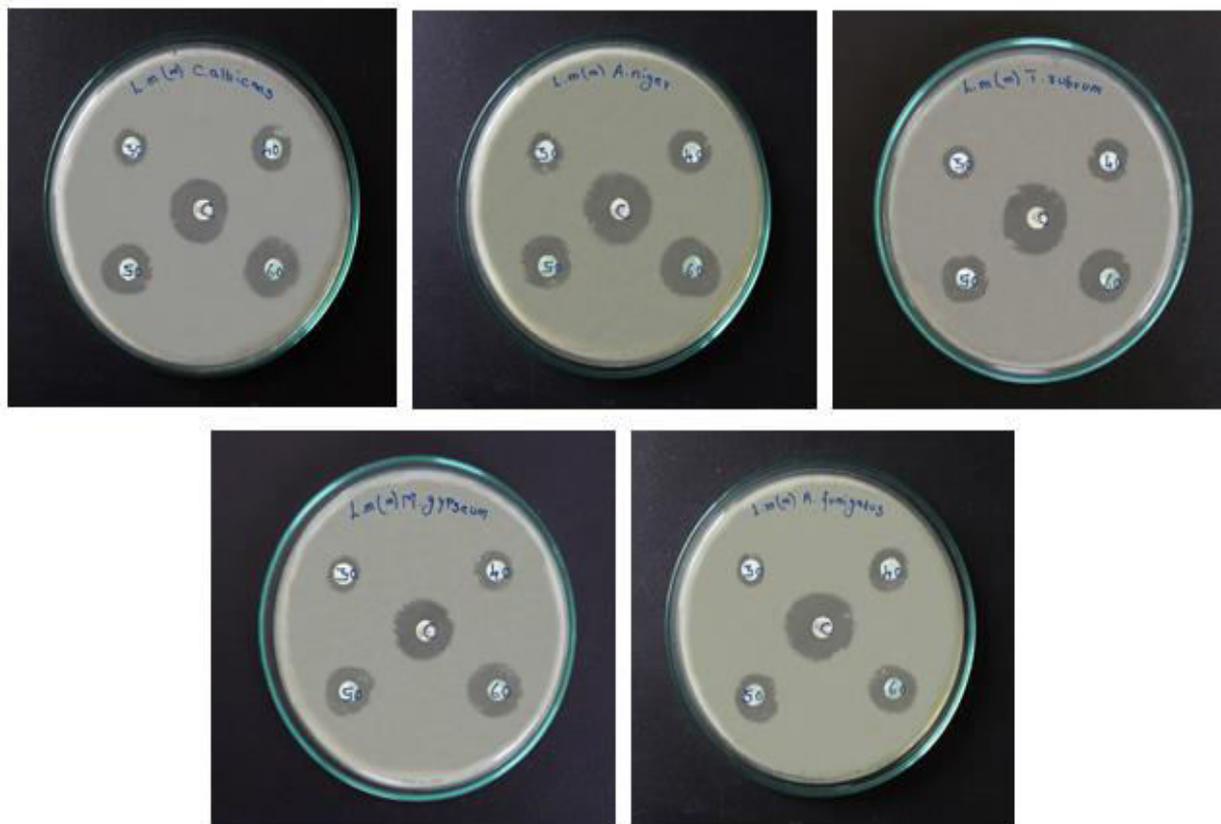
Organisms		Control	Concentration (µl)			
			30	40	50	60
Bacteria	Escherichia coli	17	9	12	15	17
	Bacillus subtilis	18	9	12	16	18
	Staphylococcus aureus	19	10	14	18	21
	Salmonella typhi	22	14	17	20	22
	Bacillus cereus	21	11	14	16	19
Fungal	Candida albicans	18	9	12	14	18
	Aspergillus niger	22	11	13	15	18
	Trichophyton rubrum	18	10	13	15	17
	Aspergillus fumigatus	23	9	13	15	17
	Microsporium gypseum	19	10	12	15	18



Five antibacterial organisms (*E. coli*, *B. subtilis*, *S. aureus*, *S. typhi* and *B. cereus*) and the antifungal activity (*C. albicans*, *A. niger*, *T. rubrum*, *A. fumigatus* and *M. gypseum*) were tested. The antibacterial activity for *E. coli* (17mm), *B. subtilis* (18mm), *S. aureus* (21mm), *S. typhi* (22mm) and *B. cereus* (19mm) with the highest inhibition in antibacterial activity seen in *S. typhi* next to it is *S. aureus*. The Antifungal activity for *C. albicans* (18mm), *A. niger* (18mm), *T. rubrum* (17mm), *A. fumigatus* (17mm) and *M. gypseum* (18mm) with the highest inhibition in antifungal activity is seen in *C. albicans*, *A. niger* and *M. gypseum*.

Antibacterial Plates of Lagerstroemia Macrocarpa in Methanol Extract





Antifungal Plates of Lagerstroemia Macrocarpa in Methanol Extract

The development of drug resistance in bacteria and fungus (microbes) led to the current endeavour. Agar well-diffusion method was used for antimicrobial screening using a standard protocol of clinical laboratory prescribed by national committee (Wayne, 2011). Antibiotics made from extracted plants are secure, efficient, and rarely cause adverse effects (Rehman et al., 2015). The biological activity of the active phytochemicals, such as the antibacterial action against infections, aids in the development of new antibiotic medicines (Sharifi-Rad, 2016; Alghazeer et al., 2012; Edziri et al., 2010).

Because of differences in membrane structure and composition, two strains of gram-positive and gram-negative bacteria have different sensitivities (Lambert, 2002). Numerous studies found that gram-positive bacteria from different plant species had higher potential activity than gram-negative bacteria (Afolayan, 2003; Nair and Chanda, 2007; Yaghoubi et al., 2007; Turker et al., 2009). The cell membrane and cell wall structure of *S. aureus* are responsible for its potential sensitivity (Zaika, 2007). Negative strain bacteria have an exterior impermeable membrane that, in effect, can reduce the amount of antibiotics in the cell and cause it to develop resistance (Bockstael and Aerschot, 2009).

CONCLUSION

In this study, antimicrobial activities of *L. microcarpa* traditional medicinal plants were assessed by Soxhlet apparatus method. The extraction were carried out using methanol and acetone extract. The yield percentage was high in methanolic extract. The preliminary phytochemical analysis was carried out for both the extract. The methanolic extract shows more phytoconstituents than methanolic extract. Antimicrobial activity was carried out for ten organism's gram positive, gram negative and fungal organisms. The result showed potential antibacterial effects of *L. microcarpa* extracts against bacterial strains tested. The extract of *L. microcarpa* also exhibited antifungal activity. To assess the researched plant extracts as a potential antibacterial agent, it is also necessary to study additional plant sections. For the investigation of the antimicrobial activity of plant extracts, essential oils, and the chemicals extracted from them, some broad principles must be established. The defining of common parameters, such as plant material, methodologies used, growth media, and microorganisms tested, is of vital importance. The selection of the plant material should be based on scientific standards. Additionally, the selection of plants should be based on to an ethno-pharmacological in order to avoid the use of random criteria.

REFERENCES

1. Afolayan A. J., 2003. Extracts from the shoots of *Arctotis arctotoides* inhibit the growth of bacteria and fungi, *Pharmaceutical Biology*, 41(1), 22–25, 2003.
2. Akacha L., Dikko J., Khan M., Anyam J., and Igoli, 2016. Phytochemical screening and antimicrobial activity of *bryophyllum pinnatum* extracts, *British Biotechnology Journal*, 16(2), 1–8.
3. Alghazeer R., El-Saltani H., Saleh N., Al-Najjar A., and Hebail F., 2012. Antioxidant and antimicrobial properties of five medicinal Libyan plants extracts, *Natural Science*, 4(5), 324–335.
4. Amiri H., 2012. Volatile constituents and antioxidant activity of flowers, stems and leaves of *Nasturtium officinale* R. Br, *Natural Product Research*, 26(2), 109–115.
5. Anand, U.; Jacobo-Herrera, N.; Altemimi, A.; Lakhssassi, N. A Comprehensive Review on Medicinal Plants as Antimicrobial Therapeutics: Potential Avenues of Biocompatible Drug Discovery. *Metabolites* 2019, 9, 258.
6. Aslam, B.; Wang, W.; Arshad, M.I.; Khurshid, M.; Muzammil, S.; Rasool, M.H.; Nisar, M.A.; Alvi, R.F.; Aslam, M.A.; Qamar, M.U.; et al. Antibiotic resistance: A rundown of a global crisis. *Infect. Drug Resist.* 2018, 11, 1645–1658.
7. Bauer, A.; Kirby, W.; Sherris, J. C.; Turck, M. Antibiotic susceptibility testing by a standardized single disk method. *Am. J. Clin. Pathol.* 1966, 45, 493–496.
8. Bockstael K., and Aerschot, 2009. Antimicrobial resistance in bacteria, *Open Medicine*, 4(2), 141–155.
9. Boots, A.W.; Haenen, G.R.; Bast, A. Health effects of quercetin: From antioxidant to nutraceutical. *Eur. J. Pharmacol.* 2008, 585, 325–337
10. Brain K.R., and Tuner T.D., 1975. The practical evaluation of phyto pharmaceuticals. Wright Scientifica Publishers, Bristol. 57-58.
11. Caleja C, Barros L, Antonio A L, Carochio M, Oliveira M B, and Ferreira I C (2016). Fortification of yogurts with different antioxidant preservatives: a comparative study between natural and synthetic additives. *Food Chem.* 210, 262–268. doi: 10.1016/j.foodchem.2016.04.114
12. Clarke D, Tyuftin A A, Cruz-Romero, M C, Bolton D, Fanning S, Pankaj S K, et al. (2017). Surface attachment of active antimicrobial coatings onto conventional plastic-based laminates and performance assessment of these materials on the storage life of vacuum-packaged beef sub-primals. *Food Microbiol.* 62, 196–201. doi: 10.1016/j.fm.2016. 10.022.
13. Crag GM, Newman D, Ann J, Acad NY. (2001). *Sci.* 953, 3.
14. Cushnie T. P. T., and Lamb A. J., 2005. Antimicrobial activity of flavonoids, *International Journal of Antimicrobial Agents*, 26(5), 343–356.
15. Edziri H., Mastouri M., Chéraif I., and Aouni M., 2010. Chemical composition and antibacterial, antifungal and antioxidant activities of the flower oil of *Retama raetam* (Forssk.) webb from Tunisia,” *Natural Product Research*, 24(9), 789–796.
16. Epanand R. F., Savage P. B., and Epanand R. M., 2007. Bacterial lipid composition and the antimicrobial efficacy of cationic steroid compounds (Ceragenins), *Biochimica et Biophysica Acta (BBA)—Biomembranes*, 1768(10), 2500–2509.
17. Evans, W.C., Trease, and Evans, 1996. *Pharmacognosy*. 14th Ed. London: WB Saunders Ltd; 119–159.
18. Fernández-López J, Zhi N, Aleson-Carbonell L, Pérez-Alvarez J A, and Kuri V (2005). Antioxidant and antibacterial activities of natural extracts: application in beef meatballs. *Meat Sci.* 69, 371–380. doi: 10.1016/j.meatsci. 2004.08.004
19. Ge. Y., Difuntorum. S., Touami. S., Critchley. I., Burli. R., Jiang. V., Drazan. K., Moser. H., 2002. In vitro antimicrobial activity of GSQ1530, a new heteroaromatic polycyclic compound. *Antimicrobial Agents and Chemotherapy* 46: 3168-3174.
20. Gyawali R, and Ibrahim S A (2014). Natural products as antimicrobial agents. *Food Control* 46, 412–429. doi: 10.1016/j.foodcont.2014.05.047

21. Harborne J.B., (1973). *Phytochemical Methods*, Chapman and Hall, Ltd., London, 49-188.
22. Hatab S, Athanasio R, Holley R, Rodas-Gonzalez A, and Narvaez-Bravo C (2016). Survival and reduction of shiga toxin-producing *Escherichia coli* in a fresh cold-pressed juice treated with antimicrobial plant extracts. *J. Food Sci.* 81, 1987–1995. doi: 10.1111/1750-3841.13382
23. Hernandez N. E., Tereschuk M. L., and Abdala L. R., 2000. Antimicrobial activity of flavonoids in medicinal plants from Tafi del Valle (Tucuman, Argentina), *Journal of Ethnopharmacology*, 73(1-2), 317–322.
24. Herouart. D., Sangwan. R.S., Fliniaux. M.A., Sangwan- Norreel. B.S., 1988. Variations in the Leaf Alkaloid Content of Androgenic Diploid Plants of *Datura innoxia*. *Planta Med* 54: 14-17.
25. Karunyadevi S, Arun N, Surekha V. Screening of phytochemical compounds, antioxidant and antimicrobial activity of *Aloe vera* And *Arkaa*. *Advanced Biotech.* 2009; 9: 38-43.
26. Krishnaiah D., Devi T., Bono A., Sarbatly R., (2009). Studies on phytochemical constituents of six Malaysian medicinal plants. *J. Med. Plants Res.*, 3(2): 67-72.
27. Lambert P. A., 2002. Cellular impermeability and uptake of biocides and antibiotics in gram-positive bacteria and mycobacteria, *Journal of Applied Microbiology*, 92(1), 46S–54S.
28. Loliger. J., 1991. The use of antioxidants in food. In. O. I. Aruoma, & B. Halliwell (Eds.), *Free radicals and food additives*. pp. 129-150.
29. Nair R., and Chandra S., 2007. Antibacterial activities of some medicinal plants of the western region of India, *Turkish Journal of Biology*, 31(4), 231–236.
30. Nair. R., Chanda. S., 2005 Anticandidal activity of *Punica granatum* exhibited in different solvents. *Pharmaceutical Biology* 43: 21-25.
31. Neogi. U., Saumya. R., Mishra. R.K., Raju. K.C. 2008. Lipid content and in vitro-antimicrobial activity of oil of some Indian medicinal plants. *Current Research in Bacteriology* 1: 1-6.
32. Rehman A., Rehman A., and Ahmad I., 2015. Antibacterial, antifungal, and insecticidal potentials of *Oxalis corniculata* and its isolated compounds, *International Journal of Analytical Chemistry*, Article ID 842468.
33. Rossolini, G.M.; Arena, F.; Pecile, P.; Pollini, S. Update on the antibiotic resistance crisis. *Curr. Opin. Pharmacol.* 2014, 18, 56–60.
34. Sanjoaquin M. A., Appleby P. N., Spencer E. A., and Key T. J., 2004. Nutrition and lifestyle in relation to bowel movement frequency: a cross-sectional study of 20 630 men and women in EPIC-Oxford,” *Public Health Nutrition*, 7(1), 77–83.
35. Sato Y., Shibata H., Arai T., 2004. Variation in synergistic activity by flavone and its related compounds on the increased susceptibility of various strains of methicillin-resistant *Staphylococcus aureus* to β -lactam antibiotics, *International Journal of Antimicrobial Agents*, 24(3), 226–233.
36. Savithramma N., Rao M.L., and Suhrulatha D., 2011. Screening of medicinal plants for secondary metabolites, *Middle-East Journal of Scientific Research*, 8 (3), 579–584.
37. Sharifi-Rad J., 2016. Herbal antibiotics: moving back into the mainstream as an alternative for “superbugs”, *Cellular and Molecular Biology*, 62(9), 1-2.
38. Shirwaikar A., Rajendran K., and Barik R., 2007. Effect of *Garuga pinnata*. Roxb aqueous bark extract on tissue antioxidant activity in streptozotocin-nicotinamide-induced type II diabetic rats, *Pharmaceutical Biology*, 45(3), 205–209.
39. Siddhuraju P., and Decker K., (2003). Antioxidant properties of various solvent extracts of total phenolic constituents from three different agro-climatic origins of drumstick tree (*Moringa oleifera* Lam) leaves. *Journal of Agriculture and Food Chemistry*, 51(8), 2144- 2155.
40. Suffredini, I.B.; Sader, H.S.; Gonçalves, A.G.; Reis, A.O.; Gales, A.C.; Varella, A.D.; Younes, R.N. Screening of antibacterial extracts from plants native to the brazilian amazon rain forest and atlantic forest. *Braz. J. Med. Biol. Res.* 2004, 37, 379–384.

41. Topping D. L., and Clifton P. M., 2001. Short-chain fatty acids and human colonic function: roles of resistant starch and nonstarch polysaccharides, *Physiological Reviews*, 81(3), 1031–1064.
42. Turker H., Yıldırım A. B., and Karakaş F. P., (2009). Sensitivity of bacteria isolated from fish to some medicinal plants,” *Turkish Journal of Fisheries and Aquatic Sciences*, 9 (2).
43. Wayne P., *Performance Standards for Antimicrobial Susceptibility Testing*, Clinical and Laboratory Standards Institute, Wayne, PA, USA, 2011.
44. Westh H, Zinn CS, Rosdahl VT. (2004). An international multicenter study of antimicrobial consumption and resistance in *Staphylococcus aureus* isolated from 15 hospitals in 14 countries. *Microbe Drug Resist.* 10, 169-176.
45. WHO. (2005). World Health Organization Geneva. *Global Atlas of Traditional, Complementary and Alternative Medicine*. 2 vol. set. Vol. 1 contains text and vol. 2, maps.
46. Yaghoubi M., Gh G., and Satari R., 2007. Antimicrobial activity of Iranian propolis and its chemical composition, *DARU Journal of Pharmaceutical Sciences*, 15(1), 45–48.
47. Zaika L. L., 2007. Spices and herbs: their antimicrobial activity and its determination 1, *Journal of Food Safety*, 9(2), 97–118.

Biosynthesis of Silver Nanoparticles Using Euphorbia Hirta and Euphorbia Heterophylla Methanolic Leaf Extract and Their Synthesis, Characterization, Antibacterial and Antioxidant Activity

Shameem A*, Akilan P, Chandrasekaran V and Bhadusha N

Department of Chemistry, Government Arts College (Autonomous), Salem -7, India

ABSTRACT

Biosynthesized nanoparticles are gaining popularity due to their distinctive biological applications as well as biologically active secondary metabolites from plants that aid in green synthesis. In order to synthesize silver nanoparticles, this research used the antibacterial and antioxidant properties of the leaves of Euphorbia hitra (E.hitra) and Euphorbia heterophylla (E.heterophylla) in methanolic leaf extract. The reaction of 5% methanolic leaf extract of E. hitra and 1 mM silver nitrate developed AgNPs. The antibacterial and antioxidant activity of the AgNPs was properly evaluated and described. Silver nanoparticles (AgNPs) synthesized by E.hitra and E.heterophylla were examined using a variety of methods, including scanning electron microscopy, Fourier transform infrared (FTIR) spectroscopy, and UV-visible spectroscopy (SEM). To identify the phytochemicals in charge of the reduction and capping of the biosynthesized AgNPs, phytochemical analysis was carried out. Utilizing the DPPH, ABTS, and Reducing Power Assays, the antioxidant activity of the biosynthesized nanoparticles was assessed. They were examined for antibacterial activity against Salmonella typhi, Escherichia coli, Bacillus subtilis, Staphylococcus aureus and Klebsiella pneumonia. With a significant zone of inhibition and dosage-dependent inhibitory activity, the biosynthesized nanoparticles were more effective against S.typhi and E.coli than other organisms. It is important to even further utilise the biosynthesized E. heterophylla AgNPs as a potential candidate for antioxidant and antibacterial activities.

Keywords: E.hitra, E.heterophylla, Methanolic extract, UV-visible spectroscopy, FTIR, SEM and Green synthesis.

INTRODUCTION

Due to their unrivalled abundance of chemical diversity, natural products such as plant extracts, whether in the form of pure chemicals or standardised extracts, provide unlimited prospects for the discovery of novel drugs (Cosa et al., 2006). More than 80% of the world's population relies on traditional medicine for their primary healthcare requirements, according to the World Health Organization (WHO). Due to global issues related to environmental concerns, "green" environmentally friendly procedures in chemistry and chemical technologies are becoming ever more popular and essential (Thuesombat et al., 2014). One of the most widely used nano-materials is silver, which is produced in five hundred tonnes annually (Larue et al., 2014) and is expected to grow over the next few years. The main and most affordable source of medicinal plants and plant products is Indian greeneries. These therapeutic plants have been used extensively in Ayurveda for ages. Because of their unique chemical composition and wide range of applications in numerous emerging disciplines of research and development, many such plants have recently started to gain attention. One of the most active fields of study in modern material science is called nano-biotechnology, where plants and various plant products are used crucially in the creation of nanoparticles (NPs). NPs are often defined as particles with a size of less than 100 nm. Compared to the larger particles of the mass material from which they were formed, these particles have shown entirely new and improved features in terms of size, distribution, and morphology (Van den Wildenberg, 2005). It is generally known that NPs of noble metals, such as gold, silver, and platinum, have important uses in electronics, magnetics, optoelectronics, and information storage (Gratzel, 2001, Okuda et al., 2005; Dai and Bruening, 2002; Murray et al., 2001).

It is known to have potent inhibitory and bactericidal effects in addition to its significance in the fields of high sensitivity bio-molecular detection, catalysis, biosensors, and medicine. It also has anti-fungal, anti-inflammatory, and anti-angiogenesis actions (El-Chaghaby & Ahmad, 2011; Veerasamy et al., 2011). Greener methods for creating nanoparticles are also superior to conventional ones since they are rapid, quick, inexpensive, environmentally friendly, and generally reproducible, and they frequently produce more stable compounds (Mittal et al., 2014). Nanoparticles can also be created using microorganisms, but their production proceeds more slowly than it does while using plant-mediated synthesis (Ahmed et al., 2015). The potential of higher plants as a source, however, has basically gone unexplored.

Due to its extensive range of applications in microbiology, chemistry, food technology, cell biology, pharmacology, and parasitology, silver nanoparticles (NPs) are among metal NPs that are attracting a great deal of attention from the research community (Nour et al., 2019). The silver nanoparticles' shape determines both their physical and chemical characteristics (Bondarenko et al., 2013). Basically, a variety of ways have been used to create silver nanoparticles, including the sol-gel method, hydrothermal method, chemical vapour deposition, thermal decomposition, microwave-assisted combustion method, etc (Pal et al., 2009; Wu et al., 2012; Zhang et al., 2019). Recent years have seen a large amount of research on the bio-genic synthesis of silver nanoparticles (AgNPs) employing biomaterials like plant extract and bacteria as reducing agents (Remya et al., 2019; Rafique et al., 2017). AgNPs are created when various biomolecules, including flavonoids, ketones, aldehydes, tannins, carboxylic acids, phenolic, and the protein of plant extracts, oxidise Ag⁺ to Ag⁰.

Around the world, euphorbia plants are abundant in nature and range from herbs and shrubs to trees in both tropical and temperate climates (Bremer, 1994). It is a locally used remedy known as spurge weed (Mosango, 2008). The largest genus, Euphorbia, has over 1600 species, while there are 280 genera and 730 species in the family Euphorbiaceae overall. In India, *E. hirta* and *E. heterophylla* are quite important economically. Small new-borns with skin diseases are bathed in a cool leaf extract. In traditional medicine, it is used to treat female diseases. The plant has been utilised for many female disorders due to its milky latex, which is known to increase milk flow in women, according to a variety of ethno-medical types of literature (Al-Snafi, 2017). Additionally, it indicated that the herb is utilised as a treatment for stiffness, diabetes, inflammation, and cancer (Patil et al., 2009). They typically have distinctive milky latex. Traditional medicine makes use of *E. heterophylla* leaf as a laxative, anti-gonorrhoea, migraine, and heart remedy. Fish poison and pesticides have been made from plant latex in the past (Falodun et al., 2003). In the field of biomedical research, systematic plant screening with the goal of finding new bioactive chemicals is a common practise. Therefore, to create silver nanoparticles and study their biological activity, crude extracts of *E. hirta* and *E. heterophylla* were employed.

MATERIALS AND METHODS

Collection and Preparation of Plant Materials

Fresh *E. hirta* and *E. heterophylla* plant leaves were randomly selected from the Yercaud area of the Salem District of Tamil Nadu. Soxhlet extraction was utilized to extract crude plant extract. A thimble was filled evenly with 20gm of powdered plant material, and 250ml of methanol solvent was used for the extraction. The extraction procedure should always be continued for 24 hours or until the solvent in the extractor's glass funnel appears colourless. The extract was then placed in a beaker and heated on a hot plate at 30 to 40 degrees Celsius until the solvent fully evaporated.

Synthesis of Silver Nano-Particles

The silver nitrate solution 100 ml of a 1 mM solution was prepared. 9 ml of 1 mM silver nitrate was combined with 1 ml of plant extract. Throughout the experiment, the aqueous leaf extracts of the *E. hirta* and *E. heterophylla* leaf and silver nitrate solution were utilised as a control (Smetana et al., 2005). 200 ml of the finished solution was centrifuged for 25 minutes at 18,000 rpm. At -4^o C, the collected pellets were stored at that temperature. Around 50^o to 95^o C was used to heat the supernatant. During the heating process, the colour of the solution appeared to change.

Screening of Antibacterial Activity

The antibacterial activity was screened using the disc diffusion method (Bauer et al., 1966). Using Muller Hinton Agar (MHA) purchased from Hi-media, in vitro antibacterial activity was tested (Mumbai). 15 ml of molten medium was added to sterilised petri plates to produce the MHA plates. The 0.1% inoculum suspension was evenly swabbed onto plates just after plates had solidified for 5 minutes. The inoculums were then given 5 minutes to dry. The extracts were placed onto a 6 mm sterile disc at a concentration of 40 mg/disc. The loaded disc was placed on the medium's surface, the extract was given five minutes to diffuse, and the plates were then stored for a 24 hour incubation period at 37°C.

Characterization of Synthesised Silver Nanoparticles

Shimadzu UVe visible spectrophotometer was used to perform the UVe Vis spectral analysis (UV-1800, Japan). Between 200 and 800 nm, an UVe Visible absorption spectrophotometer with a resolution of 1 nm was utilized. The material was pipetted into a test tube with a volume of one millilitre, and then it was examined at room temperature. The average size of silver nanoparticles synthesized synthetically was determined using dynamic light scattering (Spectroscatter 201). The KBr pellet method was used to record FTIR spectra on a Perkin Elmer

4000-400 cm^{-1} platform. SEM, which operates at an accelerated voltage of 20 kV, was used to analyse the surface morphology and particle size.

Antioxidant Activity

Several recognized techniques were used to examine the in vitro antioxidant activity of all the extracts. The extract's final concentration and the standard solutions' final concentrations were 100, 200, 300, 400, and 500 $\mu\text{g/ml}$. Utilizing spectrophotometry, the absorbance was calculated in comparison to the equivalent blank solution.

Dpph Radical Scavenging Activity

DPPH radical scavenging activity was performed using Molyneux's technique (2004). Equal volumes of the test sample in methanol of various concentrations were added to 1.0 ml of 100.0 μM DPPH solution in methanol and incubated for 30 minutes in the dark. A spectrophotometer set at 514 nm was used to measure the absorbance and monitor the colouring change. The control tube received 1.0 ml of methanol instead of the test sample.

ABTS Radical Scavenging Activity

Re et al., (1999) determined the extract's ABTS radical-scavenging capacity. The reaction between 5 ml of 4.9 mM potassium persulfate ($\text{K}_2\text{S}_2\text{O}_8$) solution and 5 ml of 14 mM ABTS solution, stored at room temperature in the dark for 16 hours, led to the formation of the ABTS +cation radical. This solution was thinned down with ethanol before use to get an absorbance of 0.700 ± 0.020 at 734 nm. The plant extract was homogenized with 1 ml of ABTS solution at a range of concentrations, and its absorbance at 734 nm was measured. Each experiment included running ethanol blanks, and all measurements were completed at least six minutes later. Similar to this, 950 μl of ABTS+ solution and 50 μl of BHT were combined to create the reaction mixture for the standard group. The scavenging capacity of ABTS was measured as IC_{50} (g/ml), which reflects its antiradical activity.

Reducing Power Assay

The sample was spiked with 2.5ml of phosphate buffer (0.2 M, pH 6.6) and 2.5ml of 1% potassium ferricyanide in addition to solutions of ascorbic acid. For 20 minutes, the mixture was heated to 50°C in a water bath. After being quickly cooled, the resultant solution was spiked with 2.5 ml of 10% trichloroacetic acid and centrifuged at 3000 rpm for 10 min, distilled water, 1ml of 0.1% ferric chloride, and 5ml of supernatant were combined, and the mixture was incubated for 10 minutes. On a spectrophotometer, the absorbance was discovered at 700 nm. The graph of absorbance at 700 nm against extract concentration was used to determine the extract concentration which generated the absorbance (Oyaizu, 1986).

Percentage of inhibition was calculated from the equation

$$[(\text{Absorbance of test} - \text{Absorbance of control}) / \text{Absorbance of control}] \times 100.$$

IC_{50} value was calculated using Graph pad prism 5.0.

RESULT AND DISCUSSION

Using the solvents methanol extract, yield from the plant material of *E. hirta* and *E. heterophylla* were obtained. The methanol extract shows higher yield. Because of the surface plasmon vibrations, silver nanoparticles (AgNPs) appear yellowish brown in aqueous media (Krishnaraj et al., 2010). The colour of the solution changed as the leaf extracts were added to an aqueous silver nitrate solution, proceeding from a faint light to a yellowish brown to a reddish brown and finally to a colloidal brown, indicating the formation of AgNP (Lalitha et al., 2013). This confirmed that the reaction between the leaf extract and AgNO_3 had been finished. Both the aqueous extract and the crude extract of a plant sample were used to create the silver nanoparticles (Philip and Unni, 2011).

AgNPs have been synthesised using a variety of techniques, including chemical reduction, microwave-based systems, micro-emulsions, radiation, hybrid approaches, photochemical reduction, and sono-electrochemical processes. Recently, a green synthesis route has also been established (Socol et al., 2002; Solanki and Murthy, 2010; Nadagouda et al., 2011; Iravani et al., 2014). At present, bactericide is frequently used to stop and manage bacterial illnesses. However, because of severe environmental pollution and bacterial resistance caused on by the usage of chemicals in nations that grow rice, there is an increasing need for the development of novel prevention and control techniques. A significant amount of interest is being demonstrated in the application of biosynthesized AgNPs in the field of agriculture due to their antioxidant and broad range of antibacterial action as well as their eco-friendly, biocompatible, and economical character. The nanoparticles demonstrate many

bactericidal actions in addition to being reported for improving plant growth (Oves et al., 2013; Aziz et al., 2016; Qayyum et al., 2017; Mahawar and Prasanna, 2018).

UV Analysis

After dilution of a small aliquot of the sample into distilled water, the UV-Vis spectra of the reaction medium was measured to monitor the reduction of pure Ag⁺ ions. Visual observation was used to document the colour change in the reaction mixture (metal ion solution + *E. heterophylla* extract). The UV-Vis spectrophotometer UV-1800 (Shimadzu) was employed for the analysis that included the wavelength range of 200–800 nm. The presence of silver nanoparticles is shown by the UV analysis for synthetic methanolic *E. heterophylla* extract, which seems to be 427 nm. Using UV-Vis spectroscopy, the Ag nanoparticles that were generated in each extract solution were examined. Various quantities of AgNO₃ (from 1 mM to 5 mM) were created, and this was done to determine the characteristics of the peak spectrum of the Ag nanoparticle wavelength.

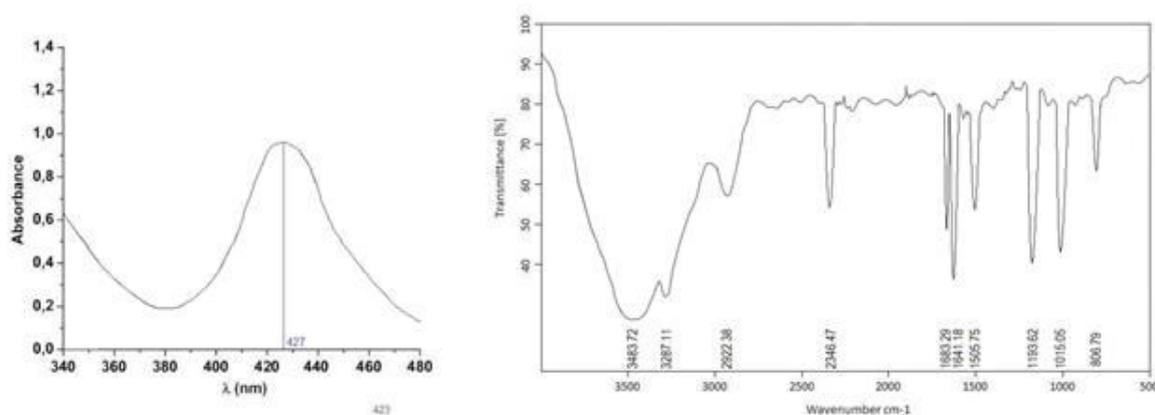


Figure 1: UV and FTIR Analysis of *E. heterophylla* in Synthesised Methanol Extract

FTIR Analysis

The AgNPs derived from each type of synthetic plant extract were characterised by FTIR analysis. According to Siddiqui et al., 2000 and Huang et al., 2007, these bands imply stretching vibrational bands that are responsible for substances like flavonoids and terpenoids, and they could thus be held responsible for the effective capping and stabilizing of produced AgNPs.

SEM And TEM Analysis

Using scanning electron microscopy, the silver nanoparticles made from *E. heterophylla* extract were examined (SEM). SEMs are a particular kind of electron microscope that produce images of samples by raster-scanning them with high-energy electron beams. Silver nanoparticle size and form were seen using the SEM technique. Figure displays the SEM pictures of the AgNPs. It can be observed that using various leaf extracts as reducing and capping agents led to the production of AgNPs in a variety of forms. This might be because the various leaf extracts include capping agents in varying amounts and types. The changes and differences in peak areas discovered by the FTIR study also support this.

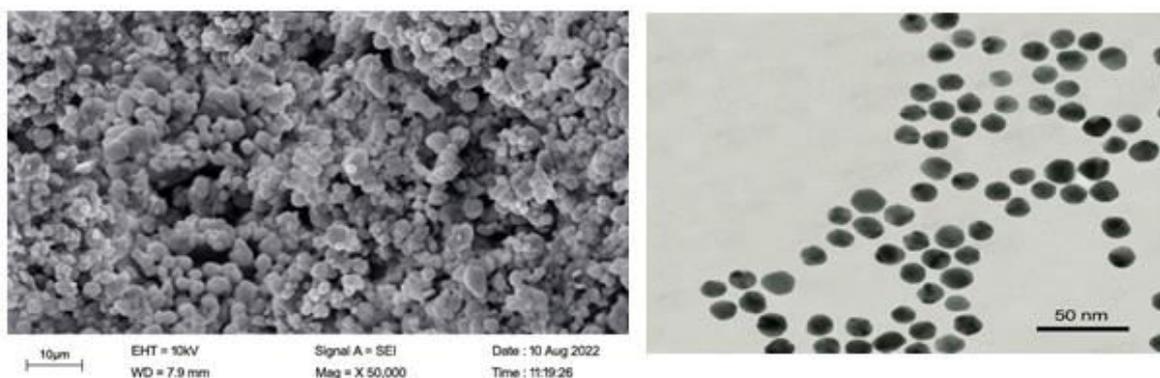


Figure 2: SEM and TEM Analysis of *E. heterophylla* in Synthesised Methanol Extract

Antioxidant Activity

It is well recognised that free radicals play a significant part in a wide range of clinical symptoms. Antioxidants save us from numerous diseases by combating free radicals. They either work by removing reactive oxygen species from the environment or by defending the antioxidant defence mechanisms (Umamaheswari and Chatterjee, 2008). The ability of natural products to donate electrons can be assessed by 2, 2-diphenyl-1-picrylhydrazyl radical (DPPH) solution bleaching (Nunes et al., 2012). *E. heterophylla* used to have an inhibition concentration of 263.97 $\mu\text{g/ml}$ and *E. hirta* had a value of 350.53 $\mu\text{g/ml}$ for the DPPH assay. The technique depends on the DPPH being scavenged by the addition of an antioxidant or radical species that renders the DPPH solution less colourful. The concentration and potency of the antioxidants are negatively correlated with the degree of colour change. Considerable free radical scavenging activity of the test compound is demonstrated by a significant decrease in the absorbance of the reaction mixture. (Krishnaiah et al., 2011).

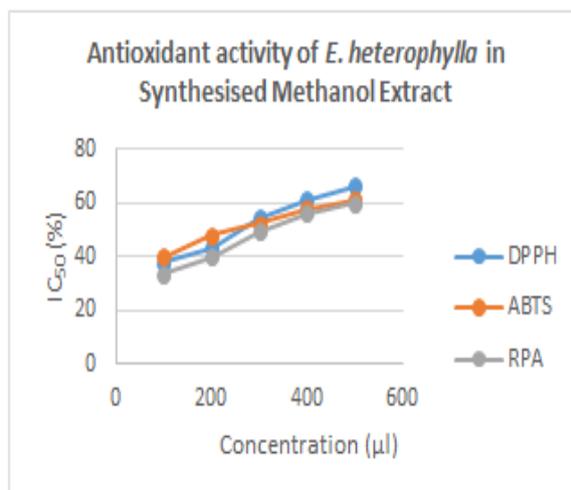
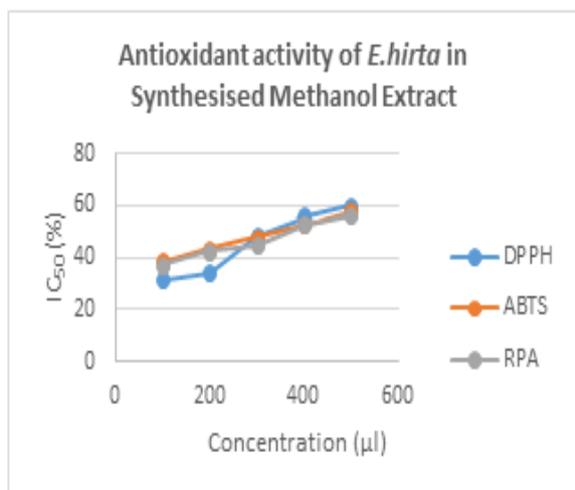
The ABTS radical scavenging assay uses a technique that causes the reaction of ABTS with potassium persulfate to produce a blue/green ABTS+ chromophore. The oxidation of ABTS with potassium persulfate produces the ABTS radical cation, and the reduction of this radical in the presence of antioxidants that donate hydrogen is detected spectrophotometrically at 745 nm. *E. heterophylla* had an inhibition concentration of 261.90 $\mu\text{g/ml}$ and *E. hirta* had one of 341.93 $\mu\text{g/ml}$ for the ABTS assay. Strong ABTS scavenging activity was present in all of the fractions, which is a discovery that is confirmed by other researchers (Sahreen et al., 2010).

Table 1: Antioxidant activity of *E.hirta* in Synthesised Methanol Extract

Concentration	DPPH assay		ABTS Assay		RPA assay	
	%IC ₅₀	IC ₅₀	%IC ₅₀	IC ₅₀	%IC ₅₀	IC ₅₀
100	31.47	350.53	38.62	341.93	37.16	365.94
200	34.27		43.45		42.57	
300	48.25		47.59		44.59	
400	55.94		52.41		52.70	
500	60.14		57.93		56.76	

Table 2: Antioxidant activity of *E. heterophylla* in Synthesised Methanol Extract

Concentration	DPPH assay		ABTS Assay		RPA assay	
	%IC ₅₀	IC ₅₀	%IC ₅₀	IC ₅₀	%IC ₅₀	IC ₅₀
100	37.76	263.97	40.00	261.90	33.78	331.46
200	43.36		48.28		39.86	
300	54.55		52.41		49.32	
400	61.54		57.93		56.08	
500	66.43		61.38		60.14	



In a reducing power assay, the test solution's yellow colour turns to green depending on the test specimen's reducing power. The Fe³⁺/ferric cyanide complex is reduced to the ferrous form in the presence of the reductants in the solution. As a result, the measurement of absorbance at 700 nm can be used to monitor Fe²⁺. For the reducing power assay, it was observed that *E. heterophylla* had an inhibition concentration fifty percent of 261.90 $\mu\text{g/ml}$ while *E. hirta* had a value of 365.94 $\mu\text{g/ml}$. According to earlier reports, the reducing

characteristics have been demonstrated to have antioxidant effects by donating an atom of hydrogen to break the chain of free radicals (Gordon, 1990).

Antibacterial Activity

By developing Bacillus and E. coli colonies on nutrient agar plates with AgNPs added, Bacillus and E. coli colonies were used in this study to examine the antibacterial property of AgNPs. The outcomes are displayed in Table 1. The obtained inhibition zones show that the test sample's antibacterial activity is at its peak. The antibacterial potential of AgNPs is also supported by findings from earlier studies. Five different species were tested for antibacterial activity: Salmonella Typhi, Escherichia coli, Bacillus subtilis, Staphylococcus aureus, and Klebsiella pneumonia. S. typhi (29 mm) was found to have a strong zone of inhibition, while E. coli was found to be nearly (28 mm).

Table 3: Antibacterial Activity in Synthesised Methanol extract of E. heterophylla

Organisms	Control	Concentration (μ l)			
		C30	C60	S30	S60
Klebsiella pneumoniae	19	12	20	19	25
Escherichia coli	18	15	22	20	28
Bacillus subtilis	20	10	18	19	22
Staphylococcus aureus	21	11	16	15	20
Salmonella Typhi	19	14	21	23	29

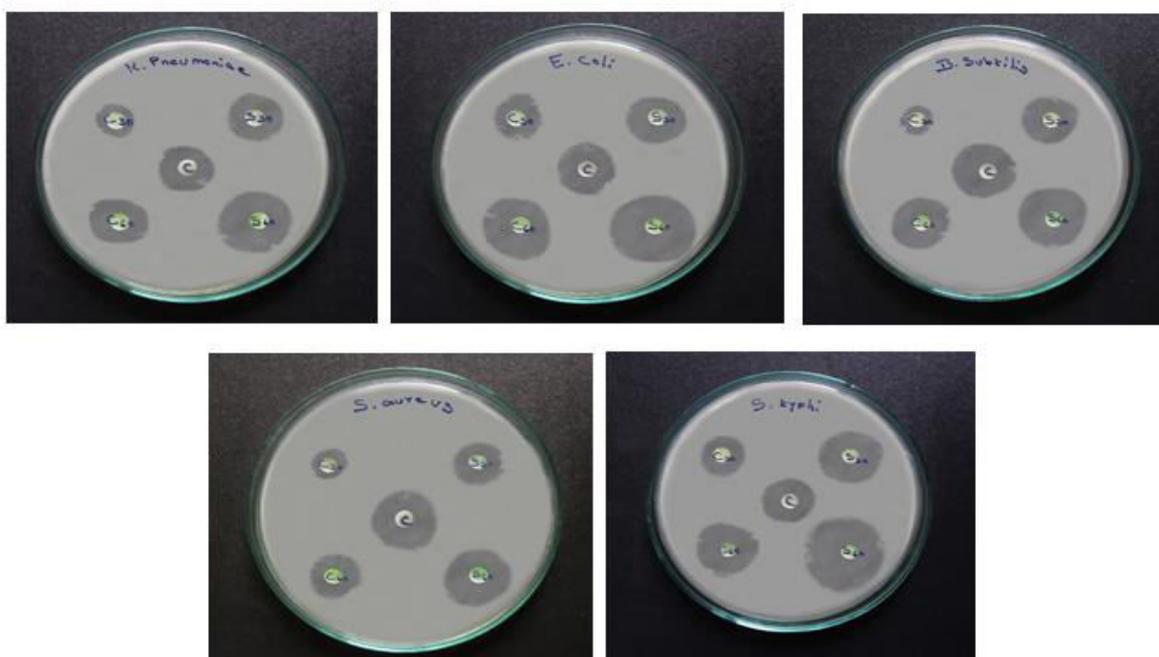
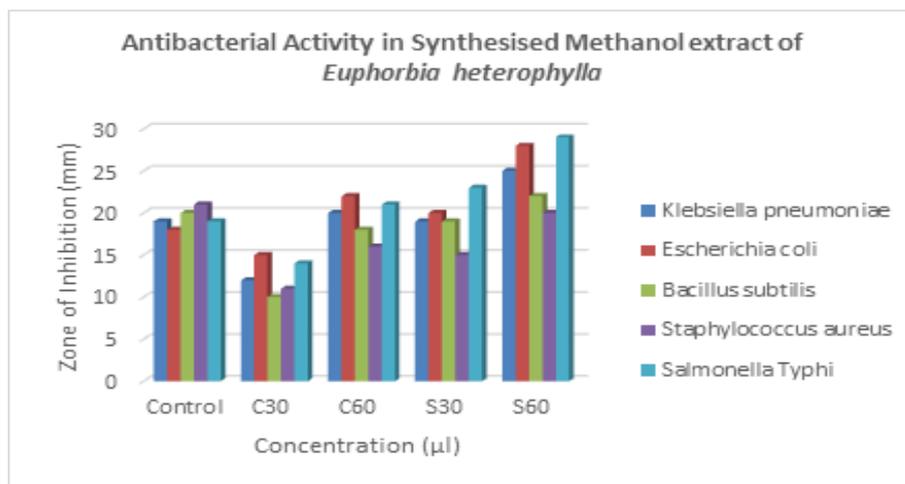


Figure 3: Antibacterial Activity in Synthesised Methanol extract of E. heterophylla

There is a severe problem with antibiotic resistance among bacterial strains. Genetic alterations may occur so quickly that standard antibiotics' potency could be lost in just five years (Chandra et al., 2017). The outcomes of the disc diffusion assay could be influenced by a variety of variables. First off, the diameter of the zones may not accurately reflect the strength of the extract's antimicrobial activity because it depends on the rate of diffusion of the antimicrobial ingredient (Eldeen et al., 2005; Turnidge et al., 2007).

CONCLUSION

The synthesised methanolic extract of *E. heterophylla* has shown superior performance in antioxidant/free radical scavenging activity as well as in antibacterial tests, which aids in modifications of disease prevention or control, according to recent research. Antioxidant activity is known to exist in natural products made from dietary components such Indian species and medicinal herbs. A biological system's regular physiological performance may be maintained by increasing dietary antioxidant consumption in order to maintain an acceptable antioxidant state. Humans have evolved a highly complex and sophisticated antioxidant defence system to protect the body's cells and organ systems against reactive oxygen species.

REFERENCES

1. Ahmed, S., Ahmad, M., Swami, B. L., & Ikram, S. (2015). Plants extract mediated synthesis of silver nanoparticles for antimicrobial applications: a green expertise. *Journal of Advance Research*. <http://dx.doi.org/10.1016/j.jare.2015.02.007>.
2. Aziz, N., Pandey, R., Barman, I., and Prasad, R. (2016). Leveraging the attributes of mucor hiemalis-derived silver nanoparticles for a synergistic broad-spectrum antimicrobial platform. *Front. Microbiol.* 7:1984. doi: 10.3389/fmicb.2016.01984.
3. Bauer, A.; Kirby, W.; Sherris, J. C.; Turck, M. Antibiotic susceptibility testing by a standardized single disk method. *Am. J. Clin. Pathol.* 1966, 45, 493–496.
4. Bondarenko, K. Juganson, A. Ivask, K. Kasemets, M. Mortimer and A. Kahru, *Arch. Toxicol.*, 2013, 87, 1181–1200.
5. Chandra H, Bishnoi P, Yadav A, Patni B, Mishra AP, Nautiyal AR (2017) Antimicrobial Resistance and the Alternative Resources with Special Emphasis on Plant-Based Antimicrobials-A Review. *Plants (Basel, Switzerland)* 6(2):16
6. Cosa, P., Vlietinck, A.J., Berghe, D.V., Maes, L. (2006). Anti-infective potential of natural products: How to develop a stronger in vitro 'proof-of-concept'. *J. Ethnopharmacol.* 106: 290–302.
7. Dai J, Bruening ML (2002) Catalytic nanoparticles formed by reduction of metal ions in multilayered polyelectrolyte films. *Nano Lett* 2:497–501.
8. El-Chaghaby, G. A., & Ahmad, A. F. (2011). Biosynthesis of silver nanoparticles using pistacia lentiscus leaves extract and investigation of their antimicrobial effect. *Oriental Journal of Chemistry*, 27, 929e936.
9. Eldeen I. M. S., E. E. Elgorashi, and J. van Staden, "Antibacterial, anti-inflammatory, anti-cholinesterase and mutagenic effects of extracts obtained from some trees used in South African traditional medicine," *Journal of Ethnopharmacology*, vol. 102, no. 3, pp. 457–464, 2005.
10. Gordon MH: The mechanism of antioxidant action in vitro. In *Food antioxidants*. Edited by Hudson BJ. London: Elsevier Applied Science; 1990: pp. 1–pp. 18.
11. Gratzel M (2001) Photoelectrochemical cells. *Nature* 414:338–344
12. Huang Q, Li D, Sun Y, Lu Y, Su X, Yang H, Wang Y, Wang W, Shao N, Hong J, Chen C: Biosynthesis of silver and gold nanoparticles by novel sundried *Cinnamomum camphora* leaf. *Nanotechnol* 2007, 18: 105104. [10.1088/0957-4484/18/10/105104](https://doi.org/10.1088/0957-4484/18/10/105104).
13. Iravani S., Korbekandi H., Mirmohammadi S. V., Zolfaghari B. (2014). Synthesis of silver nanoparticles: chemical, physical and biological methods. *Res. Pharm. Sci.* 9 385–406.
14. Krishnaiah D, Sarbatly R, Nithyanandam RR: A review of the antioxidant potential of medicinal plant species. *Food Bioprod Process* 2011, 89:217–233.
15. Krishnaraj C, Jagan EG, Rajasekar S, Selvakumar P, Kalaichelvan PT, Mohan N (2010) Synthesis of silver nanoparticles using *Acalypha indica* leaf extracts and its antibacterial activity against water borne pathogens. *Colloids Surf B: Biointerfaces* 76:50–56.

16. Lalitha, A., Subbaiya, R and Ponmurugan.P (2013). Green synthesis of silver nanoparticles from leaf extract *Azadirachta indica* and to study its anti-bacterial and antioxidant property, 2(6): 228-235
17. Larue, C., Castillo-Michel, H., Sobanska, S., Ceccillon, L., Bureau, S., Barthes, V., et al. (2014). Foliar exposure of the crop *Lactuca sativa* to silver nanoparticles: evidence for internalization and changes in Ag speciation. *Journal of Hazardous Materials*, 264, 98e106.
18. Mahawar H., Prasanna R. (2018). Prospecting the interactions of nanoparticles with beneficial microorganisms for developing green technologies for agriculture. *Environ. Nanotech. Monitor Manage* 10 477–485. 10.1016/j.enmm.2018.09.004.
19. Mittal, J., Batra, A., Singh, A., & Sharma, M. M. (2014). Phytofabrication of nanoparticles through plant as nanofactories. *Advances in Natural Sciences: Nanoscience and Nanotechnology*, 5. [http:// dx.doi.org/10.1088/2043-6262/5/4/043002](http://dx.doi.org/10.1088/2043-6262/5/4/043002), 043002.
20. Molyneux, P. (2004). The use of the stable free radical diphenylpicrylhydrazyl (DPPH) for estimating antioxidant activity. *Songlanakarin Journal of Science and Technology*, 26, 211-219.
21. Murray CB, Sun S, Doyle H, Betley T (2001) Monodisperse 3d transitionmetal (Co, Ni, Fe) nanoparticles. *MRS Bull* 26:985–991.
22. Nadagouda M. N., Speth T. F., Varma R. S. (2011). Microwave-assisted green synthesis of silver nanostructures. *Acc. Chem. Res.* 44 469–478. 10.1021/ar1001457.
23. Nour S, N. Baheiraei, R. Imani, M. Khodaei, A. Alizadeh, N. Rabiee and S. M. Moazzeni, *J. Mater. Sci.: Mater. Med.*, 2019, 30, 120.
24. Nunes PX, Silva SF, Guedes RJ, Almeida S: Biological oxidations and antioxidant activity of natural products, *Phytochemicals as nutraceuticals - Global Approaches to Their Role in Nutrition and Health*. 2012.
25. Okuda M, Kobayashi Y, Suzuki K, Sonoda K, Kondoh T, Wagawa A, Kondo A, Yoshimura H (2005) Self-organized inorganic nanoparticle arrays on protein lattices. *Nano Lett* 5:991–993
26. Oves M., Aslam M., Rauf M. A., Qayyum S., Qari H. A., Khan M. S., et al. (2018). Antimicrobial and anticancer activities of silver nanoparticles synthesized from the root hair extract of *Phoenix dactylifera*. *Mater. Sci. Eng. C Mater. Biol. Appl.* 89 429–443. 10.1016/j.msec.2018.03.035.
27. Oyaizu, M. (1986). Studies on products of browning reactions: anti-oxidative activities of products of browning reaction prepared from glucosamine. *Japanese Journal of Nutrition*, 44, 307–315.
28. Pal A., S. Shah and S. Devi, *Mater. Chem. Phys.*, 2009, 114, 530–532.
29. Philip, D. and C. Unni, 2011. Extracellular biosynthesis of gold and silver nanoparticles using *Krishna tulsi* (*Ocimum sanctum*) leaf. *Physica E*, 43: 1318-1322.
30. Qayyum S., Oves M., Khan A. U. (2017). Obliteration of bacterial growth and biofilm through ROS generation by facilely synthesized green silver nanoparticles. *PLoS One* 12:e0181363. 10.1371/journal.pone.0181363.
31. Rafique M., I. Sadaf, M. S. Rafique and M. B. Tahir, *Artif. Cells, Nanomed., Biotechnol.*, 2017, 45, 1272–1291.
32. Re R, Pellegrini N, Proteggente A, Pannala A, Yang M, Riceevans C. Antioxidant activity applying an improved ABTS radical decolorization assay. *Free Radical Biology and Medicine* 1999; 26, 1231–1237.
33. Remya V. R., V. K. Abitha, P. S. Rajput, A. V. Rane and A. Dutta, *Chem. Int.*, 2019, 3, 165–171.
34. Sahreen S, Khan MR, Khan RA: Evaluation of antioxidant activities of various solvent extracts of *Carissa opaca* fruits. *Food Chem* 2010, 122:1205–1211.
35. Siddiqui BS, Afshan F, Faizi GS, Naqui SNH, Tariq RM: Two insecticidal tetranortriterpenoids from *Azadirachta indica*. *Phytochemistry* 2000, 53: 371–376. 10.1016/S0031-9422(99)00548-8.
36. Socol Y., Abramson O., Gedanken A., Meshorer Y., Berenstein L., Zaban A. (2002). Suspensive electrode formation in pulsed sono-electrochemical synthesis of silver nanoparticles. *Langmuir* 18 4736–4740. 10.1021/la015689f.

37. Solanki J. N., Murthy Z. V. P. (2010). Highly monodisperse and sub-nano silver particles synthesis via microemulsion technique. *Colloids Surfaces A Physicochem. Eng. Aspects* 359 31–38. 10.1016/j.colsurfa.2010.01.058.
38. Thuesombat, P., Hannongbua, S., Akasit, S., & Chadchawan, S. (2014). Ecotoxicology and environmental safety effect of silver nanoparticles on rice (*Oryza sativa* L. cv. KDML 105) seed germination and seedling growth. *Ecotoxicology and Environmental Safety*, 104, 302e309.
39. Turnidge J. D., M. J. Ferraro, and J. H. Jorgensen, “Susceptibility test methods: general considerations,” in *Manual of Clinical Microbiology*, P. R. Murray, E. J. Baron, J. H. Jorgensen, M. L. Landry, and M. A. Pfaller, Eds., pp. 1146–1151, ASM press, Washington, DC, USA, 9th edition, 2007.
40. Umamaheswari M, Chatterjee TK: In vitro antioxidant activities of the fractions of *Coccinia grandis* L. leaf extract. *African Journal of Traditional Compl Altern Med* 2008, 5:61–73.
41. Van den Wildenberg W (2005) Roadmap report on nanoparticles. W&W Espana sl, Barcelona, Spain
42. Veerasamy, R., Xin, T. Z., Gunasagaran, S., Xiang, T. F. W., Yang, E. F. C., Jeyakumar, N., et al. (2011). Biosynthesis of silver nanoparticles using mangosteen leaf extract and evaluation of their antimicrobial activities. *Journal of Saudi Chemical Society*, 15, 113e120.
43. Wu T., H. Shen, L. Sun, B. Cheng, B. Liu and J. Shen, *ACS Appl. Mater. Interfaces*, 2012, 4, 2041–2047.
44. Zhang X., H. Sun, S. Tan, J. Gao, Y. Fu and Z. Liu, *Inorg. Chem. Commun.*, 2019, 100, 44–50.
45. Al-Snafi AE. Pharmacology and Therapeutic Potential of *Euphorbia hirta* (Syn: *Euphorbia pilulifera*) - A Review. *IOSR Journal of Pharmacy*. 2017; 7(3): 07- 20.
46. Patil SB, Nilofar S, Naikwade NS, Magdum CS. Review on Phytochemistry and Pharmacological Aspects of *Euphorbia hirta* Linn. *J. Pharma. Res. Health Care*. 2009; 1(1):113-133.
47. Bremer K. *Asteraceae Cludistics and Classification*, Timber Press Portland Oregon, 1994.
48. Mosango D.M. *Euphorbia heterophylla* L. in: G.H Schumelzer and A.Gurib-Fakim, (Editors). *Prota* 11(1). Medicinal Plants PROTA, Wageninge: Netherlands, 2008.
49. Falodun A., E.O.P. Agbakwuru, and G.C.Ukoh. Antibacterial Activity of *Euphorbia heterophylla* Linn (Family Euphorbiaceae). *Pakistan Journal of. Scientific Research* 46(6), 2003, 471 – 472.

Cybernetic Ischemic Stroke Spotting With Machine Learning

Shravya Vasanth P and Pushpalatha R

Visvesvaraya Technological University Centre for PG Studies, Mysore- 570029, India

ABSTRACT

The prediction of the stroke type is a growing problem for world health. The current approach is manual, time-consuming, and calls for more qualified physicians. One of the most prevalent disorders nowadays in medicine is the prognosis of strokes. As early stroke illness and type prediction is challenging, our suggested method makes use of machine learning techniques to predict early stroke disease and associated kinds. Most research on robot-aided stroke diagnosis has concentrated on computer tomography (CT) and magnetic resonance imaging (MRI). The machine learning technique offers a generalized approach to resolving the issues. To predict the onset of a stroke infection, it uses a neural system that does order calculation. By using machine learning to foresee the onset of stroke illness, we can enhance the accuracy of the analytical forecasts and raise their consistency. Stroke prediction automation utilizing machine learning is the proposed approach.

I. INTRODUCTION

Strokes are the second most frequent cause of fatalities and are linked to severe and protracted impairment. A stroke is the abrupt loss of brain cells owing to oxygen deprivation, which is brought on by blood artery blockages or disruptions in the supply line to the brain. According to the World Health Organization, more people will die from strokes in the next year. Among the leading three causes of mortality and disability, stroke ranks third most frequently. A stroke is an attack on the mind that may happen at any moment. Vein blood cells have the potential to clot or burst.

In order to prevent further increases, dangerous situations should be resolved as soon as is practically practicable under the conditions. Every year, one million people worldwide have a stroke. Abilities include the ability to speak, see, move, or face distortions. An analogy to a heart attack, which causes heart damage a stroke is a serious and serious condition that affects the brain. Brain cells are not supplied with enough oxygen and blood flow. Everybody bears the gamble of stroke. A stroke can cause loss of development, sharp chest torment, trouble talking, loss of memory and mental capacity, foggy state or even death. Anyone of any age can suffer a stroke. Adjustable risk variables and useful controls can be used to balance them. According to research, the most common correctional errors occur when medications are used, not updated, incorrect assessments are made, and when the wrong patient is treated.

Generally speaking, three composers per stroke:

- Transient ischemic stroke
- Hemorrhagic stroke
- Ischemic stroke

II. RELATED WORKS

One of the chronic disorders caused by the deterioration of the nervous system is ischemic stroke, which causes serious injury and dramatically reduces people's quality of life. In the absence of outward signs, an ischemic stroke may be diagnosed or predicted by analyzing certain risk factors. It is important to derive effective predictors from physiological data. In this investigation, namely [1]. Allowing for Accurate Stroke Prediction via Analysis of Sleep-Related Factors, In 2018, IEEE PAPER Zhiwen Yu, Bin Guo, Jia Xie, and Zhu Wang They have implemented this plan with the use of free software tools for analyzing data, such as Rapid Miner. Rapid Miner's limitations include that although comparable programs like R-Tool and Weka Tool and Rapid Miner make it easy to gather data and create insights, they do not provide the verification or validation of those discoveries. The dataset that was used to make the forecast is rather little. Less trustworthy results using a support vector machine (SVM) and a random forest together. [2] Predicting stroke infections requires an ordered neural calculating method. Prediction of stroke illness using an artificial neural network increases analytical accuracy and consistency. Limitations include the difficulty in distinguishing between the graphical outputs generated by the Random Forest and SVM approaches due to the graphical approach. We utilized very little datasets. Static data from the UCI Machine Learning Repository is the dataset used in the implementation.

The classification method has two steps [3]. A clustering method creates a model from examination of a training data set in the first phase, known as the Learning Phase, which provides a set of class labels and established

ideas. The classification accuracy of the model is evaluated using a test data set in the second step, which is referred to as the Test Phase.

A genetics-based associative classification system is effective for illness prediction[8], the inspiration for this comes from the fact that a genetic algorithm may be used to find high-level prediction rules that are both easy to understand and very accurate and intriguing.

To minimise the number of variables required for an accurate prediction of the existence of heart disease. The risk of developing heart disease was first predicted using a list of 13 factors. In this research, we apply An genetic algorithm to identify the patient-reported characteristics most useful in making a diagnosis of heart disease[9], hence reducing the overall number of diagnostic procedures that patients must undergo. Using a genetic search algorithm, we were able to narrow down a list of thirteen characteristics to only six. Then, after reducing the number of features, the three classifiers are used to predict patients' prognosis with the same accuracy as before feature reduction. These classifications are naive base, classification by clustering and decision tree.

An automated feature selection approach[10], based on the heuristic of "Conservative mean," capable of selecting durable characteristics. The area under the ROC curve (AUC) obtained by our suggested feature selection strategy when utilized in combination with Support Vector Machines (SVMs) is much greater when compared to the Cox proportional hazards model and the L1 regularised Cox feature selection technique.

Different machine learning techniques for improved stroke prediction are analysed in this research. Analysis uses several methods, including Naive Bayes, Logistic Regression, Decision Tree, Random Forest, and Gradient Boosting. make use of an 11-factor dataset containing sociodemographic like age and gender and health indicators like body mass index. Univariate and multivariate plots are used [11] in the study of these characteristics to see how they are related to one another. Age, gender, and smoking status are all shown to be significant variables, but location is shown to be less so. Apache Spark, a multi-purpose distributed computing framework, is used to realise the suggested work.

Stroke prediction for clinical diagnosis utilising incomplete and diverse physiological data [12]; development of a hybrid machine learning technique. It's a two-stage deal. First, missing data were imputed using random forest regression, and then the data were classified. Second, we use an automated hyperparameter optimization (AutoHPO) method based on a deep neural network (DNN) for the problem of stroke prediction using an imbalanced data set.

METHODOLOGY

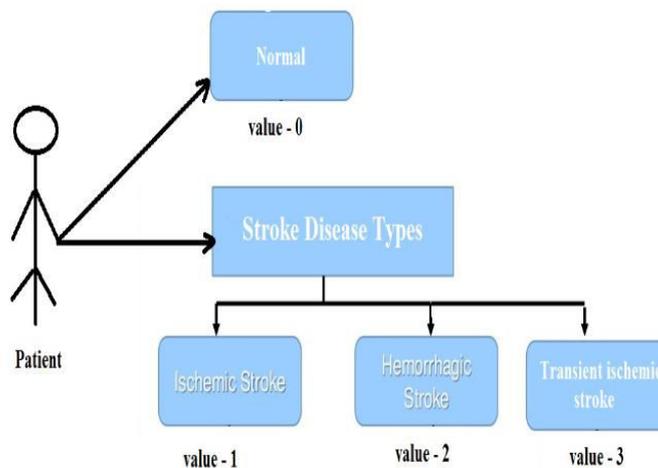
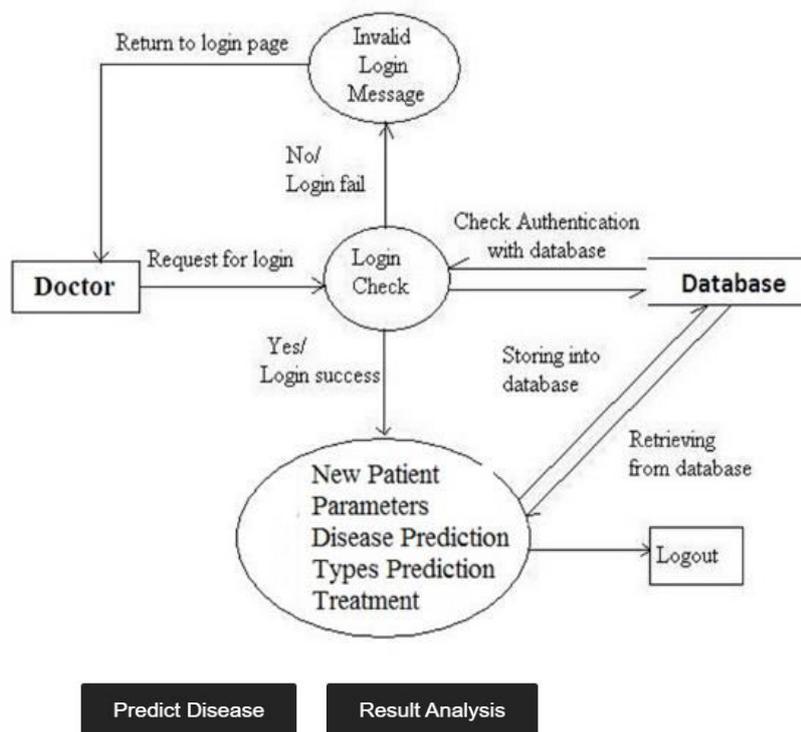
Machine Learning

The process of searching for a system using data is called machine learning. Data science includes machine learning, which uses machine learning algorithms to analyze data.

Assistive Learning Method

It is a predictive model that is used in functions that must forecast a value based on information from other values in the data collection. There are fixed statuses for supervised learning. It categorizes an element based on the characteristics of one of the specified categories of labels.

Many different kinds of math are used in supervised learning to build models. Some examples are KNN, Naive Bayes, Decision Trees, ID3, Random Forests, SVM, Regression methods, and others. Based on the needs, labels, parameters, and dataset, we choose the optimum estimate method. An algorithm is used to create a model that uses the data to generate predictions in the face of uncertainty.



KNN Algorithm

K-nearest neighbor is a popular supervised machine learning method.

The K-NN approach sets the new instance in the same class as the existing ones and assumes that the new state and the current states are similar.

The K-NN algorithm records all information that is available and ranks fresh data points according to similarity. This shows that new information might be precisely and immediately characterized utilizing the K-NN strategy.

Although the K-NN method may be used to classification and regression issues, classification issues are the ones where it is most often applied.

K-NN Since it is non-parametric, it does not make any assumptions about the underlying data.

Due to its inability to rapidly understand the training data, this is also known as a "lazy" algorithm. Instead, it uses a data set to classify the data as it performs an action.

The KNN method uses a dataset for training, and when fresh data is added, it places it in a category that is identical to the training data.

Example: Assume we have a photograph of a variety that looks like the two felines and canines, yet we're uncertain which one it is. Because it is based on a similarity measure, the KNN approach is appropriate for this definition. A fresh data set is classified as either cats or dogs by our KNN model based on similarities between its attributes and those of photos of cats or dogs.

KNN Algorithm Steps

Step 1: K-operation NNs may be described using the following procedure:

Stage 2: Determine your neighbors' K numbers as a first step. From that point forward, get the Euclidean distance among K and its closest neighbors.

Step 3: Utilizing the predetermined Euclidean distance, pick the K closest neighbors.

Stage 4: Count the quantity of data of interest in every class among these k neighbors.

Stage 5: Adding of new information focuses to the classification with most neighbors.

Naïve Bayes Steps

Step 1: Convert the given dataset into frequency tables.

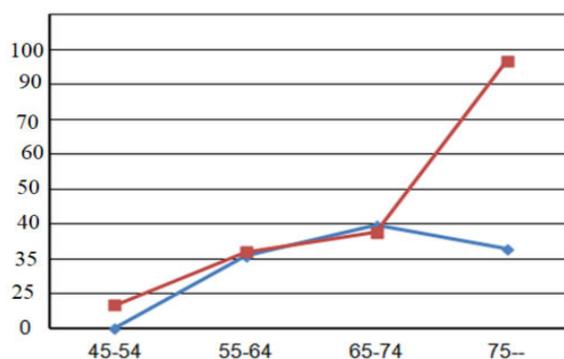
Step 2: Generate Likelihood table by finding the probabilities of given features.

Step 3: Now, use Bayes theorem to calculate the posterior probability.

RESULTS

Comparative Analysis of Algorithms!!

Constraint	KNN	Naive Bayes
Accuracy	96.7213114754098%	93.4426229508197%
Time (milli secs)	2755	4255
Correctly Classified	96.7213114754098%	93.4426229508197%
InCorrectly Classified	3.27868852459017%	6.55737704918032%



Comparative Analysis

- KNN
- Naïve Bayes

CONCLUSION

Stroke diagnosis is one of the most prevalent disorders today. This proposed approach can help in the early prediction of stroke disease and related types, as early stages of the disease and stroke types are difficult to predict. A system that helps doctors make faster and smarter decisions. The system uses artificial intelligence techniques to deliver efficient and accurate results. The "random forest" technique and the "k nearest" algorithm are the two most effective classifiers we have used. This system is an effective real-time application for the medical industry.

REFERENCE

1. IEEE PAPER TITLE: Enabling Efficient Stroke Prediction by Exploring Sleep-Related Features 2018 Jia Xie, Zhu Wang, Zhiwen Yu, Bin Guo.
2. IEEE PAPER TITLE: Comparison of Different Machine Learning Approaches to Model Stroke Subtype Classification and Risk Prediction. 2018 Luis Garcia-Temza, Jose L. Risco-Martin, Jose L. Ayala, Gemma Reig Rosello, Juan M. Camarasaltas.
3. IEEE PAPER TITLE: Prediction and Control of Stroke by Data Mining. 2016 Fariborz Khorvash, Rasul Norouzi.
4. 'Pre-eminent Strategy for Effective Utilization of Power in Data Center' 'Pushpalatha R, B Ramesh , K Thippeswamy 'International Journal of Recent Technology and Engineering (IJRTE)' 8
5. Amalgamation of Neural Network and Genetic Algorithm for Efficient Workload Prediction in Data Center. Pushpalatha R, B Ramesh, International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8 Issue-5, January 2020
6. Workload prediction based virtual machine migration and optimal switching strategy for cloud power management R Pushpalatha, B Ramesh Wireless Personal Communications 123 (1), 761-784
7. Load Balancing and Predictive Analysis Model Implementation in Public Cloud , Authors:-MN Gagandeep, R Pushpalatha, B Ramesh Publication date:-2021/11/19
8. Genetic Algorithm Based Approach For Predict Disease and Avoid Congestion in Data Mining J. Adamkani¹, M. Wasim Raja²
9. Enhanced Prediction of Heart Disease with Feature Subset Selection using Genetic Algorithm, October 2010 International Journal of Engineering Science and Technology 2(10) Authors: Anbarasi Masilamani, Anupriya, N Ch Sriman Narayana Iyenger
10. An integrated machine learning approach to stroke prediction Authors: Aditya, Khosla Yu, Cao Cliff, Chung-Yu, Lin Hsu-Kuang, Chiu Junling Hu, Honglak Lee
11. Stroke Prediction Using Machine Learning in a Distributed Environment Authors:-Maihul Rajora, Mansi Rathod & Nenavath Srinivas Naik
12. A hybrid machine learning approach to cerebral stroke prediction based on imbalanced medical dataset Author: - Tianyu Liu, Wenhui Fan, ChengWu
13. Duen-Yian Yeh a, Ching-Hsue Cheng b, Yen-Wen Chen b A predictive model for cerebrovascular disease using data mining., Science, Vol. 8970- 8977, 2011.
14. Cheng-Ding Chang a, Chien-Chih Wang b, Bernard C. Jiang Using data mining techniques for multi-diseases prediction modeling of hypertension and hyperlipidemia by common risk factors Vol 38,5507–5513, 2011.
15. Genetics and Genomics of Stroke Novel Approach Alison E. Baird, MBBS, Ph.D. Brooklyn, New York Vol. 56, No. 4, 2010.
16. M. Anbarasi et. al. Enhanced Prediction of Heart Disease with Feature Subset Selection using Genetic Algorithm International Journal of Engineering Science and Technology Vol. 2(10), 5370-5376,2010.
17. Shantakumar B. Patil, Y. S. Kumaraswamy. „Predictive data mining for medical diagnosis of heart disease prediction“ Jyoti Soni, ujma Ansari, dipesh Sharma IJCSE Vol .17, 2011.
18. <https://www.researchgate.net/publication/5880405>
19. Lela Mirtskhulava, Gillian Pearce, et al Artificial Neural Network Model in Stroke Diagnosis 2015 17th UKSIM-AMSS International Conference on Modelling and Simulation.
20. Mirtskhulava Lela, Al-Majeed Salah, Gillian Pearce, Gogoladze Tamar, Ivane Javakhishvili. Blood clotting prediction model using Artificial Neural Networks and Sensor Networks. GESJ: Computer Science and Telecommunications 2014|No.3(43). ISSN 1512-1232. Proceedings of the 2nd International Conference on Inventive Communication and Computational Technologies (ICICCT 2018) IEEE Xplore Compliant .

Plants Genetic Resource Conservation in India: A Review Article

Tambe S. S

MGV'S LVH Art's Science and Commerce College Panchavati Nashik, India

ABSTRACT

India is known for its rich heritage of biological diversity, having already documented over 89,000 species of animals and 46,000 species of plants in its 10 biogeographic regions. Nearly 6,500 native plants are still used prominently in indigenous healthcare systems. Thousands of locally-adapted crop varieties, grown traditionally since ancient times, and over 130 native breeds of farm livestock, continue to thrive in its diversified farming systems. India has participated actively in all the major international events related to environment protection and biodiversity conservation over the past decades and has ratified all the major biodiversity and environment related global conventions. PGR activities, viz. germplasm collection, introduction, exchange and quarantine, characterization and evaluation, maintenance, documentation, conservation and utilization

Keywords: PGR, Biodiversity, Conservation, India

INTRODUCTION

Due to the overwhelming dominance of *Homo sapiens*, natural environments are no longer self-sustaining, and their continued existence will depend on human agreement to sustain them. Given present commercial historical realities, such agreement will require new kinds of moral reasoning about the relationship between human beings and ecological systems. The preservation of natural environments is obviously of great human utility as a source of valued things. But the sustenance of natural ecosystems and their inhabitants, on the basis of their intrinsic worth, does not yet have an effective theoretical defense against human specialism, the continual expansion of capitalistic systems, and the present dependence of humans on human-made physical and social environments

Plant genetic resources (PGR) are the basic materials that are essential for development of improved crop varieties designed to combine high yield potential with superior quality, resistance to diseases and pests, and also better adaptation to abiotic stress environments. Their continued availability to plant breeders is necessary not only for sustaining advances in crop productivity but also for stabilizing production in the country. These resources of known or potential use to man constitute a broad spectrum of diverse gene pools representing assemblage of landraces, primitive cultivars, varieties of traditional agriculture as well as wild and weedy relatives of crop plants. In the last two decades or so, much attention has been drawn to indigenous locally adapted cultivars in particular because of the useful genetic variation they contain as an invaluable resource for present and future plant breeding, and the rapid rate at which they are disappearing through replacement by high yielding varieties. In addition, the natural habitats of wild relatives of crop plants are continuously getting eroded threatening survival of these populations. This diversity is not yet adequately represented in the existing collections at national, regional and international levels.

Indian national programmer on genetic conservation aims at exploring and collecting, classifying, evaluating, conserving and documenting this natural heritage for its current and future use. All these operations constitute a chain of activities that are now better understood and carried out by the national and international centers mandated with such responsibilities. The last thirty years have seen the great upsurge of this activity, with more awareness generated by the FAO, IBPGR, the IARCs and also by the IUCN, UNESCO and the WWF in their concern for conservation of biodiversity with particular reference to in-situ aspects. Equally important in this context has been the phenomenal growth in biotechnology during the past two decades which has also created new awareness about the value of plant genetic resources since sexual process of fertilization and recombination was no longer a pre-requisite to shuffling of desirable traits.

Importance of geographical areas of diversity of crop plants and the richness of this genetic wealth in the Indian subcontinent has been reflected. Subsequent chapters deal largely with the methodologies and approaches that are followed in executing role in the management and monitoring of these activities has been highlighted with a view to focusing attention on the newly emerging Indian National Plant Genetic Resources System.

PGR activities, viz. germplasm collection, introduction, exchange and quarantine, characterization and evaluation, maintenance, documentation, conservation and utilization. In this chapter, the work carried out by the National Bureau of Plant Genetic Resources (NBPGR), the national nodal organisation for such activities, and its coordinating

PGR Activities

While all these activities and on-going programmers are important to Bureau's functioning, certain aspects need priority consideration (Paroda et al., 1988) to fulfill national needs. These are (Rana, 1990):

1. Upgrading of facilities for maintenance, evaluation, documentation and medium-term storage of national active collections of crop genetic resources at the Bureau's stations as well as at the collaborating institutes/centers.
2. Expanding the capacity of long-term storage of base collections from the existing 2,00,000 to nearly 8,00,000 seed samples.
3. Developing a computer-based National Database on Plant Genetic Resources for use by plant breeders and other researchers.
4. Setting up of Crop Advisory Committees and establishment of fully developed Indian National Plant Genetic Resources System.
5. Promoting development of suitable facilities at some selected sites for conducting post-entry quarantine inspection relevant to clearance of imported germplasm for research purpose.
6. Strengthening the National Herbarium of Cultivated Plants and developing the National Research Centre on Biosystematics and Evolutionary Studies.
7. Improving the quality of training programmers.

The Bureau also collaborates with International Agricultural Research Centers like ICRISAT, ICARDA, IRRI in exploration and collection of germplasm as well as evaluation and documentation of germplasm holdings and promising breeding materials. It also implements work plans developed under Memoranda of Understanding and bilateral agreements with different international organizations and countries. IBPGR's office for South and South-East Asia is located in the NBPGR Campus and there is an active collaboration based on biennial work plans. In addition to organizing joint exploration and collection programmers in this region, the IBPGR is assisting the NBPGR in developing training programmers relevant to conservation and management of plant genetic resources developed primarily for the Asian region. An Indo-USAID Project on Plant Genetic Resources, with a budget provision of over 21 million dollars, is currently being implemented to increase NBPGR's capability at the national level and also to enhance its role at the international level (Rana, 1990).

Besides operating the network of active germplasm collections maintained at different collaborating centers in the country (Appendix I),

No.	Crop	NAG site* (NAGS)	No. of accessions currently available
1.	Wheat	Directorate of Wheat Research, Indian Agricultural Research Institute, New Delhi 110012	17,000
2.	Rice	Central Rice Research Institute, Cuttak 753006 (Orissa)	20,000
3.	Maize	All India Coordinated Maize Improvement Project, Indian Agricultural Research Institute, New Delhi 110012	25,000
4.	Barley	All India Coordinated Barley Improvement Project, IARI Regional Station, Karnal 132001 (Haryana)	...
5.	Sorghum	National Research Centre (Sorghum), Rajendranagar, Hyderabad 500030 (AP)	2,767
6.	Pearl millet	All India Coordinated Pearl Millet Improvement Project, College of Agriculture, Shivaji Nagar, Pune 411005 (Maharashtra)	...
7.	Minor Milletes	All India Coordinated Minor Millets Project, University of Agricultural Sciences, Gandhi Krishi Vigyan Kendra Campus, Bangalore 560065 (Karnataka)	8,572
8.	Pulses	Directorate of Pulses Research (ICAR), Kanpur 208024 (UP)	9,310
9.	Soybean	National Research Centre for Soybean, Bhawerkua Farm, Khandwa Road, Indore 452001 (MP)	2,500

10.	Oilseeds	Directorate of Oilseeds Research, (ICAR), Rajendranagar, Hyderabad 500030 (AP)	15,629
11.	Rape seed & Mustard	All India Coordinated Crop Improvement Project (Rapeseed & Mustard), Haryana Agricultural University, Hisar 125004	15,082
12.	Groundnut	National Research Centre for Groundnut, Timbawadi P.O., Dist. Junagadh 362105 (Gujarat)	6,432
13.	Sugarcane	Sugarcane Breeding Institute, Coimbatore 641007 (TN)	3,979
14.	Cotton	Central Institute for Cotton Research, Panjori Farm, Wardha Road, P.B. No. 125, G.P.O. Nagpur, Nagpur 440001 (Maharashtra)	6,896
15.	Jute & Allied Fibres	Central Institute for Jute and Allied Fibres, Barrackpore 743 101 (WB)	3,226
16.	Vegetables	National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi 110012	16,139
17.	Potato	Central Potato Research Institute, Shimla 171001 (Himachal Pradesh)	2,375
18.	Forages	Indian Grassland and Fodder Research Institute (Forage Crops), Gwalior-Jhansi Road, Jhansi 284003 (UP)	6,267
19.	Spices	National Research Centre for Spices, Marikunnu, Calicut 673012 (Kerala)	2,847
20.	Tobacco	Central Tobacco Research Institute Rajahmundry 533105 (AP)	1,500
21.	Plantation Crops	Central Plantation Crops Research Institute, Kasaragod 673024 (Kerala)	307
22.	Medicinal & Aromatic Plants	All India Coordinated Research Project on Medicinal & Aromatic Plants National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi 110012	375
23.	Agro-Forestry Plants	National Research Centre for Agro-Forestry, Indian Grassland and Fodder Research Institute, Jhansi 284003 (UP)	40
24.	Fruits (semi-arid)	All India Coordinated Project (Semi Arid Fruits), Haryana Agricultural University, Hisar 125004 (Haryana)	541
25.	Fruits (Subtropical & Temperate)	NBPGR Regional Station, Phagli, Shimla 171004 (HP)	454
26.	Fruits	Indian Institute of Horticultural Research, 255 Upper Palace Orchards, Bangalore 560080 (Karnataka)	13,118
27.	Citrus	National Research Centre for Citrus, Seminary Hills, Nagpur 440 006 (Maharashtra)	51
28.	Mango	Central Institute of Horticulture for Northern Plains, B-117, Indira Nagar, Lucknow 226016 (UP)	587
29.	Tuber Crops	Central Tuber Crops Research Institute, Sreekariyam, Trivandrum 695017 (Kerala)	3,586
30.	Pseudo-Cereals	NBPGR Regional Station, Phagli, Shimla 171 004 (HP)	3,682
		Total holdings	1,88,262

The ex-situ and in-vitro approaches to conservation of plant genetic resources, are being integrated with a strategy for in-situ conservation of wild relatives of crop plants in the form of gene sanctuaries and eco-system conservation (Table a and b). This phase will be undertaken in active collaboration with the Department of Environment and Forests that administers the relevant agencies like the Botanical Survey of India, the Forest Survey of India and the Indian Council of Forestry Research and Education. (Rana,1990).

The ex-situ and in-vitro approaches to conservation of plant genetic resources, as outlined above, are being integrated with a strategy for in-situ conservation of wild relatives of crop plants in the form of gene sanctuaries and eco-system conservation (Table a and b). This phase will be undertaken in active collaboration with the Department of Environment and Forests that administers the relevant agencies like the Botanical Survey of India, the Forest Survey of India and the Indian Council of Forestry Research and Education.

Table (a). Conservation and utilisation of India's heritage in plant wealth

Organisation	National mandate
National Bureau of Plant Genetic Resources	Ex-situ conservation of crop genetic resources (National genebank comprising long-term seed storage, in-vitro repository and clonal field genebanks)
Department of Environment and Forests	In-situ conservation of wild flora including relatives of cultivated plants and forest resources as well as living collections of threatened and rare plant species

Table (b). In-situ conservation in India

Bio-graphic region	Biosphere reserve	Area (Sq. km.)	States involved
Himalaya	Nanda Devi	1,560	Uttar Pradesh
Burma monsoon forests	Nokrek	80	Meghalaya
Bengalian Rain forest	Manas	2,837	Assam
Bengalian Rain forest	Sundarbans	9,630	West Bengal
Coromandel	Gulf of Mannar	555	Tamil Nadu
Malabar rain forest	Nilgiri	5,520	Karnataka, Kerala and Tamil Nadu
A. & N. Islands	Great Nicobar	885	Andaman & Nicobar Islands

PGR Conservation And Management

Many leading countries have well developed system for assemblage, enrichment, documentation and conservation of plant genetic resources. Several of them also have computerized databases working in the form of crop networks. International Agricultural Research Centers (ICARs) have also come up in a big way in recent years with respect to their mandate crops. The International Board for Plant Genetic Resources (IBPGR) has contributed significantly to these efforts, particularly by offering expertise and training. USAID has been contributing funds to assist some promising national programmers in developing suitable facilities and trained manpower. Some Asian countries, such as Myanmar, Sri Lanka, Bangladesh, Pakistan and Thailand have also utilized Japanese assistance and expertise through JICA, - Japanese International Cooperation Agency (including establishment of pre-fabricated genebanks) for this purpose.

The ICAR has set up a National Policy Planning and Review Committee on Plant Genetic Resources in 1986 under the chairmanship of the Director General, ICAR to streamline and co-ordinate plant genetic resources activities. It is intended to bring all policy issues concerning collection and conservation of plant genetic resources under the preview of this high-level body. A subcommittee dealing with this aspect under the Director, IARI, New Delhi has framed policy proposals, bringing within its fold CSIR, (ICFRE, BSI), with NBPGR as the nodal organisation at national level. It stresses on national coordination of plant resources activities through linkage and cooperation of all concerned organizations. In the regional context, this linkage is being strengthened through the efforts put forth by the member countries of South Asian Association for Regional Cooperation (SAARC). The first SAARC meeting on exploration activities of this region was held at NBPGR, New Delhi. In this context, NBPGR operates as the nodal agency for developing and implementing work plans under memoranda of understanding/bilateral agreements with different countries related to PGR activities. The Indian National PGR system has emerged as a rapidly vibrant system responsive to learning from rich experience of other nations in this field and is also willing to share Indian expertise and capabilities.(Table C)

Table C. Active germplasm collections at NBPGR

Station/Centre	Holdings	Major Crops
Delhi	38,708	Cereals, legumes, oilseeds, vegetables, forages, fruits, M & AP.
Akola	39,004	Chickpea, pigeonpea, sorghum, groundnut, small millets, soybean, safflower, sesame, lentil, amaranths, horsegram.
Amravati	5,800	Mung bean, rice bean, urid bean, sem, sweet potato, chillies, onion, garlic, fruits (grapes, pomegranate, papaya).
Shi ml a	13,105	French bean, rice bean, soybean, lentil, Minor millets, pseudo-cereals, oilseeds, temperate fruits, ornamentals.
Jodhpur	12,076	Guar, moth bean, mung bean, sesame, cowpea, castor
Trichur	8,936	Paddy, horsegram, cowpea, finger millet, chillies, bittergourd, ginger, Curcuma, Colocasia, cassava, Dioscorea.
Bhowali	5,894	Wheat, maize, barley, lentil, beans, hill paddy, Allium spp.
Cuttack	1,943	Rices
Amravati	5,800	Mung bean, rice bean, urid bean, sem, sweet potato, chillies, onion, garlic, fruits (grapes, pomegranate, papaya).
Shi ml a	13,105	French bean, rice bean, soybean, lentil, Minor millets, pseudo-cereals, oilseeds, temperate fruits, ornamentals.

CONCLUSION

Protecting and conservation of biodiversity is in our self-interest. Biological resources are the pillars upon which we build civilizations. Nature's products support such diverse industries as agriculture, cosmetics, pharmaceuticals, pulp and paper, horticulture, construction and waste treatment. The loss of biodiversity threatens our food supplies, opportunities for recreation and tourism, and sources of wood, medicines and energy. It also interferes with essential ecological function. Aspect of biodiversity is the variety of ecosystems such as those that occur in deserts, forests, wetlands, mountains, lakes, rivers, and agricultural landscapes. In each ecosystem, living creatures, including humans, form a community, interacting with one another and with the air, water, and soil around them

REFERENCES

1. Appendix I. Indian Plant Genetic Resources System. Directory of National Active Germplasm Sites (NAGS).
2. Paroda, R.S., R.K. Arora and K.P.S. Chandel (Eds.) 1988. Plant genetic resources. Indian perspective. Proc. National Symp. Plant Genetic Resources, NBPGR Sci. Monogr. 545 p
3. Rana, R.S. 1990. Partnership in conservation and use of plant germplasm. Golden Jubilee lecture, Indian Society of Genetics and Plant Breeding, New Delhi

Review on Different Synthetic Routes of Substituted Quinoline Moiety and Its Biological Utility

Yogita Gulabrao Bodkhe and *Jyotsna V. Khobragade

Department of Chemistry, Guru Nanak College of Science, Ballarpur, India

ABSTRACT

Now a day's many new diseases are emerging such as malaria, cholera, tuberculosis etc. It was a great job for scientist to face big challenges. These studies didn't have any limit, curiosity increased, developing the discovery of new pathogens and their diseases resulting in discovery of innumerable techniques over them. From ancient time Quinoline was extracted from tree and found to be very effective to treat malaria. Many synthetic routes were developed to synthesize Quinoline. Present study focuses on the various synthetic routes for Quinoline synthesis and its biological application studied by various researchers.

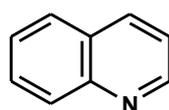
Keywords: malaria, antibacterial, antioxidant, synthesis etc.

INTRODUCTION

In ancient times fighting against diseases was not an easy task. Many well known personalities had contributed for this purpose. One of them were - Charak, Sushru well known researchers had found plant extraction useful for curing several disease.

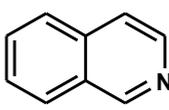
Even after the introduction of several solutions pathogens resistance power was not something to be easily fought against with. Development of pathogens resistance resulted in more attention by the scientist towards microbes. An extracted substance from the bark of cinchona tree was found to be as suitable antidote against malaria. Eventually, in 1890 Paul Ehrlich from England came up with quinine as an anti malarial drug.

Quinoline a ten membered bi-cyclic fusion of two rings viz. benzene and pyridine. In earlier days it was mostly derived from coal tar but nowadays different synthetic methods are available. Quinoline is aromatic in nature since it obeys the Huckel rule with 10π electrons. Quinoline easily undergoes electrophilic and nucleophilic substitution reaction as lone pair of electrons is readily available on the nitrogen atom. More electron density occurred on benzene ring as compared to pyridine ring of quinoline so chances of electrophilic substitution reaction are better at benzene ring of quinoline particularly at 5th and 8th position. Quinoline is also active towards nucleophilic substitution reaction and mostly occurs at 2nd and 4th position. The three different isomers of quinoline are well known and more research is done on this nucleus.



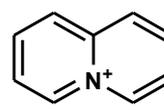
Quinoline

(1)



Iso quinoline

(2)



Quindizinium salt

(3)

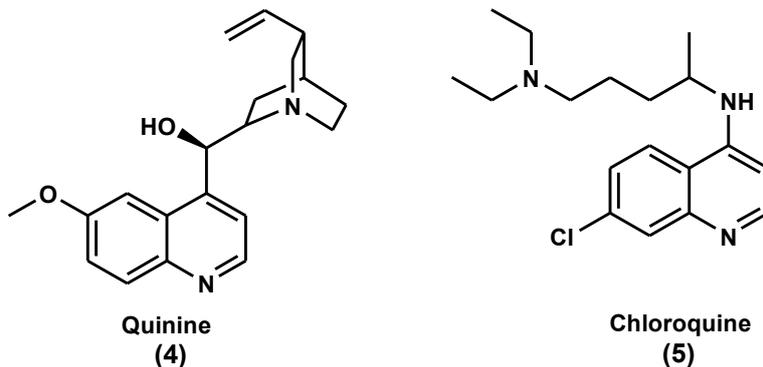
Utility of quinoline nucleus in this golden era is deeply studied by researchers and was found to be good remedy against malarial pathogens¹.

The survey of World Health Organisation (WHO), elaborated that every year 300-500 million deaths was due to only malaria. The causing agents of malaria are two species namely *P. falciparum* and *P. vivax* belonging to the class protozoa. Generally, these species are present in the salivary gland of female mosquito and complete it all developing stages. This female mosquito bites to human being it transfers this species from salivary gland to blood of the victim. The malaria parasite mostly affects the children below the age five and the pregnant women. In 2006, 0.8 million deaths were due to malaria and it suffers the East Asia, African region. In golden era cinchona tree extract proved as a most useful remedy on malaria. The bark of Cinchona tree mostly comprises various alkaloids, so the demand on cultivation of this tree was increased in Java, Sri Lanka and India. More research was going on this direction of quinoline nucleus and lastly researchers synthesized the drugs Chloroquine, Amodiaquine, and Quinacrine which incorporated the quinoline nucleus and reported as best antimalarial agent.

Chloroquine

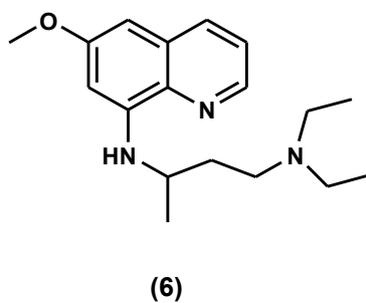
Quinine (4) and Chloroquine (5), derivatives of quinoline are applicable for malarial infection. These drugs interfere with the pre and ex. erythrocytic phases of parasites. Chloroquine not only used for malarial treatment

but also have some applications as anti-inflammatory, local anaesthetic. The general procedure for the synthesis of Chloroquine is by treating enol isomer of diethyl 2-ketoglutarate with 3-chloroaniline.



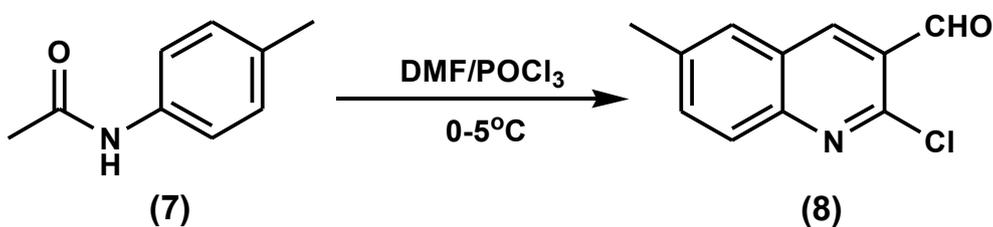
Primaquine

The mainly accessible antimalarial drug in the market is Primaquine which is efficient against *P. vivax* and *P. malaria*. Pamaquine (8) is synthesized by condensing 6-methoxy-8-amino quinoline and 1-bromo pentylamine hydrobromide.



Biological Activity

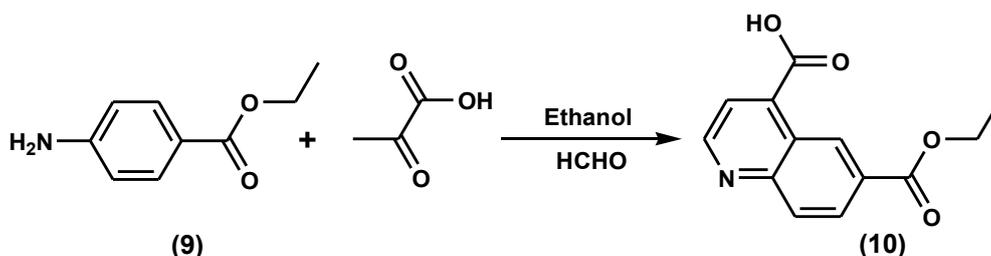
This broad spectrum of biological and neurotoxin actions of quinoline has been further deliberate by researchers². Quinoline contains drugs such as Doxorubicin and Mitoxantron that are the most efficient anticancer agents with broad applications such as treatment of leukaemia and lymphomas along with chemotherapy of solid tumors³. Derivatives of quinoline ring reported to possess imperative pharmacological properties such as antitubercular⁴, anticancer⁵, anti-fungal⁶, anti-inflammatory⁷, antibacterial⁸. Due to wide range of applicability of quinoline nucleus in the direction of medicinal science, the researchers pay attention to synthesize some novel derivative of quinoline. 2-Chloro quinoline 3-carbaldehyde which has been synthesized by Vilsmeier-Haack reaction was the initial substance of this current research⁹. The general steps for the synthesis of 2-chloro quinoline 3-carbaldehyde is the acetylation of aryl amine by acetic anhydride, resulting formation of aryl acetamide (7) which on further treatment with Vilsmeier-Haack reagent (DMF and POCl₃) gives 2-chloro quinoline 3-carbaldehyde (8)¹⁰.



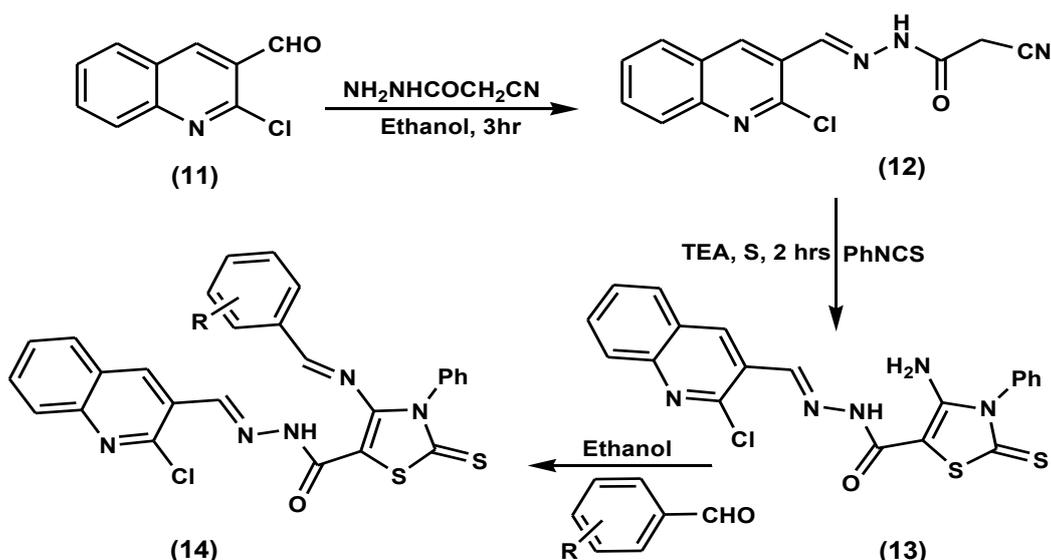
Synthetic Route for Different Biologically Active Quinoline Derivatives

Following are the various synthetic routes suggested by researchers for quinoline and its derivatives.

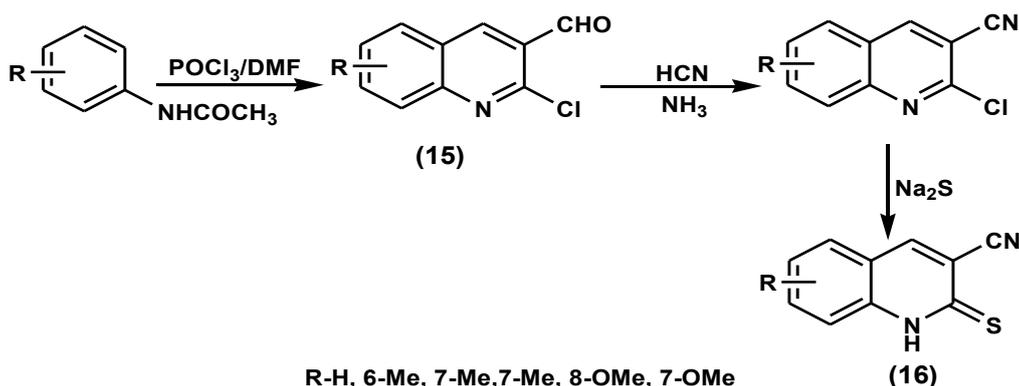
1. Al. Juboory, S. et al.¹¹ 12 have reported different new derivatives of quinoline such as 6-(ethoxycarbonyl)quinoline-4-carboxylic acid (9) was synthesized by cyclization of ethyl p-aminobenzoate (10), formaldehyde, and pyruvic acid and evaluated their antifungal activity against *A. terreus*.



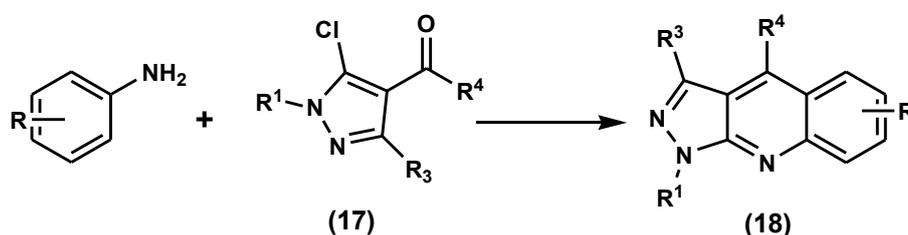
2. Desai, N. et al.¹² described the synthesis of 1-[1-aza-2-(2-chloro(3-quinolyl))vinyl]-2-cyanoacetamide (12) by the reaction of 2-Chloroquinoline-3-carbaldehyde (11) and 2-cyanoacetohydrazide in ethanol which on further reaction with phenyl isothiocyanate yielded carboxamide (13), which on further treatment with corresponding aldehyde gave carboxamide derivatives (14).



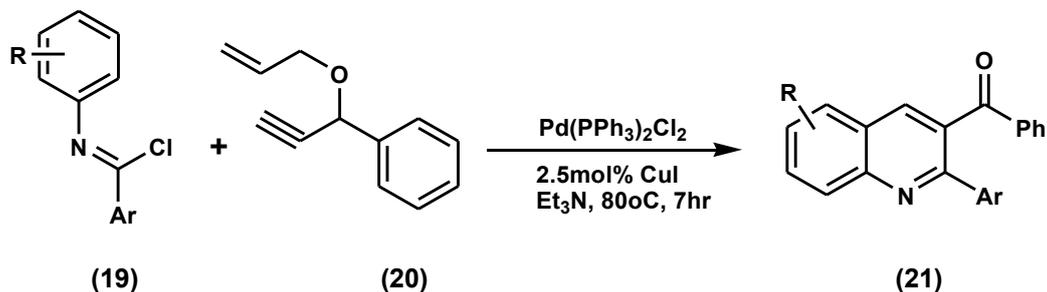
3. Singh, R. et al.¹³ reported another application of quinoline by synthesizing different derivatives of quinoline 2-thioxo-1, 2-dihydroquinoline-3-carbonitril (16) by the reaction of 2-chloro-3-formyl quinoline (15) (formed from N-aryl acetamides with Vilsmeier reagent) with different compound such as sodium sulphide or hydroxyl amine.



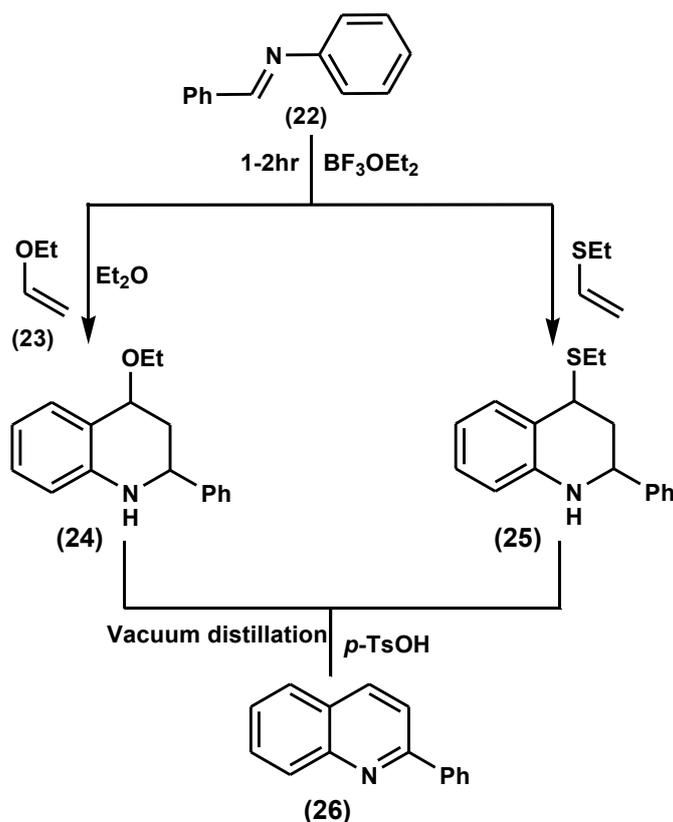
4. Afghan, A. et al.¹⁴ has utilised a novel and efficient method for the synthesis of 1H-pyrazolo [3,4-b]quinolines (18) by condensation of a 5-halo-4-acylpyrazole (17) with an respective aniline.



5. Gao, et al.¹⁵ has reported synthesis of quinoline derivatives (**21**) by the reaction of benzimidoyl chlorides (**19**), with 1-(1-(allyloxy) prop-2-ynyl) benzene (1,6 enynes) (**20**) through palladium-catalysed Sonogashira coupling and subsequent cyclization.

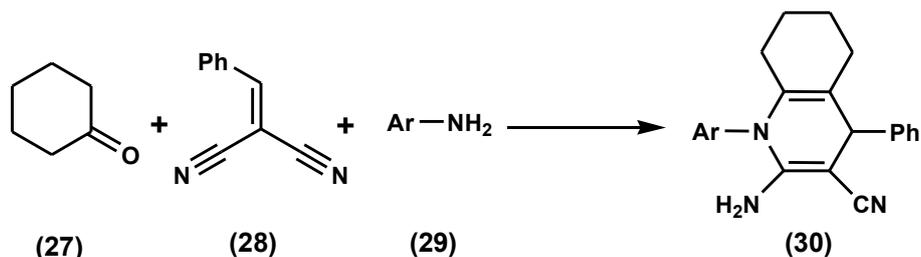


6. Kouznetsov et al.¹⁶ has reported the synthesis of phenyl substituted quinolines (**26**)

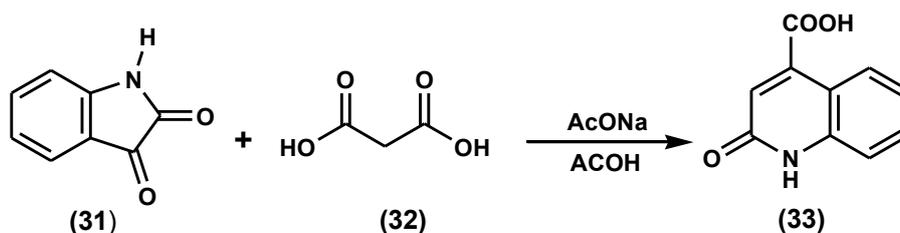


by subjecting a mixture of ethyl vinyl ether or ethyl vinyl (**23**) and N-aryl aldimine (**22**) to acidic catalysis in the presence of boron trifluoride etherate ($\text{BF}_3\cdot\text{OEt}_2$) to yield 2,4- substituted tetrahydroquinolines, (**25**) which were then converted to 2-phenyl substituted quinolines under vacuum distillation with tosylic acid ($p\text{-TsOH}$).

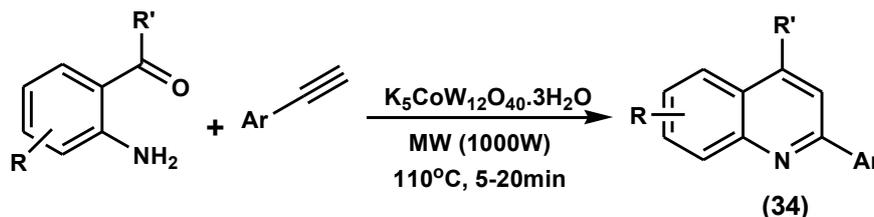
7. Maher, A. et al.¹⁷ carried out the synthesis of amino substituted quinoline-3-carbonitrile derivatives (**30**) by treating cyclohexanone (**27**), 2-benzylidene malononitrile (**28**) and respective aniline derivatives (**29**).



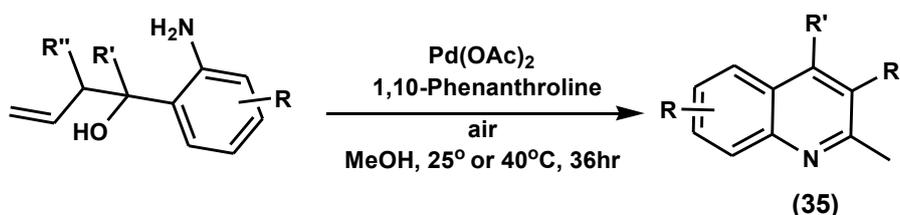
8. Elyoussfi, A. et al.¹⁸ reported the synthesis of 2-oxo-1, 2-dihydroquinoline-4-carboxylic acid (**33**) by the reaction of isatin (**31**) and malonic acid (**32**) by using solvent acetic acid and sodium acetate as base.



9. Potassium dodecatungstocobaltate trihydrate ($\text{K}_5\text{CoW}_{12}\text{O}_{40}\cdot 3\text{H}_2\text{O}$) a reusable and environmentally benign catalyst was utilized by Iraj et al.¹⁹ under microwave irradiation and solvent-free conditions for the synthesis of 2,4-disubstituted quinolines (34) through a one-pot reaction of different 2-aminoaryl ketones with several arylacetylenes.



10. Wang et al.²⁰ has proposed the synthesis of 2-methylquinolines (35) with good yields under mild conditions by Palladium-catalysed Wacker-type oxidative cyclization.



CONCLUSION

Above literature reviews explained the importance of Quinoline in pharmaceutical sciences and push the mind of researchers to synthesize more new heterocyclic compound bearing Quinoline moiety. Also reveals that Quinoline and its derivatives are synthetically showing more potent activity towards microbes.

REFERENCES

1. T. J. Egan, Expert, Opinion on Therapeutic Patents., vol. 11, no. 2, pp. 185-209, 2001.
2. S. Deshpande and B. Kuppast., Med. Chem., vol. 6, no. 1, p.1-11, 2016.
3. L. M. Antinarelli, A.M. Carmo, F. R. Pawan, C. Q. Leite, A.D. Da Silva, E.S. Coimbra and D. B. Salunke, Org. Med. Chem. Lett. , vol. 2, no. 16, p. 1-8, 2012.
4. K. Devi and M. Kachroo., Der Pharma Chemica., vol. 6, no. 5, pp. 353–359, 2014.
5. Maruthamuthu, A. Dileepan , S. Rajam and C. Stella, Der Pharma Chemica., vol. 7, no. 8, pp. 130–136, 2015.
6. T. Elavarasan, D. Bhakiarajand and M. Gopalakrishnan, Der Pharma Chemica, vol. 6, no. 2, pp. 391–400, 2014.
7. M. A, El-Hashash, S. M. Sherif, A. E. Badawy, and H. R. M. Rashdan, Der Pharma Chemica., vol. 6, no. 4, pp. 23–29, 2014
8. C. M. Meléndez Gómez, and V. Kouznetsov, Formatex., pp.666-677, 2013.
9. J. Azimvand, J. Chem.Pharm. Rese., vol. 4, no. 8, pp. 3905-3908, 2012.
10. P. S. Girase and B. R. Chaudhari, Intern. J. pharm. Rese. Bio-science., vol. 6, no. 1, pp. 465–480, 2016.
11. S. B. Al-juboory and A. A. Razzak M. Kubba, Der Pharma Chemica., vol. 8, no. 4, pp. 63–66, 2016.
12. N. C. Desai, N. Shihory, K. Rajpara, A. Dodiya, and M. Chemistry, Ind. J. Chem., vol. 51, no.B, pp. 508–513, 2012.

13. A. Srivastava, A. Chandra, and R.M. Singh, *Ind. J. Chem.*, vol. 44, no.B, pp. 2077–2081, 2005.
14. M. M. Baradarani, J. A. Joule and A. Afghan, *Arkivoc.*, vol. 2009, no. ii, pp. 20–30, 2009.
15. G. L. Gao, Y. N. Niu, Z. Y. Yan, H.L. Wang, G.W. Wang, A. Shaukat, Y.M. Liang, *J. Org. Chem.* vol.75, pp. 1305–1308, 2010.
16. V. V. Kouznetsov, *Tetrahedron*, vol. 65, pp. 2721–2750, 2009.
17. L. Osama, L. A. Abou-Zeid, M. N. A. Nasr, and A. S. Tantawy, *Der Pharma Chemica.*, vol. 8, no. 14, pp. 100–110, 2016.
18. A. Elyoussfi, A. Dafali, H. Elmselle, Y. Bouzian, A. Zarrouk, K. Cherrak, E. M. Essassi, A. Aouniti and B. Hammouti, *Der Pharma Chemica.*, vol. 8, no. 4, pp. 226–236, 2016.
19. M. B. Iraj, T. Shahram, M. Majid, M. Valiollah, A. Salma, M. Arsalan, *Synlett*, vol. 20, pp. 3104–3112, 2010.
20. Y.Wang, J.Ai, Y.Wang, Y.Chen, L. Wang, G.Liu, M. Geng, A. Zhang, *J. Med. Chem.* vol.54, pp. 2127–2142, 2011.

Role of Women in Labour Market in India

Koel Roy Choudhury

S.I.E.S (Nerul) College of Arts, Science and Commerce, Sector- V, Nerul, Navi Mumbai, India

ABSTRACT

The participation of women in the workforce of the country is an indicator of their status in the society. However, India has seen falling labour force participation among women. What is concerning is that major employment of women is seen in the agricultural sector and the unorganized sector in spite of improvement in education attainment levels among women. Government has initiated measures to improve labour force participation. Yet, further measures need to be adopted to improve the participation of women in labour market.

INTRODUCTION

Women in India have been increasingly playing a significant role in the progress of the country as an emerging economy. The participation of women in the workforce of the country is an indicator of their status in the society. As India becomes more globalized, women continue to contribute in the nation building with their talent, dedication and enthusiasm. India being one of the fastest growing nations, the contribution of women is increasing at a steady pace. However, what is concerning is that major employment of women is seen in the agricultural sector and the unorganized sector in spite of improvement in education attainment levels among women.

Research suggests that women's economic empowerment through productive employment has positive impact on gender equality, poverty eradication and financial inclusion. It is positively linked to the nation's economic growth. McKinsey's 2015 'Power of parity' report states that if we raise India's female force participation by 10% points, this will bring in 68 million female workforce in the economy and by 2025, help to increase the country's GDP by \$ 0.5 trillion. Study by IMF suggests an increase in India's annual GDP from higher participation of women in Indian labour force.

Given the important role women play in economy, it is important to analyze the trends of female labour participation rates in India and the policy measures needed to increase the trend. The article is divided into following sections. Section 2 studies the literature review. The trends in female labour force is analyzed in section 3. Section 4 highlights the schemes launched by Government for economic empowerment of women in India. The section 5 deals with policy initiatives to improve female employment and section 6 gives the conclusion.

SECTION 2: LITERATURE REVIEW

This section cites few selected work done abroad and in India related to female labour force in India.

Duflo (2012) discusses the close relationship between women's empowerment and economic development. Empowerment of women changes the decision making process in the country which has a direct effect on development of the nation. The economist argues that the direct relation between women's empowerment and development are not self sustaining in the long run and there is a need for continuous policy intervention towards gender equality to achieve women's empowerment.

Bhalla and Kaur (2011) argues that India has one of the lowest labour force participation rates among females in the world. The labour force participation rate is higher among females in rural India on account of higher levels of poverty. They write that expanding of education among women has a positive impact on LFPR. They contend that LFPR among females should be close to 50% in the next decade which will be lower than the labour force participation rates (around 60%) of other developing countries.

Klasen and Pieters (2012) argues that there is a gap at the rates at which the Indian economy has grown and the female labour force participation rates. According to them, the reason for higher participation of women in employment in urban areas is mainly due to economic necessity than increased availability of jobs. Self employment and regular employment in service sector has improved among highly educated women. It is the highly qualified women who are benefitting from progress of the Indian economy.

Kapsos, Silberman and Bourmpoula (2014)'s research is on the main factors behind the sharp fall in female labour force participation in India in recent years. They studied the causes of long term stagnation in female participation rates in India. According to them, the chief reason is the changes in measurement methodology during survey rounds which has not been able to differentiate between domestic responsibilities and

contributory family responsibility. The long-term challenge facing lack of job opportunities among women is issues like occupational segregation.

According to Mehrotra and Sinha (2019), gender gap related to employment is high in India. This is due to fall in female employment in agriculture with no corresponding increase in non-agricultural sector. They advocate policies to increase employment in different sectors and investment in these sectors. There also has to be improvement in child care facilities and other services to enable women to join the labour force in large numbers.

SECTION 3: TRENDS OF LABOUR FORCE PARTICIPATION OF WOMEN IN INDIA

Trends shows that female labour force participation rates in India have declined from 31.2% in 2011-12 to 25.1% in 2020-21. According to the Global Gender Gap Report 2022, India ranks 135 among a total of 146 countries in the Global Gender Gap Index 2022.

Table 1; Global Gender Gap Report 2022

India	Rank 2022(Out of 146 Countries)
Global Gender Gap Index	135
Economic Participation and Opportunity	143
Educational attainment	107
Health and survival	146
Political empowerment	48

Source: World Economic Forum

Table 1 is based on the Global Gender Gap Index 2022 for India. The gender gap is based on four dimensions of economic participation and opportunity, educational attainment, Health and political empowerment. India ranks 143 out of 146 countries in economic participation and opportunity with a score of 0.350.

Table 2: Labour Force Participation of females in India

Date	Rural			Urban			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
2017-18	54.9	18.2	37.0	57.0	15.9	36.8	55.5	17.5	36.9
2018-19	55.1	19.7	37.7	56.7	16.1	36.9	55.6	18.6	37.5
2019-20	56.3	24.7	40.8	57.8	18.5	38.6	56.8	22.8	40.1
2020-21	57.1	27.7	42.7	58.4	18.6	38.9	57.5	25.1	41.6

Source: Periodic Labour Force Survey (PLFS) -Annual Report(July2020-June2021)

The Table 2 shows that Labour Force Participation of females in both rural and urban areas. While the rates have increased from 18.2 % in 2017-18 to 27.7% in 2020-21 in rural areas, the rates have increased marginally from 15.9% in 2017-18 to 18.6% in 2020-21 in urban areas. The female Participation rates in all years is half of that of males reflecting the gender inequality that exists in India.

SECTION 4: GOVERNMENT SPONSORED SCHEMES FOR WOMEN

STEP: Support to training and employment programme for women (STEP) was introduced by Government in 1986-87 with the motive of improving the skills of women and providing them with sustainable employment. The scheme included training women in areas like agriculture, dairy, handloom and handicraft and provided women with training for longer period. The scheme is an initiative by the Government to enable women to become entrepreneurs.

National Rural Live lihood Mission (NRLM): This scheme was launched in 2011. The scheme encouraged members to create Self Help Group (SHG) with the aim of reducing rural poverty .The initiative promotes skilling and self employment opportunities. NRLM is based on three pillars of universal social integration, financial inclusion and opportunity for livelihood.NRLM is founded on the basis of community based groups.

National Urban livelihood Mission: NULM: NULM is targeted at urban poor with the motive to channelise them into SHGs. The training includes skill development and marketing skills. The mission aims at providing homes with essential services to the urban homeless. In addition, the Mission provides employment opportunities to street vendors by enabling access to appropriate spaces, institutional credit and social security.

Tejaswini: It is a scheme implemented by Mahila Arthik Vikas Mahamandal in Maharashtra in 1993. Under this scheme, women are encouraged to create SHGs. The scheme focuses on financial discipline and promotion of credit linkage among members through commitment to repayment of loans.

Maternity Benefits (Amendment) Act 2017: The Maternity Benefit Act, 1961, and its amended the Maternity Benefit (Amendment) Act, 2017, provides for paid maternity leave to women employees. The amendment has increased the paid maternity leave from 12 weeks to 26 weeks.

Pradhan Mantri Ujjwala Yojana: The purpose of the scheme is to make clean cooking fuel such as LPG available to the rural and poor households. Launched in 2016, the scheme gives free LPGs to women belonging to poor household across the country.

Integrated Child Development Scheme: The integrated child development scheme was launched in 1975. The scheme involves both childcare and women empowerment. ICDS services are provided through a vast network of ICDS centres, known as "Anganwadis". Another scheme which is integrated with ICDS is The National Crèche Scheme. It aims to make available day care facilities to children (age group of 6 months to 6 years) of working mothers.

Mahatma Gandhi National Rural Employment Guarantee Act It is based on the idea of creating job opportunities, social security to the poor. Mahatma Gandhi NREGS is a gender positive programme which promotes participation of women by providing wage parity with men, provision of separate schedule of rates of wages for women, facilities for crèche, work-side sheds for children and child care services.

Pradhan Mantri Mudra (Micro Units development and Reference Agency): The MUDRA scheme was designed with the aim of increasing micro-finance lending for small businesses. Upto ₹10 lakh loans can be availed from MUDRA empanelled financial institutions. Further, under this scheme, there is provision for reduction of 25 bps on interest rates for financial institutions giving loans to women, thereby motivating women entrepreneurs.

Pradhan Mantri Jan Dhan Yojana: PMJDY was implemented with the endeavor of providing universal access to financial services. Accounts are opened along with overdraft facilities and Rupay debit cards and life and accident insurance. PMJDY has increased the number of women account holders. Financial literacy and credit counseling (FLCC) centers are set up to disseminate knowledge about the financial products.

The Equal Remuneration Act 1976: It is a central legislation created to ensure equal remuneration in employment for both men and women. The Act was amended in 1987 to make it more effective by including even subsequent conditions of service as such promotions, transfers and training within the purview of the Act.

The Sexual Harassment of Women at the Workplace (Protection, Prohibition, Redressal) Act, 2013: The legislation is aimed at providing women with access to safe workplace free from any form of sexual harassment. The law requires establishment of committees internally within workplaces for addressing issues related to sexual harassment.

SECTION 5: MEASURES NEEDED FOR IMPROVING LABOUR MARKET PARTICIPATION OF WOMEN

Following are some of the measures that can be adopted to improve the participation of women in labour market.

Reduce the Unpaid Work Done by Women: In India, bulk of household activity is done by females. According to the Global Gender Gap Index 2016, proportion of unpaid work per day is 66 for females while it is 12 for males. Even the contribution made by women in agricultural sector is not remunerated as the product is not marketed. Efforts need to be made to increase investments in child care, elderly care, day care services to enable women to join labour force in larger numbers.

Improve Accessibility to Secondary and Higher Education: While the enrolment ratio of females has increased at the primary school level, there is a need to reduce the drop out rates for girls at the secondary and higher education level. Creation of educated workforce among women will help to increase job opportunities for them.

Development of Semi-Urban Areas: Employment of females is restricted primarily to agriculture in rural areas. Opportunities for working in service sector or self employment is limited in the rural economy. It is important to increase public investment in infrastructure like roads, safe transportation facilities, communication

networks and affordable housing in the semi-urban areas. This may encourage more females to join the labour force in smaller cities.

Ownership of Productive Assets: Though there are legislation that grants women's rights to property and assets, yet women face difficulties in gaining access to productive resources. Women should have ownership and greater accessibility to resources including loans, saving options, credit facilities to allow them to set up their own enterprises and contribute to the family income.

Encourage Entrepreneurship Among Women: Government has initiated several policies to encourage entrepreneurship among women. But most of these schemes are implemented in a piecemeal manner. Women face different barriers like availability of productive assets, credit, marketing, operational difficulties. The schemes created for women should be comprehensive including counselling and guidance.

Skill Development: To improve the employability of women, efforts have to be made to improve the skill development among them. Women have to be given basic skills of accounting, computer skills, and technical skills to run their own businesses. Institutes like SIDBI and other skill development programmes are imparting training to women to start their own business.

Social Protection: There is a need to improve beneficiary identification especially for schemes related to females. There is also need to reduce procedural delays, payment delays to make the schemes effective. Continuous monitoring and evaluation is needed to understand the impact of the schemes. The coverage of laws related to equal remuneration should be extended from the formal to the informal sector.

Workplace Safety: Lack of safety can be major hurdles to women to join workforce. There laws need to be amended to ensure that organization take appropriate steps to create a safe working environment for women.

Participation in Policy and Decision Making: Women has to be represented in large number in discussion forums related to employment and workplace. Though women have increasingly gaining political representation, yet their economic representation remains inadequate.

SECTION 6: CONCLUSION

The analysis shows that the gender gap in labour force participation in India has been increasing over the period of time. The main source of employment of females still remains the agriculture and the informal sector. The Government has taken several initiatives to improve the economic conditions of women through SHGs, employment creation, Law for equal remuneration and micro-finance.

For improving the labour force participation of women, efforts will have to be taken to create employment opportunities in semi-urban areas. Steps have to be taken to reduce the unremunerated work done by women. The safety conditions of workplace has to be improved for women to enter labour market in greater numbers. Women play very important role in India's growth and it is therefore crucial that measures are taken to improve the their labour force participation.

BIBLIOGRAPHY

1. Bhalla, S., & Kaur, R. (2011). Labour force participation of women in India: some facts, some queries.
2. Duflo, E. (2012). Women empowerment and economic development. *Journal of Economic literature*, 50(4), 1051-79.
3. Global Gender Gap Report 2022, World Economic Forum.
4. Kapsos, S., Silbermann, A., & Bourmpoula, E. (2014). Why is female labour force participation declining so sharply in India? (pp. 1-51). Geneva: ILO.
5. Klasen, S., & Pieters, J. (2012). Push or pull? Drivers of female labor force participation during India's economic boom. *Drivers of Female Labor Force Participation during India's Economic Boom*.
6. Kumar, R., Rajagopalan, R., Agarwal, A and Gupta, V (2020), 'Women's Economic Empowerment in India A Policy Landscape Study', January 2020.
7. Mehrotra, S., & Sinha, S. (2019). Towards higher female work participation in India: what can be done?.
8. Periodic Labour Force Survey (PLFS) -Annual Report (July 2020-June 2021)

Retail Banking Sector: Covid, Challenges & Indian Government Measures

Archana Singh and Jyoti Chandel

Department of Commerce and Business Administration, University of Allahabad, Prayagraj, Uttar Pradesh, India

ABSTRACT

The global COVID-19 pandemic has emerged as the “black hole event for the entire globe”. It brings darkness and dejection everywhere which lacks behind various developed as well as developing economies. In comparison to the Indian economy, which continues to face numerous challenges in a variety of sectors, the epidemic has broken the Indian economy's rib. After the situation has settled, the higher authorities must work together to implement economic measures. They need the Indian government to take massive global efforts to aid in the restoration of economic stability.

Despite the fact that the pandemic is likely to be confined, numerous economic scenarios foresee a larger-than-expected global recession. The problem has arisen at a time when India's economy is growing at its weakest pace in over a decade. In recent years, there have been signs of a rebound in the Indian economy. However, India's banking and space sectors are expected to be affected by the virus's spread. The government and authorities are working on an economic stimulus plan that will involve a variety of steps to increase liquidity and allow banks to operate regularly.

Keywords: Indian Banks, Retail Banking, Financial Crisis, Mergers And Acquisitions, Indian Government Policy

JEL Classification

G21, G01, G28, G34

INTRODUCTION

The COVID-19 outbreak has had a profound impact on everyone's lives, infecting people in 185 countries. Although a vaccination for this sickness has since been created, work from home, social separation, and just a few critical services were permitted prior to the lockdown. The only way to keep this crisis under control was to impose a curfew and restrict people's movement. All commercial activity was halted as a result of the actions taken by all governments, leaving all firms, banks, and financial institutions to count losses and costs. Covid-19 puts our economy on the back foot, paralyzing all of the sky-touching industries as well as the emerging ones.

The most difficult thing is that, once the crisis has passed, the government and its various personnel must start with a good idea and execute it well. It must begin with little steps in order to protect all sectors from harm. 12 public sector banks, 22 private sector banks, 46 foreign sector banks, 56 regional rural banks, 1485 urban co-operative banks and 96,000 rural co-operative banks, including cooperative credit institutions, make up India's banking system. Because all of our forward-looking goals and objectives are tied to this sector, it's a significant financial arena that requires more attention.

Although the RBI governs the Indian banking sector through the RBI Act 1934, which was followed by the Banking Regulation Act 1949, the RBI has custody of Indian banks and so regulates the banking sector by issuing numerous guidelines, notifications, and policies on a regular basis. The Federal Reserve System (government) oversees and controls a diverse range of financial institutions, keeping a close eye on their operations. It is their responsibility to ensure that their operations are safely managed and that the nation receives an equitable service.

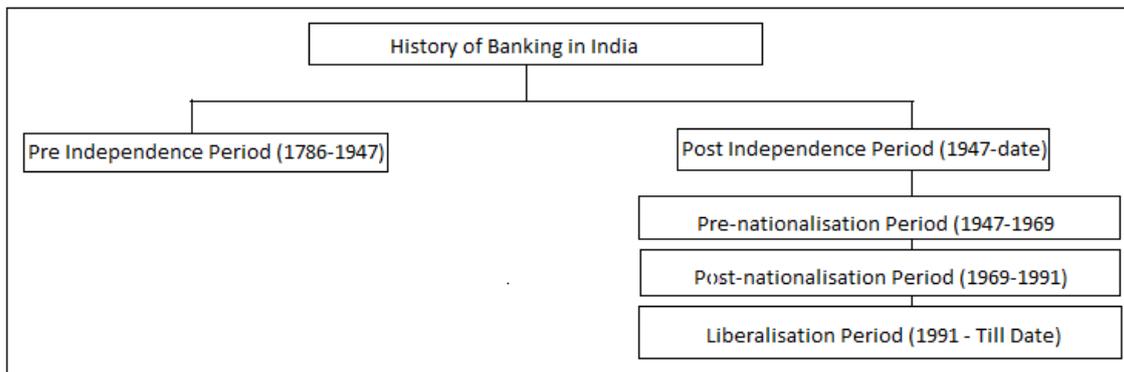
The government owns and operates public sector banks, whereas private entities are run by private players and their members with certain government exemptions. The government adopts a theoretical approach by enacting rules and regulations and intervening when necessary to ensure the economy's well-being.

LITERATURE REVIEW

- Asli Demircuc-kunt and others (2021), the research paper demonstrates the significance of policy announcements on the stocks of banks during the COVID era. Singh, Jitender, and Bodla, B. S. (2020), this article attempts to examine the impact of the pandemic on banks and NBFCs as a result of the lockdown, which has resulted in the closure of all commercial organisations, educational institutions, government and private offices, suspension of public and private transportation, and other measures. Jyoti Tanwar and colleagues (2020) used Data Envelopment Analysis to measure the overall efficiency of the Indian banking

sector. This research only looked at the internal issues that have an impact on the banking industry. Monika Chaudhary and others are among them (2020), the research study examines COVID's influence on the affected industries as well as the potential for India. Others, including Nicola Maria (2020), this research study examine the government's involvement in transforming society's socioeconomic position. Others, including Sonia Singh (2018) shows that the purpose of the study was to see how mergers and acquisitions affected bank performance in India.

History of Indian Banking Sector



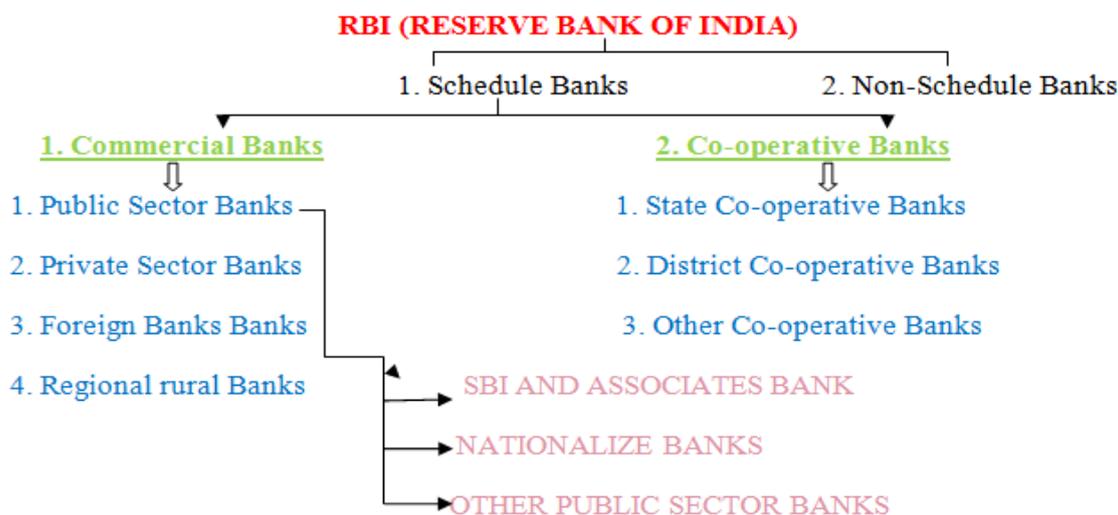
Phases of Indian Banking Sector: The banking sector development can be divided into three phases:

Phase I: The Phase I which is from 1770 to 1969.

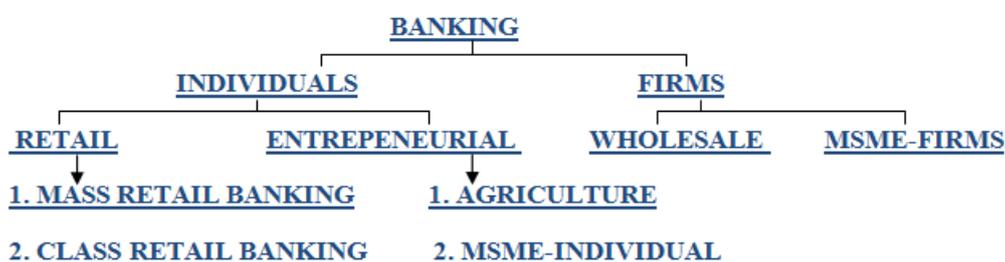
Phase II: The Nationalisation Phase II which is from 1969 to 1991.

Phase III: The Liberalisation or the Banking Sector Reforms Phase III which began in 1991 and still continues till date.

Organisational Structure of Banking Sector



Organisational Structure of Mass Retail Banking Sector



Retail banking is just like a mass-marketing which consist large number of customers with huge amount of transactions. It is well coordinated among banks, retailers, customers within the sector. In the developing country like India, retail banking sectors is at good pace because it provides financial services to their customers for smooth functioning of their day to day activities.

It consists of personal banking, business banking, international banking and corporate banking. Retail Banking is the accumulation of all banking activities which is provided to their customers on a single platform.

Objectives

1. To study the impact of covid-19 on the Indian retail banking sector.
2. To study the efficacy of Indian Government measures.

RESEARCH METHODOLOGY

For this paper, researcher studies the secondary data which is related with the Indian retail banking sector and the government initiatives All the data and the resources used in this study is from authentic sources which includes Banking statistics, published by Reserve bank of India, various reports of Indian banks, economic surveys ,use of internet and various news channel.

Performance Report of Public Sector Banks

- Public sector Banks (PSBs) controls over **60 per cent of banking assets. This sector faces dual regulation of RBI and Banking Regulation act.**
- The **private-credit to GDP ratio**, a key measure of credit flow, stands at **50 per cent**, much lower than international benchmarks — in China it is 150 and in South Korea it is 150 per cent.
- India's **Gross NPA ratio was 8.2 per cent in March 2020**, with differences between PSBs (10.3 per cent) and private banks (5.5 per cent).
- The result is **PSBs banks have lower profitability** compared to private banks.
- Indian banking sector facing lots of disparities along with the new regulations which creates lots of hindrances in the growth of banking sector.

Major Crisis and Downfall

The financial sector of our country is dwindling from last few years, with lots of disparities in their internal system along with the dynamic external policies.

Banking sector are the primary source of finance for the people. Even before the covid era, this sector is still finding the way to get out from the financial strain. Weak management policies, tighter control, dual regulation, falsifying balance sheet, favour to strong parties are the major reasons of bank crisis and these factors lead banking system in a drowning situation. Economic situation of India is still prevailing down from in the recent past years and banks are directly linked to a country's economic growth. It makes them more vulnerable is that they are connected to every sector as they are source of capital. So, if the power companies suffer, so do banks. If the real-estate sector goes down, banking system suffers a major loss.

"The banks are the lifelines of the economy and play a catalytic role in activating and sustaining economic growth, especially, in developing countries and India is no exception, " S S Mundra, deputy governor of the Reserve Bank of India said in a speech recently. However, India's banks face different kinds of problems, which have affected their profitability and financial stability, as per S S Mundra's speech.

The banking sector is became a debatable topic in every household as it occurs as a controversial one. This sector has shown lots of crisis in one to one sectors like aviation sector, infrastructure sector, and communication sector accompanied with big bull defaulters. With the PMC bank outcry in November 2019, the financial sector brings lot of liquidity crunch in the market and distrusts their customers. If the co-operative banks suffer from crisis, it will create lots of disturbance in the lives of low income groups.

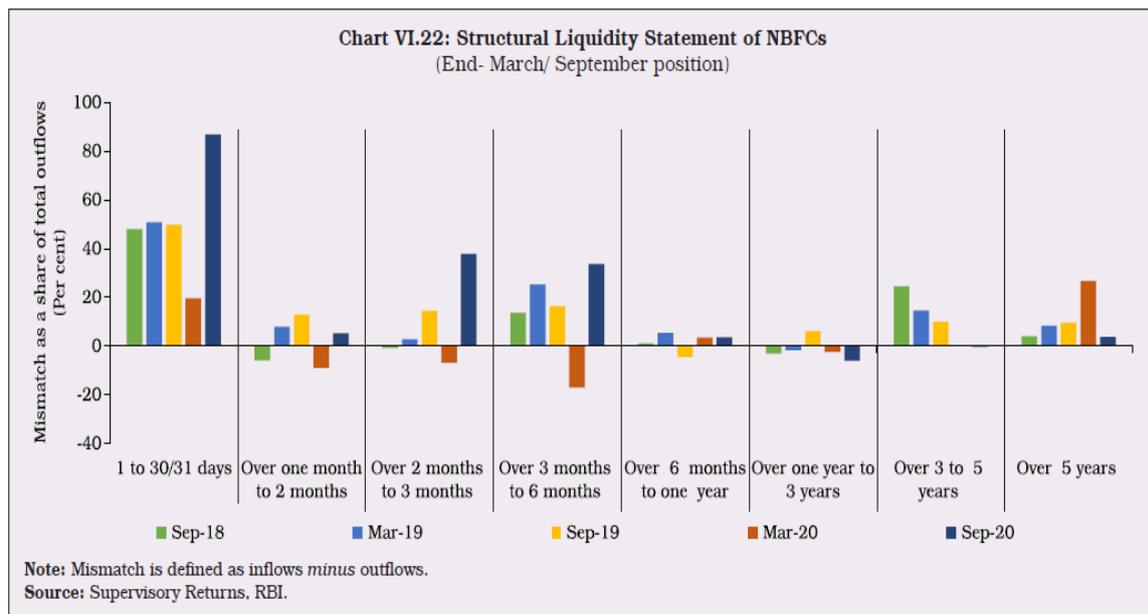
The next major financial calamity comes in the shape of the Yes Bank collapse, which suggests that the Indian economy is on the verge of collapsing. The RBI has currently placed Yes Bank under a ban, stating that depositors cannot withdraw more than Rs 50,000, barring extraordinary circumstances. If the government and RBI do not come up with help, SBI would invest at least Rs 2,500 crore to rescue the bank, which had a loan book of 3 lakh crore, and this might lead to a full-fledged crisis since about one-third of the financial sector is in financial difficulty.

1. Bad Debts Increasing

Experts believe that the level of NPAs should double owing to the economic impact of the pandemic. With rising levels of NPAs (bad debts) and provisions, their performance had been poor. And now a depressing economy will only add to those woes and worsen the situation.

2. NBFC Liquidity Issues

The non-banking financial firms (NBFC) crisis, which began in 2018 with the failure of IL & FS, is still wreaking havoc on the Indian banking industry. These 10,000+ poorly regulated NBFCs are not only a vital source of finance for small and medium-sized firms, but they are also interconnected with the larger banking industry. "Due to the Indian government's backing, the credit crisis caused by the COVID-19 epidemic is projected to raise systemic risks and generate more challenges ahead," stated CRISIL.



Source: Report on Trend and Progress of Banking in India 2019-2020

3. Operational Risks

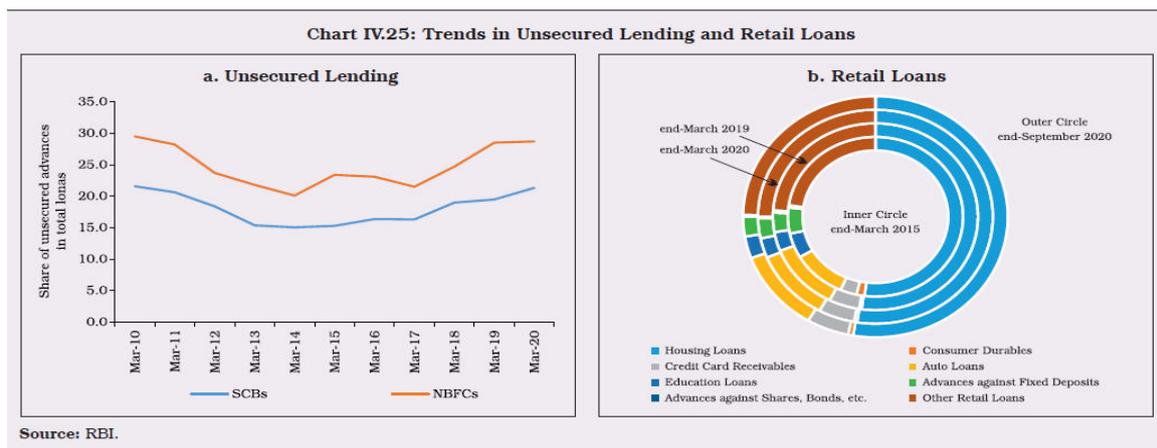
Operational Hazards Loss caused by errors made by the company's employees, procedures, or systems is referred to as operation risk. Operational risk has risen to prominence as a significant source of risk. Despite the fact that loans accounted for 98 percent of all frauds in terms of dollar amount, their occurrence was spaced out over several years. Large-value scams were concentrated, with the top fifty credit-related frauds accounting for 76% of the total amount reported as fraud in 2019-20.

(Cases in number and amount in ₹ crore)

Area of Operation	2017-18		2018-19		2019-20		2019-20 (April-September)		2020-21 (April-September)	
	Number of frauds	Amount involved	Number of frauds	Amount involved	Number of frauds	Amount involved	Number of frauds	Amount involved	Number of frauds	Amount involved
Advances	2,525	22,558	3,604	64,548	4,611	1,82,117	2,441	1,10,639	1,664	63,950
Off-balance Sheet	20	16,288	33	5,538	34	2,445	22	2,059	14	439
Forex Transactions	9	1,426	13	695	8	54	3	52	1	0
Card/Internet	2,059	110	1,866	71	2,677	129	1,234	53	1,244	49
Deposits	691	457	593	148	530	616	274	484	245	148
Inter-Branch Accounts	6	1	3	0	2	0	2	0	2	0
Cash	218	40	274	56	371	63	208	24	132	21
Cheques/DDs, etc.	207	34	189	34	202	39	98	13	76	48
Clearing Accounts, etc.	37	6	24	209	22	7	15	6	4	1
Others	144	247	200	244	250	174	113	44	106	25
Total	5,916	41,167	6,799	71,543	8,707	1,85,644	4,410	1,13,374	3,488	64,681

Notes: 1. Refers to frauds of ₹1 lakh and above.
2. The figures reported by banks and financial institutions are subject to change based on revisions filed by them.
3. Frauds reported in a year could have occurred several years prior to year of reporting.
4. Amounts involved are as reported and do not reflect the amount of loss incurred. Depending on recoveries, the loss incurred gets reduced. Further, the entire amount involved in loan accounts is not necessarily diverted.

Source: RBI.



Source: Report on Trend and Progress of Banking in India 2019-2020

4. Rating Drops by Rating Agencies

Fitch, a ratings organization, shares this viewpoint and has consequently reduced the Indian banking system's ratings. According to them, the viral spread will 'worsen India's already precarious operating conditions.' As a result, the 'viability rating' of the country's main banks has been downgraded: SBI, Axis Bank, ICICI Bank, and Bank of Baroda. Banks will suffer more, but not to the point of failure, they believe. And if there is a risk of this happening, the government will step in.

5. Economic Slowdown

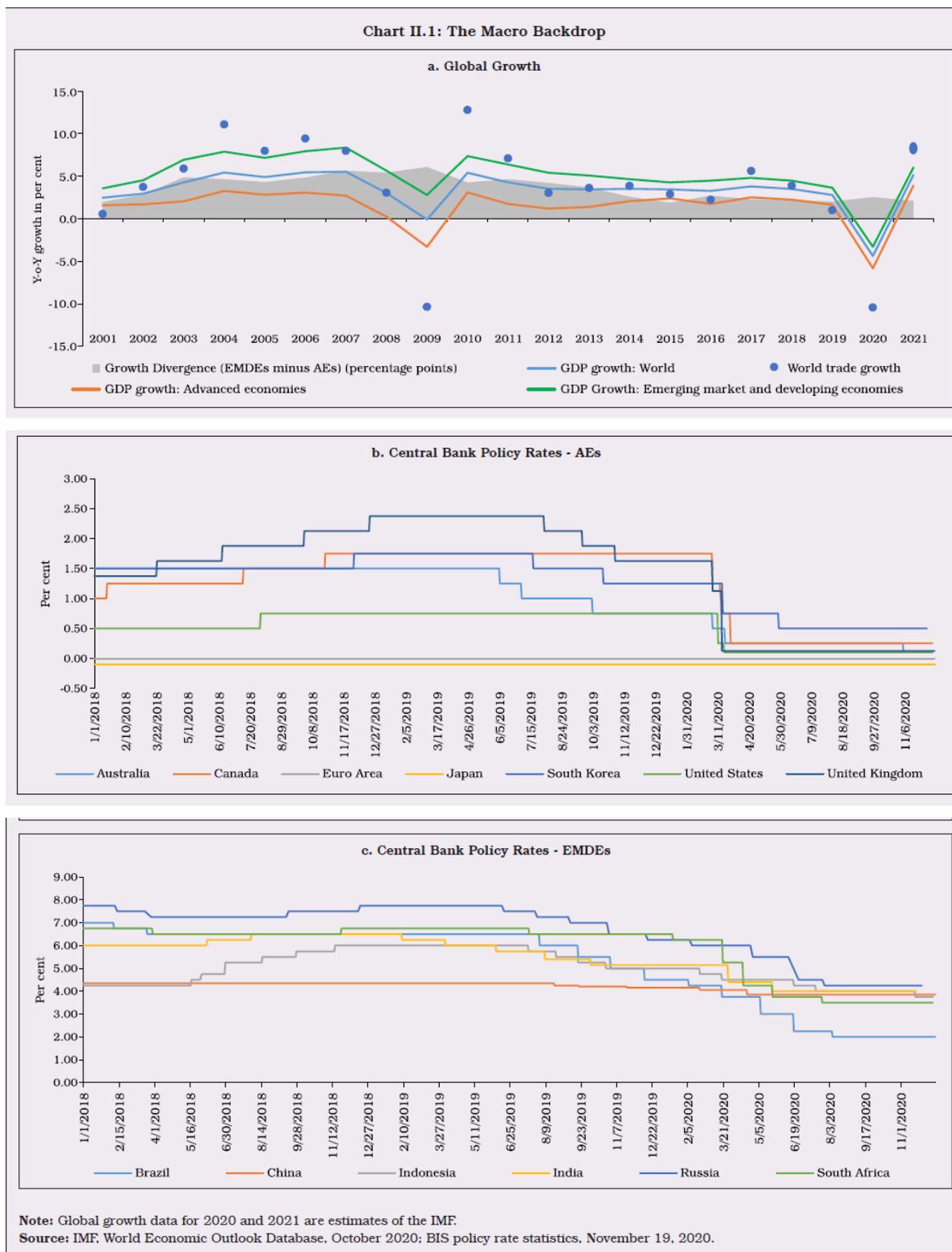
Crisil predicted that the GDP would fall by 5% in 2020 as a result of the COVID-19 shutdown hurting business conditions. As the lockdown drags on, the government's economic package is unlikely to give enough help, putting increasing strain on the financial sector.

Pre-covid scenario of Retail Banking Sector

- In the 1990s, India implemented an LPG strategy under which new bank licences were provided to private sector firms who began operations. By the early 2000s, they had established themselves as challengers to the PSBs.
- Market-based mechanisms to reduce the level of NPAs from the Securitisation and Reconstruction of Financial Assets and Enforcement of Security Interest (SARFAESI) Act of 2002. It allowed asset reconstruction companies (ARCs) to securitize problematic loans and resell them at a discount on the secondary market.
- NPAs peaked at about 25% of gross loans in the mid-1990s before decreasing to 2.2 percent in 2007-08, mainly to bank recapitalization and a strong economy. In the banking industry, non-performing assets (NPAs) account for over 70% of total assets. After then, the process of writing off non-performing assets (NPAs) and recapitalization commences. To meet legislated capital-adequacy standards, government bailouts have been used extensively, both in the 1990s and presently.
- To sustain the statutory CRAR, 3.8 trillion has been injected into 18 public-sector banks during the last decade. Following the global financial crisis of 2008–09, these standards were reinforced even further under the new Basel 3 framework.
- These fell marginally in 2019-20, but remained at an all-time high of 8.5 percent. In the fiscal year 2018-19, nonperforming assets (NPAs) accounted for nearly 5% of India's GDP. The situation will intensify as nonperforming assets (NPAs) grow again and national production is expected to fall.
- The financial crisis has had a negative impact on credit demand and supply. It is one of the main explanations for the decline in private investment during the previous decade. From 6.4 percent in 2015-16 to 2.2 percent in 2019-20, the benchmark real repo rate (the nominal repo rate minus the average of the wholesale and consumer price indices) has been steadily declining. NPAs would rise to 12.5 percent in 2020–21 in a business-as-usual scenario, and to 14.7 percent if the COVID-related problem worsened, according to the RBI's latest Financial Stability Report (June 2020).

Assessing the Impact

Banks and financial institutions must prepare for scenarios that might occur after covid. This would be essential in developing a flexible contingency plan that best equips the banks for crisis management and provides supportive solutions to its customers.



Source: Report on Trend and Progress of Banking in India 2019-2020

Government Measures to Boost Indian Banking Sector

According to the Greenwich Report, "the COVID-19 situation and the numerous other challenges confronting India's banking sector are impacting the competitive posture of some PSBs and private lenders, as well as the

industry's overall soundness." Both the Indian government and the Reserve Bank of India are taking beneficial steps to enhance the banking system as a whole.

Banks are using various recovery channels to recover the loan amount sooner so that it won't affect the working activities of the bank. The government and authorities have responded by putting together an economic stimulus package that includes a number of measures to boost liquidity and grant forbearance on a number of financial and regulatory obligations. In response to the epidemic, financial institutions have taken steps to limit in-person interactions, shrink operations, and provide financial assistance to retail and institutional customers.

They will need to inject additional capital into the banking system, and they may even be forced to rescue some tiny, failing banks, as they have done in the past through mergers and acquisitions. PSBs in India have recently been merged by the Indian government. This reduces the number of PSBs while also simplifying governance. It ignores, however, the institutional decay that needs more drastic measures, such as privatisation. Private sector banks are experiencing a less severe NPA issue than public sector banks. This merger becomes effective on April 1, 2020.

Oriental Bank of Commerce and United Bank of India will be merged into Punjab National Bank, Syndicate Bank will be merged into Canara Bank, Allahabad Bank will be merged into Indian Bank, and Andhra and Corporation Bank will be merged into Union Bank of India, according to the plan. Taking into account previous mergers, the total number of public sector banks has decreased from 27 to 12 (including SBI and its associates). The central government announced an Rs 20 trillion economic package in May 2020 to provide liquidity and credit support to businesses, particularly MSMEs, during the pandemic, develop farm sector infrastructure, and ensure migrant workers' livelihoods.

Major long-term structural reforms were also initiated at the same time. The banks had to be recapitalized by the government. Since 2008-09, the government has invested a total of Rs. 3 trillion (\$42 billion) in PSBs, accounting for 2% of India's GDP (gross domestic product). This is a significant fiscal drag for a government committed to fiscal consolidation. As the official banking regulator, the Reserve Bank of India (RBI) is responsible for disciplining, regulating, and supervising government-owned banks. The RBI has imposed a less stringent supervision on PSBs. This exacerbated the NPA crisis because the RBI allowed banks to postpone recognition of the bad news through various restructuring schemes.

Reasons for Privatisation of Banks

- Various studies show that government ownership in the banking sector leads to lower levels of financial development and growth.
- This led to waves of banking sector privatisations that swept emerging markets in the 1990s.
- Cross-country evidence suggests that bank privatisations improve both bank efficiency and profitability.

(Amount in ₹ crore)

Recovery Channel	2018-19				2019-20			
	No. of cases referred	Amount involved	Amount recovered*	Col. (4) as per cent of Col. (3)	No. of cases referred	Amount involved	Amount recovered*	Col. (8) as per cent of Col. (7)
1	2	3	4	5	6	7	8	9
Lok Adalats	40,87,555	53,484	2,750	5.1	59,86,790	67,801	4,211	6.2
DRTs	51,679	2,68,413	10,552	3.9	40,818	2,45,570	10,018	4.1
SARFAESI Act	2,35,437	2,58,642	38,905	15.0	1,05,523	1,96,582	52,563	26.7
IBC	1,152@	1,45,457	66,440	45.7	1,953@	2,32,478	1,05,773	45.5
Total	43,75,823	7,25,996	1,18,647	16.3	61,35,084	7,42,431	1,72,565	23.2

Notes: 1. Data are provisional.

2. DRTs: Debt Recovery Tribunals

3. *: Refers to the amount recovered during the given year, which could be with reference to the cases referred during the given year as well as during the earlier years. In the case of IBC, the realisation does not include amount realisable for operational creditors, from guarantors of corporate debtors and disposal of avoidance transactions.

4. @: Cases admitted by National Company Law Tribunals (NCLTs) under IBC. However, figures appearing for amount involved and amount recovered are for cases whose resolution plan was approved during the given financial year i.e. 81 cases for 2018-19 and 135 cases in 2019-20. Also, the amount recovered refers to realisables by all financial creditors, not just SCBs.

5. The resolution plan of Essar Steel India Ltd. was approved in 2018-19. However, as apportionment among creditors was settled in 2019-20, the recovery is reflected in the latter year data.

Source: Off-site returns, RBI and Insolvency and Bankruptcy Board of India (IBBI).

Table 3: CRAR of Banks: Pre- and Post-Merger

(Per cent)

	March 31, 2020 (Pre-Merger)	June 30, 2020 (Post-Merger)
Punjab National Bank	14.14	
Oriental Bank of Commerce	11.55	12.63
United Bank	5.56	
Canara Bank	13.65	
Syndicate Bank	11.52	12.77
Union Bank of India	12.81	
Andhra Bank	11.12	11.62
Corporation Bank	11.53	
Indian Bank	14.12	
Allahabad Bank	12.01	13.45

Table 4: NNPA Ratio

(Per cent)

	March 31, 2020 (Pre-Merger)	June 30, 2020 (Post-Merger)
Punjab National Bank	5.80	
Oriental Bank of Commerce	5.00	5.39
United Bank	4.88	
Canara Bank	4.18	
Syndicate Bank	4.61	4.08
Union Bank of India	5.49	
Andhra Bank	4.92	4.75
Corporation Bank	5.14	
Indian Bank	3.13	
Allahabad Bank	5.66	3.76

Table 5: Provision Coverage Ratio

(Without write-off adjusted, in per cent)

	March 31, 2020 (Pre-Merger)	June 30, 2020 (Post-Merger)
Punjab National Bank	62.39	
Oriental Bank of Commerce	62.84	64.47
United Bank	66.86	
Canara Bank	50.20	
Syndicate Bank	63.44	56.27
Union Bank of India	64.37	
Andhra Bank	72.80	69.61
Corporation Bank	66.26	
Indian Bank	53.11	
Allahabad Bank	70.18	66.92

Source: Report on Trend and Progress of Banking in India 2019-2020

CONCLUSION

According to the economic report, India's leading public-sector banks must become more efficient in order for the country to grow to a \$5 trillion economy. Instead of cutting back on lending, the economy wants the PSU banks to perform to their full potential and boost economic growth. Instead of having the present largest PSU bank, State Bank of India, which is the 55th largest global bank, India should have at least six banks in the top 100. The poll assumes that if Indian banks were proportionately large in comparison to the size of the Indian economy, the banking sector would have been one of the sectors driving the stock market surge in the last decade, with returns of more than 200 percent. As a result of the burgeoning entrepreneurial activity, major banks have been giving big loans to powerful corporate tycoons. Accounting scams encountered the same concerns as overextended balance sheets. It struggled to find major investors willing to put money into the project. Furthermore, it saw a consistent loss of funds, worsening their financial situation. The RBI cut the repo rate by 40 basis points to 4.0 percent on May 22, the lowest rate since 2000, further reducing banking industry profits.

Meanwhile, the RBI has prolonged a three-month suspension on loan payments till August 2020. These moves were viewed as a significant component of the government's reaction to the COVID-19 crisis, with demand falling across the Indian economy. Experts, on the other hand, feel that lower interest rates will reduce bank profitability during a crisis.

"The loan payment embargo takes the banking industry into unprecedented terrain," according to CRISIL, "with huge ramifications for bank earnings, loan-to-deposit ratios, and the country wide non-performing loan cleaning." The current issues are anticipated to result in substantial capital infusion requirements for financial institutions in order to sustain both regulatory and growth capital. While the pandemic's long-term effects on the

Indian financial services sector are uncertain, banks and NBFCs will undoubtedly have learnt a few lessons when normality returns. These might include how to maintain operational resilience in the face of future pandemics, as well as how to develop new operating models like different work arrangements and novel methods to communicate with clients in a distant setting. Furthermore, the pandemic might hasten the transition to future infrastructure, such as digital channels and networking.

REFERENCES

1. “Demirguc-Kunt, Asli; Pedraza, Alvaro; Ruiz-Ortega, Claudia. 2020. Banking Sector Performance during the COVID-19 Crisis. Policy Research Working Paper; No. 9363. World Bank, Washington, DC. © World Bank. <https://openknowledge.worldbank.org/handle/10986/34369> License: CC BY 3.0 IGO.”
2. Singh, Jitender & Bodla, Bhag. (2020). Covid-19 Pandemic and Lockdown Impact On India's Banking Sector: A Systemic Literature Review.
3. Tanwar, Jyoti & Seth, Himanshu & vaish, arun & Rao, N V M. (2020). Revisiting the Efficiency of Indian Banking Sector: An Analysis of Comparative Models through Data Envelopment Analysis. *Indian Journal of Finance and Banking*. 4. 10.46281/ijfb.v4i1.585.
4. Chaudhary, M., Sodani, P. R., & Das, S. (2020). Effect of COVID-19 on Economy in India: Some Reflections for Policy and Programme. *Journal of Health Management*, 22(2), 169–180. <https://doi.org/10.1177/0972063420935541>
5. Nicola, Maria & Alsafi, Zaid & Sohrabi, Catrin & Kerwan, Ahmed & Al-Jabir, Ahmed & Iosifidis, Christos & Agha, Maliha & Agha, Riaz. (2020). The Socio-Economic Implications of the Coronavirus and COVID-19 Pandemic: A Review. *International Journal of Surgery*. 78. 10.1016/j.ijssu.2020.04.018.
6. Singh, Sonia & Das, Subhankar. (2018). Impact of post-merger and acquisition activities on the financial performance of banks: a study of Indian private sector and public sector banks Impacto de las actividades posteriores a la fusión y adquisición en el desempeño financiero de los bancos: un estudio de los bancos del sector privado y del sector público de la India. *Espacios*. 39. 25.

BIBLIOGRAPHY

1. <https://www.livemint.com/Sundayapp/fjheowjLjiFNsGcjzVZXsO/Banking-crisis-An>
2. <https://economictimes.indiatimes.com/industry/banking/finance/a-major-crisis-may-be-brewing-for-indian-banks/articleshow/70458734.cms?from=mdr>
3. <https://www2.deloitte.com/in/en/pages/financial-services/articles/gx-banking-industry-outlook.html>
4. <http://www.businessworld.in/article/What-s-The-Root-Cause-Of-Indian-Banking-Failure-/17-03-2020-186408/>
5. <https://www.thebanker.com/World/Asia-Pacific/India/Slow-burning-crisis-set-to-ravage-India-s-banks>
6. <https://www.oliverwyman.com/our-expertise/insights/2017/dec/risk-journal-vol-7/emerging-risks/the-public-sector-banking-crisis-in-india.html>
7. https://www.researchgate.net/publication/259122205_The_financial_crisis_and_Indian_banks_Survival_of_the_fittest
8. <https://www.financialexpress.com/opinion/banking-crisis-is-not-over-yet-but-recapitalisation-hides-the-truth/1820899/>
9. [http://blog.franklincoveysouthasia.com/inner.aspx?PostID=34&sessionId=gf@dsew45\\$785fdf457415\\$](http://blog.franklincoveysouthasia.com/inner.aspx?PostID=34&sessionId=gf@dsew45$785fdf457415$)
10. <https://www.thehindu.com/opinion/open-page/the-crisis-in-indian-banking/article22845842.ece>
11. <https://nickledanddimed.com/2018/08/29/the-indian-banking-crisis/>
12. www.ideasforindia.in
13. <https://www.eastasiaforum.org/2019/10/03/banking-crisis-impedes-indias-economy/>
14. <http://www.businessworld.in>

Women in History Textbooks of West Bengal Board of Secondary Education and Central Board of Secondary Education

Barsha Chhetri and Lalbiakdiki Hnamte

Department of Education, India

ABSTRACT

Textbooks are one of the most common and widely used educational tools that help in constructing social realities. As the nation is thriving for gender equality in all walks of life, education remains one of the significant areas. Gender equality in education is not possible unless the discrimination that exist in layers in education system is eradicated. Gender representation in textbooks, history textbook in particular has been a matter of concern. The present study aims at evaluating and comparing history textbooks of West Bengal Board of Secondary Education (WBBSE) and Central Board of Secondary Education (CBSE) from gender perspective. The findings which emerged from the study highlighted underrepresentation of women in the textbooks prescribed by central as well as state board. The number of male references was extremely higher than that of females both in content and visuals. The female depiction in CBSE textbook was more conspicuous than in WBBSE textbook, although, still a lot lesser than their male counterpart. Disparity in gender representation indicates that, women are still hidden from historical records. The findings of this study could be instrumental in making necessary changes, in order to create a gender-neutral textbook.

Keywords: Gender, History Textbooks, Content, WBBSE and CBSE

INTRODUCTION

Textbooks are the medium that reflects and shapes social realities and serves as significant means of transmitting knowledge and values. It plays crucial role in analysing the distribution of power and principles of social control by legitimizing the power relation established between class, group or sex (Esen, 2007). In a country like India, that is thriving for gender equality in all walks of life, school curriculum often comes under limelight for various reasons such as the cartoonistic depiction of Nehru and Ambedkar which created a buzz in the parliament and sought an immediate deletion of certain portions of textbook and punitive proceedings against those responsible for the inclusion of these portions (Kumar, 2012). Apart from that, gender issues in school curriculum, particularly in textbooks have been a matter of concern. Gender representation in history textbooks has raised debate among historians and feminists. The history and experiences of women have been underrepresented in the subject (Osler, 1994). One of the significant underlying reasons that prevent women from historical discourse is the fact that history is considered as subject of transmission of politics, execution of power and economics, while another crucial reason is that a majority of historians are men (Pamuk & Muç, 2021). Women were mostly depicted in traditional roles and as caregivers. The representation of women in history is comparatively lesser than men, indicating hierarchy in social structure rooted from patriarchal past of the society (Hnamte & Chhetri, 2021).

In academia, gender issues have been highlighted by various commissions and policies. A crucial initiative was taken by National Policy on Education (NEP-1986) and Programme of Action (POA) 1992, which stressed on eliminating sexist bias and sex stereotypes from school textbooks. The knowledge and information transmitted through textbooks, directly and indirectly influence choices and perceptions in certain ways and helps to construct reality based on it (Brummelen, 1991). Similarly, National Policy for the Empowerment of Women (2001) advocated gender sensitive curricula at all levels of education and highlighted sex stereotyping as one of major causes of gender discrimination. Increase in enrolment should not be viewed as only a means to achieve gender equality in education. Several underlying layers of reasons concerning gender inequality that exist in the educational system till date require adequate attention in order to mitigate it.

The Central Board of Secondary Education (CBSE) uses textbooks produced by National Council of Educational Research and Training (NCERT). These textbooks are prepared under the guidelines laid by National Curriculum Framework, that is responsible for developing framework for school curriculum across the nation. While, West Bengal Board of Secondary Education (WBBSE) uses textbooks produced by state board and prepared under NCF guidelines. Various studies related to textbooks have been done in the past, however a comparative study between the central and state board in terms of gender is seldom a topic of discussion. Therefore, it becomes crucial to evaluate the textbooks in order to comprehend where we stand and what we lack in achieving gender equality in education.

Gender and Textbooks

The digital interventions to make education accessible to all, through various online platforms are evidenced by its widespread use at different levels of education. National Mission on Education through Information and Communication Technology (NMEICT) is one such scheme that aims to cater educational needs of people of India. However, textbook is regarded as one of the most common and widely used educational tool for imparting knowledge. For instance, history textbook is viewed as a medium through which legitimate past knowledge is carried down to upcoming generation. It is considered as powerful cultural, ideological and political tool of the society that mould current society (Chiponda & Wassermann, 2011). Textbooks are considered as prime site in curriculum designing by National Curriculum Framework (2005).

The concept of gender inequality or sexism in textbooks has emerged as one of the major areas of research in social sciences and gradually in natural sciences. It gained conscious awareness after it became evident that gender inequality in education is not confined to girls' enrolment in school. It is difficult to achieve gender equality as long as multi-layered and multidimensional discrimination that predominantly exist in education system is eliminated (Nurul, 2021). Although, various studies across the globe have revealed gender inequality in textbooks, there is no radical change in the content as it continues to produce gender stereotypes (Ballantine, Hammack & Stuber, 2017).

Textbooks immensely contribute in understanding gender role as distinct power of social structure. It directly and indirectly imparts idea of gender roles and gender appropriate behaviours among the readers (Taştekin, 2019 in Pamuk & Muç, 2021). Gender stereotypes in textbooks are reflected through presentation of activities, locations and occupations that seem to be appropriate and designated for particular gender (Nurul, 2021). Stereotyping in any form such as visuals, language, content etc. may potentially transmit undesirable information. Women have been underrepresented in existing historical record. Although, progress has been made but the real understanding of women's life in the past to create balance history is yet to be achieved (Osler, 1994).

The main objective of the study is to evaluate and compare history textbooks of CBSE and WBBSE from gender perspective. The following research questions shaped the present study-

1. How are women from the past represented in history textbooks?
2. What are the different kinds of occupation/ profession women and men are portrayed in history textbooks?
3. What are the frequencies of appearance of women and men in the content of book?
4. Do the visuals equally portray men and women?

METHODOLOGY

Qualitative research design was used in the present study. In order to analyse textbooks, content analysis of the textbook was done with the help of Evaluation Tool for Textbooks Analysis from a Gender Perspective developed by NCERT. Content analysis is potentially one of the most important research techniques that allows investigator to view data as representations not of physical events but of texts, images and expressions that are created to be seen, interpreted and acted on for their meanings (Krippendorff, 2004).

RESEARCH SAMPLE

The sample of the study comprised of history textbooks of Standard X of Central Board of Secondary Education and West Bengal Board of Secondary Education.

DATA ANALYSIS

Description of cover page of WBBSE history textbook -The front cover depicted men on horse holding swords and guns. The visual reflects power and male supremacy.

The back cover depicted two sets of picture, the lower half of the back cover depicted same picture as front cover and the upper half portrays a village scenario with men riding on horses and others doing their jobs. The same page portrayed women carrying matka (earthen pot used for fetching water) and holding a child. The cover page reflects women in traditional role.

Description of Cover Page of CBSE History Textbook -The front cover includes miscellany of pictures that depicts both male and female. The visuals displayed inside of cover page illustrates pictures of deities where male deity is seen as mighty and ferocious while female deity was portrayed as holding a child and feeding a cat.

The back cover depicted the same picture of deities and its inside contain picture of Gandhiji. However, the pictures of deities used inside the cover page mill was mill labels (also called tickets) that was intended to paste on bolts of clothes to indicate the flourishing textile industry. Further, the cover page reflects inclusivity in terms of gender representation but illustrates women in stereotypical role.

Occupational activities in WBBSE textbook- The representation and engagement of women in any professional activities varied in different chapters. Some depicted women engage in different occupation, while other portrayed them as caregiver such as wife, daughter and mother. Whereas, men were portrayed in diverse range of activities.

Occupational Activities in CBSE Textbook- Engagement of women in occupational activities was bare minimum in comparison to men. Their depiction was accidental and superficial in most of the chapters while, it portrayed the engagement of men in various activities and represented number of male luminaries.

The following table shows the visibility and appearance of male and female in content and visuals in different chapters.

Chapter	Male				Female				Visuals containing both male and female	
	Content		Visual		Content		Visual		CBSE	WBBSE
	CBSE	WBBSE	CBSE	WBBSE	CBS E	WBBS E	CBSE	WBBS E		
1	31	104	7	7	-	14	3	1	4	-
2	26	76	9	18	3	5	2	-	4	-
3	31	43	10	8	-	1	2	-	1	-
4	16	48	10	4	1	4	2	2	6	-
5	37	47	12	4	2	-	3	-	7	1
6	27	59	8	12	3	-	2	-	5	3
7	40	33	9	8	12	27	1	8	7	-
8	51	19	11	4	10	-	8	-	3	1
Total	259	429	76	65	31	51	23	11	37	5

FINDINGS

Representation of Women in History Textbooks

The representation of women in history textbook of WBBSE was bare minimum in comparison to men. Their portrayal was incidental and non-existent in majority of chapters and those that depicted women do not provide adequate information or elaboration on their existence in the past. Although, inclusion of women in the textbook cannot be denied, yet, it was far from achieving a balanced representation. Indeed, portrayal of women were confined and hidden in most of the chapters. The portrayal of men were prominent and diverse throughout the text. The cover page of the textbook indicated pre-conceived notion of women as caregiver, who are entitled to do only household chore and look after the family. It reflected patriarchal ideology rooted from the past. Gender inequality and patriarchal ideals go hand in hand (Chakraborty, 2013), that is evident in the present study.

Depiction of men in history textbook of CBSE was prominent, although women were not forgotten. It illustrated social status of women and their struggle in male dominated society which was prevalent during that period. Women were barely addressed by their name and designation and as specific individual that gives a gist of identity crisis. They were mostly represented as part of a group rather than significant individual. However, the text depicted unfair treatment towards women in the past, their engagement in economic activities and education. It represented a good number of inspiring male luminaries, while the portrayal of women was basic. The cover page reflected inclusivity in terms of gender representation but illustrated women in stereotypical role.

Occupation/ Professional Engagement

The depiction of women in occupation/ professional activities in WBBSE textbook was less. Apart from their representation in few activities, they were depicted in family relations such as wife, daughter, widow, sister etc. While, depiction of men in various professional activities was extravagant. The representation and occupational engagement of men from different strata of society indicated their significance in the past and present. Similarly, in CBSE textbook, engagement of women in occupation/professional activities is less and insubstantial in comparison to men. However, they were represented in basic economic activities that did not attach significance to their existence.

Frequencies of Appearance

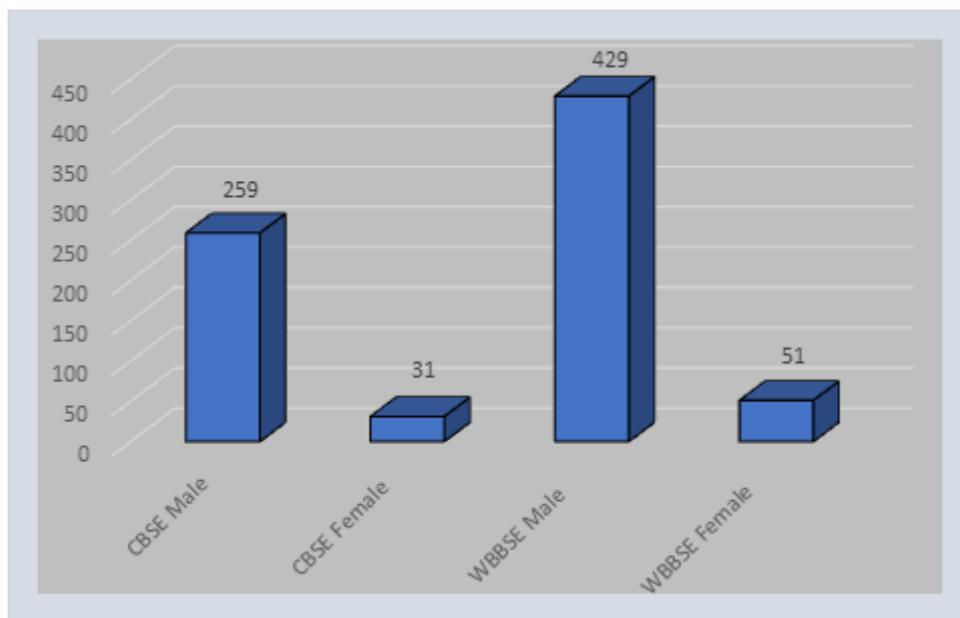


Figure showing frequencies of male and female appearance in content of CBSE and WBBSE history textbook

The findings highlighted underrepresentation of women in textbooks of both central and state board. Male-female ratio in WBBSE textbook was 429:51 i.e., 143:17. This indicated dominant representation of men in textbook. Similarly, in CBSE textbook, male-female ratio was 259:31. This shows a huge gap in terms of gender representation that is evident in textbooks. This sought immediate attention in order to create gender balance and gender sensitive textbooks.

Visual Depiction

The visual representation of women was comparatively less than men in textbooks of both central and state board. The visuals that were blurry and indistinct were omitted from the study. The pictorial depiction of men was exceedingly higher than women in WBBSE textbook. Likewise, gender gap in visuals was evident in CBSE textbook. The visuals portrayed women in stereotypical roles shaped by patriarchal ideology. The pictures that depicted both male and female represented men as significant and women as subordinate.

DISCUSSION

The difference in gender representation is clearly evident from the present study. Textbooks of both central and state board showed underrepresentation of women in content as well as in visuals. However, the representation varied in different chapters, their depiction was distinct in some chapters and non-existent in another. The number of male reference and picturization was exceedingly higher than females. In comparison to WBBSE textbook, representation of women in CBSE text was more prominent although, their portrayal as significant individual was still missing in the textbook. Majority of the chapters portrayed information about women, their struggle and unfair treatment towards them in patriarchal society. The central board uses textbook developed by NCERT that stated gender as most pervasive form of inequality which operates across all classes, communities and castes.

The depiction of women was not as striking as men. Their representation was basic and insubstantially sculptured under hierarchal belief. The undistinguished representation of women in the textbooks indicated identity crisis among them. One of the several reasons behind exclusion of women in historical records is that they were considered as mothers, wives, servants, whose life and work are regarded irrelevant to history (Rose, 2018). A history textbook should provide reliable information about the past (Thapar, 2005). Gender equality has been one of the major objectives of educational policies in India. Serious inquiry into curricula, content, the gender construction of knowledge as well as a more critical and pro-active approach to issues of gender is necessary. Gender has to be recognized as cross-cutting issue and as critical marker of transformation, it must become an important organizing principle of the national and state curricular framework as well as every aspect of the actual curricula (NCERT, 2006). Inclusion of women in these textbooks is undeniable, yet it is far from achieving gender balance content.

Majority of visuals portrayed men, indicating dominance and significance of their existence. Gender stereotyping through images mould our perception of gender appropriate roles to be performed in life. The visuals that depicted hierarchy of system plays significant role in restoring gender inequality in society. The underrepresentation of females in the text, in comparison to their male counterparts visibly reflects patriarchal roots of the society (Hnamte & Chhetri, 2020). History textbook is viewed as significant tool for interpreting, producing and converting gender roles into behavior (Pamuk & Muç, 2021), therefore development of gender sensitive textbooks becomes more essential.

IMPLICATIONS

The present study highlighted underrepresentation of women in history textbooks. Further, the difference in gender representation between textbook of central and state board was also distinct. The findings of the present study can be crucial in aligning with new guidelines suggested by National Education Policy (2020).

CONCLUSION

Gender equality is essential for the progress of community and nation as whole. Gender inequality in educational system, particularly in textbooks has been a matter of great concern. As the knowledge and information transmitted through textbooks help in constructing social realities, there is a need of more radical depiction of women befitting today's society, their accolades and contributions to present day society, in order to mould young minds and shape their thoughts and approach. Likewise, male depiction in textbooks needs to be revised and stereotypical portrayal of both gender in terms of their job profile needs to be erased. The gender gap revealed through present study in terms of representation in content and visuals, both in quantity and quality indicates amount of work that need to be done, in order to create gender balanced textbooks.

REFERENCES

1. Brummelen, H.V. (1991). The world portrayed in texts: An analysis of the content of elementary school textbooks. *The Journal of Educational Thought*, 25(3), 202-221. https://www.jstor.org/stable/23767373#metadata_info_tab_contents
2. Ballantine, J., Hammack, F., & Stuber, J. (2017). *The sociology of education: A systematic analysis*. Routledge.
3. Bhog, D (2002). Gender and curriculum. *Economic and Political Weekly*, vol 37(17),1638-1642. <https://www.jstor.org/stable/4412041>
4. Chiponda, A. & Wassermann, J. (2011). Women in history textbooks- what message does this send to the youth?. *Yesterday & Today*, 6. Retrieved from <http://www.scielo.org.za/pdf/yt/n6/06.pdf>
5. Chakraborty, D. (2013). *Curriculum and gender: A sociological investigation of secondary education in West Bengal* [Doctoral dissertation, University of Calcutta]. Shodhganga.
6. Esen, Y. (2007). Sexism in school textbooks prepared under education reform in Turkey. *Journal for Critical Education Policy Studies*,5(2), 1-20. https://www.researchgate.net/publication/310447802_Sexism_in_School_Textbooks_Prepared_under_Education_Reform_in_Turkey
7. Elster, C.A. (1998). Influences of text and pictures on shared and emergent readings. *Research in the Teaching of English*, 32(1), 143-78. <https://www.jstor.org/stable/40171566>
8. Hnamte, L. & Chhetri, B. (2020). Content analysis of history textbook of West Bengal Board of Secondary Education. *Towards Excellence*, 13(3), 430-437. <https://hrdc.gujaratuniversity.ac.in/Publication/article?id=3722>
9. Kumar, K. (2012). Quality constraints in education: Fallout of the cartoon controversy. *Economic and Political Weekly*, 47(22), 12-13. <https://www.jstor.org/stable/23214995>
10. Kalyan, C. (2020). *History and Environment*. Oriental Book Company Pvt. Ltd.
11. NCERT (2014). *Indian and the contemporary world-II*. Nation Council of Educational Research and Training.
12. NCERT -Evaluation tool for textbooks analysis from a gender perspective. Retrieved from https://ncert.nic.in/dgs/pdf/Evaluation_tool.pdf
13. National Policy on Education (1986). Ministry of Human Resource Development.

14. Nurul, O. (2021). Analysis of gender fairness of primary school mathematics textbooks in Turkey. *International Journal of Psychology and Educational Studies*, 8(4), 78-95. <https://dergipark.org.tr/en/download/article-file/2070393>
15. Osler, A. (1994). Still hidden from history? The representation of women in recently published history textbooks. *Oxford Review of Education*, 20(2), 219-235. https://www.jstor.org/stable/pdf/1050624.pdf?refreqid=excelsior%3A00095876507f8cfb656dc934e7df3f27&ab_segments=&origin=
16. Pamuk, A. & Muç, K. (2021). Women's gender roles in history textbooks in Turkey. *International Journal of Psychology and Educational Studies*, 8(2), 133-147. https://www.researchgate.net/publication/352783274_Women's_Gender_Roles_in_History_Textbooks_in_Turkey
17. Rose (2018) In Pamuk, A. & Muç, K. (2021). Women's gender roles in history textbooks in Turkey. *International Journal of Psychology and Educational Studies*, 8(2), 133-147. https://www.researchgate.net/publication/352783274_Women's_Gender_Roles_in_History_Textbooks_in_Turkey
18. Schrader, C.E. & Wotipka, C.M. (2011). History transformed? Gender in World War II narratives in U.S. history textbooks, 1956-2007. *Feminist Formations*, 23(3), 68-88. <https://www.jstor.org/stable/pdf/41301673.pdf>
19. Shah, M.U. (2019). Content analysis of English language textbook of Jammu and Kashmir state board of secondary education for class 8th from gender perspective. *Online Journal of Multidisciplinary Subjects*, 13(1), 664-679. <https://files.eric.ed.gov/fulltext/ED604218.pdf>
20. Thapar, R. (2005). National curriculum framework & the social sciences. *Social Scientist*, 33(9), 55-58. <https://www.jstor.org/stable/pdf/3518090.pdf>
21. Taştekin, O. (2019) in Nurul, O. (2021). Analysis of gender fairness of primary school mathematics textbooks in Turkey. *International Journal of Psychology and Educational Studies*, 8(4), 78-95. <https://dergipark.org.tr/en/download/article-file/2070393>
22. Krippendorff, K. (2004). *Content Analysis: An introduction to its methodology*. Sage Publications.

Patients's Attitude Regarding Satisfaction Level on Higher Health Service Quality in Public and Private Hospitals in Punjab

Satpal and Munish Kumat Talwar
Rayat Bahra University Mohali Punjab, India

ABSTRACT

World is dynamic. Thus globalization competition has been intensifying and creating an environment of constant change. Considering the current scenario of business World, winning and keeping customers has become very burning issue. Conventional knowledge advises all business undertakers to keep themselves loyal to their customers by all costs. The Health Care Service Provider organizations like any other service provider organizations are facing a rapidly changing environment, particularly more demanding patients.

In Health Care Service Provider organizations, the entire range of activities and generation of incomes twirls round the patients. Recently hospitals have realized that cost of attracting replacement patients is far quite more than retaining existing patients, so hospitals are emphasizing more upon patient satisfaction. The present study genuinely attempts to know patient's attitude regarding satisfaction level on higher service quality and to analyze its determinants by comparing public and private hospitals in Punjab.

This study has been conducted in ROPAR city. A sample of 500 respondents has been used by collecting data through Convenient Sampling method. Correlation, Chi square test and Reliability test (CRONBACH's Alpha) have been used in order to get research results. This study concluded that Private hospitals are most preferred by the patients because of providing more satisfaction level on higher service quality.

Keywords: Patient satisfaction, Higher Service quality, Public and Private Hospitals, Hospitals study, Recommendations

1 INTRODUCTION

The health sector of any country plays very vital role in the economic development of country. Finance is an integral part and considered as the oxygen of trade and industry. The development of health sector within the country has placed India amongst the top 3rd fastest growing economies of the world. Whole of the world is looking towards India as world's markets in producing medicines. That is why India is known as Hub of Medicines. Recently the health sector has touched the lives of almost every citizen in every sphere of life whenever he wants to keep his health strong and sturdy. These days patients demand for timely, fast and higher quality services and medicines in order to defend themselves from epidemics and new pandemics. The present research has been conducted keeping in view the attitude of patients regarding satisfaction level on higher service quality on public and private hospitals in India.

Different researchers opined different views regarding customer's satisfaction on different angles. Some researcher emphasized on retaining customers at all costs while some advised for providing higher quality services according to their aspirations. Actually there are no any unanimous opinions among researchers and authors. The views of Juran, Deming and Crosby are very appreciable and praise worthy as recited under Juran, Deming and Crosby, "The quality of the product or service satisfies a customer". The service quality school defined it in a different way and marked it satisfaction as an antecedent of service quality - satisfaction with individual transactions "decay" into an overall mindset towards service quality. The satisfaction school expresses that attitude refers to satisfaction level of customers that is directly relates to assessments of service quality. But a big and robust link between customer satisfaction and customer retention can be observed. Here customer's attitude regarding Service and Quality of product will determine the success of the product or service in the market. If experience of the service is more than expectations, then clients would feel more satisfaction and vice versa. Literature advises for managing loyal customers to maximum extent to all costs. In this matter customer retention plays a pivotal role because its main purpose is to keep customers for the long term by undertaking various types of activities. Thus loyal customers can be retained by doing the following written activities

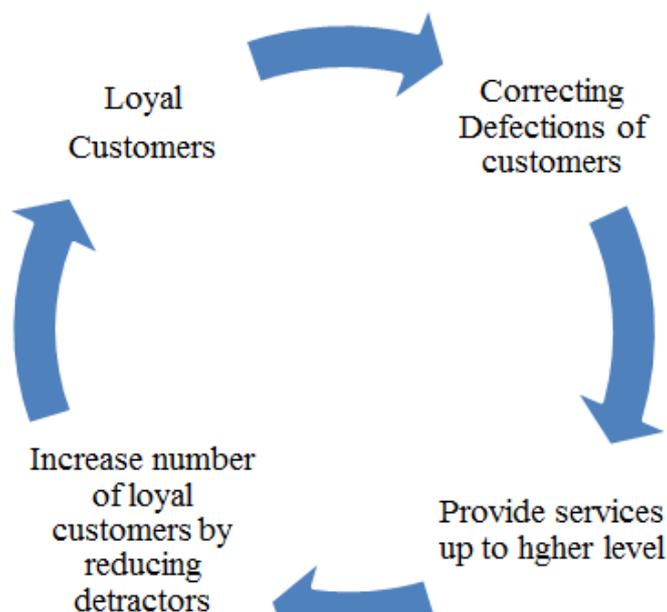


Figure-1

- Correcting defections of customers
- Providing services up to higher level
- Increase the number of loyal customers by reducing detractors.

2 REVIEW OF LITERATURE

- **Ghazanfar Et Al (2017)** studied on comparison of patients satisfaction levels in public and private tertiary care centers. Study resulted paucity of patient satisfaction in public area as compare to private area. Finally study suggested for taking necessary measures to eradicate this problem.
- **Al-Hanawi Et Al (2018)** studied on householder's attitude regarding health care services. After studying it was found that customer satisfaction plays an important role in running organizations well.
- **Al-Hanawi Et Al (2019)** studied on health care human resource development in Saudi Arabia: emerging challenging and opportunities and resulted that health care services must be provided to all employees in order to satisfying them. Due to paucity of these services negative impact will be borne by organizations.
- **Al -Harajin Et Al (2019)** studied on waiting time and patient satisfaction in outpatient clinics. After studying it was found that less waiting time increases patient satisfaction
- **Rahman.R (2020)** highlighted privatization of health care system in Saudi Arabia and its impact on patient satisfaction. Study resulted increasing level of patient satisfaction because of privatization.

3 RESEARCH PROBLEM

There is a stiff and destructive level competition between public and private hospitals. Private hospitals are liked and preferred for fast, qualitative and timely services. Whereas, public hospitals are criticized for late, inferior and untimely health services to patients in spite of various government health schemes. It has been debated and researched that timely and qualitative health services enhance patient experience by bringing the patients closer to their hospitals. On the other hand, inferior quality, untimely health services, more documentation, tyrannical attitude and behavior of medical staffs make patients unsatisfied towards hospitals. So there is a need of the hour to assess the satisfaction level of patients in public and private hospitals to provide the suggestions for improvement of services.

4 RESEARCH OBJECTIVES

After going through review of literature, this study seeks to obtain the primary objective by throwing light on hospitals that are largely availed by the patients through analyzing the expectations and the satisfaction level towards the services rendered by public and private hospitals in Punjab. This study has some specific objectives as given under

- To compare the perceptions of the patients in and public and private hospitals in Punjab.
- To determine the perceptions of patients regarding the service quality in hospitals in Punjab.
- To understand preferences towards types of services provided by the public and private hospitals in Punjab
- To identify the factors impacting the satisfaction level of patients with hospitals in Punjab

5 CONCEPTUAL FRAMEWORK

It is expected that patient's attitude is influenced by satisfaction level regarding higher health services like good health services, doctor's attitude, timely treatment, behavior of auxiliary staffs, nutrition facilities, on line services, good diagnostic services and recommendations. Thus patient's attitude towards health services is taken as independent variable while good health services, doctor's attitude, timely treatment, behavior of auxiliary staffs, nutrition facilities, on line services, good diagnostic services and recommendations are as dependent variables.

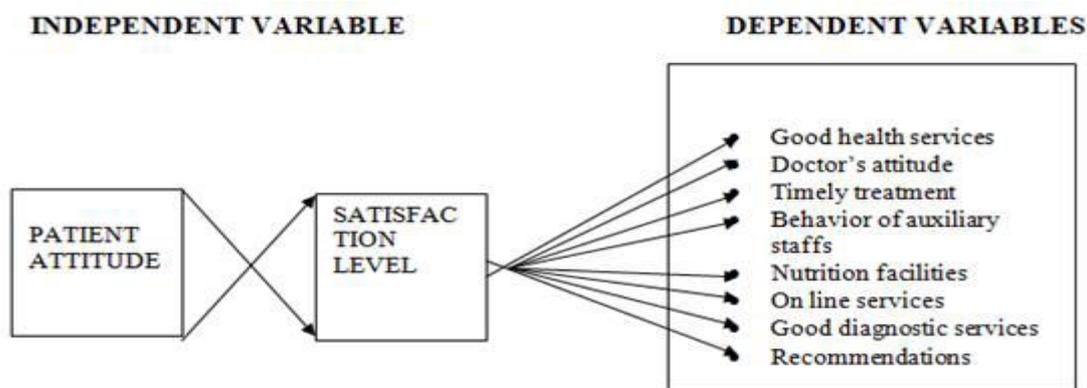


Figure-2

6 HYPOTHESIS OF THE STUDY

Hypothesis has been propounded on the basis of objectives to be tested as given under

H₀: There is no significant difference in satisfaction level of patients in public and private hospitals in Punjab.

H₁: There is no correlation between selected attributes of patient satisfaction level in public and private hospitals in Punjab

7 RESEARCH METHODOLOGY

This study has been conducted in ROPAR city with the help of primary data which had collected by using questionnaires from patients in hospitals under convenient sampling method. In case of secondary data, it was gathered from internet, books, journals, and newspapers and research papers. Two types of data had been utilized for this study ie Categorical and Numerical data.

7.1 Tools of Analysis

This study utilized Percentage analysis, Correlation, Chi square test and Reliability test (CRONBACH's Alpha) for analyzing data

7.2 Target Respondents

Patients in hospitals had been considered for this study.

7.3 Sample Size

The number of samples collected for this study is 500.

7.4 Cronbachs Alpha - Reliability Test

In this study reliability was examined on all items by utilizing CRONBACH's Alpha test for representing internal consistency. All the variables are having values greater than threshold of 0.60 (Walsh, 1995). Hence it can be concluded that the items reliably measure the defined constructs of this study. It is depicted in the following table -1

CRONBACH's Alpha Test	Applied Test On Standardized Items	No of items
.745	.756	8

Table-1

7.5 Response Rate

This study obtained 90% response rate because 450 questionnaires have been returned after distributing among patients in hospitals in ROPAR. This response rate is termed as excellent in research area

8 ANALYSES AND INTERPRETATION

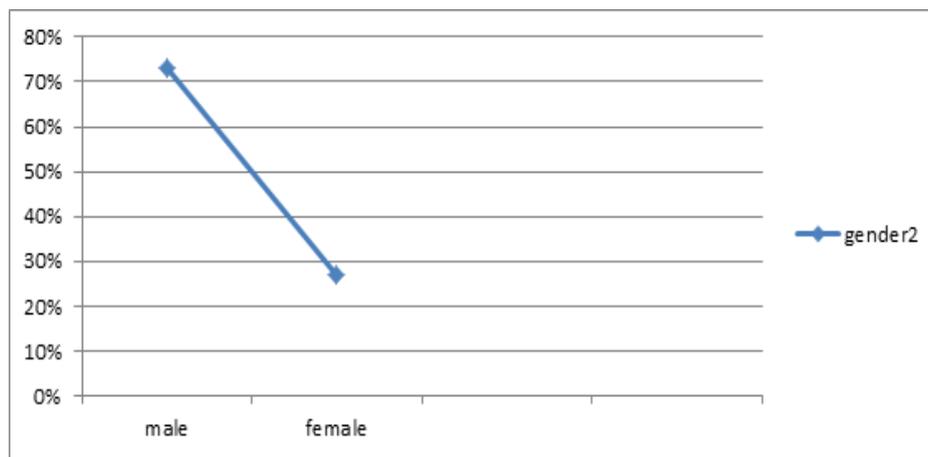
Demographic Profile of Respondents

8.1 respondents on the Basis of Gender

Male	73%
Female	27%

Table-2

This table -2 infers that most of the respondents were males (73%) who participated in this study as compare to (27%) females. Its graphical representation is given under

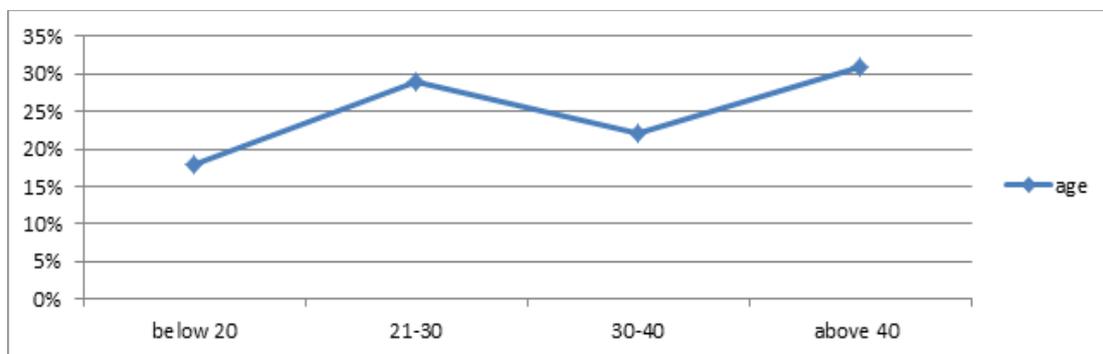


8.2 Respondents On the Basis of Age

Below 20	18%
21-30	29%
30-40	22%
Above 40	31%

Table-3

This table-3 depicts age of the respondents who participated in this study. It results that most of respondents (31%) were above 40 as compare to below 20, between 21-30 years and 30 -40 years. Its graphical representation is given under

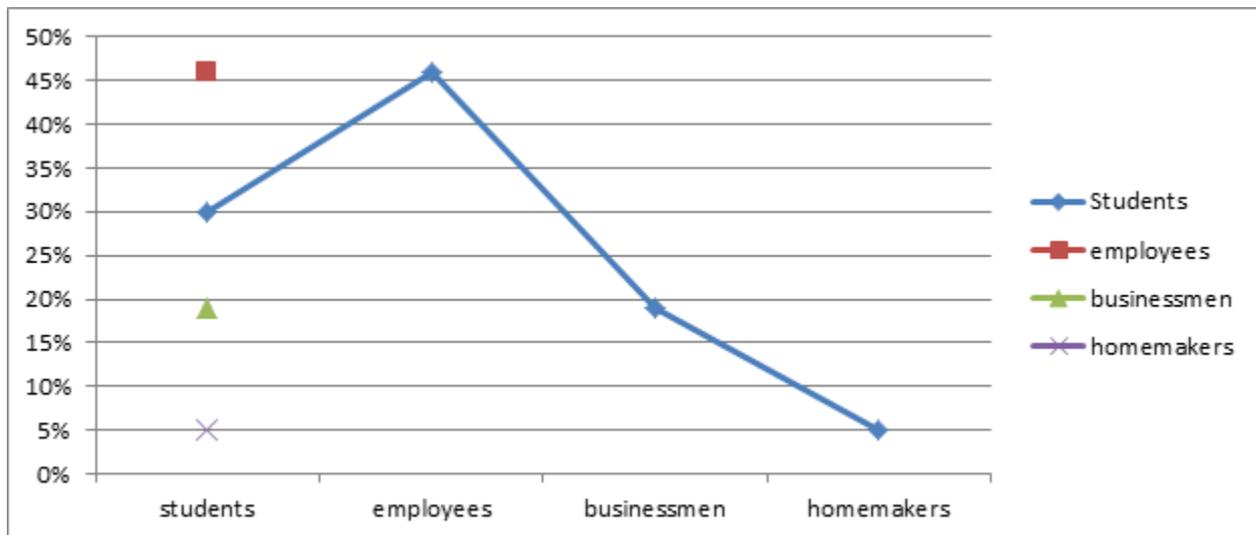


8.3 Respondents On the Basis of Occupation

Students	30%
Employees	46%
Businessmen	19%
Homemakers	5%

Table-4

This table -4 shows that most of the respondents (46%) were employees who participated in this study as compare to students (30%), businessmen (19%) and homemakers (5%). Its graphical representation is given under.

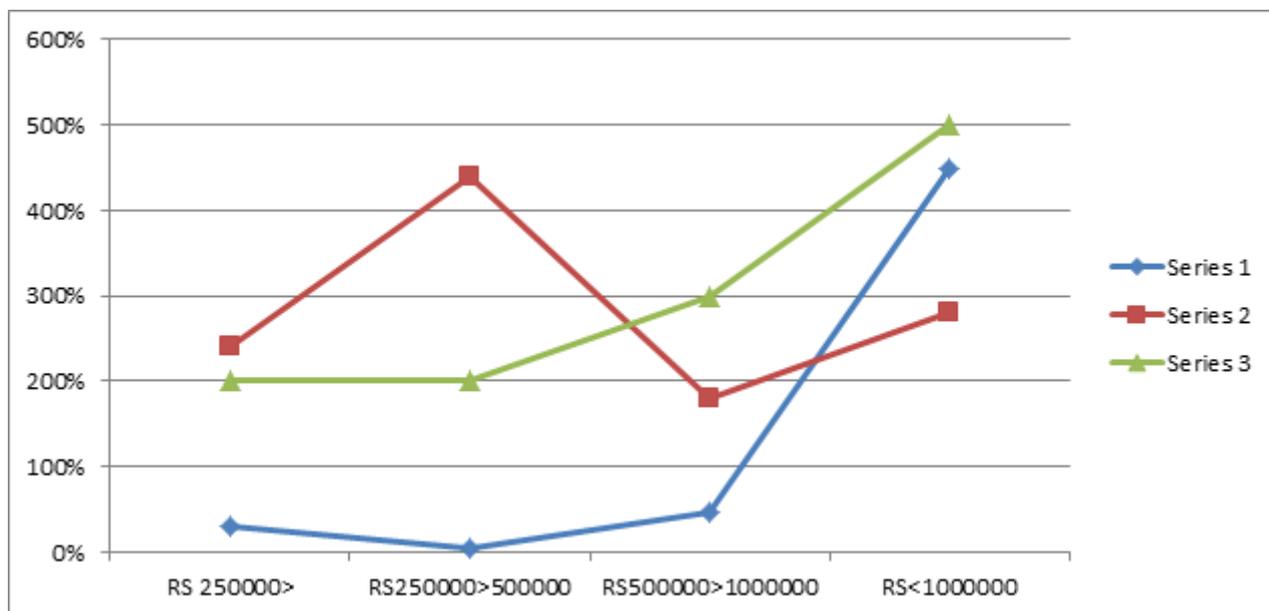


8.4 Respondents On the Basis of Annual Income

RS 250000>	31%
RS 250000>500000	5%
RS 500000>1000000	47%
RS <1000000	17%

Table-5

This table-5 presents annual income of the respondents who were participants in this study. This table infers that most of the respondents were having annual income RS 500000>1000000. Its graphical representation is given under.

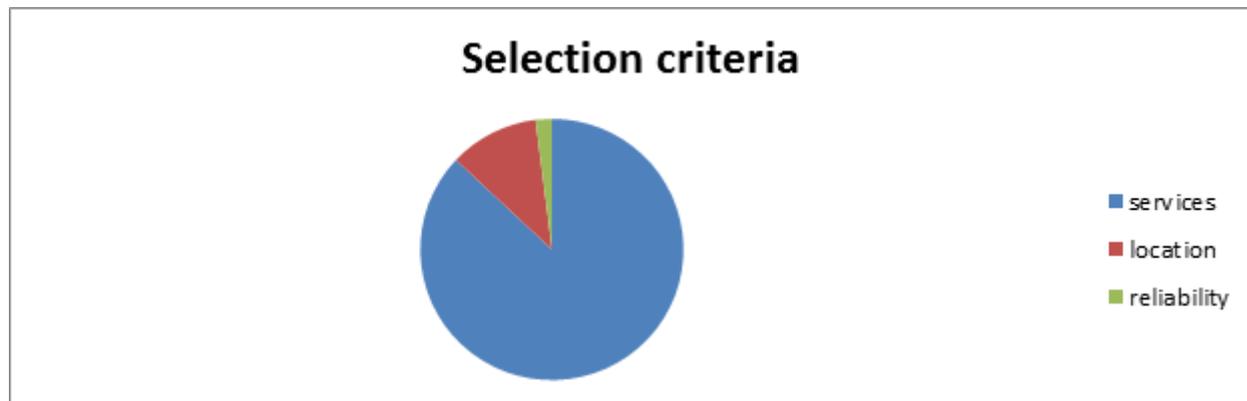


8.5 Selection Criteria by Respondents

Services	87%
Location	11%
Reliability	2%

Table-6

This table-6 throws light on selection criteria of respondents regarding services, location and reliability. It infers that respondents give their preferences to services (87%) as compare to location (11%) and reliability (2%). Its graphical representation is given under.

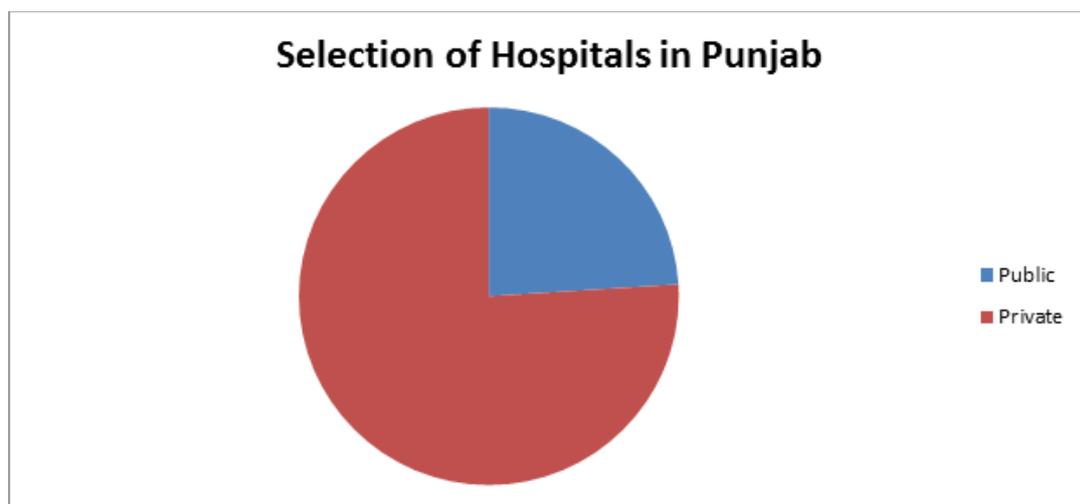


8.6 Selection Criteria by Respondents Regarding Selection of Hospitals

Public Hospitals	24%
Private Hospitals	76%

Table-7

This table-7 depicts selection of hospitals by respondents regarding health services in Punjab. It results that most of the respondents preferred (76%) private hospitals in Punjab because of good services provided by them. Its graphical representation is given under.



8.7 Correlation Analysis

This is utilized in order to detect the relationship between dependent and independent variables in the study. Here Correlation table –8 shows significant level of overall performance.

Correlation Table

		Years	Overall performance
Years	Pearson Correlation	1	.365
	Sig (Tailed-1)		.000
	N	450	450
Overall performance	Pearson Correlation	.366	1
	Sig (Tailed-1)	.000	
	N	450	450

Correlation is Significant at the 0.01 level (Tailed -1)

Table-8

8.8 Correlation Matrix

This shows various levels of correlation among all items or dependent and independent variables with different values in the table -9 as given under

	Good Health services	Doctors attitude	Timely treatment	Behavior of auxiliary staffs	Nutrition facilities	On line services	Good Diagnostic services	Recommendation
Good Health services	1.00	.84	.056	.63	.182	.060	.119	.088
Doctors attitude	.84	1.00	.374	.260	.195	.235	.132	.419
Timely treatment	.066	.37	1.00	.517	.316	.586	.225	.423
Behavior of auxiliary staffs	.063	.260	.517	1.00	.281	.334	.503	.250
Nutrition facilities	.182	.195	.316	.281	1.00	.443	.398	.345
On line services.	.60	.235	.586	.334	.443	1.00	.329	.679
Good diagnostic services	.119	.132	.225	.503	.396	.329	1.00	.245
Recommendation	.088	.419	.424	.250	.345	.579	.243	1.00

Table-9

8.9 Chi Square Test

	Most Selected Hospitals	Health Services
Chi -Square	76.234 ^a	127.900 ^b
Do	1	3
Asymp. Sig	.000	.000

A. 0 Cells (.0%) Have Expected Frequencies Less Than 5. The Minimum Expected Cell Frequency Is 50.0

B. 0 Cells (.0%) Have Expected Frequencies Less Than 5. The Minimum Expected Cell Frequency Is 20.0

9 ANALYSIS AND FINDINGS OF THE STUDY

FINDINGS

According to Hypothesis H_{a0} there is no significant difference in satisfaction level of customers in public and private hospitals in Punjab but the findings of the study shows that private hospitals are providing better health services in terms of good health services, doctor's attitude, timely treatment, behavior of auxiliary staffs, nutrition facilities, on line services, good diagnostic services and recommendations. **Thus hypothesis H_{a0} there is no significant difference in satisfaction level of customers in public and private hospitals in Punjab stands to be rejected.**

In case of correlation among items, it can be observed that correlation show positive impact of variables with each other. **Thus it also rejects the second hypothesis H_{a1} : There is no correlation between selected attributes of patient satisfaction level in public and private hospitals in Punjab.**

10 LIMITATIONS OF THE STUDY

Every research has some limitations. Thus this study stems few limitations as given under

- The results of this study are limited in terms of generalization because it extinguishes the opportunity of making comparison and generalizing to the other countries.
- Some of the respondents are reluctant to answer the questions.
- Time and money constraints
- The results of this depend upon the responses of respondents

11 SUGGESTIONS

Based on the study conducted there are suggestions given by the respondents. These are the comments given by regarding the improvement of health services in Punjab,

- Government should take necessary actions regarding improving health services in public hospitals in Punjab
- Good diagnostic services must be prioritized in public hospitals
- The behavior and attitude of medical staffs must be reformed and they must be courteous to patients.
- Timely treatment should be provided to patients because it causes deaths of lacs.
- Nutrition facilities should be specially cared by Government of Punjab.
- On line services should also be provided by public hospitals to patients all times

12 CONCLUSION

As per the current data of the study, many shortcomings have been observed in public hospitals as compare to private hospitals in Punjab. To provide good health services to patients is the need of the hour in public hospitals in Punjab. This research further strengthens that public hospitals should give more importance to patients because if patients would never satisfy then closing of public hospitals is compulsory in Punjab. Doctors and medical staffs should create their good, cordial and personal relationships with patients. Most of the respondents were of the view that public hospitals are ignoring patients and not attending them with heart and soul. That is why even poor patients are also aspired to treat themselves in private hospitals as compare to public hospitals in Punjab. Thus this research will be more beneficial to Government of Punjab in order to start new strategies in order remove deficiencies in health services in public hospitals in Punjab.

REFERENCES

1. Aladham, majd Abdul Rahman Fred. (2004). Determine the quality of service perceived health in Palestinian hospitals. MPhil, Najah University, Palestine.
2. Al-Mudhaf, buthaina. (2007). Program quality in the health sector in the State of Kuwait, the quick Gulf Forum for quality. Kuwait.
3. Al-Tai, Hamid and Al-Alaq, Bashir. (2009). Marketing services, strategic Dimension. Amman: Dar Alyazu
4. Bitner, M.J. and Hubbert, A.R. (1994), "Encounter satisfaction versus overall satisfaction versus quality: the customer voice", in Rust R.T. and Oliver, R.C.(Eds), Service Quality, New Directions in Theory and Practice, Sage publications, London, 72-94.
5. Ghazanfar A, Idres IN ,Zia Z, Munir N, Maryam S , Comparison of patients satisfaction levels in public and private territory care centers ,J Pak Med Assoc .2017,67(8) ;1305-8

Studies of Bioethanol Production Using *Saccharomyces Cerevisiae* J-16

Jyoti Kumari

P G Department of Chemistry, Magadh University, Bodh Gaya, Bihar, India

ABSTRACT

Biologically produced alcohol, most commonly bioethanol are produced by the action of microorganisms and enzymes through the fermentation of sugars. Bioethanol is another biofuel capable of providing enough energy when burnt to be used as a fuel for transport. The production of bioethanol must be increased using cheaper and ecofriendly raw materials. Based on these characteristics, sugar industry byproduct (SIB) can be considered as cheaper and ecofriendly. In this study different fruit wastes were used as a raw material for the production of bioethanol by using *Saccharomyces cerevisiae* and the result was studied.

Keyword: *Saccharomyces cerevisiae*, microorganisms, biofuel, bioethanol, fermentation.

INTRODUCTION

Fermentation process, one of the very oldest methods, is a very special physiological bioprocess of some microbes and microbial process to well synthesise a good variety of some bioproducts well including foods, beverages, pharmaceuticals as well as many other chemicals as well as biochemicals.¹ Ethyl alcohol C_2H_5OH is well next to H_2O water and is employed in our laboratory as well as our chemical industry. Much of this alcohol C_2H_5OH is well synthesized from the chemical ethylene, however, its biosynthesis from process of fermentation using some variety of very cheap sugary material is still industrially very significant. The microorganisms employed for alcoholic fermentation bioprocess must have a very high tolerance for C_2H_5OH alcohol and must grow very vigorously to give a huge amount of C_2H_5OH ethyl alcohol.

Some Yeasts, particularly/ Specially *Saccharomyces cerevisiae* shows the best well known active species employed in the bioproduction of C_2H_5OH alcohol. A few inexpensive substrates/materials employed in C_2H_5OH alcohol industries are molasses solution from some cane sugar or waste sulphite liquor from some paper industries. Starch giving grams (corn), potatoes, grapes may also be employed as a material if their costs allow. Alcoholic C_2H_5OH fermentation bioprocess well refers to some biodegradation of molasses solution by the fast activity of some yeast into C_2H_5OH alcohol and (CO_2) carbon dioxide gas. The bioproduction of C_2H_5OH alcohol depends on the efficiency of a particular fungal yeast strain employed in the fermentation bioprocess. The scientist Fgamberdiey et al.² The cheapest and easily available source for the production of bioethanol is fruit wastes. It is a potential energy sources, from which ethanol can be obtained. Fruit waste is thrown outside or away has very good antimicrobial and antioxidant potential.³

RESULTS

Biosynthesis of C_2H_5OH alcohol from different sources has been studied by many research workers. It may be obtained from any fermentable sugar by fungal yeasts under optimised parameters. Alcohol C_2H_5OH on large scale were bioproduced from wheat and its products. According to Boruff and Van Lanen⁴ wheat was used as a good carbohydrate source because of the huge demand for C_2H_5OH alcohol. The shortage of molasses, and the surplus of wheat during the early years of world war I. However, the distillers were not experienced in the use of wheat and often did not have the best facilities for processing it or for recovery of by-products. The researcher Stark et al.⁵, reported their findings in the use of wheat for alcohol C_2H_5OH bioproduction. They found that the white or soft red winter types of wheat were best suited for alcohol C_2H_5OH bioproduction.

The research worker Leonard and Higny⁶ used wood sugars for bioproduction of alcohol C_2H_5OH the various materials have been employed in different fermentative bioprocess. Apart from the forms of substrate its dilution in fermenting medium also plays vital role for the maximum bioproduction of C_2H_5OH alcohol. The substrates are generally ranged to a concentration between 5% to 25% depending upon the nature of raw material and fungal strain (of yeast used along with composition of the fermenting medium. The researcher of this field Beck and Friedrich⁷ employed 2% molasses solution for microbial nutrients in fermentation bioprocess. Singh and Tiwari⁸ also employed lower concentrations of simple sugar sucrose i.e., 5% for the bacterial fermentation of lactic acid. Many other⁹⁻¹¹ have also employed some sugar solution (SSS) in dilution between 5% to 20% for different fermentation bioprocess by bacteria as well as fungi.

Ph of the (PM) Production Medium

C_2H_5OH Alcoholic fermentation bioprocess proceeds best when the mash (is adjusted to a pH of 4.0 to 5.5. Sulphuric acid H_2SO_4 is commonly used to adjust the pH of the mash, although lactic acid is satisfactory. Lactic

acid favours the development of yeast but inhibits the growth and development of the butyric acid bacteria, which are detrimental to the fungal yeast fermentation bioprocess. Neish¹² found that hydrogen ion (H⁺) concentration of culture media profoundly influences the growth as well as the various metabolic activities of the microorganism.

Temperature of the Production Medium

In general, an enzyme formation and fermentation bioprocess reactions are presumed to occur best at the optimal growth temperature. Temperature has an universal influence on microbes and microbial process in that the rate of enzyme reactions increase with the increasing temperature and since microbial activity and growth are manifestations of enzymatic action, the cardinal temperature falls between 0 °C to 90 °C. Many workers¹³⁻¹⁴ reported best results in fermentations bioprocess for different bioproducts using different strains of microbes at temperature between 25 °C to 50 °C. Incubation period of the production medium The fermentation bioprocess capacity of a fungal strain is much related with incubation period and varies from strain to strain. A fermentation bioprocess is usually completed in 50 hrs to 60 hours or less, depending on the temperature, sugar concentration and some other important factors. Keeping in view the wide difference in cultural conditions of various species and strains, the authoress thought it necessary to optimize parameters for alcoholic C₂H₅OH fermentation bioprocess from sugar industry byproduct by *Saccharomyces cerevisiae* J-16. They include the following : i.e., selection of substrate and its % dilution, pH, temperature and incubation period of the production medium for microbial biodegradation of molasses to alcohol C₂H₅OH.

Study of the Influence of Different Ph of the Production Medium

10 sets each consisting of 3 fermentor flasks were prepared as described in experimental portion of this chapter. Now, to the first five sets requisite amount of lactic acid buffer solution were added to adjust the pH at 1.2, 1.4, 1.6, 1.8 and 2.0 respectively. Similarly the pH values 3.0, 4.0, 5.1, 5.2 and 5.5 were kept in the set from 6th to 10th respectively. The pH adjusted in each case was ascertained by a pH meter. All the fermentor flasks were sterilized, cooled, inoculated, incubated and analysed for C₂H₅OH alcohol and residual sugar as mentioned in experimental portion of this chapter.

Study of the Effect of Different Temperature

10 sets each consisting of 3 fermentor flasks were prepared as described in experimental portion of this chapter. These fermentor flasks were sterilized, cooled and inoculated with 0.5ml inoculum of *S.cerevisiae* -J.16. 1st to 10th set of fermentor flasks were incubated at temperatures 15, 20, 25, 30.5, 32, 36, 38, 40, 45 and 50°C respectively for 55 hrs. The contents of the fermentor flasks were analysed for C₂H₅OH alcohol bioproducted and molasses left unfermented as described in general experimental methods.

Study of the Effect of Different Incubation Period

10 sets, each of 3 fermentor flasks were prepared as described in experimental portion of this chapter. The fermentor flasks were sterilized, cooled and inoculated with 0.5 ml inoculum of *S. cerevisiae* -J.16 and were incubated at temperature 30.5 °C in an incubator. The contents of the above fermentor flasks were analysed after 15, 20, 25, 35, 55, 75, 90, 95, 100 and 105 hours of incubation period for the bioproduction of alcohol C₂H₅OH and molasses solution left unfermented.

DISCUSSION

The results of the analysis for the C₂H₅OH alcohol bioproduction by *Saccharomyces cerevisiae* J.16 are given in different tables: 1 to 5. The values reported are mean of three trails in each case.

Table-1 Effect of different carbohydrates (DC) on the yield of C₂H₅OH ethyl alcohol in 55 hours of incubation period (IP) by *Saccharomyces cerevisiae* -J.16

S.No.	Carbohydrates (CBH)	Yield of alcohol* in ml/100 ml	Carbohydrate* left unfermented in g/100ml
1.	Arabinose (ABN)	1.28	-
2.	Rhamnose (RMNO)	0.58	-
3.	Xylose (XLO)	0.38	-
4.	Glucose (GLU)	4.98	2.802
5.	Fructose (FRU)	3.88	4.003
6.	Galactose (GLT)	3.08	4.804
7.	Sorbose (SB)	0.28	-

8.	Lactose (LT)	2.08	-
9.	Sucrose (SUC)	4.88	3.042
10.	Maltose (MLT)	0.16	-
11.	Starch (STR)	0.79	-
12.	Inulin (INU)	-	-
13.	Dextrine (DXT)	-	-
14.	Raffinose (RF)	-	-
15.	Mannitol (MT)	-	-
16.	Molasses (MLS)	5.100	.901

*Each value represents mean of three trials.

Experimental Deviation + 2.5-3.5%.

S.No. 1-6 monosaccharides, 8-10 disaccharides,

11-14 polysaccharides, 15 polyalcohol, 16 molasses

Table-2 Effect of different pH on yield of alcohol C₂H₅OH by *Saccharomyces cerevisiae* J.16 in 55 hours of incubation period (IP) by (by 25% w/v molasses (MLS)).

S.No.	pH	Yield of alcohol* in ml/100 ml	Molasses* left unfermented in g/100ml
1.	1.2	-	-
2.	1.4	-	-
3.	1.6	-	-
4.	1.8	-	-
5.	2.0	-	-
6.	3.0	3.26	4.268
7.	4.0	5.19	2.351
8.	5.1**	6.28***	1.283
9.	5.2	6.13	1.267
10.	5.5	5.08	1.238

*Each value represents mean of three trials.

Experimental Deviation + 2.5-3.5%.

Table-3 Effect of concentrations of substrate (molasses) (MLS) on the yields of alcohol C₂H₅OH by *Saccharomyces cerevisiae* J.16 in 55 hrs. of incubation period (IP).

S.No.	% concentration of sugar (molasses) in g(w/v)	Yield of alcohol* in ml/100 ml	Molasses* left unfermented in g/100ml
1.	2	0.38	-
2.	5	0.98	-
3.	10	2.07	-
4.	15	3.39	0.081
5.	20	4.88	0.202
6.	25**	6.29***	1.243
7.	30	6.22	-
8.	35	5.86	-
9.	40	-	-
10.	45	-	-

*Each value represents mean of three trials. Experimental Deviation+ 2.5-3.5%.

Table-4 Effect of different temperature (T) on yield of alcohol C₂H₅OH by *Saccharomyces cerevisiae* J.16 in 55 hours of incubation period (IP) (by 25% w/v molasses (MLS)).

S.No.	Temperature in 0 ^o C	Yield of alcohol* in ml/100 ml	Molasses* left unfermented in g/100ml
1.	15	2.52	5.001
2.	20	4.36	3.153
3.	25	5.12	1.260
4.	30.5**	6.35***	1.413
5.	32	5.71	1.364
6.	36	5.31	-
7.	38	-	-
8.	40	-	-
9.	45	-	-
10.	50	-	-

*Each value represents mean of three trials. Experimental Deviation + 2.5-3.5%.

Table-5 Effect of different incubation period (IP) on yield of alcohol C₂H₅OH by *Saccharomyces cerevisiae* J.16 (by 25% w/v molasses (MLS)).

S.No.	Incubation period in hours	Yield of alcohol* in ml/100 ml	Molasses* left unfermented in g/100ml
1.	15	2.52	5.007
2.	20	3.03	4.506
3.	25	3.26	4.354
4.	35	3.76	3.829
5.	55**	6.30**	1.256
6.	75	6.08	1.220
7.	90	5.72	1.203
8.	95	-	-
9.	100	-	-
10.	105	-	-

*Each value represents mean of three trials. Experimental Deviation + 2.5-3.5%.

DISCUSSION

The results (vide Table 1-5) obtained show that optimum values for alcoholic C₂H₅OH fermentation bioprocess has been found when molasses solution 25% (w/v) is allowed to ferment for 55 hours at temperature 30.5^oC +1^oC by maintaining the pH value of the fermentation bioprocess medium at (pH) 5.1 in the presence of fungal stem of *Saccharomyces cerevisiae* J.16. The data obtained support the view that in general alcoholic C₂H₅OH fermentation bioprocess by fungal yeasts become easier as the size, molecular weight and complexity of the substrates molecules decreases. It is clear from the results that the sugars monosaccharide, ie, glucose and fructose both are most fermentable due to the presence of aldehydic -CHO and >C=O ketonic groups which is very frequently phosphorelated. The results also reveals that the fermentability of the sugars galactose is much similar to Simple sugar glucose and fructose. The alcohol C₂H₅OH forming capacity of the sugars arabinose, rhamnose and sorbose was found to be negligible.

In case of sugar disaccharides: sucrose has been found very suitable for the C₂H₅OH alcoholic fermentation bioprocess, the sugar lactose was found to be very unsuitable while maltose sugar was fermented.

In case of imporant polysaccharides: starch material was very less fermentable and very unsuitable for C₂H₅OH alcoholic fermentation bioprocess. In case of inulin, dextrin and raffinose no alcohol was found. In case of polyalcohols: mannitol could not produce C₂H₅OH alcohol by fermentation bioprocess.

In case of molasses solution 6.29 ml alcohol C₂H₅OH has been found from 25% fermentable molasses solution. Thus molasses solution has been employed as a cheapest as well as richest source of carbohydrate substrate

during the course of present investigation for the C₂H₅OH alcoholic fermentation by *Saccharomyces cerevisiae* J.16

The organism *Saccharomyces cerevisiae* has been tested by the Singh et al.¹⁵ in fermentation production medium. It was considered worthwhile to fluctuate some concentration of some carbohydrate material to study the effect on C₂H₅OH alcoholic fermentation bioprocess. The concentrations of molasses (MLS) solution thus optimised are with a substrate concentration of 25% molasses (MLS) (w/v) under the optimized/best conditions developed and different molasses solution concentrations used are mentioned in the Table-3. Maximum bioconversion is obtained by using 25% molasses solution in 55 hours of incubation period. It has been found that higher concentrations of molasses solution interferes with the mycological enzymes potentialities and activity and therefore, retards the bioproduction of alcohol C₂H₅OH.

The results of the influence of pH are recorded in the Table-2. It was observed that at pH values of 1.2 to 2.0 the C₂H₅OH alcohol was found to be nil. It was further found that at pH values of 3.0 a low C₂H₅OH alcohol bioproduction i.e. 3.26 ml/100ml was found. It is obvious from the Table-2 that a pH 5.1 is optimum and best for the bioproduction of C₂H₅OH alcohol by using molasses solution as a substrate. There was a gradual decrease in the bioproduction of C₂H₅OH alcohol with the increase in pH values from 5.1 to 5.5. It was thus concluded that pH 5.1 was optimum and best for the maximum bioproduction of C₂H₅OH alcohol and therefore, this optimum pH was maintained in the medium employed in the experiments carried out in the thesis.

The data recorded in the Table-4 indicates the fermentative bioproduction of C₂H₅OH alcohol increases with the increase in temperature from 15^oC to 30.5^oC. At lower temperature, the yield of C₂H₅OH alcohol was minimum, i.e., 2.52 ml/100 ml at 15^oC while the maximum yield of C₂H₅OH alcohol, 6.35 ml/100 ml was found at temperature 30.5^oC. The bioproduction of C₂H₅OH alcohol gradually decreases with increase in temperature from 32^oC to 36^oC. It was thus concluded that temperature 30.5^oC was most effective and favourable for alcoholic C₂H₅OH fermentation from sugar industry byproduct by *Saccharomyces cerevisiae* -J.16 and therefore, this temperature of 30.5^oC was maintained in all the experiments described in the thesis.

The data of Table-5 reveals that the bioproduction of C₂H₅OH alcohol increases with increase in incubation period from 15 hours to 55 hours and then it gradually falls (from 75 hrs to 90 hrs of incubation period). The study of the effect of incubation period on C₂H₅OH alcoholic fermentation from molasses solution reveals that it proceeds in several phases. The first one completes in 20 hrs where slow molasses solution consumption is accompanied by poor bioproduction of C₂H₅OH alcohol. The second phase occurs during 25 hrs and 35 hrs of incubation period where molasses solution consumption and C₂H₅OH alcohol bioproduction follows the first phase slight improvement.

After 35 hrs. of incubation period the 3rd phase i.e., in 55 hrs. In this way 55 hrs of incubation period gives the maximum yield of C₂H₅OH alcohol i.e., 6.30 ml/100 ml. Thus, it is concluded that the incubation period of 55 hrs is the best and optimum for the maximum alcoholic C₂H₅OH fermentation from sugar industry byproduct by *Saccharomyces cerevisiae* J.16. In all the experiments for research investigation described in this thesis, the amount of C₂H₅OH alcohol formed was estimated after 55 hours of optimum incubation period.

Selection of the Raw Substrate and Its % Dilution:

Alcoholic C₂H₅OH fermentation bioprocess from sugar industry byproduct by *Saccharomyces cerevisiae* J-16 are dependent on the sugar material and its % dilution in H₂O water. The main role of sugar substrate in biotransformation of molasses solution to C₂H₅OH ethanol is to provide desired energy for different metabolic pathways. Generally simplest sugar substrate is utilized by fungal yeasts cells.

CONCLUSION

The studies on the production on bioethanol from *Saccharomyces cerevisiae*-J.16 gave the highest cumulative ethanol yield. This concentration is appreciable thereby suggesting that *Saccharomyces cerevisiae*-J.16 could be harnessed for large scale production of ethanol after further feasibility studies and validation.

REFERENCES

1. Keith, A.B. *RigvedaBrahmanas* 25, 369-370 (1920).
2. Egamberdiev, N.B. Shaforastova, L.D. and Terusalimskil, N.D. *Izv. Akad. Nauk. SSSH. Ser. Biol.* 3, 408-415 (1968)
3. Dhanaseeli, P. B., & Balasubramanian, V. *Biosci Biotechnol Res Asia*, 11, 19-23 (2014).
4. Boruff, C.S. and Van Lanen, J.M. *Ind. Eng. Chem.* 39, 934 (1947).

5. Stark, W.H., Kolachov, P. and Willkie, H.F. *Ind. Eng. Chem.* 35, 133 (1943).
6. Leonard, R.H. and Hijny, G.J. *Mimeo*, No. R. 1466, U.S. Deptt. Agr., Forest Products Lab. (1944).
7. Beck, T. and Friedrich, G. *Neth, Appl.* 6, 509, 037 (Cl Cl₁₂ d) Jan. 14, 1986 *Ger Appl.* July 13 pp-9 (1964).
8. Singh, S.P. and Tiwari, K.P. *Zbl. Bakt. II Abt.* 135, 328-331 (1980).
9. Sinha, L.K., Singh, S.P., Rathor, N., Sinha, R.P. and Singh, B.K. *Indian, J. Agric Chem.* vol. XXI (1&2) 43 & 50 (1988).
10. Tandon, S.P. and Srivastava, A.S. *Sydowia, Annales Myologisci Ser II vol XXV Heft 1-6* (1971).
11. Tiwari, K.P. and Mishra, N. *Proc. Natl. Acad. Sci. India* 48(A) III, 170 – 172 (1978).
12. Neish, A.C. *First Intern. Congr. Biochem. (Cambridge) England* 533-535 (1949).
13. Tiwari, K.P., Pandey, A. and Mishra, N. *Zbl. Bakt II Abt.* 134, 544-546 (1979).
14. Tiwari, K.P. and Pandey, A. *Indian J. Dairy, Sci.* 31, 4, 383-384 (1978).
15. Singh, S.P., Prasad, M., Sinha, A.P., Kumar, B. and Roy, B.N. *Indian J. Agric. Chem.* Vol. XXIII, No. (2) (1990).

Microwave Assisted Synthesis of Acid Activated Fly Ash Catalyst and Application in Esterification Reactions

Kiran Parashar¹, Deepa Meena, Sakshi Kabra Malpani and Ashu Rani*

¹Department of Pure and Applied Chemistry, University of Kota, Kota, Rajasthan, India

²Department of Chemistry, Jyoti Nivas College Autonomous, Bengaluru, Karnataka, India

ABSTRACT

A heterogeneous catalyst has been prepared by microwave assisted chemical activation of Class-F fly ash by HNO₃. The synthesized catalyst showed excellent catalytic performance on a series of esterification reactions. Microwave irradiations facilitated the overall catalyst synthesis procedure by shortening the preparation time from several hours under conventional refluxing to only a few minutes. Physico-chemical properties of this catalyst were further studied by using different techniques like FT-IR, XRD, BET surface area analysis, XRF, SEM etc. Various reaction parameters such as amount of catalyst, reaction temperature, reaction time, nature of reactants (carboxylic acids and alcohols) have been analyzed, optimized for achieving excellent yield of products and final results are reported herein. Results showed that this solid acid catalyst prepared in an economical, faster, easier way exhibited high catalytic activity which produced good yield of industrially important esters.

Keywords: Acid activation, Esterification, Fly ash, Microwave irradiations.

I INTRODUCTION

Esterification is one of the widely employed reaction in academia and industries generally catalysed by various types of Brønsted as well as Lewis acids such as H₂SO₄, HCl, HI, AlCl₃, BF₃, ZnCl₂, SbF₅, phosphoric acid, p-toluenesulfonic acid etc. as the catalyst remains in homogeneous systems [AR8-1]. The use of the above mentioned catalysts are undesirable from the environmental point of view as these chemicals involve risks in their handling, containment, disposal and regeneration due to toxic and corrosive nature [AR8]. There is a need to eliminate the ecologically harmful homogeneous acid catalysts to carry out a large number of acid catalyzed industrial processes. These drawbacks can be avoided by the development of cost effective strong solid acid catalysts that are stable, reusable and active at moderate temperatures. Recently, esterification reactions of carboxylic acids with alcohols, catalyzed by various kinds of novel solid acid catalysts such as ion exchange resins [AR13-7, 8], solid superacids [AR13-9], heteropoly acids (salts), lipase, sulfonic acids supported on molecular sieves, active carbon, polymers etc. [AR13-10-14] have been reported. These solid acid catalysts possess high catalytic activity and can be easily separated from reaction mixture, but they also have some drawbacks; ion exchange resins fail to work effectively at high temperatures. Yet most of the reported solid acid catalysts are expensive and their synthesis is quite difficult [AR13]. Esters fall under a very wide category ranging from aliphatic to aromatic with various substitutions and multifunctional groups [247-1,2]. Organic esters are most frequently used as plasticisers, solvents, perfumery and flavor chemicals and also as precursors to a gamut of pharmaceuticals, agrochemicals and other fine chemicals [247]. This reaction is significant in synthetic organic chemistry as it protects carboxylic acid groups in various organic transformations [8], that's why we choose this reaction for determination of catalytic activity of our prepared catalyst.

Fly ash (FA), a waste produced during the combustion of coal in the electricity generation processes, enriched with SiO₂ and Al₂O₃ with a portion of unburnt carbon is a suitable raw material to be utilized in building materials, soil amendment and fillers, zeolite synthesis, also as an adsorbent in wastewater treatment. It also has a great potential in preparation of heterogeneous catalysts already documented in earlier reports [...] Microwave assisted synthesis of solid acid catalysts not only cut shorts the overall catalyst synthesis time period but also reduces energy consumption of whole procedure.

In the present work, the synthesis of HNO₃/FA catalyst (HFAC) showed excellent catalytic activity for esterification reaction at ambient temperature to produce esters with high yield and purity up to at least five reaction cycles. The use of FA based solid acid catalyst for esterification reactions offers many advantages from an environmental perspective and offer the potential for recyclability as well as reusability. In this study, we carried out the esterification reactions in the presence of HFAC catalyst and achieve the following objectives: (1) substituting homogeneous catalysts with an economical heterogeneous catalyst, (2) microwave assisted easier and fast catalyst synthesis, (3) recycling and reuse of catalyst upto 5 reaction cycles in industrially beneficial esterification reactions.

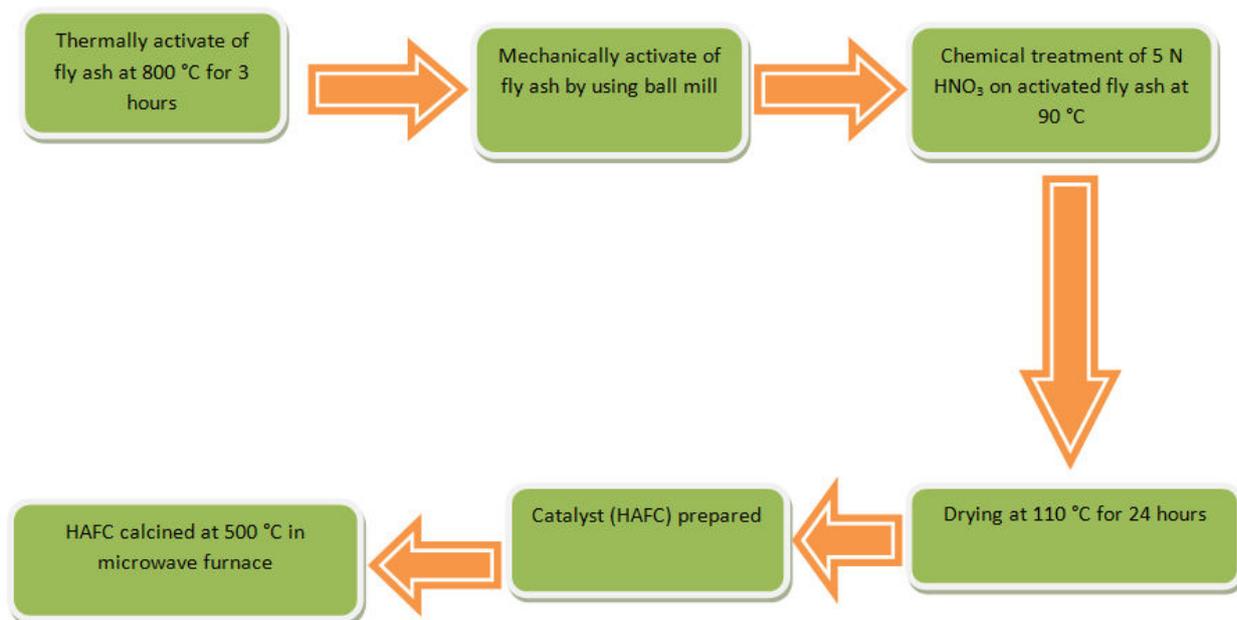
II EXPERIMENTAL METHODS

A. Materials

Class F-type FA ($\text{SiO}_2 + \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3 > 70\%$), collected from Kota Super Thermal Power Station, Rajasthan, India used as solid support for the synthesis of heterogeneous catalyst. All chemicals, HNO_3 (98%), n-propanol (99.5%), n-butanol (99.5%), acetic acid (99.7%), propanoic acid (99%), benzoic acid (99.5%) and crotonic acid (97%) were purchased from Loba Chemie Pvt. Ltd., India, ethanol (99.9%) from S. D. Fine Chem. Ltd., India and methyl laurate (99%, GC Grade) from SRL Pvt. Ltd., India.

B. Catalyst Synthesis

FA was properly washed with distilled water to remove soil and dust followed by drying at 100 °C for 24 h. After that, mechanical activation of dried FA was done by using a high energy planetary ball mill (Retsch PM-100, Germany) in an agate grinding jar using agate balls of 5 mm ball size with ball to powder weight ratio (BPR) of 10:1 for 15 h with 250 rpm rotation speed. followed by thermally activation at 800 °C for 3 h to remove C, S and other impurities. Chemical treatment of mechanically activated FA was carried out in a microwave synthesis system by stirring 5 N HNO_3 in the ratio of 1:2 (FA: acid) in an open vessel system at 90 °C and 100 W power for 30 minutes followed by washing till pH 7.0 with complete removal of soluble ionic species (NO_3^- etc.) and drying at 110 °C for 24 h. Then the synthesized catalyst (HAFC) was calcined at 500 °C for 1 h under static condition in a microwave furnace [AR-2]. The whole synthesis process is indicated in scheme 1.



Scheme 1 Flow diagram of catalyst synthesis

C. Catalyst Characterization

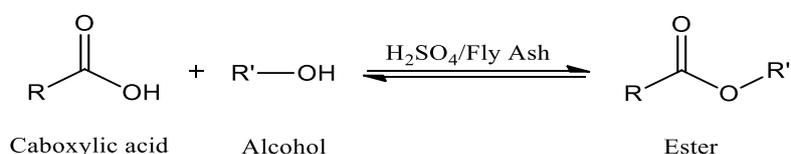
Powder X ray diffraction data for structural analysis were collected by using a X ray analytical diffractometer (Philips X'pert) with monochromatic $\text{CuK}\alpha$ radiation ($k = 1.54056 \text{ \AA}$) covering 2θ between 2° and 80° . The peak of maximum intensity ($2\theta = 26.57$) was used to determine crystallite size of the crystalline phase by using Scherrer formula [30] with a shape factor (K) of 0.9. BET surface area was obtained using a Quantachrome NOVA s1000e surface area analyzer with N_2 adsorption-desorption isotherm study at liquid nitrogen temperature (77 K). The silica content was analyzed by X-ray fluorescence spectrometer (Philips PW1606). The functionalization study of the sample was done by Bruker FT-IR spectrophotometer (Tensor-27) in DRS (Diffuse Reflectance Spectroscopy) mode by mixing the sample with KBr (sample to KBr weight ratio = 1:20) for better resolution. The spectrum was recorded in the range $400\text{--}4000 \text{ cm}^{-1}$ with a resolution of 4 cm^{-1} . Lewis and Bronsted acidity of the catalysts were measured by pyridine adsorbed FT-IR spectrum with DRS mode. The detailed imaging information about the morphology and surface texture of the sample was provided by scanning electron microscope (SEM) (Model-Philips XL30 ESEM TMP). The acid activation of FA was carried out in the Microwave synthesis system CEM, USA (Model-Discover) single mode type, using an open vessel system (Figure 1).



Figure 1. Microwave Synthesis System

D. Catalytic Activity Tests

Catalytic activity of HFAC was tested by the esterification reaction of carboxylic acids with alcohols to give different esters in liquid phase batch reactor (Scheme 1).



Scheme 1: Esterification of carboxylic acid with alcohol over HFAC

A mixture of carboxylic acid, alcohol in a molar ratio of 1.5:1 and HFAC (varying amount) were added to a 100 mL two-necked round bottom flask equipped with a reflux condenser, thermometer and a magnetic stirrer. Then, the reaction mixture was heated at different temperatures ranging from 80 to 120 °C for the desired time in the oil bath. Upon completion of this reaction (tested by TLC), the mixture was cooled to room temperature and catalyst was separated from the reaction mixture by filtration and the excess amount of alcohol with water was removed by distillation under reduced pressure by using rotary evaporator (Heidolph) to purify the product. Moreover, the remaining mass was treated with solid sodium carbonate to remove the unreacted carboxylic acid and then treated with diethyl ether to extract the ester in organic phase. Analysis of products was performed by melting point measurement, FT-IR Spectroscopy and gas chromatography (Agilent 7820A GC), equipped with a FID detector and HP-5 capillary column (Description: 30 m length and 0.25 mm diameter). Reactants and products were identified by comparison with authentic samples in the presence of methyl laurate as internal standard.

Table 1: Esterification reaction of carboxylic acids with alcohols in different optimization condition (Conventional heating)

S. No.	Substrates	Molar ratio	Catalyst amount (g)	Reaction Time (h)	Reaction Temperature (°C)	Products	% Yield
1.	Acetic acid + ethanol	1.5:1	0.2	2	80	Ethyl acetate	97
2.	Acetic acid + n-propanol	1.5:1	0.2	2	100	Propyl acetate	97
3.	Acetic acid + n-butanol	1.5:1	0.2	2	110	Butyl acetate	96
4.	Propanoic acid+ ethanol	1.5:1	0.2	2	80	Ethyl propionate	96
5.	Propanoic acid+ n-propanol	1.5:1	0.2	2	100	Propyl propionate	95
6.	Propanoic acid+ n-butanol	1.5:1	0.2	2	115	Butyl propionate	95
7.	Benzoic acid+ ethanol	1.5:1	0.5	6	80	Ethyl benzoate	90
8.	Benzoic acid+ n-propanol	1.5:1	0.5	6	100	Propyl benzoate	88
9.	Benzoic acid+ n-butanol	1.5:1	0.5	6	120	Butyl benzoate	87
10.	Crotonic acid + ethanol	1.5:1	0.3	3	80	Ethyl crotonate	93
11.	Crotonic acid + n-propanol	1.5:1	0.3	3	110	Propyl crotonate	93
12.	Crotonic acid + n-butanol	1.5:1	0.3	3	120	Butyl crotonate	92

Table 2: Esterification reaction of carboxylic acids with alcohols in different optimization condition (microwave heating)

S. No.	Substrates	Molar ratio	Catalyst amount (g)	Reaction Time (minutes)	Reaction Temperature (°C)	Products	% Yield
1.	Acetic acid + ethanol	1.5:1	0.2	15	60	Ethyl acetate	97
2.	Acetic acid + n-propanol	1.5:1	0.2	15	70	Propyl acetate	97
3.	Acetic acid + n-butanol	1.5:1	0.2	15	80	Butyl acetate	96
4.	Propanoic acid+ ethanol	1.5:1	0.2	15	60	Ethyl propionate	96
5.	Propanoic acid+ n-propanol	1.5:1	0.2	15	70	Propyl propionate	95
6.	Propanoic acid+ n-butanol	1.5:1	0.2	15	90	Butyl propionate	95
7.	Benzoic acid+ ethanol	1.5:1	0.5	8	60	Ethyl benzoate	90
8.	Benzoic acid+ n-propanol	1.5:1	0.5	8	70	Propyl benzoate	88
9.	Benzoic acid+ n-butanol	1.5:1	0.5	8	100	Butyl benzoate	87
10.	Crotonic acid + ethanol	1.5:1	0.3	10	60	Ethyl crotonate	93
11.	Crotonic acid + n-propanol	1.5:1	0.3	10	80	Propyl crotonate	93
12.	Crotonic acid + n-butanol	1.5:1	0.3	10	100	Butyl crotonate	92

E. Catalyst Regeneration

After completion of the reaction, the spent HFAC was recovered by filtration. The recovered catalyst was washed thoroughly with acetone and dried in an oven at 110 °C for 12 h followed by microwave activation at 500 °C for 1 h in constant conditions prior to the use in next reaction cycles under the similar reaction conditions. The regenerated catalyst was used for further reaction cycles up to five times without significant loss in the yield of product under the similar reaction conditions.

RESULTS AND DISCUSSION

A. Physico-Chemical Characterization

Physico-chemical properties of FA and HFAC analyzed by XRF are given in Table 2 which illustrate that silica content in HFAC is greatly increased from 62% to 86% which illustrates the loss of crucial quantities of other components during the chemical activation. After chemical activation, BET surface area of FA is increased from 17 m²/g to 23 m²/g, which could be due to surface alteration of FA by acid treatment.

Table 2: Physico-chemical properties of FA and HFAC

Catalyst	BET surface area (m ² /g)	Silica (Wt %)	Crystallite Size (nm)
FA	17	62%	33
HFAC	23	86%	13

B. Structural Properties

X-ray diffraction (XRD) analysis of FA and HFAC was carried out to study the effect of chemical activation on the crystalline nature of FA. These results as shown in Fig. 1a and b indicate that the orthorhombic mullite (3Al₂O₃·2SiO₂) and hexagonal quartz (SiO₂) are the main crystalline phases in both FA and HFAC. After chemical activation with HNO₃, the amorphous phase of FA is increased, resulting in reduction in its crystallite size from 33 nm to 13 nm due to the formation of silane bridges after surface alteration. It could also be due to dissolution of crystalline phases of silica and alumina and also leaching of minor metal

Oxides from FA after chemical activation.

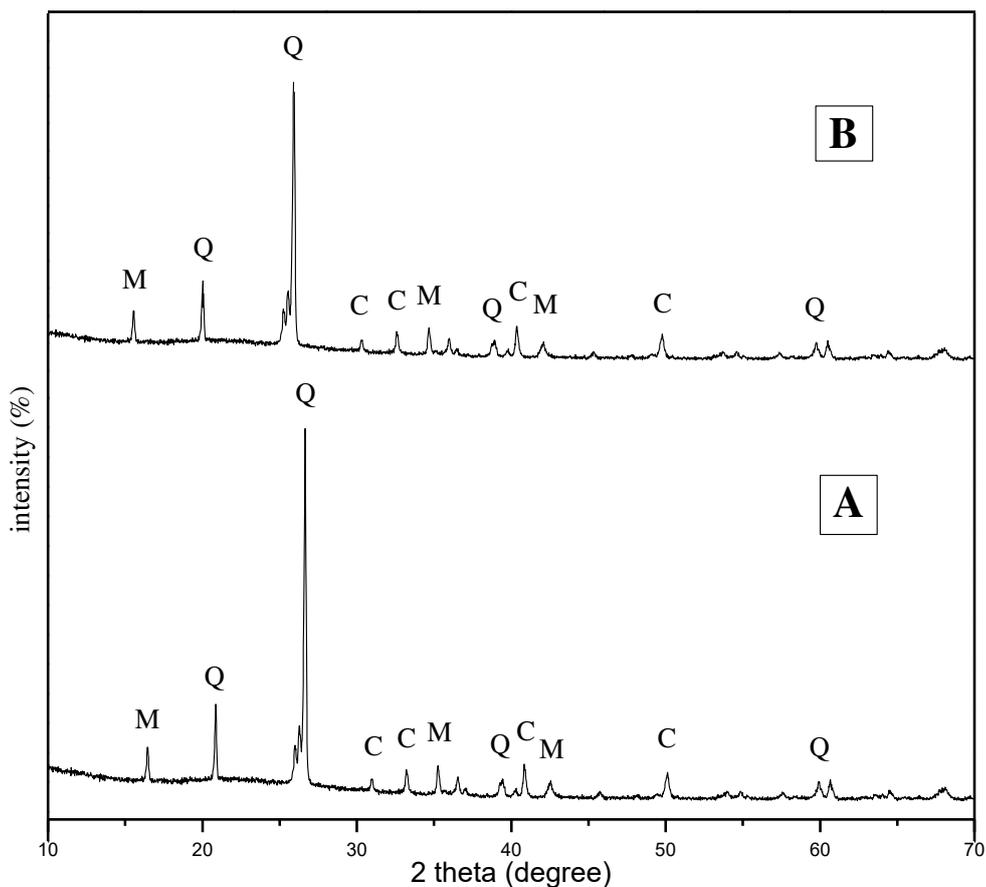


Fig. 1: X-ray diffraction patterns of (a) FA and (b) HFAC

FT-IR spectra of FA and HAFC in Fig 2a and b show a broad band between $3600-3000\text{ cm}^{-1}$ [AR16], which is attributed to surface $-\text{OH}$ groups of silanol groups ($-\text{Si}-\text{OH}$) and adsorbed water molecules on the surface. The broadness of the band is due to the strong intramolecular hydrogen bonding between the hydroxyl groups as reported earlier [AR16-11,12]. The hydroxyl groups do not exist in isolation and a high degree of association is experienced as a result of extensive hydrogen bonding with other hydroxyl groups. A peak at 1606 cm^{-1} [AR6-16] in the spectra of FA is attributed to bending mode ($\delta\text{O}-\text{H}$) of water molecules. After chemical activation with HNO_3 , tremendous increment in broadness as well as intensity at $3600-3000\text{ cm}^{-1}$ region is seen (Fig. 2b) as compared with pure FA which is ascribed to $-\text{OH}$ stretching vibrations and strong hydrogen bonding between the hydroxyl groups due to increased $-\text{OH}$ groups on the surface of HFAC. The increased amorphous silica content in HFAC can also be revealed by an increase in intense band in the range $1350-1000\text{ cm}^{-1}$, [AR6-17] which is attributed to $\text{Si}-\text{O}-\text{Si}$ valence asymmetric stretching vibrations in silicate oxygen skeleton. The main absorption band of the valence oscillations of the groups $\text{Si}-\text{O}-\text{Si}$ in quartz appears with a main absorption maximum at 1159 cm^{-1} [26].

SEM images of FA (Fig. 3a) show that the most of the particles present in it are hollow cenospheres, irregularly shaped amorphous particles, mineral aggregates and agglomerated particles. FA could be said to be an ensemble of macroporous and mesoporous particles distributed over a large range of particle sizes ranging from 840 nm to $6.95\text{ }\mu\text{m}$. After chemical activation of FA with HNO_3 , these silica and alumina cenospheres got transformed into agglomerations of large gelatinous mass formed by the breaking and dissolution of alumino-silicate skeleton as evident from Fig. 3b. These agglomerated particles are dispersed conferring the increase in surface area and silica content, resulting in decrease in irregularly shaped particles.

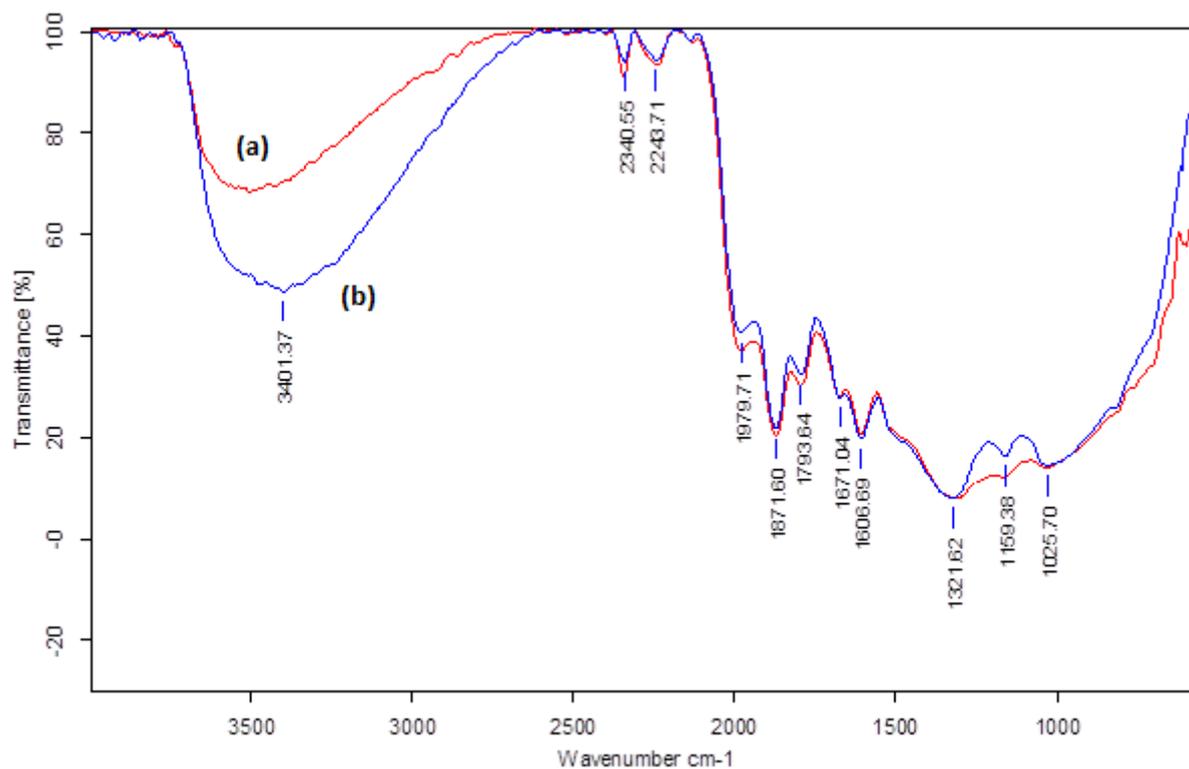


Fig. 2: FT-IR spectra of (a) FA and (b) HFAC

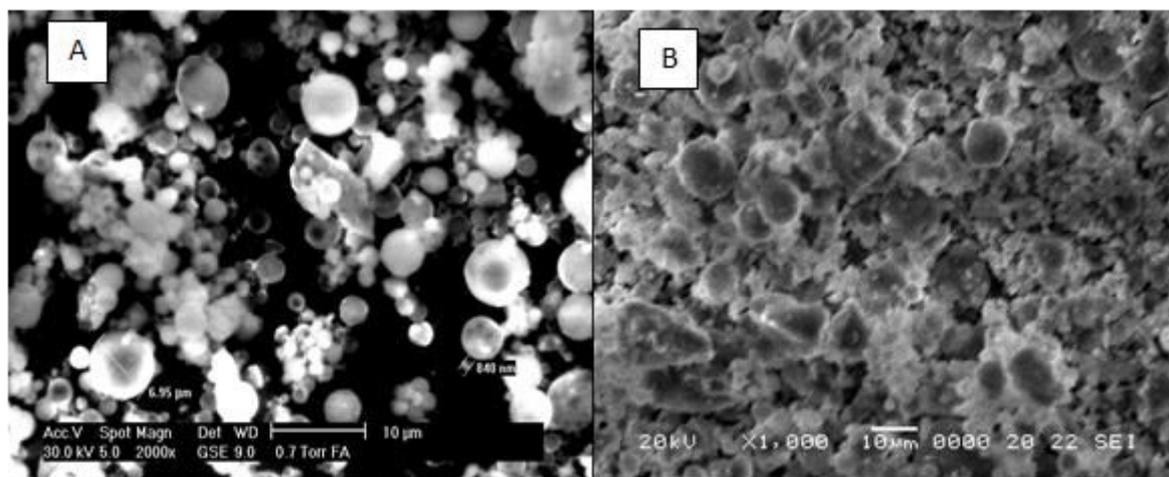


Fig. 3: SEM images of (a) FA and (b) HFAC

C. Catalytic Performance of Hfac

The catalytic performance of HFAC was tested by the esterification reaction of carboxylic acids with alcohols in single step and solvent free reaction conditions. Various reaction parameters like reaction temperature, time, acid/alcohol molar ratio and amount of catalyst were optimized to get maximum percentage conversion and yield of the ester. To optimize the reaction temperature for obtaining maximum yield of ester, the reactions were carried out at different temperatures ranging from 70 to 140 °C for 2 h, acid/alcohol molar ratio 1:1 in the presence of 0.2 g catalyst. When reaction temperature was raised above the boiling point of alcohol, yield of ester was decreased due to decrease in the contact time of alcohol with carboxylic acid, as the former mostly remained in the vapour phase during the reaction. The results show that the maximum yield of corresponding ester was found at different temperatures for different reactions i.e., the optimum temperature for the maximum conversion of acid to ester depends on the nature of reaction. Similarly, optimum reaction time, acid/alcohol molar ratio and desired amount of catalyst were also specified. It is interesting to note the optimized conditions for maximum conversion are different for different esterification reactions. Thereafter, it was concluded that the maximum conversion and yield of ester was found when reaction was carried out at 80-120 °C (figure 4) for 2-6 h, taking carboxylic acids/alcohols molar ratio 1.5:1, in the presence of 0.2-0.5 g of catalyst. The spent catalyst

from the reaction mixture was filtered, washed with acetone and regenerated at 500 °C/15 minutes in the microwave furnace to use for the next reaction cycle. The catalyst was equally efficient up to 5 reaction cycles (figure 5) which indicates that the acid sites are not leached off in the reaction mixture. It shows that the catalyst is easily regenerated by thermal treatment without loss of catalytic activity. The conversion was decreased after the 5th cycle, which may be due to blocking of active sites by the deposition of organic residues of reactants and product on the external surface of the used catalyst.

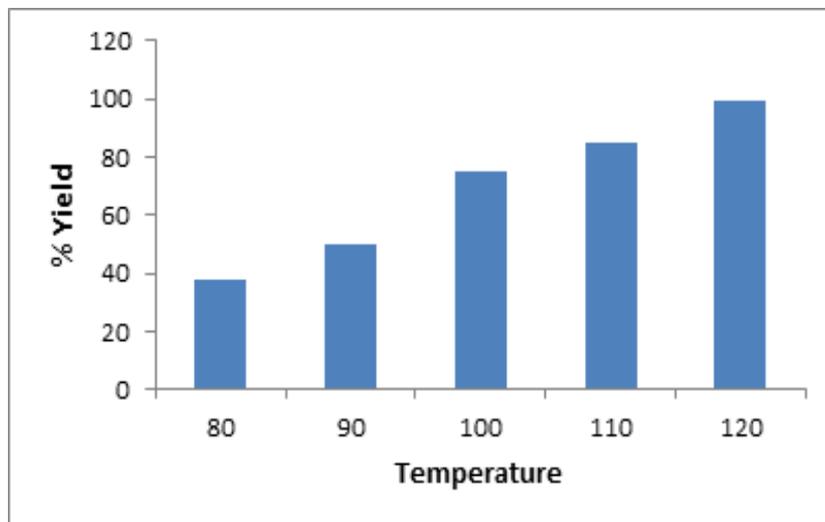


Figure 4. Effect of reaction temperature on yield % (conventional heating)

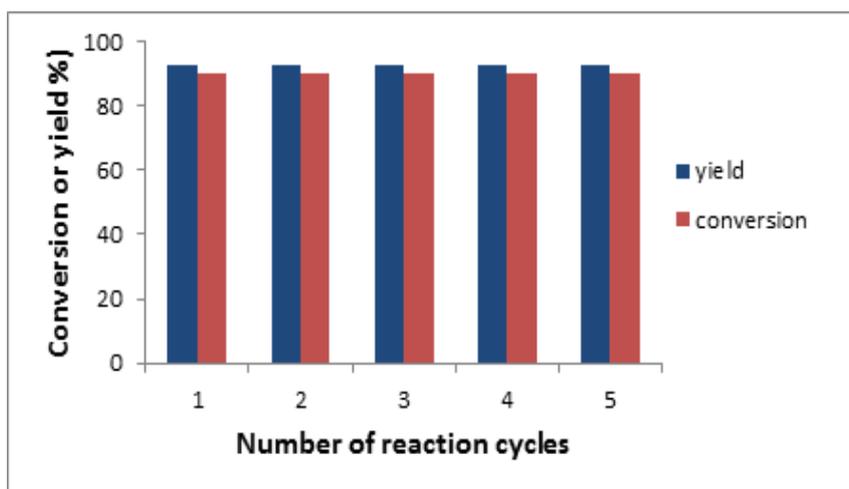


Figure 5. Effect of reusability on conversion and yield (conventional heating)

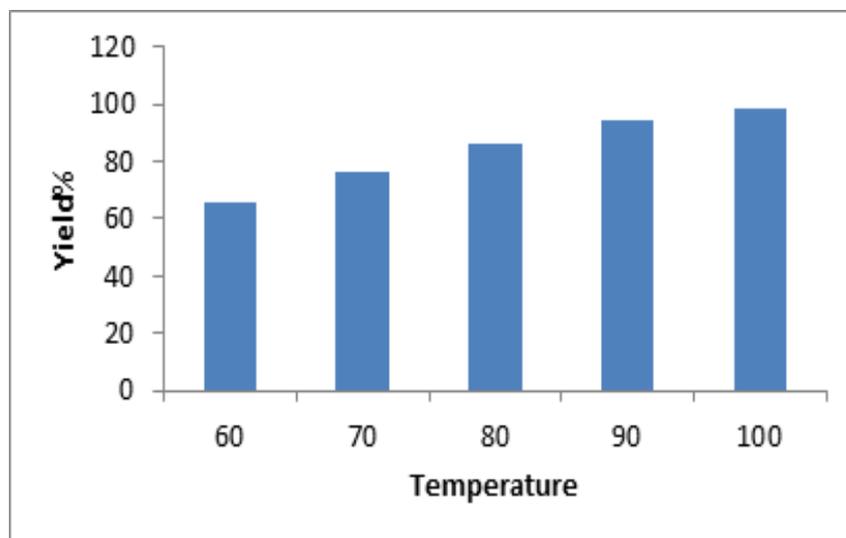


Figure 6. Effect of reaction temperature on yield % (microwave heating)

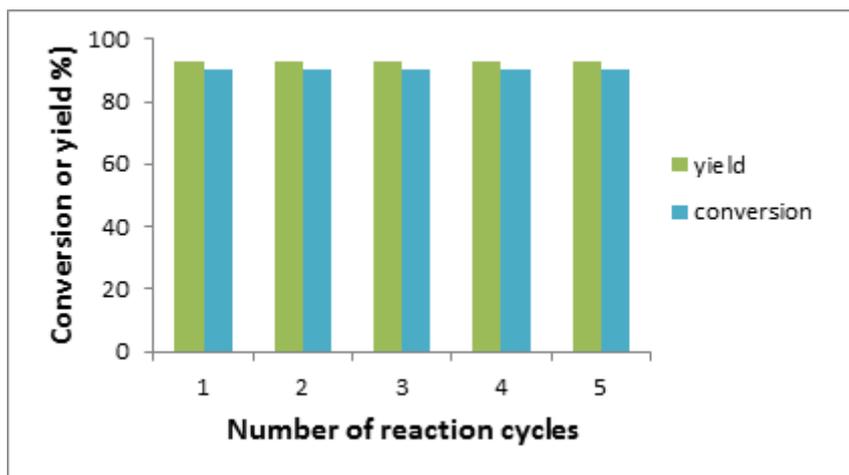


Figure 7. Effect of reusability on conversion and yield (microwave heating)

III CONCLUSION

The study provides promising use of HFAC as an efficient solid acid catalyst for esterification reactions, which is evident from high conversion of carboxylic acids to corresponding esters under heterogeneous, solvent-free optimized reaction conditions at low temperature with excellent yields. It can be concluded that FA surface modification by nitric acid activation can generate sufficient active sites on FA surface rendering its potential application in heterogeneous catalysis. As prepared HFAC was found to possess significant acidity due to increase in silica content and surface silanol groups, which initiate the esterification reaction in the proper way and produce ester with very high yield under solvent free reaction conditions. The catalyst was easily separated by simple filtration and recycled up to many reaction cycles, which made the process economic. It is confirmed that under experimental conditions, the leaching of active sites or deactivation of the catalyst is practically negligible. This investigation brings into light the structural aspects of a novel FA supported solid acid catalyst which is cost effective, environmentally safe and recyclable after activation without loss of activity and can be used in catalytic amounts in solvent free organic transformations. This study also suggests that FA could be an economical source of silica for synthesizing novel solid acid catalysts for catalyzing industrially important reactions in a cost effective manner.

ACKNOWLEDGEMENT

The financial support was provided by Fly Ash Unit, Department of Science and Technology, New Delhi, India, vide project sanction no. FAU/DST/600(23)/2009-10.

REFERENCES

- [AR8-1] Igbokwe, P.K., Ugonabo, V.I., Iwegbu, N.A., Akachukwu, P.C. and Olisa C.J., Journal of university of chemical technology and metallurgy, 43(3) (2008) 345-348.
- [247-1] M.A. Ogliaruso, J.F. Wolfe, Synthesis of Carboxylic Acids, Esters and Their Derivatives, Wiley, New York, 1991.
- [247-2] G.D. Yadav, P.H. Mehta, Ind. Eng. Chem. Res. 33 (9) (1994) 2198-2208.
- [247] G.D. Yadav, M.B. Thathagar, Esterification of maleic acid with ethanol over cation-exchange resin catalysts, Reactive & Functional Polymers 52 (2002) 99-110.
- [AR8] Anita Sharma, Stuti Katara, Sakshi Kabra and Ashu Rani, Acid Activated fly Ash, as a Novel Solid Acid Catalyst for Esterification of Acetic Acid, INDIAN JOURNAL OF APPLIED RESEARCH, Volume : 3 | Issue : 4 | April 2013, 37-39.
- [AR13-7] Blagova, S., Paradaa, S., Bailerb, O., Moritzb, P., Lamc, D., Weinandd, R., Hassea, H., Chem. Eng. Sci., Vol. 61, pp.753, 2006.
- [AR13-8] Zhang, Y., Ma, L., Yang, J., "Kinetics of esterification of lactic acid with ethanol catalyzed by cation-exchange resins", React. Funct. Polym., Vol. 61, pp.101-114, 2004.
- [AR13-10] Abd, E., Wahab, M.M., Said, A.A., J. Mol. Catal. A. Chem., Vol. 240, pp 109, 2005.
- [AR13-11] Sepulveda, J. H., Yori, J. C., Vera, C. R., "Repeated Use of Supported H3PW12O40 Catalysts in the Liquid Phase Esterification of Acetic Acid with Butanol," Appl. Catal. A. Vol. 288(1), pp. 18-24, 2005.

10. [AR13-12] Peres, C., Harper, N., Marco, D.R., *Enz. Micro. Tech.*, Vol. 37(1), pp.145-149, 2005.
11. [AR13-13] Novak, Z., Habulin, M., Krmelj, V., Knez, Z., "Silica aerogels as support for lipase catalyzed esterifications at sub- and supercritical conditions", *J. Supercrit. Fluids.*, Vol. 27 (2), pp.169-178, 2003.
12. [AR13-14] Manabe, K., Kobayashi, S., "Dehydrative Esterification of Carboxylic Acids with Alcohols Catalyzed by Polymer-Supported Sulfonic Acids in Water", *Adv. Synth. Catal.*, Vol. 344 (3-4), pp.270-273, 2002.
13. [AR13] Anita Sharma, Vijay Devra and Ashu Rani, Fly Ash Supported Perchloric Acid (PAFA): A Green, Highly Efficient and Recyclable Heterogeneous Catalyst for Series of Esterification, *IJRSET*, Vol. 3, Issue 1, January 2014, 8607-8619.
14. [AR16] Chitralkha Khatri, Deepti Jain, Ashu Rani, Fly ash-supported cerium triflate as an active recyclable solid acid catalyst for Friedel-Crafts acylation reaction, *Fuel*, 89 (2010) 3853-3859.
15. [AR16-11] Khatri C, Mishra MK, Rani A. Synthesis and characterization of fly ash supported sulfated zirconia catalyst for benzoylation reactions. *Fuel Process Technol* 2010;91(10):1288-1295.
16. [AR16-12] Khatri C, Rani A. Synthesis of a nano-crystalline solid acid catalyst from fly ash and its catalytic performance. *Fuel* 2008;87:2886-2892.
17. [AR6-16] Palomo A, Grutzeck MW, Blanco MT. Alkali-activated fly ashes a cement for the future. *Cem Concr Res.* 1999;29:1323-1329.
18. [AR6-17] Saikia BJ, Parthasarthy G, Sarmah NC, Baruah GD. Fourier-transform infrared spectroscopic characterization of naturally occurring glassy fulgurites. *Bull Mater Sci.* 2008;31(2):155-158.
19. [AR1-Ying et al, 2007] Ying, C., Jinyu, H., Haitao, Z. (2007). Structure and acid base properties of surface modified mesoporous silica. *App. Surf Sci.*, 253, 9400-9406.
20. [AR14-21] Lee WKW, Van Deventer JSJ. Structural reorganisation of class F fly ash in alkaline silicate solutions. *Colloids Surf A Physicochem Eng Asp* 2002;211(1):49-66.
21. [AR15-24] G.S. Pappas, P. Liatsi, I.A. Kartsonakis, I. Danilidis, G. Kordas, Synthesis and characterization of new SiO₂-CaO hollow nanospheres by sol-gel method: bioactivity of the new system, *J. Non-Cryst. Solids* 354 (2008) 755-760.
22. M. Bertalmio, G. Sapiro, V. Caselles, and C. Ballester, "Image inpainting", in *Proc. SIGGRAPH*, pp. 417-424, 2000.
23. A. Criminisi, P. Perez, and K. Toyama, "Region filling and object removal by exemplar-based image inpainting.", *IEEE Transactions on Image Processing*, vol. 13, no.9, pp. 1200-1212, 2004.
24. Marcelo Bertalmio, Luminita Vese, Guillermo Sapiro, Stanley Osher, "Simultaneous Structure and Texture Image Inpainting", *IEEE Transactions On Image Processing*, vol. 12, No. 8, 2003.
25. Yassin M. Y. Hasan and Lina J. Karam, "Morphological Text Extraction from Images", *IEEE Transactions On Image Processing*, vol. 9, No. 11, 2000

Topical Application of Oil Gel Derived From N-(2-Aminoethyl)-Oleamide

Joshi Narendra¹, Govinda Waghulde², Chandrakant Sarode³ and Gaurav Gupta^{4*}

¹Department of Chemistry, Arts, Commerce and Science College, Bodwad- 425310, India

²Department of Chemistry, D.D.N. Bhole College, Bhusawal- 425310, India

³Department of Chemistry, Bhusawal Arts, Science and P.O.Nahata Commerce College, Bhusawal, India

⁴Department of Chemistry, G.T.P. Arts, Commerce and Science College, Nandurbar- 425412, India

ABSTRACT

Aims: To evaluate the suitability of a gel for the topical applications.

Study design: In this study gels of different oils such as mustard oil, sesame oil, citriodora oil and coconut oil were prepared by using N-(2-aminoethyl) oleamide as the gelator. In addition to that DMSO also used as a solvent for gelation under optimized reaction conditions. The resulting gels were then evaluated for the different parameters to understand the possible compatibility of the gel with the skin.

Place and Duration of Study: Department of Chemistry, D.D.N.Bhole College, Bhusawal and Trans-Genica Services Pvt. Ltd., Nagardeola, between March 2019 to June 2022.

Methodology: Firstly synthesis of the gelators have been executed very aptly. Thereafter the synthesized gelators and their gels with variety of oils have been subjected to thorough analytical analysis using modern spectral tools like FT-IR, ¹HNMR, ¹³CNMR, MS-MS and thermal methods of analysis as well. Finally, the fully characterized gels were evaluated for the topical application over the skin.

Results: The gels were white to yellow in color with appreciable homogeneity and pH ranging from 6.01-7.19. The spreadability was measured using a wooden apparatus. The viscosity was found in the range 417 mPa·s to 3980 mPa·s. the skin irritation study was done on New Zealand Rabbits and found negligibly irritant to skin.

Conclusion: To our delight, the synthesized gels were found very encouraging towards topical skin applications. Especially, the results obtained for coconut oil gel was found very promising from the perspectives of their compatibility with the skin.

Keywords: gel, spreadability, erythema, oedema, skin irritation.

1. INTRODUCTION

Recently, the study of the gels, which have been developed by performing the solute-solvent interactions between low molecular mass gelators and the solvents of appropriate properties offering fascinating applications in modern disciplines of the science. In order to provide a flourishing advancement to the field of gels and their explorations needs a thorough understanding of the fundamental aspects of the structure induced properties of the gelators and the solvating ability of the solvent, in other words the solute-solvent interactions, solute-solute interactions in presence of solvent and the solvent-solvent interactions in presence of solute have significant impact on gel formation, stability of the resulting gels and other physical properties of the gels. In addition to that, the basic aggregate structures in the gels at various length scales is the key reason behind the commercial explosion in the applications of the gels. Furthermore, the state-of-the art involvement of the spectroscopically active organic compound as a gelator or modification of the natural products as a gelator for sensing and actuation applications gives an exceptional boost to the field. In this regard, variety of gel structural technologies, new inorganic superstructures have successfully been advanced using such an outstanding gelators for potential uses in separation and catalysis, for (rewritable) information recording (exemplar liquid crystal gels that can behave as dynamically functional materials have been created).

In recent times, controlled release applications, oil recovery, gelling cryogenic fuels, and other applications, supramolecular gels are very crucial parameters behind commercialization of gels and gel forming ingredients. They can also be used as media for a variety of purposes in the science of molecules. The lubricant industry has traditionally utilized supramolecular organogels [1] because of their gelation ability and thermal characteristics [2, 3]. The gelation of cryogenic propellants has also been developed a great deal of interest, since it have significant impact on the density of the fuel, imparts safety during handling and minimises the leakage possibilities. In addition to that, supramolecular organo-gelators have had an exceptional awareness in order to treat the oil spills and provide a sustainable solution to dispose the used household oil in a safe manner. Noticeably an ability of gelation of alanine derivatives have successfully been explored to separate oil from oil/water mixtures very selectively [4]. Furthermore, the structural resemblance of the macromolecular

biomolecules present in the life beings as primary or secondary metabolite directed the formation of hydrogels with body fluid under highly optimized normal body conditions, such hydrogels have currently been advanced and explored in the area of tissue engineering or biotechnology [5, 6].

As we know, a gel is a colloid that is usually 99% wt liquid and is immobilized by surface tension with a macromolecular network of fibers built from a small amount of a gelating material [7]. In pharmaceutical sciences, localized drug distribution through the skin, vagina, rectal and ocular cavities is known as topical drug administration [8], and hydroxypropyl methylcellulose (HPMC), Carbapol 934P, Sodium alginate has been used as hydrophilic polymers topically in gel drug delivery system [9, 10]. A series of grades based on molecular fractions of these polymers are used at a concentration between 1 to 5% in topical gel formulation. Due to their non greasy properties, they can provide easily washable film on the skin [9, 10]. HPMC, Carbapol 934P, Sodium alginate polymers of high molecular weight do not penetrate the skin and are non-toxic in nature [9, 11]. The results of the study manifests that, the skin irritation study is very important for the future administration of the gels on human skin. The gel sample to be tested was applied in a single dose to the skin of an experimental animal; untreated skin areas of the test animal serve as the control. The degree of irritation/corrosion have been read and scored at specified intervals and is further described in order to provide a complete evaluation of the effects. The duration of the study should be sufficient to evaluate the reversibility or irreversibility of the effects observed. If a corrosive effect is observed after any of the three sequential exposures, the test is immediately terminated. If a corrosive effect is not observed after the last patch is removed, the animal is observed for 14 days, unless corrosion develops at an earlier time point. In those cases, the test chemical is not expected to produce corrosion but may be irritating, a single patch should be applied to one animal for the time interval of four hours. If a corrosive effect is not observed in the initial test, the irritant or negative response have been encountered using up to two additional animals, each with one patch, for an exposure period of four hours, in such a case an irritant effect is observed in the initial test, the confirmatory test may be conducted in a sequential manner, or by exposing two additional animals simultaneously. In the exceptional case, in which the initial test is not conducted, two or three animals may be treated with a single patch, which is removed after four hours. When two animals are used, if both exhibit the same response, no further testing is needed. Otherwise, the third animal is also tested. Equivocal responses may need to be evaluated using additional animals [12-14].

The duration of the observation period should be sufficient to evaluate fully the reversibility of the effects observed. However, the experiment should be terminated at any time that the animal shows continuing signs of severe pain or distress. To determine the reversibility of the effects, the animals should be observed up to 14 days after removal of the patches. If reversibility is seen before 14 days, the experiment should be terminated immediately.

All animals should be examined for signs of erythema and oedema, and the responses scored at 60 minutes, and then at 24, 48 and 72 hours after patch removal. For the initial test in one animal, the test site is also examined immediately after the patch has been removed. Dermal reactions are graded and recorded according to observations. If there is damage to skin which cannot be identified as irritation or corrosion at 72 hours, observations may be needed until day 14 to determine the reversibility of the effects. In addition to the observation of irritation, all local toxic effects, such as defatting of the skin, and any systemic adverse effects (e.g., effects on clinical signs of toxicity and body weight), should be fully described and recorded. Animals showing continuing signs of severe distress or pain at any stage of the test should be humanely killed, and the test chemical assessed accordingly.

We have prepared gels of N-(2-aminoethyl)-oleamide with some solvents and oils. The oils can be considered as the drug delivery agents for topical application. Apart from drug delivery, oils can also be applied for cosmetic and health applications. In the present work, we have studied our previously prepared gels for topical application on skin by evaluating parameters characteristic of topical formulation.

2. EXPERIMENTAL DETAILS

For the synthesis of gelator n-(2-aminoethyl)-oleamide, initially oleoyl chloride was synthesized by reacting 20 ml of thionyl chloride and 52 ml of oleic acid in a round bottom flask fitted with a condenser and maintained at 60°C for 15 minutes with continuous stirring. After completion of the reaction, the reaction mixture was allowed to cool in an ice-bath and purified by distillation. The resulting oleoyl chloride was then added to equimolar ethylene diamine taken in a beaker placed in an ice-bath. The crystals of the crude product were separated out as a white solid which were recrystallized from ethyl acetate. The gels were synthesized by heating the mixture of oil and small quantity of gelator followed by cooling at room temperature [2].

The pH of the gels was measured on Equiptronic pH meter by mixing with water. Spreadability was measured using wooden apparatus with glass slides. The viscosity of the gel was measured with RheolabQC rheometer at SAIF, Chandigarh. Skin irritation was made with New Zealand white male rabbits (*Oryctolagus cuniculus*) having weight in the range 2342-2315g at the beginning of the test at Trans-Genica Services Pvt. Ltd. Nagardeola.

2.1 Evaluation of the Gel

Appearance

The gel appears as opaque, viscous semisolid. The colour of the gels is mentioned in Table 2.1.

Homogeneity

All developed gels were tested for homogeneity by visual inspection after the gels have been set in the container. They were tested for their appearance and presence of any aggregates.

PH

About 2.5g of the gel was taken in dry beaker and 50ml water was added to it. It was stirred vigorously so as to get homogeneous solution. The pH of this solution was measured using a pH meter (Equiptronics). The pH of the gels is listed in Table 2.1.

Spreadability

The gel was examined for its spreadability by a wooden apparatus. The apparatus consists of a wooden block with a pulley at one end with fixed glass plate on the block. On this glass plate, about 3g of the gel was placed and the weight was added to the pan. The time were noted for the upper slide to separate completely from the fixed slide [15]. Then the spreadability was calculated by using the formula:

$$S = M \cdot L / T$$

Where,

S = Spreadability

M = Weight tied to upper slide

L = Length of the glass slide

T = Time taken to separate completely from each other

The observations are presented in Table 2.1.

Viscosity

The viscosity of the gel was measured with RheolabQC rheometer at SAIF, Chandigarh. The viscosities of the gels are listed in Table 2.1.

Table 2.1: Values of evaluation parameters of developed gels

Gel	Colour	pH	Spreadability (g·cm/s)	Viscosity (mPa·s)	Homogeneity
Sesame oil gel	Pale yellow	6.39	5.2	3980	Good
DMSO gel	White	6.91	4.8	696	Very Good
Mustard oil gel	Yellow	6.01	4.9	3940	Good
Coconut oil gel	White	7.19	5.8	1980	Very Good
Citriodora oil gel	Pale yellow	6.50	3.8	417	Good

2.2 SKIN IRRITATION STUDY

Based on the observations presented in Table 2.1, we have selected coconut oil gel for skin irritation study on New Zealand Rabbits. All animals were acclimatized for minimum 5 days. During acclimatization all animals has been observed once for clinical signs for mortality and morbidity. The individual animal was subjected to a detailed clinical examination before allocation to study to ensure that the selected animals are in good state of health. The animals used for this study were randomly selected from those suitable, available at that time. The animals were caged according to internal procedure. Day and night cycle was maintained in animal room 12 hours for a day.

The room temperature and humidity were regulated by an air conditioning unit and continuously monitored. Recordings of the housing conditions are retained in Trans-Genica files. The cages and the housing room were cleaned before animal accommodation, and then cleaning and disinfection were periodically performed. The

animals were fed with standard pellet complete diet supplied by the authorized breeder. Animals were identified by labeling the cages. The test sample was in semi-solid state hence directly applied on skin. Three New Zealand white rabbits were used for study.

The dorsum of each animal was divided in four parts and the right caudal region and the left cranial region has been treated with the test sample (0.5 gm)

The right cranial region and the left caudal region were treated with distilled water used as control. The reaction in the treated area was compared with the control area. About 24 hours before the test, the fur was removed from the area of application approximately 6 cm² wide, were designed for the application of the test sample (Figure 2.1).



Figure 2.1: Skin preparation for application of the gel

0.5 gm of the test sample was applied directly to the skin on the two sites of each rabbit and covered with non-occlusive dressing, and then the trunk was then protected with a semi occlusive bandage (Figure 2.2). The patches were removed after 4 hours of the application and residual sample was removed and cleaning the skin with sterile water.



Figure 2.2: Application of the gel and covering of patches



Figure 2.3: Skin after removal of patches

Animals were daily observed. Reactions were evaluated at (1 ± 0.1) h, (24 ± 2) h, (48 ± 2) h and (72 ± 2) h after removal of the patches. Skin irritation was scored and recorded according to the scores reported in Table 2.2.

Table 2.2: Skin reaction and irritation score

Reaction	Irritation Score
Erythema and eschar formation	
No erythema	0
Very slightly erythema (barely perceptible)	1
Well defined erythema	2

Moderate defined erythema	3
Severe erythema (beet redness) to eschar formation preventing grading of erythema.	4
Oedema Formation	
No oedema	0
Very slight oedema (barely perceptible)	1
Well defined oedema (edges of area well defined by definite raising)	2
Moderate oedema (raised approximately 1 mm)	3
Severe oedema (raised more than 1 mm & extending beyond exposure area)	4
Maximal Possible score for irritation	8

Acute exposure of the test item, the Primary Irritation Index (PII) determined as follows.

Each animal was added together for Primary Irritation Scores of the test substance for both erythema and oedema as specified at each time and divide by the total number of observations. Primary Irritation Score for the vehicle controls were subtracted from the score of the test substance to obtain the Primary Irritation Score. Only used 24 hours, 48 hours and 72 hours observations for calculations. Observations made prior dosing or after 72 hours, recovery monitoring duration, were not used in the determination.

Scores of each animal were added and divided by the total number of animals. This value is the Primary Irritation Index. Number with description in Table 2.3 characterizes the Primary Irritation Index:

Table 2.3: Irritation index and response category

Mean Score	Response Category
0 to 0.4	Negligible
0.5 to 1.9	Slight
2 to 4.9	Moderate
5 to 8	Severe

2.3. RESULTS AND DISCUSSION

From the results listed in Table 5.1, coconut oil gel was found suitable for topical application. The results obtained towards skin irritation study of coconut oil gel are listed in Table 2.4.

Table 2.4: Skin irritation test results

Time after removal of patches	Clinical signs	Rabbit No.					
		A01		B02		C03	
		Test Side	Control Side	Test Side	Control Side	Test Side	Control Side
60 Minutes	Erythema	0	0	0	0	0	0
	Oedema	0	0	0	0	0	0
24 Hours	Erythema	0	0	0	0	0	0
	Oedema	0	0	0	0	0	0
48 Hours	Erythema	0	0	0	0	0	0
	Oedema	0	0	0	0	0	0
72 Hours	Erythema	0	0	0	0	0	0
	Oedema	0	0	0	0	0	0

There were no signs of erythema and oedema, detected in all treated (test) sites of all animals during the study. As well as no signs of erythema and oedema were detected in all control sites of all animals during the study. Based on the interpretation of results, data interpreted according to scientific articles, the test item Coconut oil gel was considered as "NEGLIGIBLY IRRITANT" for skin.

4. CONCLUSION

The coconut oil gel was found to be compatible with the skin with almost neutral pH, sufficient spreadability, good viscosity and very good homogeneity. The application has wide scope for the further study of drug release through topical application.

ACKNOWLEDGEMENTS

We acknowledge this work to Department of Chemistry, Arts, Commerce and Science College, Bodwad, D.D.N.Bhole College, Bhusawal for their support, Sophisticated Analytical Instrument Facility (SAIF), Punjab University, Chandigarh and Shivaji University, Kolhapur, SOCS KBC NMU, Jalgaon. Trans-Genica Services Pvt. Ltd., Nagardeola for their services.

REFERENCES

1. Terech P, Weiss RG. Low Molecular Mass Gelators of Organic Liquids and the Properties of Their Gels. *Chem Rev.* 1997;97(8): 3133-3160. <https://doi.org/10.1021/cr9700282>
2. Joshi NS, Waghulde GP, Gupta GR, Phalak RP. Design, Synthesis and Gelation of Low Molecular Weight Organo-gelators derived from Oleic acid via amidation. *Orient J Chem.* 2021;37(5):1109-1116. <http://dx.doi.org/10.13005/ojc/370514>
3. Joshi NS, Waghulde GP, Gupta GR, Phalak RP. Thermo-physical Investigations of oils, N-(2-aminoethyl)-oleamide and Resulting Gels using TGA-DSC. *Orient J Chem.* 2021;37(6):1496-1500. <http://dx.doi.org/10.13005/ojc/370632>
4. Ghosh YK, Bhattacharya S. First report of phase selective gelation of oil from oil/water mixtures. Possible implications toward containing oil spills. *Chem Commun.* 2001:185-186. <https://doi.org/10.1039/B007848O>
5. Lee KY, Mooney DJ. Hydrogels for Tissue Engineering. *Chem Rev.* 2001;101(7):1869-1880. <https://doi.org/10.1021/cr000108x>
6. Provost C. Transparent oil-water gels. *Int J Cosmet Sci.* 1986;8(5):233-247. <https://doi.org/10.1111/j.1467-2494.1986.tb00453.x>
7. Ferry JD. *Viscoelastic Properties of Polymers.* 3rd Ed. New York: Wiley; 1980.
8. Rashmi MS, Kumar S. Topical gel: A review. *Pharm Rev.* 2008;6:1-3.
9. Shivhare UD, Jain KB, Mathur VB, Bhusari KP, Roy AA. Formulation Development and Evaluation of Diclofenac Sodium Gel Using Water Soluble Polyacrylamide Polymer. *Dig J Nano & Bio.* 2009;4(2):285-290.
10. Fried JR. *Polymer Science and Technology.* 3rd Ed. New Jersey: Prentice Hall; 1998.
11. Allen LV, Popovich NG, Ansel HC. *Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems.* 9th Ed. Lippincott Williams & Wilkins; 2010.
12. Rawlings AV, Harding CR. Moisturization and skin barrier function. *Dermatol Ther.* 2004; 17:43-48. <https://doi.org/10.1111/j.1396-0296.2004.04S1005.x>
13. Marty JP. NMF and cosmetology of cutaneous hydration. *Ann. Dermatol. Venereol.*, 2002; 129:131-136.
14. Cravello B, Ferri A. Relationships between skin properties and environmental parameters. *Skin Res Technol.* 2007; 14:180-186. <https://doi.org/10.1111/j.1600-0846.2007.00275.x>
15. Gupta GD, Gound RS. Release rate of nimesulide from different gellants, *Indian J Pharm Sci.* 1999; 61:229-234.

Patient Satisfaction: Impact on Public and Private Hospitals in Punjab

Satpal and Munish Kumar Talwar

University School of Management Studies, Rayat Bahra University, Mohali, India

ABSTRACT

Health industry has been becoming challenging sector during last three decades. Actually patients describe their perceptions regarding satisfaction from various lenses. Recently Health service quality is considered to be very crucial in health industry. This study attempted to assess the impact of health service quality on patient satisfaction in Public and Private Hospitals in Punjab.

- **Objective:** The main objective of the study is to assess the impact of health service quality on patient satisfaction in public and private hospitals in Punjab. Specifically, objectives of the study include: impact of admission and reception, doctors and nurses's attitude and behavior, communication levels of auxiliary staffs, waiting time, bed room quality and services, rest room quality and services, quality of food and diet of patients under study.
- **Design/Methodology/Approach:** Being descriptive study, survey sample research design was utilized in order to collect primary data from 500 respondents (patients) from Rup Nagar and Mohali.
- **Tools of analysis:** in order to analyze research data, CRONBACH's Alpha, correlation and Regression have been utilized in SPSS-22 Version software.
- **Findings:** From this study it is revealed that there is a positive impact for health service quality on patient satisfaction level in Private hospitals as compare to Public hospitals.
- **Keywords:** Quality, health care, patient satisfaction, impact, suggestions.

1 INTRODUCTION

World is dynamic and competitive. Thus there are various communication channels all over the world. These channels create variations in decisions of public in every sphere of life. Health sector is one of them which has been impacting day by day because of increasing knowledge and awareness among patients regarding quality of health care services. This has increased pressure on health sector for promoting patient satisfaction. That is why patient satisfaction has become a big indicator of health care quality because it has direct impact on their financial performance. Pekacz A (2010) suggested patient satisfaction an integral part of quality assessment. In case of Punjab, health care services are being provided by public and private hospitals. In public hospitals, these are entirely managed by Ministry of Health and Ministry of Higher Education. Ministry of Health and Ministry of Higher Education have been trying to provide better health services to public to maximum extent. But however people are not satisfied by their services because of some problems regarding admission and reception, doctors and nurses 's attitude and behavior, communication level of auxiliary staffs, waiting time, bed room quality and services, rest room quality and services and quality of food and diet etc

GAroonroos (2001) revealed that service quality in health sector determines patient trends while treating in different hospitals. Quality provides convenience to patients while treating themselves.

2 SIGNIFICANCE OF THE STUDY

This study would be of great beneficial to patients and hospitals. In case of patients, this study will bring good quality services of health sector in the future. Health sector will try to solve the problems of patients in order to reap good fruits in order to improve their financial performance. This study would help health sector to formulate different strategies in order to increase patient satisfaction regarding their health services. This study will also provide difference in quality services health in case of Public and Private hospitals. Researcher feels that this is very vital and sensitive topic in health service sector.

PROBLEM OF THE STUDY

The problem lies in assessing the impact of health service quality on patient satisfaction in Public and Private Hospitals in Punjab. To obtain these objectives we answer the following questions:

- What is the impact of health service quality on admission and reception in Public and Private Hospitals in Punjab

- What is the impact of health service quality on doctor and nurses's attitude and behavior in Public and Private Hospitals. in Punjab.
- What is the impact of health service quality on communication levels of auxiliary staffs in Public and Private Hospitals in Punjab
- What is the impact of health service quality on waiting time in Public and Private Hospitals in Punjab
- What is the impact of health service quality on bed room quality and services in Public and Private Hospitals in Punjab
- What is the impact of health service quality on rest room quality and services in Public and Private Hospitals in Punjab
- What is the impact of health service on quality of food and diet in Public and Private Hospitals in Punjab

3 REVIEW OF LITERATURE

The review of literature assists to know the previous studies in order to find research gap. Further it determines research objectives of the current study. Thus review of literature of some prominent researches on the subject has been given below.

Review of Studies

Brand image plays an important in the area of product and service. It is a media through which full information is conveyed to consumers. This helps in creating effective buying decisions.

Shkukani (2003)¹ stated impact of perceived quality on profitability and growth by comparing commercial banks and private hospitals in Jordan. For this study data was collected from 1500 respondents. Finally it was researched that comfortable working environment must be accelerated in both sectors in order to increase customer satisfaction because it has positive impact on customer satisfaction.

Abu Musa (2004)² explained the main objective of service quality on customer satisfaction and profitability in Jordanian bank by studying Housing Bank and Jordanian Bank. This study tried to link with impact on rate return on investment. For this study, data was gathered from primary sources through questionnaires by distributing among clients, staffs and directors respectively. This study revealed positive impact between quality of services and customer satisfaction..

Aladham (2004)³ studied impact of perceived quality health in Palestinian hospitals including public, private and charitable. This study was based upon primary data collected through questionnaires on 650 employees and patients. This study concluded that public(Nablus) hospitals have paucity of workable system and there is a direct relationship between service procedure and patient satisfaction.

Al-Ghanim, S.A (2004)⁴ studied significant factors that motivate customers to utilize private clinics in Saudi Arabia. For this study, data had been gathered from patients regarding income, health services, education, gender, health insurance, location etc. It was researched that these study variables play an important role in impacting public clinics and private clinics.

Shahin(2006)⁵ studied on service quality and model of service quality gaps in Iran. For this study, primary data was utilized from 52 customers by using SERVQUAL SCALE. Finally it concluded that service quality plays a major role in satisfying customer. For improving quality, SERVQUAL SCALE must be used for checking quality of services.

Irfan, S.M., A and Farooq, M.M (2012)⁶ studied on five variables regarding quality like empathy, tangibles, timeliness and assurance. Findings resulted that public hospitals are not serious regarding delivering quality services to patients.

Sidhiqua, J. and Choudhry, A .H (2014)⁷ studied on service quality between public and private hospitals. After studying, it was concluded that private hospitals are providing satisfactory services to patient without considering income or occupation.

Francis, Michael & Mohammed (2016)⁸ highlighted comparative analysis of patient satisfaction between Private and Public hospitals of Bawku Presbyterian hospital and Case Medical Centre. in the upper east region of Ghana. For this study, data was gathered from 200 patients by using convenient sampling technique. Finally it was concluded that private hospitals have more quality health services as compare to public hospitals.

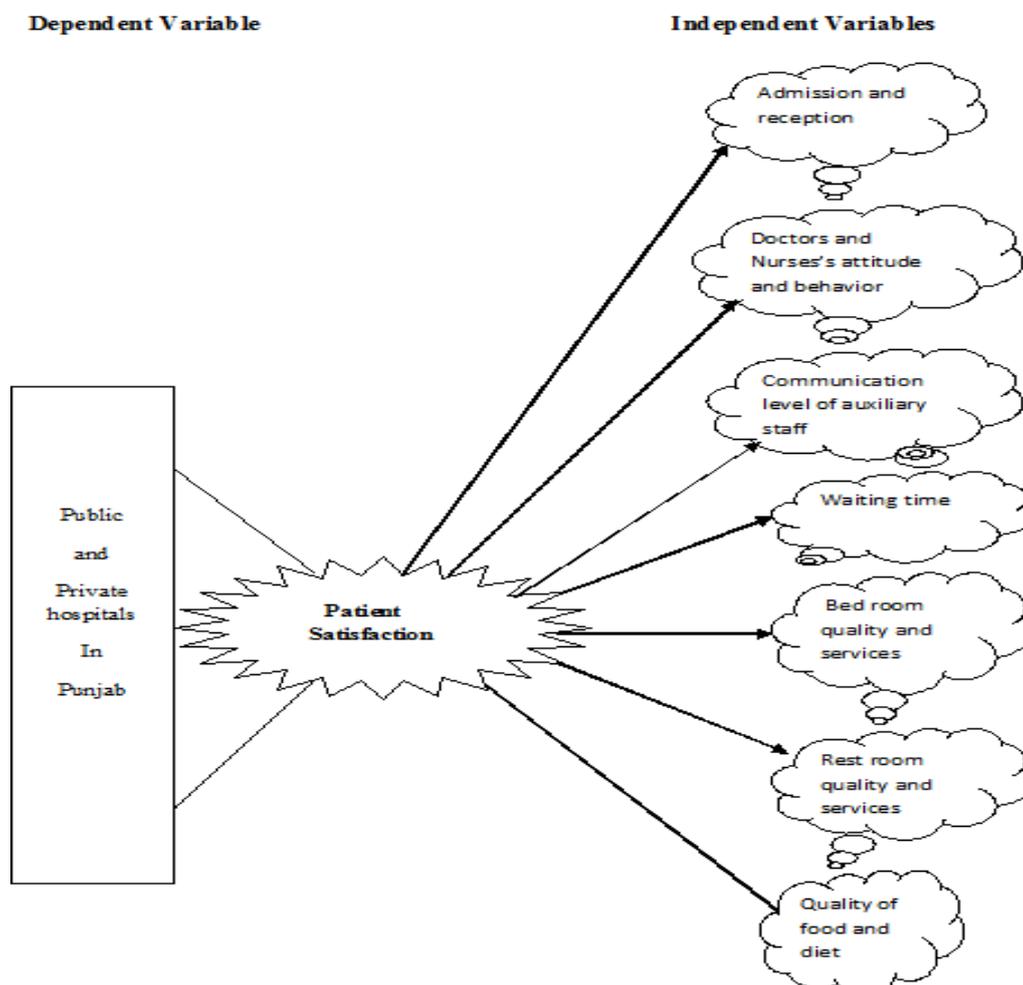
5 OBJECTIVES OF THE STUDY

Objective: The main objective of the study is to assess the impact of health services quality on patient satisfaction in public and private hospitals in Punjab. It will include the specific objectives as given under

- 1) To assess the impact of health services quality on admission and reception in Public and Private Hospitals in Punjab under study
- 2) To assess the impact of health services quality on doctors and nurses's attitude and behavior in Public and Private Hospitals in Punjab under study.
- 3) To assess the impact of health services quality on communication levels of auxiliary staffs in Public and Private Hospitals in Punjab under study.
- 4) To assess the impact of health services quality on waiting time in Public and Private Hospitals in Punjab under study.
- 5) To assess the impact of health services quality on bed room quality and services in Public and Private Hospitals in Punjab under study.
- 6) To assess the impact of health services quality on rest room quality and services in Public and Private Hospitals in Punjab under study
- 7) To assess the impact of health services quality on quality of food and diet in Public and Private Hospitals in Punjab under study

6 CONCEPTUAL FRAME WORK

It is expected that health service quality is being influenced by patient satisfaction. Thus this current study has taken patient satisfaction as the dependent variable while admission and reception, doctors and nurses's attitude and behavior, communication levels of auxiliary staffs, waiting time, bed room quality and services, rest room quality and services, quality of food and diet of patients are taken as independent variables.



7 TESTABLE HYPOTHESES

On the basis of upper stated objectives, the following hypotheses have been tested:

H01: There is no relationship between impact of health services quality on admission and reception in Public and Private Hospitals in Punjab under study

H02: There is no relationship between impact of health services quality on doctors and nurses 's attitude and behavior in Public and Private Hospitals in Punjab under study

H03: There is no relationship between impact of health services quality on communication level of auxiliary staffs in Public and Private Hospitals in Punjab under study

H04: There is no relationship between impact of health services quality on waiting time in Public and Private Hospitals in Punjab under study

H05: There is no relationship between impact of health services quality on bed room quality and services in Public and Private Hospitals in Punjab under study

H06: There is no relationship between impact of health services quality on rest room quality and services in Public and Private Hospitals in Punjab under study

H07: There is no relationship between impact of health services quality on quality of food and diet in Public and Private Hospitals in Punjab under study

8 RESEARCH METHODOLOGIES

8.1 RESEARCH DESIGN: This study has adopted a survey research design through administration of Structured questionnaires raised on a five point Likert Scale pattern (SA=Strongly Agree (2), A=Agree (1), N=Neutral (0), D=Disagree (-1), Strongly Disagree (-2).

8.2 Scope of the Study

The study assessed the impact of health services quality on patient satisfaction on a sample of 500 patients from Rup Nagar and Mohali. In order to collect primary data, structured questionnaires had been constructed and distributed among patients for filling it.

8.3 Research Design

This study used descriptive research design. The main purpose of this research design is to find out the impact of health service quality on patient satisfaction in public and private hospitals in Punjab.

8.4 Sample and Sampling Techniques

The sampling frame list includes patients from Rup Nagar and Mohali.

8.5 INSTRUMENTS

8.5.1 questionnaires

Structured questionnaires have been used in order to collect primary data from 500 respondents. All the respondents were personally contacted in order to fill the questionnaires. The current study conducted reliability and validity test on questionnaires.

8.5.2 Data Processing And Analysis

Data was entered, edited and analyzed by using SPSS VERSION -22 through CRONBACH's Alpha, correlation and Regression.

8.5.3 Reliability and Validity

In order to check the internal reliability and validity, CRONBACH'S ALPHA Coefficient of a psychometric test score was run for study variables. The instrument has an acceptable level of reliability as CRONBACH'S (CRONBACH, 1951) is greater than 0.70 for all the scales.

Table: 1 Cronbach's Alpha for Reliability of Study Variables

Independent variables	CRONBACH's Alpha
Admission and reception	7.4
Doctors and nurses 's attitude and behavior	7.5
Communication level of auxiliary staffs	8.1
Waiting time	7.7
Bed room quality and services	7.1

Rest room quality and services	7.3
Quality of food and diet	7.7
Dependent variable	
Patient Satisfaction	8.1

8.5.4 Correlation

	Patient satisfaction (DV)	Admission and reception (IV-1)	Doctors and nurses's attitude and behavior (IV-2)	Communication level of auxiliary staffs (IV-3)	Waiting time (IV-4)	Bed room quality and services (IV-5)	Rest room quality and services (IV-6)	Quality of food and diet (IV-7)
Patient satisfaction Pearson Correlation	.71	.69	.65	.72	.66	.64	.68	.63
Sig(2-tailed)	1	.00	.00	.00	.00	.00	.00	.00
N	500	500	500	500	500	500	500	500

Table-2

The current study used correlation analysis to measure the inter-relationship between independent variables and dependent variable. This table depicts significant relationships between dependent variable and independent variables. The correlation of admission and reception is .69 that shows that admission and reception have large impact on patient satisfaction. The correlation of doctors and nurses's attitude and behavior is .65 that shows strong relationship between patient satisfaction and their attitude and behavior. This table also shows that communication level of auxiliary staffs has large impact on patient satisfaction. The correlation of waiting time is .66 that shows large impact of it on patient satisfaction. The correlation of the last three independent variables ie bed room and rest room quality and services, quality of food and diet are having correlation levels .64, .68 and .63 respectively that also show large impact of it on patient satisfaction.

9 REGRESSION ANALYSIS

TABLE-3

The current study used regression analysis whose main purpose is to evaluate and understand the relationships between the dependent and independent variables.

Model Summary

Model	R	R Square	Adjusted R Square	Std Error of the estimate
1	.70a	.49	.47	.4327

- Predictors: (Constants) admission and reception, doctors and nurses's attitude and behavior, communication levels of auxiliary staffs, waiting time, bed room quality and services, rest room quality and services, quality of food and diet
- Dependent variable: patient satisfaction

Table 9.1 shows the model summary in which value of R is .70. This shows that there is strong correlation between dependent variable and independent variables. Here the value of Adjusted R Square is .47 that shows that our model is good fit. Therefore our all alternative hypotheses are accepted having significance value less than 0.05. This shows that all independent variables have great impact on dependent variable patient satisfaction.

Table 4 Anova

Model	Sum of square	DF	Mean Square	F	Sig
1 regression	381.49	1	381.49	28.40	.000
residual	325.94	26	12.53		
Total	707.43	27			

- Predictors: (Constant), admission and reception, doctors and nurses's attitude and behavior, communication levels of auxiliary staffs, waiting time, bed room quality and services, rest room quality and services, quality of food and diet
- Dependent Variable: patient satisfaction
- This table shows that significance value of F (.000) which is less than 0.05. This describes that all independent variables have done their good jobs in explaining dependent variable.
- Table 5
- Coefficients table of impact of patient satisfaction against the independent variables (admission and reception, doctors and nurses's attitude and behavior, communication levels of auxiliary staffs, waiting time, bed room quality and services, rest room quality and services, quality of food and diet (coefficients)

Model	Un-Standardized coefficients		Std coefficients	Beta	T
	B	Std error			
Constants	3.376	.0132	-----	25.75	.000
Admission and reception	.87	.042	.095	1.68	.023
Doctors and nurses 's attitude and behavior	.274	.034	.033	6.808	.033
Communication level of auxiliary staffs	.424	.0185	.0185	5.890	.043
Waiting time					
Bed room quality and services	.134	.575	.075	2.73	.037
Rest room quality and services	.122	.455	.430	4.23	.23
Quality of food and diet	.132	.344	.343	6.33	.37
	.433	.453	.572	4.78	.34

10 RESEARCH FINDINGS AND DISCUSSIONS

10.1 response Rate

This study obtained excellent response rate according to table of Babbie (1990)

Table -6 of Babbie (1990)

Adequate	50%
Good	60%
Very good	70%
Excellent	Above 70%

The study issued 500 questionnaires from which 500 filled questionnaires were returned. This brought the response rate to 100%.

11 .IMPACT OF HEALTH SERVICE QUALITY ON PATIENT SATISFACTION IN PUBLIC AND PRIVATE HOSPITALS IN PUNJAB

11.1 Descriptive Statistics of Impact of Health Service Quality On Patient Satisfaction In Public And Private Hospitals In Punjab

A very high percentage of respondents (100%) strongly agreed that admission and reception do not impact patient satisfaction in Public hospitals while (100%) respondents agreed that admission and reception impact patient satisfaction in Private hospitals. (80%) respondents agreed that patient satisfaction is being impacted by doctors and nurses's attitude and behavior in private hospitals while all respondents strongly agreed (100%) that patient satisfaction is not being impacted by doctors and nurses's attitude and behavior in public hospitals. (90%) respondents agreed that communication level of auxiliary staffs impacts patient satisfaction in public hospitals while (100%) respondents agreed that communication level of auxiliary staffs does not impact patient satisfaction in private. Hospitals. (60%) respondents agreed that waiting time impacts patient satisfaction in public hospitals while (90%) respondents agreed that waiting time does not impact patient satisfaction in private hospitals .On the other hand (83.33%) of respondents strongly agreed that bed room quality and services impact patient satisfaction to maximum extent in public hospitals while (100%) respondents strongly agreed that bed room quality and services do not impact patient satisfaction in private hospitals. 90% respondents agreed that rest room quality and services impact patient satisfaction in public hospitals while (100%) respondents agreed that rest room quality and services do not impact patient satisfaction in private hospitals. All respondents (70%) strongly agreed that quality of food and diet impact patient satisfaction in public hospitals while (100%) respondents agreed that quality of food and diet do not impact patient satisfaction in private hospitals. It can be concluded that health service quality impacts patient satisfaction to maximum extent in public and private hospitals in Punjab.

11.2 Impact of Admission and Reception on Patient Satisfaction in Public and Private Hospitals in Punjab

(100%) of the respondents strongly agreed that admission in private hospitals is very easy while (70%) respondents agreed that admission in public hospitals is not very easy while (100%) also agreed that admission process is very easy in private hospitals while (80%) respondents agreed that admission in public hospitals is not very easy. 90% respondents agreed that admission documentation is very less in private hospitals while (100%) respondents agreed that admission documentation is not very less in public hospitals. 100% of the respondents agreed that attendants of reception are difficult to locate in public hospitals while (100%) respondents agreed that attendants of reception are not difficult to locate in private hospitals. Thus it can be concluded that admission and reception deeply influence patient satisfaction in public and private hospitals in Punjab

11.3 Impact of Doctors and Nurses 'S Attitude and Behavior on Patient Satisfaction in Public and Private Hospitals in Punjab

(90%) of the respondents strongly agreed that doctors and nurses of public hospitals behave almost rude while (100%) respondents agreed that doctors and nurses of private hospitals do not behave almost rude. (80%) strongly agreed that doctors and nurses do not attend patients with keen interest in public hospitals while (90%) respondents agreed that doctors and nurses attend patients with keen interest in private hospitals.(86%) respondents agreed that doctors and nurses attend patients carelessly in public hospitals while (100%) respondents agreed that doctors and nurses do not attend patients carelessly in private hospitals. 70% of respondents strongly agreed that attitude of doctors and nurses is against humanity in public hospitals while 100% of respondents strongly agreed that attitude of doctors and nurses is not against humanity in private hospitals. Thus it can be concluded that doctors and nurses's attitude and behavior influence patient satisfaction to maximum extent in public and private hospitals in Punjab

11.4 Impact of Communication Level of Auxiliary Staffs on Patient Satisfaction in Public and Private Hospitals in Punjab

(96%) of the respondents strongly agreed that auxiliary staffs in public hospitals do not help patient in difficult time while 100% respondents strongly agreed that auxiliary staffs in private hospitals help patient in difficult time.(93%) of the respondents strongly agreed that their services are useless for patients in public hospitals while 100% respondents strongly agreed that their services are not useless for patients in private hospitals 6.66% of the respondents are neutral regarding their role in public hospitals while (80%) of respondents strongly agreed that patients are ignored by auxiliary staffs in public hospitals while 100% respondents agreed that patients are not ignored by auxiliary staffs in private hospitals Thus it can be concluded that communication level of auxiliary staffs impact patient satisfaction in public and private hospitals in Punjab.

11.5 Impact of Waiting Time on Patient Satisfaction in Public and Private Hospitals in Punjab

(90%) respondents strongly agreed that patients wait for long time for doctors in public hospitals while 100% respondents strongly agreed that patients do not wait for long time for doctors in private hospitals. (93%) of the respondents strongly agreed that doctors are not available in public hospitals while 100% respondents strongly agreed that doctors are available in private hospitals. 16% of the respondents are neutral regarding waiting time in public and private hospitals. (97%) respondents strongly agreed that waiting time causes deaths in public hospitals while 98% respondents strongly agreed that waiting time does not cause deaths in private hospitals. Thus it can be concluded that waiting time also impacts patient satisfaction in public and private hospitals in Punjab.

11.6 Impact of Bed Room Quality and Services on Patient Satisfaction in Public and Private Hospitals in Punjab

(99%) respondents strongly agreed that patients live in dusty and unclean room in public hospitals while (100%) respondents strongly agreed that patients do not live in dusty and unclean room in private hospital. (83%) of the respondents strongly agreed that cleanliness is ignored in public hospitals while (100%) respondents strongly agreed that cleanliness is not ignored in private hospitals. (66%) of the respondents are neutral regarding bed room quality and services in public and private hospitals. (98%) respondents strongly agreed that dusty and unclean rooms cause other diseases in public hospitals while (100%) respondents strongly agreed that dusty and unclean rooms do not cause other diseases in private hospitals. (98%) respondents strongly agreed that bed rooms are not airy and sunny in public hospitals while (100%) respondents strongly agreed that bed rooms are airy and sunny in private hospitals. Thus it can be concluded that bed room quality and services also impacts patient satisfaction in public and private hospitals in Punjab.

11.7 Impact of Rest Room Quality and Services on Patient Satisfaction in Public and Private Hospitals in Punjab

(96%) respondents strongly agreed that patients are treated in dusty and unclean rest room in public hospitals while (100%) respondents strongly agreed that patients are not treated in dusty and unclean rest room in private hospitals. (83%) of the respondents strongly agreed that fans do not work properly in public hospitals while (100%) respondents strongly agreed that fans work properly in private hospitals. (98%) respondents strongly agreed that sweepers do not clean rest rooms all times in public hospitals while (100%) respondents strongly agreed that sweepers clean rest rooms all times in private hospitals. (98%) respondents strongly agreed that rest rooms do not contain clean bed sheets and curtains in public hospitals while (100%) respondents strongly agreed that rest rooms contain clean bed sheets and curtains in private hospitals. Thus it can be concluded that rest room quality and services impacts patient satisfaction to maximum extent in public and private hospitals in Punjab.

11.8 Impact of Quality of Food and Diet on Patient Satisfaction in Public and Private Hospitals in Punjab

(76%) respondents strongly agreed that patients eat food of inferior quality in public hospitals while (100%) respondents strongly agreed that patients do not eat food of inferior quality in private hospitals. (83%) of the respondents strongly agreed that diet of patient is not mostly preferred in public hospitals while (100%) of the respondents strongly agreed that diet of patient is mostly preferred in private hospitals. (78%) respondents strongly agreed that food is not cooked well in public hospitals while (100%) respondents strongly agreed that food is cooked well in private hospitals. (98%) respondents strongly agreed that role of dietician is not important in public hospitals while (100%) respondents strongly agreed that role of dietician is important in private hospitals. Thus it can be concluded that quality of food and diet impacts patient satisfaction to maximum extent in public and private hospitals in Punjab.

12 ANALYSES OF HYPOTHESES

12.1 Impact of Admission and Reception on Patient Satisfaction in Public and Private Hospitals in Punjab

(100%) of the respondents strongly agreed that admission in private hospitals is very easy while (70%) respondents agreed that admission in public hospitals is not very easy while (100%) also agreed that admission process is very easy in private hospitals while (80%) respondents agreed that admission in public hospitals is not very easy. 90% respondents agreed that admission documentation is very less in private hospitals while (100%) respondents agreed that admission documentation is not very less in public hospitals. 100% of the respondents agreed that attendants of reception are difficult to locate in public hospitals while (100%) respondents agreed that attendants of reception are not difficult to locate in private hospitals. Thus it can be concluded that admission and reception deeply influence patient satisfaction in public and private hospitals in Punjab

Thus the hypothesis (H01) that there is no relationship between impact of health services quality on admission and reception in Public and Private Hospitals in Punjab under study stands to be rejected

12.2 Impact of Doctors and Nurses 'S Attitude and Behavior on Patient Satisfaction in Public and Private Hospitals in Punjab

(90%) of the respondents strongly agreed that doctors and nurses of public hospitals behave almost rude while (100%) respondents agreed that doctors and nurses of private hospitals do not behave almost rude. (80%) strongly agreed that doctors and nurses do not attend patients with keen interest in public hospitals while (90%) respondents agreed that doctors and nurses attend patients with keen interest in private hospitals. (86%) respondents agreed that doctors and nurses attend patients carelessly in public hospitals while (100%) respondents agreed that doctors and nurses do not attend patients carelessly in private hospitals. 70% of respondents strongly agreed that attitude of doctors and nurses is against humanity in public hospitals while 100% of respondents strongly agreed that attitude of doctors and nurses is not against humanity in private hospitals. Thus it can be concluded that doctors and nurses' attitude and behavior influence patient satisfaction to maximum extent in public and private hospitals in Punjab

Thus the hypothesis (H02) that there is no relationship between impact of health services quality on doctors and nurses 's attitude and behavior in Public and Private Hospitals in Punjab under study stands to be rejected.

12.3 Impact of Communication Level of Auxiliary Staffs on Patient Satisfaction in Public and Private Hospitals in Punjab

(96%) of the respondents strongly agreed that auxiliary staffs in public hospitals do not help patient in difficult time while 100% respondents strongly agreed that auxiliary staffs in private hospitals help patient in difficult time. (93%) of the respondents strongly agreed that their services are useless for patients in public hospitals while 100% respondents strongly agreed that their services are not useless for patients in private hospitals 6.66% of the respondents are neutral regarding their role in public hospitals while (80%) of respondents strongly agreed that patients are ignored by auxiliary staffs in public hospitals while 100% respondents agreed that patients are not ignored by auxiliary staffs in private hospitals Thus it can be concluded that communication level of auxiliary staffs impact patient satisfaction in public and private hospitals in Punjab

Thus the hypothesis (H03) that there is no relationship between impact of health services quality on communication level of auxiliary staffs in Public and Private Hospitals in Punjab under study stands to be rejected.

12.4 Impact of Waiting Time on Patient Satisfaction in Public and Private Hospitals in Punjab

(90%) respondents strongly agreed that patients wait for long time for doctors in public hospitals while 100% respondents strongly agreed that patients do not wait for long time for doctors in private hospitals. (93%) of the respondents strongly agreed that doctors are not available in public hospitals while 100% respondents strongly agreed that doctors are available in private hospitals. 16% of the respondents are neutral regarding waiting time in public and private hospitals. (97%) respondents strongly agreed that waiting time causes deaths in public hospitals while 98% respondents strongly agreed that waiting time does not cause deaths in private hospitals. Thus it can be concluded that waiting time also impacts patient satisfaction in public and private hospitals in Punjab.

Thus the hypothesis (H04) that there is no relationship between impact of health services quality on waiting time in Public and Private Hospitals in Punjab under study stands to be rejected

12.5 Impact of Bed Room Quality and Services on Patient Satisfaction in Public and Private Hospitals in Punjab

(99%) respondents strongly agreed that patients live in dusty and unclean room in public hospitals while (100%) respondents strongly agreed that patients do not live in dusty and unclean room in private hospital. (83%) of the respondents strongly agreed that cleanliness is ignored in public hospitals while (100%) respondents strongly agreed that cleanliness is not ignored in private hospitals. (66%) of the respondents are neutral regarding bed room quality and services in public and private hospitals. (98%) respondents strongly agreed that dusty and unclean rooms cause other diseases in public hospitals while (100%) respondents strongly agreed that dusty and unclean rooms do not cause other diseases in private hospitals. (98%) respondents strongly agreed that bed rooms are not airy and sunny in public hospitals while (100%) respondents strongly agreed that bed rooms are airy and sunny in private hospitals. Thus it can be concluded that bed room quality and services also impacts patient satisfaction in public and private hospitals in Punjab.

Thus the hypothesis (H05) that there is no relationship between impact of health services quality on bed room quality and services in Public and Private Hospitals in Punjab under study stands to be rejected

12.6 Impact of Rest Room Quality and Services on Patient Satisfaction in Public and Private Hospitals In Punjab

(96%) respondents strongly agreed that patients are treated in dusty and unclean rest room in public hospitals while (100%) respondents strongly agreed that patients are not treated in dusty and unclean rest room in private hospitals. (83%) of the respondents strongly agreed that fans do not work properly in public hospitals while (100%) respondents strongly agreed that fans work properly in private hospitals. (98%) respondents strongly agreed that sweepers do not clean rest rooms all times in public hospitals while (100%) respondents strongly agreed that sweepers clean rest rooms all times in private hospitals. (98%) respondents strongly agreed that rest rooms do not contain clean bed sheets and curtains in public hospitals while (100%) respondents strongly agreed that rest rooms contain clean bed sheets and curtains in private hospitals. Thus it can be concluded that rest room quality and services impacts patient satisfaction to maximum extent in public and private hospitals in Punjab.

Thus the hypothesis (H06) that there is no relationship between impact of health services quality on rest room quality and services in Public and Private Hospitals in Punjab under study stands to be rejected

12.7 Impact of Quality of Food and Diet on Patient Satisfaction in Public and Private Hospitals in Punjab

(76%) respondents strongly agreed that patients eat food of inferior quality in public hospitals while (100%) respondents strongly agreed that patients do not eat food of inferior quality in private hospitals. (83%) of the respondents strongly agreed that diet of patient is not mostly preferred in public hospitals while (100%) of the respondents strongly agreed that diet of patient is mostly preferred in private hospitals. (78%) respondents strongly agreed that food is not cooked well in public hospitals while (100%) respondents strongly agreed that food is cooked well in private hospitals. (98%) respondents strongly agreed that role of dietician is not important in public hospitals while (100%) respondents strongly agreed that role of dietician is important in private hospitals. Thus it can be concluded that quality of food and diet impacts patient satisfaction to maximum extent in public and private hospitals in Punjab

Thus the hypothesis (H07) that there is no relationship between impact of health services quality on quality of food and diet in Public and Private Hospitals in Punjab under study stands to be rejected

13 IMPLICATIONS OF THE STUDY

The findings of this current study point towards certain study implications. Firstly this study brought the impact of health service quality on public and private hospitals in Punjab. This study will help hospitals strategies and policies according to aspirations of patients. The study revealed that there is an acceptance of impact of health service quality on patient satisfaction by taking into consideration admission and reception, doctors and nurses's attitude and behavior, communication levels of auxiliary staffs, waiting time, bed room quality and services, rest room quality and services, quality of food and diet

Thus the findings of this research can help the hospitals in the formulation of policies and practices for satisfying patients in the future.

14 LIMITATIONS OF THIS STUDY

Though this study throws light on impact of health service quality on patient satisfaction in public and private hospitals in Punjab. But it is not exhaustive. Thus it is not free from limitations.

- 1 The sample size for the collection of primary data was limited to 500 respondents only.
- 2 This study has covered only Rup Nagar district and Mohali.
- 3 The findings and suggestions are based on the information collected through questionnaires
- 4 Cost and time constraints.
- 5 In spite of above limitations, this study is very helpful to hospitals since it throws light on impact of health service quality on patient satisfaction in public and private hospitals in Punjab.

15 SCOPE FOR FURTHER STUDY

- 1 The main objective of this study was to throw light on impact of health service quality on patient satisfaction in public and private hospitals in Punjab. This is not the end research of this constructs. Thus the study suggests a few aspects for further study in the future.

- 2 The present study investigated impact of health service quality on patient satisfaction in public and private hospitals in Punjab.. Further studies can be conducted by considering other variables.
- 3 Further study can be conducted by applying different methodologies.
- 4 Studies similar in nature and scope can be conducted in other area of India..

REFERENCES

1. Abbadi, Ahmad Abd Al-Haj Mohamed. (2007). An analytical study: impact of the application of TQM on Assessment of Services Expectation. *The Journal on Information Technology in healthcare*, vol. 5(1), pp. 50 —customer satisfaction in the Jordanian pharmaceutical manufacturing factories. Arab Amman University for graduate studies Amman, Jordan.
2. Abu Jalil, Mohamed. (2007). Jordanian industrial corporations' satisfaction on the quality of consultation offices operating in Jordan. MPhil, Arab Amman University for graduate studies, Amman, Jordan.
3. Abu Musa, & Rasmyieh Ahmed Amin (2000). The impact of service quality on customer satisfaction and profitability in Jordanian banks: a comparative study between the Housing Bank and the Islamic Jordanian Bank. MPhil, Al al-Bayt University, Jordan.
4. Akhdair, Noha Adel. (1994). The concept of quality in health services, the Jordanian Ministry of health in cooperation with the United States Agency for international development. Amman, Jordan.
5. Aladham, majd Abdul Rahman Fred. (2004). Determine the quality of service perceived health in Palestinian hospitals. MPhil, Najah University, Palestine.
6. Al-Mudhaf, buthaina. (2007). Program quality in the health sector in the State of Kuwait, the quick Gulf Forum for quality. Kuwait.
7. Al-Tai, Hamid and Al-Alaq, Bashir. (2009). Marketing services, strategic Dimension. Amman: Dar alyazuri.
8. Babakus, Emin, and Mangold W. Glynn (1992). Adapting the Servqual, Scale to Hospital Services: An Empirical Investigation. *Health Services Research*, Vol. 26, No. 6, pp. 765 – 786.
9. Berenson Mark L., Levine David M., and Krehbiel Timothy C. (2006). *Basic Business Statistics, concepts and applications* (3rd Edition). P. 278.
10. Bolton, R. N., and J. H. Drew. (1993). Multistage Model of Customer, Assessment of Service Quality and Value. *Journal of Consumer Research*, Vol.17, P. 75-84.
11. Cronin, J., and Taylor, S. (1992). Measuring service quality. A re-examination and Extension. *Journal of marketing*, 56 (July), PP.55-68.
12. Eltehewy, Maha, quality health care (where we are now), Faculty of medicine, Program performance simulation, University of Ain Shams, Egypt.
13. Gronroos, C. (2001). A service quality model and its marketing Implications. *European Journal of marketing*, 18 (4), PP. 36-44.
14. Haksik Lee, Yong Kilee and Dongkenn Yoo (2000). The Determinants of Perceived Services Quality and its Relationship Satisfaction. *Journal of Services Marketing*, Vol. 14, No. 3, pp. 217-231.
15. Idris, Thabit Abdul Rahman (1996). Measuring quality of service by using the gap between the perceptions and expectations, study methodology applied to health workers in the State of Kuwait. *Arab Journal of administrative*, folder 4, number 1 (pp. 9-35).
16. Idris, Thabit and Morsi, Jamal (1993). The service quality measurement and analysis of the relationship between both satisfaction and propensity and tendency to purchase. *Journal of trade and finance*, Faculty of Commerce University of Tanta, Egypt. www.ccsenet.org/ijms International Journal of Marketing Studies Vol. 4, No. 1; February 2012 Published by Canadian Center of Science and Education 133
17. Jungki Lee (2005). Measuring Service Quality in a Medical Setting in a Developing Country: The Applicability of Servqual. *Services Marketing Quarterly*, Vol. 27 (2). [http:// dx.doi.org/ 10.1300/J396v27n02_01](http://dx.doi.org/10.1300/J396v27n02_01)

18. Khshim, Mohammed. The conflict of the quality of medical care and health insurance system application, Jeddah.
19. Kotler, P., and Keller, K.L. (2006). Marketing management. (12th Edition). New Jersey, Pearson: Prentice Hall.
20. Lehtinen, J.R., and Lehtinen (1982). Service Quality: a Study of Quality Dimensions. Service Management Institute, Helsinki, unpublished working paper.
21. Lisa J. Morrison Coulthard (2004). Measuring Service Quality A review and critique of research using Servqual. International Journal of Market Research, Vol. 46, Quarter 4, pp. 479 – 498.
22. Lovelock, C., Wirtz, J., Chew, P. (2009). Essentials of service marketing. Singapore. Pearson: prentice Hall.
23. Ministry of Health (2007). Annual Statistical Book. Amman, Jordan.
24. Mohammed Ali, Hussam (2007). The impact of the use of domestic marketing for the quality of services provided to customers (patients and reviewers) in Arab Medical Center (field study). MPhil, Arab Amman University for graduate studies Amman, Jordan.
25. Myerscough Mark. (2002). Concerns about Servqual`s Underlying Dimensions. Illinois State University.
26. Niaz, Abdul Aziz Habib Allah (2007). Health care quality theoretical foundations and practical application. The Ministry of health, Saudi Arabia.
27. Parasurman A., Zeithaml V.A., and Berry L.L. (1996). The Behavioral Consequences of Service Quality.
28. Pękacz A, Kałalska E, Skoczylas A, Targowski T. Patient satisfaction as an element of healthcare quality- a single center Polish survey. Reumatologia. 2019;57(3):135–44.<https://doi.org/10.5114/reum.2019.86423>
Journal of marketing, Vol.60, pp. 31-46. <http://dx.doi.org/10.2307/1251929>
29. Parasurman A., Zeithaml V.A., and Berry, L.L. (1988). SERVQUA1:A Multiple-item Scale for Measuring Consumer Perceptions of Service Quality. Journal of retailing, VOL. 64, No. 1, pp. 12-40. .
30. Parasurman, A., Zeithaml, V.A., and Berry, L.L. (1985). Aconceptual Model of service Quality and its implication for future research. Journal of marketing, 49(Fall), PP41-50.
31. Sanjak, Ghalib (2010). The International Committee for hospitals between theory and practice in a comprehensive study of the reality of the Jordanian hospital. Amman, Jordan, Dar al-elam for publication and distribution.
32. Sahin B, Yilmaz F, Lee KH. Factors affecting inpatient satisfaction: structural equation modeling. J Med System 2007;31(1):9–16. <https://doi.org/10.1007/s10916-006 9038-8>
33. Series of legal and economic sciences (2005). The marketing of health services in hospitals, Tishreen University.Journal of scientific studies and research, Lathakia, Vol. 27, No. (2), Syria.
34. Shahin, Arash (2006). "Servqaul and Model of Services Quality Gaps, A Framework for Detmining and Prioritizing Critical Factors in delivering Quality Services" in Service Quality – An Introduction (1st Edition).Partha Sarathy, pp. 117-131.
35. Shaikh, B.T., Mobeen, N., Azam, S.Z., & Rabbani, F. (2008). Using Servqual for Assessing and Improving Patient Satisfaction at a Rural Health Facility in Pakistan. Mediterranean Health Journal, Vol. 14, No. 2.
36. Shkukani, Mounir (2003). The perceived quality impact on profitability and growth. MPhil, Arab Amman University for graduate studies, Amman, Jordan
37. Siddiqui, N., & Khandakar, A.K. (2007). Comparison of Services of Public
38. Perivale foreign Hospital from the Perspective of Bangladesh Patients. Journal of Health population and Nutrition, vol.25, No.2, pp. 221-230.
39. Teas, R, Kenneth (1993). Expectations, Performance Evaluation, and Consumers Perceptions of Quality. Journal of marketing, VOL. 57 (4), p. 8. <http://dx.doi.org/10.2307/1252216>
40. Service Quality. Journal of Marketing, VOL. 52, No. 2, pp. 35 – 48. <http://dx.doi.org/10.2307/1251263>

41. Zaroor, Grace (2003). The impact of quality and price of services provided by banks to their clients ' satisfaction of the industrial sector in Jordan. MPhil, Arab Amman University for graduate studies Amman, Jordan.
42. Zeithaml V.A., Berry L.L., and Parasuraman A. (1988). Communication and Control Process in the Delivery
43. Zimeras,S., Kostgiolas, P., and Lambrinouidakis, C. (2007). Quality Evaluation in Healthcare Based on the
44. Zamil,Ahmad Mahmoud ,Aereiqt,Ahmad Yousef (2012).The impact of health service quality on patient's satisfactionoverprivate and public hospitals in Jordon: A comparative study, international journal of marketing studies ,Vol.4, no 1;February 2012.

A Study of the Need & Adaptation of Corporate Accelerator in the Indian Startup Ecosystem

¹Tinoo Ubale and ²Gurmeet Singh

^{1,2}GLS University Ahmedabad

¹Entrepreneurship and Academic Initiatives Adani University, Ahmedabad

INTRODUCTION

Purpose – This study aims to acknowledge the current prominent corporate accelerator ecosystem. Since there are few literatures available on this burning issue from world-wide, but in India it is under researched. Whilst corporate accelerator plays a vital role in the ecosystem. Therefore, it facilitates the creation of a high business impact, safety and efficiency driven technology solutions developed by startups for a large corporate. It focuses on the investigating the need of the startup corporate collaboration to enhance result-oriented success.

Design/methodology/approach – This is qualitative research study. This paper also covers theoretical and empirical aspect of the corporate startup collaboration. Findings The research paper has evidently proven that the collaboration has created a high impact for the overall ecosystem. The return on investment (ROI) for the startup has been positive in terms of the monetary gains and brand value and for corporates it has created an impact for safety and efficiency.

Research limitations – This paper is not quantifying the degree of success of collaboration between startup and corporate due to unavailability of secondary data source. Apart from success story of collaboration between startup and corporate. Practical implications – This research will describe the process of corporate accelerator ecosystem. This paper rules out all rigidity of startup and corporate collaboration.

Established companies struggle to create, capture and deliver innovation because they inadvertently but inevitably suffer from organisational inertia (Hannan and Freeman, 1977; Hill and Rothaermel, 2003). The knowledge and skills necessary to generate innovations often reside outside the corporate boundaries (Chesbrough, 2003; von Hippel, 2005) and entrepreneurial startups are frequently considered valuable sources for corporations to mitigate this dilemma (Dushnitsky and Lenox, 2005). Under growing pressure to come up with innovative products, services and business models, established companies increasingly initiate collaborations with young, entrepreneurial ventures (Weiblen and Chesbrough, 2015; Spender et al., 2017; Viardot, 2017; Gutmann, 2019). In order to do so, launching a corporate accelerator programme has become a widespread activity which has seen a significant surge since the early 2010s (Kohler, 2016).

Corporate accelerators are typically programmes that support selected startups for a specific time to accelerate their development, sponsored by and in close collaboration with established companies (Miller and Bound, 2011; Cohen and Hochberg, 2014). The increasing number of such programmes is observable across international companies from diverse industries: examples include Volkswagen and Daimler from automotive, Merck and Bayer from pharmaceuticals or MasterCard, and ING Group from the financial services. Overall, the Corporate Accelerator Database lists more than 70 active programmes for the end of 2016 (Corporate Accelerator Database, 2016). However, estimates give an even higher number, with more than 120 active programmes currently worldwide (Desai, 2016).

These discussions highlight the importance of understanding the phenomenon of corporate sponsored accelerators (i.e., corporate accelerators) in more depth, yet broad studies about them are still rare. This is not surprising considering that the majority of these programs were launched in the past two years. Hochberg (2015) and Dempwolf et al. (2014) were among the first to treat the topic academically by offering definitions and positioning these new programs within the startup ecosystem. Authors such as Mocker et al. (2015) detailed case studies of selected corporate accelerators to provide guidance to managers who are about to start such programs.

While accelerator cannot be said to be a novelty as the first one was opened in 2005, they gained major popularity not only among other investors but also researchers only recently. Since the first accelerator opening the number of accelerators has not only significantly grown, they also spread from Silicon Valley to all around the globe gaining attention from all the different organizations and investors, making accelerators widely spread with various characteristics, thus establishing different types that are corresponding to the different objective of its backers.

Accelerators are providing help to entrepreneurs that are trying to create a successful business by mentoring, giving them opportunities for networking and funding, but there is still a lot of confusion how to define an accelerator and how to separate an accelerator from other organizations and investors in the startup ecosystem, especially incubators. As accelerators are not primarily defined as investors in the startup ecosystem but are mostly emphasizing other characteristics, this may also be reflected in the deal terms that they are offering to startups.

Despite all the popularity of accelerator programs, there is still little information whether the help that they are providing to startups actually corresponds to better success of startups, whether they are improving the survival rates of the startup.

To properly understand accelerators first, the whole startup ecosystem first has to be defined as well as the history of the startup ecosystem that enabled the successful development of accelerators. The characteristics generally associated with an accelerator are also provided as well as a comparison of these features with characteristics of other organizations and investors.

As the accelerator trend continued, many different types of accelerator were established, as not only the investors who wanted to make a profit but also other potential backers such as governments (as well as the European Union), universities and corporations recognized the potential of the accelerators. Thus, this section is focused on many different types of accelerators that are independent accelerators, corporate accelerators, university accelerators, and government accelerators and the differences that they may have due to the different strategic objectives.

Following that section is the deal terms accelerator offers to the startups. Various types of accelerators have different goals so they might also be structuring their terms of investment differently. As the terms are standardized the analysis and common terms that accelerators' deal terms provide will be done.

Lastly, it is important also to determine whether accelerator actually plays a crucial role in the startup lifecycle and is providing the essential help that they may need to succeed. If so it has to be established whether the business model is viable and what the future trends of the accelerators might be, also relating to the previously found results about the viability of the accelerator business model itself.

1.2 ECO SYSTEM

Understandably, the first phase of the startup business development is the concept stage, which includes exploring the feasibility of building a product or service based on the idea that may. The main focus in this phase is determining how to create a product or provide service and to identify all the relevant market players. Founder or a team of founders who first develop their concept from internal resources and are mainly relying on internally generated and retained earnings, credit cards and home mortgages. Some funding may be provided from family, friends or even some governmental funding may be available.

The first phase, the pre-seed stage is when start-up needs to test and evaluate assumptions made in the business plan, develop a market plan or collect market information.³ At the beginning of this stage, ventures may want to consider joining an incubator program, which provides cheap office space and other services.⁴ Similarly, helping founders with developing their ideas are the pre-accelerator programs. These programs are much shorter in duration than incubator program and are especially meant to prepare startups to join an accelerator. Accelerators, which provide capital and mentoring to the startups in exchange for equity come after, as they invest in either pre-seed stage or seed stage startups as they require startups to have some traction.

Seed stage is when ventures start first testing the market, establish the viability of the business idea and measure interest and attractiveness to investors and try to find the product-market fit. The main investors in these rounds are the angel investors, with the round also known as the Angel Round. Angel Investors often provide financing to startups that have already developed a prototype or a working model of the proposed product or service. They are investing in exchange for ownership of equity. They are often successful entrepreneurs, who wish to stay involved in the industry by investing in startups. They are not providing just capital but are helping and guiding startups as well. Recent developments and trends have provided a new investor for seed stage startups, and these are the Micro-Venture Capital Funds, which are funds that raise less than \$100 million. Start-up phase is when the product is developed, the feasibility of the product has been proved, and the market has been defined, the capital is needed to scale the company and improve distribution or establish a distribution system.

The next stage, growth or expansion stage is when the venture is taking solid revenue. Customer deployment and growth are the primary focus of this round. The main type investors in this round are Venture Capital Funds. Venture capital funds are financial intermediaries, who are pooling investors' capital and investing it in companies. Venture capital funds usually invest in high-potential, growth oriented companies that require a substantial amount of capital. They generally take a seat on the Board of Directors. This is a series where the majority of deal activity for Corporate Venture Capital happens.

Corporate Venture Capital is defined as a direct investment of corporate funds directly in startup companies. The final stage of startup business development is the exit stage or the IPO stage, which might require a bridge round (Series B or C) from VCs and culminates in an IPO or sale to a strategic player. In that stage, all the investors from the previous stages would get a return on their investment.

1.3 NEED OF ACCELERATOR IN ECO SYSTEM

Several factors influenced and enabled the emergence and the current popularity of the accelerator programs. Traditionally incubators used to nurture the nascent startups and venture capital funds provided startups with funding. This was changed with the burst of the internet bubble, which increased the rate of failure among venture capital funds' invested firms. As the aftermath, venture capital funds changed their approach and decided to reduce the amount of capital invested in early stage firms, opting rather for a less risky and less lucrative second or third round financing. The burden of funding startups in the seed stage was left entirely on angel investors and the burden turned up too big for them, which meant several startups did not receive the funding they needed, creating a gap in financing.

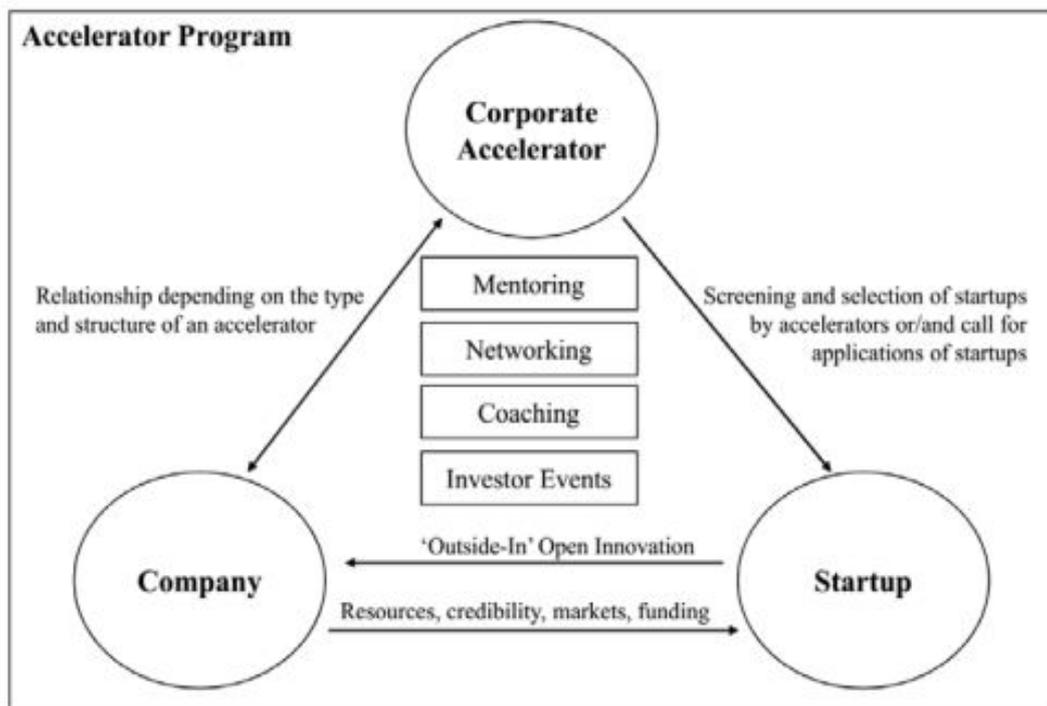
Although the dot-com boom discouraged venture capital funds investments, it at the same time also provided good conditions for the nimble internet and mobile tech startups to succeed. Moreover, the capital requirements of software startup have fallen significantly, meaning that even small capital seed accelerators provided them with, was a meaningful assistance to them. Not only is running a startup generally cheaper than it used to be (the costs are of course also connected to the sector startup is operating in), the customer acquisition costs have fallen as well.²² Open source also lowered the costs of failure, which means that many new ideas can be attempted. With the cost of failure being so low, many more ideas can be attempted and the likelihood of success is higher as many more ideas can be tested in the market. Some of the ideas was a success and for those that were not, the amount of capital invested was low, meaning that the risk of failure is low.

On the other hand, looking at historical trends, venture capital funds now raise larger sums, which they need to deploy in large increments, much larger than the amounts of funding required by early stage startups. Not only do startups now not necessarily need a large amount of capital in the early stages, their exit might also be smaller. Venture capital funds, whose investments are larger, need startups to have a larger exit. Due to above-stated reasons, venture capital funds might not be the right capital provider for early stage startups.

All the above-mentioned circumstances created perfect conditions for the development of the small seed fund programs that could invest a small amount of capital in many startups, lowering the costs of a failure by combining ideas (startups) in a portfolio. Due to all of this, new firms emerged, called the accelerators that now fill the gap by providing some of the needed support and capital for startups.

1.4 HISTORY OF ACCELERATORS

The Foundry, Inc., located in Menlo Park, California, formed in 1998, was the first-known accelerator, but a first modern accelerator was Y Combinator (Cambridge, Massachusetts, but soon moved to Silicon Valley), founded in 2005 by Paul Graham. He got the idea for it after giving a speech to student entrepreneurs at Harvard in which he advised them to look for seed money from wealthy people they knew, preferably ones who made their wealth from technology. Students turned to him for funding, and although he initially rejected them, he later decided to invest into a batch of eight ventures, with standardized terms. As Paul Graham stated, deal terms have often been a disaster, due to the confusion what the document should look like, so he decided to provide a standard source of seed funding. The establishment of Y Combinator was followed by Techstars (Boulder, Colorado), which was set up by David Cohen in Brad Feld in 2007. Since then, due to the Y Combinator's early success, the number of accelerators has grown rapidly.



Relationship of Agents within an Accelerator Program (own creation)

1.5 CORPORATE ACCELERATORS

Corporate accelerators are backed by companies whose aim is to pursue open innovation, a paradigm that suggests that firms should use external and internal ideas and internal and external paths to the market. Investing and nurturing startups may offer a corporation an opportunity to build new and different capabilities. Corporate accelerators provide insurance for the company in instances of market changes, as the new startups provide them with a way to change or grow a new business quickly to adjust to the market changes. Not only that, by admitting certain startups in their program, they might be able to follow current trends in the market. There are 71 active corporate accelerators, with companies running accelerators such as Google, Cisco, Disney, Unilever, Airbus, Intel, and BMW.

1.5.1 Strategic Objectives

Collaboration between corporations and startups can produce many positive effects for both of the parties involved. Expectations and goals of running a corporate accelerator differ, and they may be the development of new technologies and services with lesser costs involved as well as the reduction of risk to their own core operations, new source of fresh talent and ideas. Furthermore, they provide corporations with a cheaper, faster and more flexible research and development (hereinafter R&D) as accelerators manage and help to grow startups that are complementary to them. It means corporations can acquire a diverse set of experimental projects without the typical costs of launching an internal R&D. It may help closing the innovation gap, as accelerators are providing corporations with the necessary coordination of ideas that fall outside the scope of existing business units and help a company to expand to new markets. Accelerator format helps firm resolve the problem which ideas to focus on by spending intensive time with the ventures.

While most of the corporate accelerators have as an objective the above-mentioned goals, there are also exceptions. AT&T accelerator, for example, states its aim is to foster education technology and supports innovative products and services in education. It hopes to provide high school success and prepare workforce especially to students at risk for not graduating high school.

Similar to corporate venture capital objectives, corporate accelerators may serve as an intelligence gathering initiative that enables corporations to protect itself from competition. Corporate accelerators allow corporations to gather information at low cost. If the product developed is an alternative solution to a product of a corporation, a corporation has it covered as it is aware of it. While this at first glance might not seem negative, it may turn out to be, especially if this is the main goal of running the corporate accelerator. Accelerators in these instances may not structure their programs in the startups best interest as they just want to cover the entire basis and not really help ventures to grow and succeed.

Startups may help companies with their existing products and solve their business challenges, as accelerator program may stimulate startup activity around a certain platform and convince startups to build a product on top of company's platform. Running an accelerator program may rejuvenate the corporate culture, as a public commitment to supporting innovation sends strong signals to internal staff and external partners. Connecting the corporate workforce with fresh talent and fresh ideas can result in employees being the effective change agents. Corporation may also gain new entrepreneurial culture that is experimental and risk ready. The change in the corporate culture might also help with attracting and retaining talent. In addition to the above- mentioned benefits accelerator enables a corporation to screen rapidly a large number of startups operating in a particular sector or particular region. Reviewing applications and selecting between startups for an accelerator program gives the corporation an insight into a wide spectrum of business ventures and provides a possibility for a corporation to identify new opportunities. It enables them to instead of actively looking for startups and identifying potential innovation or disruption, startups come to the corporation instead as they apply. Although this is true, there is actually no guarantee that the most innovative and disruptive startups would apply to the corporate accelerators, as other seed-stage investors might provide them with more favorable investment terms.

The corporations are not the only ones benefiting from running the accelerator program. Corporations assist startups in various ways as well as they provide them with market knowledge and experience, economies of scale, an established brand. Corporations give them access to resources, such as customer and market information which is very valuable to startups, because it helps them determine what features need to be integrated into their product.¹⁴⁶ They may get access to corporations top personnel, such as engineers, product managers. Moreover, they may benefit from the corporation's proprietary resources that can quicken their development process. Startups may be able to secure the product- market fit faster, or use corporations as a distribution channel partner. Corporate backing could increase startup visibility and credibility.

As do all the accelerators, corporate-backed accelerators focus heavily on mentoring as well. What may set them apart from other accelerator programs is their narrow vertical specialization, meaning that their mentors have deep industry expertise in the industry startups operate. Mentors in these accelerators are outside experts as well as inside experts who are needed later, for the successful integration of the technology in the business model of the corporation. Having a mix of outside and inside experts might provide the optimal solution to receive a mixture of both ideas and advice not only from people who are experts in a particular industry (with the possible negative side effect that advice given might be too focused and fitted to the corporation). Outside experts could provide advice that might fall outside of their sector but could actually benefit the startup. While corporate accelerators provide obvious benefits for the startup participating in the program, there are some potential problems for the startups that may arise. Firstly, they may narrow startup's focus solely to the areas that benefit the corporation and their strategic objectives more than the startup itself.

Secondly, intensive involvement with one particular company creates significant signaling for startups. These are early stage startups, and since corporate accelerators are not neutral, there is a risk that competition might not want to engage with a startup that comes out of a rival program. As these are early stage ventures, this could potentially mean not just that potential collaboration and partnership would not be likely to happen but also that the list of potential follow-up investors would narrow down, as Corporate Venture Capital funds might not want to invest in these startups.

Looking at the data it can be found that some startups that were participating in the corporate accelerator program have been later acquired by a different company, meaning that this may not be problematic. According to crunhbase.com some of the corporate accelerators (Hub:raum, Disney Accelerator, Mediacamp Accelerator, Microsoft Accelerator) all had startups in their portfolios that were later acquired by different companies, some even by prominent corporations such as Apple, Google, Yahoo!. In fact, out of 22 startups that were acquired, only one startup was acquired by the corporation that was running the accelerator. Moreover, startup participating in a certain corporate accelerator the feedback provided to them would be very limited and not the broadest product feedback needed for success. The transfer of knowledge and mentoring provided by the corporate accelerator would thus be very company-specific. While the aim of a startup is to build a product that solves a general problem, corporate accelerators may provide them with help to design a fitted solution to one company's challenges. The corporation running an accelerator may be a competitor with the startup in the program and thus, there may be a conflict of interests as they want to gain information about their competition or even acquire it to either develop the product or service them or to prevent the further competition.

1.5.2 Types Of Corporate Accelerator Programme:

After having some deep analysis, the corporate accelerator program has been divided in four types, which has been clearly mentioned in below attached fig. 2 –

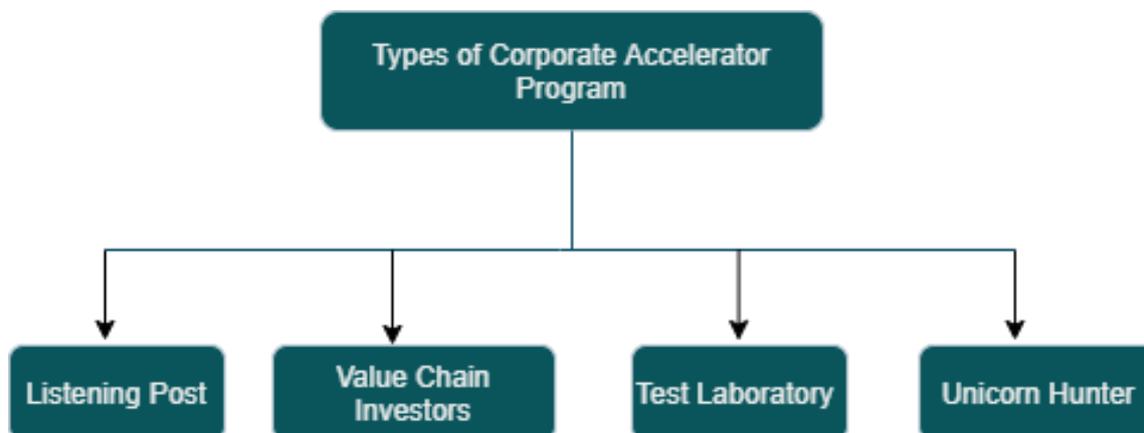


Fig.2 Types of Corporate Accelerator Program

1.5.2.1 Listening Post

The essential goal is to comprehend the general turns of events and patterns in an individual market or industry and start collaboration with new companies in these zones. Due to lesser amount of value inclusion through parent organizations, the growth of the startups gets saturated, which underlines its absolutely essential reasoning. In this explorative setting, the projects center around business territories that are essentially adjoining the parent organization, however not in the extremely severe sense. Thus, new companies that are having a very promising thoughts in domain which are not a wellspring of income for the parent organization are oftentimes admitted to these projects. As per the trade with new companies, advancements and their thoughts are of high significance to this program, new businesses that are not yet lawfully established yet have promising thoughts can routinely be admitted to these projects. The listening post-corporate accelerators are incorporated into the parent organization association and not set up as free genuine elements. By the Scout 24 entrances, the You is the new startup accelerator program with help of Microsoft ventures is designed to enhance the entrepreneurship culture within the young minds.

1.5.2.2 Value Chain Investor

The fundamental target is to distinguish and create new companies with new innovative/inventive ideas and administrations from which the parent organization can profit some place along its worth chain. These advantages may incorporate the showcasing of items or administrations through the current appropriation channels of the parent organization. Some of the financial supporter corporate accelerator with help of an external partners such as: The TechStars METRO and SPACELAB accelerator of the Media-Saturn-Holding GmbH are the instances of a worth chain support mechanism which helps the young entrepreneurs to develop their product effectively.

1.5.2.3 Test Laboratory

The main objective for this type of accelerator program is to provide the platform for testing the new business idea proposed through young entrepreneurs. From an authoritative point of view, test laboratory corporate accelerators are set up as autonomous associations as free legitimate elements going about as 100% auxiliaries of the parent organization. One illustration of a test lab corporate accelerator is the agile accelerator of the German service organization E.On and Allianz Digital Accelerator dispatched by the worldwide insurance agency, while Allianz in Germany is also providing the business incubation program.

1.5.2.4 Unicorn Hunter

The fundamental target is to procure a monetary premium on the various minority interests in new startups. The value association can be led in two unique manners, which is - the value can be moved straightforwardly in fixed terms (e.g., five percent) or as convertible loans that is changed into equity at the next financing round of the start-up. This financial orientation likewise furnishes this corporate accelerators with its name. The methodology is intended to distinguish possible future unicorns, organizations esteemed at more than \$1 billion, by putting resources into various promising organizations with the goal of probably some expanding their worth essentially. This types of programs runs as an independent legal entities with respect to authoritative viewpoints.

The rationale behind this plan decision is that it diminishes the unpredictability of endorsing the various speculations made into outer new businesses. The play accelerator and axel springer plug is the illustration of this accelerator program. Further the collaboration between startups and corporations can be classified into five major parameters, which are –

- Supporting the pilot projects
- Start-up customer
- Distribution partner
- Investment in start-up
- Acquire start-up

➤ **Supporting The Pilot Projects**

The supporting enterprise underpins a pilot project. Subsidizing the improvement of imaginative arrangements and items by new companies instead of endeavoring to do so inside bears the cost of organizations the chance to investigate development possibilities at a lower cost, in a more limited time span, and with less dangers corresponding to the center business. Enterprises may grow new items along with new companies, investigate market openings through new companies, or settle business challenges by means of new challenges via start-ups' technology or talent .

➤ **Start-Up Customers**

The supporting company becomes startup client. Collaboration with various new companies during a quickening agent program permits partnerships to find out about various answers for their business challenges. Common advantages result if the startup wins the organization as a prominent client, and the partnership finds an answer for its trouble spots; The working with a huge organization can be a significant advance for new businesses to test their item market fit and scale their activities.

➤ **Distribution Partners**

The supporting organization becomes the distribution partners of individual startups. The channel associations can be commonly advantageous, because it gives a joint answer for both enterprise and the start-up. Instead of work out their own distribution networks, new businesses would thus be able to offer their items through the organizations.

➤ **Investments In Start-Up**

The supporting company puts resources into startup: Backing and sup-orting new companies is useful for organizations as this gives them at a lower capital requirements and higher speed contrasted with inner R&D, with the admittance to a new business sectors and capacities. Simultaneously, new companies profit by positive terms comparative with conventional wellsprings of investment.

➤ **Acquire Start-Up**

In order to solve the specific business problems, acquiring the start-ups is the best way for sponsoring corporation . The corporate acceleration programs reduces the time consumptions required to develop the good level and image within the market.

1.5.3 Structural Components Of Corporate Accelerator Programme:

The below attached figure (3) depicts how the structural components of corporate accelerator program is divided into five major steps –

1.5.3.1 Selection Process

The selection process for Corporate Accelerator Program is all about the scrutinizing methodology for different kinds of existing startups. The targeted startup in this mode comes between the initial planning without any market capitalization to full scale business model development along with the validated prototype with initial tractions.

1.5.3.2 Deal

The deal denotes the start of the acceleration program and decides the legally binding ties between the start-up and accelerators [18]. The deal isn't really monetary; an arrangement can involve, among different terms, a cash assets for-value understanding, convertible credit arrangement, or "accompany no hidden obligations" non-value model.

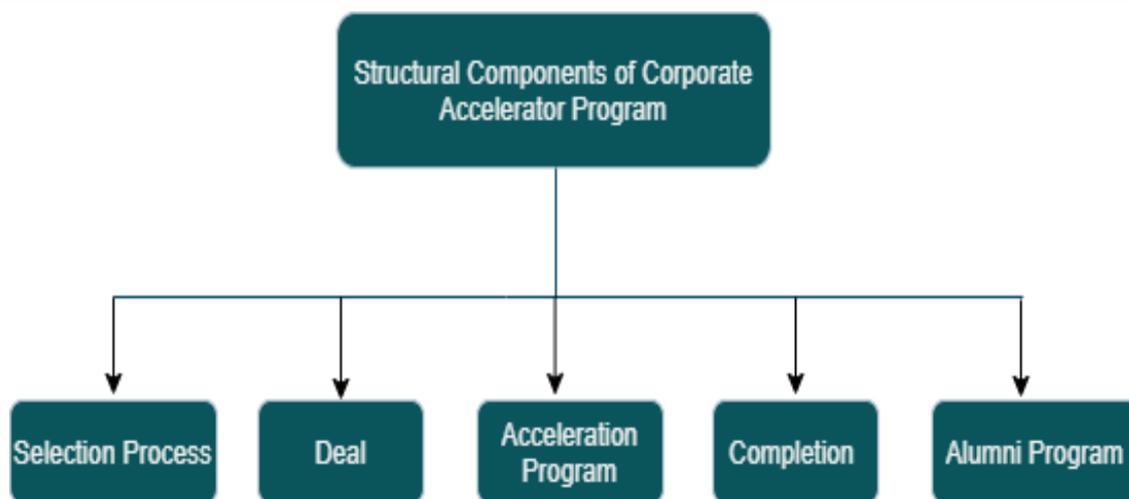


Fig.3 Structural Components of Corporate Accelerator Program

1.5.3.3 Acceleration Program

The acceleration program empowers new businesses to get active help and access amassed information, abilities, and entrepreneurial expertise required to run their business. This entrance is upheld by an established mentor network, elite occasions, workshops, and a developing graduated class organization. The mentor network is the critical component of any increasing speed program. The tremendous and drew in guide organization can uphold new businesses by sharing data concerning traps, prompting on next moves, and associating with specialists and financial backers [19].

1.5.3.4 Completion

The consummation of the official accelerator program is commonly set apart by a feature occasion frequently called demo day that associates the new start-ups to investors for follow-on subsidizing [20]. A few accelerator agents don't offer such an occasion however rather decide to associate new companies with investors independently during and after the program.

1.5.3.5 Alumni Program

The scaling and development of startups remains continuous with help of alumni programs. This kind of program also provides an opportunity for startups to get connected with investors. For monetarily determined accelerators like - Y-combinator is especially intriguing since extra speculations, an exit, or an IPO raises their profit from venture and consequently demonstrates the achievement of the program [21,22].

1.6 BUSINESS MODEL

These types of accelerators are often not profit oriented and do not offer any funding for the startups admitted to the program. If the goal of corporate-backed accelerators is not to economically benefit by achieving financial results, their strategic focus is to benefit from integrating innovating technologies or business models into their organization.¹⁶² The more corporate accelerator is vertically specialized, the higher are the chances of creation of a partnership between a corporation and a startup that could be successfully integrated. Corporations that take equity are defending their decision to do so, by stating that they do it to align the incentives. But this is a rarity, most of them don't invest in them, taking too much equity will reduce the entrepreneurial drive and might reduce their attractiveness to future investors.¹⁶³ Taking equity might provide an incentive for a corporation to help the startup after the program has ended. Most of the corporate accelerators are focused on benefiting from new technologies and ideas, and not from making a profit because the startup had a successful IPO. Startups involved in a corporate accelerator should be ventures that might want to be partnered or be acquired by the particular corporation. If the founders goal is to have a successful independent company, independent accelerators or other seed-stage investors might be more appropriate.

1.7 STARTUPS IN INDIA: OPPORTUNITIES AND GROWTH DRIVERS

Startups do not exist in a vacuum but are part of a broader business environment. Thus, the growth drivers of the Indian startup ecosystem need to be understood in the context of various factors: earlier economic reforms and current market trends, as well as the impact of technological change and changing attitudes on the part of government, large companies, and society overall. This section describes the five key opportunities and growth drivers which were identified in the interviews.

1.7.1 Scope and Characteristics of the Indian Market

India is often described as “the poster child of emerging markets” for its vast commercial potential for startups. In a country with a population of nearly 1.3 billion people, even niche products can have significant market potential. In the 1990s, economic reforms moved India towards a more market-based economic system. Since this liberalization, the overall economic development has been dynamic and as of 2017, the Indian economy had a GDP of US\$2.726 trillion. With a GDP growth of 7.0 percent in 2018, India is one of the fastest-growing large economies in the world. Therefore, the Indian market is perceived as being capable of offering an abundance of opportunities for startups.

As the Indian economy continues to grow, incomes and purchasing power are increasing steadily. Rising consumption is driven by the growth of upper-middle income and high-income segments of the population, which will grow from being one in four households today, to one in two households by 2030. Along with this, the demographics of the population are another advantage. Half of the country’s population are below the age of 25 years and the youth is inspirational. The nearly 700 million people born through the late 1980s to the 2000s carry material ambitions and have the ability to spend and make those goals a reality.

India’s huge diversity in culture, language, ethnicity and religion has proved to be both a curse and a blessing for startups. On the one hand, a startup’s understanding of customers is often limited to certain regions, where they know the local language and local people. This makes it hard for startups to scale their products to customers across the country (see section 3.2 for further detail). On the other hand, if solutions are successful in addressing the needs of diverse customers pan-India, they can likely find market uptake in other geographies such as Africa and Latin America, and even the developed world. In addition, many Indian startups do not only look at Indian problems, but offer customized solutions for markets abroad. For instance, Indian startups often do pilots and serve customers in the United States, where the user base has a much higher ability to pay.

1.7.2. Technological Change

There is a huge need for innovative solutions, particularly those that alleviate poverty and benefit a large number of people. Given the scale of India and its resource constraints, low-cost, high-impact solutions are required. Technology startups play a crucial role in accomplishing this, because of their potential for scalability and exponential growth.

Over the last few decades, technological change has reduced the cost of building digital products and has provided access to consumer markets. In the past, companies had to set up physical infrastructure to interact with customers, which implied high customer acquisition costs that proved prohibitive for small companies in the same field as established corporations. As India improved its digital connectivity, market access barriers have been brought down. The broadband penetration is increasing fast and the number of wire line subscribers in 2018 is expected to increase by 44 percent over the next four years. The number of internet users was pegged at 483 million in 2018 and is projected to reach 666.4 million in 2025. In addition, the government initiative, “Digital Saksharta Abhiyaan”, was started to promote digital literacy and help people become more knowledgeable about the digital world.

Startups rely on market access as well as possibilities to identify and charge customers. Establishing someone’s identity is grit in the wheels of commerce; as the means for identity verification and digital payments have become more widely available in recent years, startups can serve legions of new customers. The Aadhaar biometric ID system, introduced in 2009 and assigning Indian residents a unique identity number, has made it easier for companies to validate information about their customers. Successive Indian governments have also actively promoted both the opening of bank accounts and the expansion of digital payments to promote financial inclusion. Thus, large parts of the population are now able to conduct digital payments, as well as receive government benefits and subsidies, and therefore become part of the formal economy. Moreover, Adhere and the payments systems are part of the “India Stack”, which is envisioned as a new social infrastructure that will “help propel India into the 21st-century digital economy”. Increased financial inclusion, as well as the banknote demonetization in 2016, led to a boom of fintech startups, which was the top funded sector in 2018.

1.7.3 Increased Political Will and Government Support

The government under Prime Minister Narendra Modi, who assumed power in 2014, put digital transformation at the centre of its plans. The federal as well as some state governments increasingly recognize startups as important engines for economic growth. Moreover, startups are expected to create jobs that will narrow the high unemployment rate in the country. In 2018, startups accounted for 2.64 percent of the total jobs created in India that year; they are projected to create between 200,000 and 250,000 jobs in 2019.

The Modi government has made various efforts to support startups. The flagship initiative, “Startup India”, was initiated by the prime minister in 2016 “to build a strong ecosystem that is conducive for the growth of startup businesses, to drive sustainable economic growth and generate large scale employment opportunities.” Measures include a fund of INR 100 billion, financial support for incubators, establishment of tinkering labs, tax benefits, and a simplified recognition process for the setting-up of businesses, among others. So far, 14,036 startups have been recognized according to the definition of the Department of Industrial Policy and Promotion (DIPP); 660 startups have received business support; and 132 have been funded.[xvii] Some interview partners for this paper expressed doubt as to whether ‘Startup India’ has indeed made impact. However, they see the programme as a good step overall.

1.7.4 Companies Increasingly Seek to Engage in Open Innovation

In an increasingly uncertain and fast-moving business environment, large companies face pressures to innovate ever more rapidly. Their challenge is twofold: to innovate incrementally to grow their existing business, while understanding ongoing changes in their industry and making provisions for more radical innovations. The latter is proving to be difficult, and more large companies realize that they cannot simply rely on internally generated knowledge and on building everything themselves. As this ‘closed innovation’ paradigm loses its relevance, more companies turn towards open innovation approaches.

Thus, companies in India are increasingly reaching out to startups to increase their own innovativeness. They enter into exchange and strategic partnerships with startups, while supporting them with various corporate-specific resources. These engagements can be mutually beneficial. While a few years ago, corporate managers needed to be convinced of the benefits of working with startups, there has been a recognizable change in attitudes and many established companies today acknowledge the competitive advantages of startups, especially in terms of their speed and passion.

Corporate Accelerator in India

Disruptive innovations do not take place overnight. It begins with ideas that are slowly nurtured into startups. Here are accelerator programmes that can help entrepreneurs grow their idea into a startup.

India has seen a diverse set of startups growing in the last decade. Today, entrepreneurs have set their focus on innovating in areas of healthcare, digital payments, education, and others. And while setting their startups to scale, entrepreneurs also go through their share of difficulties in the initial stages.

It is here that accelerator programmes come into the picture. **Moulding startups in its infancy stage, they serve as the bridge between startups and the corporate firms.** Accelerators also guide them with practical business applications in the industry, and connect with experts and investors in their respective domain.

Most corporates today are usually keen on a startup’s potential to address the pain points they and their clients face every day. And it is here that companies like Microsoft, Google and Cisco have been incubating the entrepreneurial spirits for years.

JioGenNext

Backed by Indian multinational company **Reliance Industries (RIL)**, the **JioGenNext accelerator programme**, initiated in **2013**, focuses on entrepreneurs who are innovating for social good. The **four-week-long programme helps seed-stage startups** receive mentorship opportunities from industry experts, thought leaders, and the leadership team from Reliance as well.

Oracle Startup Cloud Accelerator

California-based IT technology company Oracle launched **Oracle Startup Cloud Accelerator in 2017**. Hosting two cohorts per year, the **six-month-long residential programme** selects five to six startups, innovating in areas of technology.

The selected startups will get mentorship from technical and business experts, access to technology, and a host of other things including Oracle customers, partners and investors, and free Oracle Cloud credits.

Some of the alumni startups that are currently leveraging technologies like **Machine Learning (ML)**, **Big Data**, and **Artificial Intelligence (AI)** are marketing platform HeyMojo and big data analytics company SustLabs.

The firm has also initiated Oracle Scale-up Ecosystem, a non-residential global programme.

HP Haven Startup Accelerator programme

Software company Hewlett-Packard launched HP Haven Startup Accelerator programme in **2015**. It is a **one-year-long programme for early-stage startups**, focussed on big data solutions.

It is aimed at shaping them into data-driven organisations, leveraging open-source platforms, equipping developers and the startups with necessary tools.

To be eligible, startups should have less than 50 employees and should not have received more than \$10 million in funding.

Amazon launchpad

Amazon Launchpad was introduced in India in **December 2016**, a year and a half after its launch in the US. The programme provides a platform for startups to effectively launch, market, and distribute their products to Amazon customers across India and around the world.

For this, the ecommerce major has tied up with the **Department for Promotion of Industry and Internal Trade (DPIIT)** for the **Startup India initiative**. This provides companies to access Startup India's self-service HR, legal templates, and other resources to build their business.

In the first year since its launch in India, there have been **200 applications per month**. Some of the best-selling brands on this platform are health food company Alpino Foods, men's grooming product company Ustraa, and Beardo, among others.

Maruti Suzuki Mobility and Automobile Innovation Lab

Mobility and Automobile Innovation Lab (MAIL) is a programme initiated by automobiles major Maruti Suzuki, in partnership with Indo-Japanese seed fund and co-creation centre GHV Accelerator.

A **four-month-long programme**, it was launched in **January 2019** to guide early-stage startups that are bringing innovation in the automobiles sector. The programme will monitor the proof of concept, optimise business models, and evaluate other key areas.

It includes 'need gap' mapping, mentoring sessions, industry testing and feedback, and interaction with domain experts, among others. The startups must be registered under Indian jurisdiction, and applicants should have business plans as well as an adequate understanding of the market needs and potential.

FINDINGS

This study found that Corporate Accelerator, Corporate Innovation and Corporate Venture are different for the various categories of core area of corporates. corporates whose core area is product, consider the Corporate Accelerator as the most effective form of engagement. The need to develop an entrepreneurial ecosystem in the nation, this form of corporate startup engagement will make scale not only startups but induce an entrepreneurial mindset across the nation. Already established and successful businesses can nurture an ecosystem of new ideas, proof of concepts, prototypes and startups.

CONCLUSION

In this paper, the need and adaptation of corporate accelerator programs in the Indian startup ecosystem. This program connects the young start-ups with corporate world for the better value creation of their products within a market. The corporate accelerator programs provide a deep mentorship to young minds who are completely new in a market. This kind of program also creates an awareness within a society like – entrepreneurship cultures, dos and don'ts within your new business and many more parameters for the development of new ideas. This program also gives the prerequisite plans which helps the young entrepreneurs to create their final product for better launch within a market. Also, the program provides a platform for young minds by connecting them to proper environment which required for the development of their products. Overall, the corporate accelerators program is helping the young minds to create their idea and providing them a valuable platform for sustaining in market. It is very important to have a clear objective for the engagement with startups. Either develop and spend to set up a corporate accelerator program or co-development projects. The ROI for both initiatives has to kept in mind. The case studies in this paper have given a straight example of how startups can co-develop useful solutions for corporate problem statements. While developing the solutions, the engagement of both parties are creating a knowledge base, innovation and also positive ROI for both parties. The format of this platform has to selected by all parties. This confluence can definitely make an high impact on the society, economy and people of the country. Very appropriate measures by the government of India in terms of Measures include a fund of INR 100 billion, financial support for incubators, accelerators. A stronger confluence can make collaboration

between startup and corporate profitable, we would want future research on the ways in which stronger collaborations can be made.

REFERENCES

1. Hansen, M. T., Chesbrough, H. W., Nohria, N., & Sull, D. N. (2000). Networked incubators. *Harvard Business Review*, 78(5), 74–84. 2) Cohen, S. (2013).
2. What do accelerators do? Insights from incubators and angels. *Innovations*, 8(3/4), 19–25.
3. Trotter, A. (2013). Six lessons for corporations building innovation accelerators. *Infosight*.
4. Blank, S., & Dorf, B. (2012). *The start-up owner's manual*. Stamford, CT: K&S Ranch.
5. Anthony, S. D. (2012). The new corporate garage. *Harvard Business Review*, 90(9), 44–53.
6. Stinchcombe, A. L. (1965). *Social structure and social organization: The handbook of organizations*. Chicago: Rand McNally.
7. Chesbrough, H. (2014). Why internal ventures are different from external startups.
8. R. C., & Lippitz, M. J. (2007). The four models of corporate entrepreneurship. *MIT Sloan Management Review*, 49(1), 75–82.
9. Kohler, T. (2016) Corporate accelerators: Building bridges between corporations and Startups College of Business, Hawaii Pacific University & visiting Scholar UC Berkeley and University of Innsbruck, 900 Fort Street Mall, Honolulu, HI 96813, U.S.A.
10. Dominik K.K., Stephan.S (2016), *The Journal of Applied Business Research –Volume 32, Number 6*.
11. Thomas Kohler (2016) Corporate accelerators: Building bridges between corporations and startups, College of Business, Hawaii Pacific University & visiting Scholar UC Berkeley and University of Innsbruck, 900 Fort Street Mall, Honolulu, HI 96813, U.S.A.
12. Sandra-Luisa Moschner, Alexander A. Fink, Stefan Kurpjuweit, Stephan M. Wagner, Cornelius Herstatt (2019), *Business Horizons* (2019) 62, 637–647
13. Cohen, S. (2013). What Do Accelerators Do? Insights from Incubators and Angels. *Innovations Accelerating Entrepreneurship*, 8(3/4), 19–25.
14. Hallen, B. L., Bingham, C. B., & Cohen, S. (2014, January). Do Accelerators Accelerate? A Study of Venture Accelerators as a Path to Success? In *Academy of Management Proceedings* (Vol. 2014, No. 1, p. 12955). Academy of Management.
15. Dominik K.K., Stephan.S (2016), *The Journal of Applied Business Research –Vol 32, Number*
16. Kohler, T. (2016). Corporate Accelerators: Building bridges between corporations and startups. *Business Horizons*, Vol. 59; 3. Pp.347-357.
17. Jackson P, Richter N. Situational logic: An analysis of open innovation using corporate accelerators. *International Journal of Innovation Management*. 2017 Oct 9; 21(07):1750062.
18. Richter N, Jackson P, Schildhauer T. Outsourcing creativity: An abductive study of open innovation using corporate accelerators. *Creativity and Innovation Management*. 2018 Mar; 27(1):69-78.
19. Radojevich-Kelley N, Hoffman DL. Analysis of accelerator companies: An exploratory case study of their programs, processes, and early results. *Small Business Institute Journal*. 2012 Oct 30;8(2):54-70.
20. Neumeyer X. Inclusive High-Growth Entrepreneurial Ecosystems: Fostering Female Entrepreneurs' Participation in Incubator and Accelerator Programs. *IEEE Transactions on Engineering Management*. 2020 Apr 16.
21. Boyd MS, Williams MR, Pennington K. Successful community college alumni programs. *Community College Enterprise*. 2009;15(1).
22. Dollinger M, Arkoudis S, Marangell S. University alumni mentoring programs: a win-win?. *Journal of Higher Education Policy and Management*. 2019 Jul 4;41(4):375-89.

END NOTES

1. NASSCOM, "Indian Tech Start-up Ecosystem, Approaching Escape Velocity," 2018.

2. "Startup India," Government of India, accessed April 17, 2019, <https://www.startupindia.gov.in/>. Inc42,
3. "Indian Tech Startup Funding Report", 2018. Inc42, "Indian Tech Startup Funding Report", 2018. Tobias Weiblen and Henry Chesbrough,
4. "Engaging with Startups to Enhance Corporate Innovation," *California Management Review* 57 (2015): 66-90; Thomas Kohler,
5. "Corporate Accelerators: Building Bridges between Corporations and Startups," *Business Horizons* 59 (2016): 347-357. NASSCOM, "Co-Innovation: Enterprise Startup Collaboration", 2019
6. NASSCOM, "Indian Tech Start-up Ecosystem, Approaching Escape Velocity," 2018. N. Balakrishnan, "InMobi: The Journey of India's First Unicorn," *The Hindu Business Line*, March 18, 2019. <https://www.thehindu-businessline.com/specials/emerging-entrepreneurs/inmobi-thejourneyof-indias-first-unicorn/article26570570.ece>.<https://yourstory.com/2019/09/startup-corporate-accelerator-programmes-incubator-india-jiogennext/amp>

Nonlinear Optical Response of Li⁺ - Cs⁺ Doped ZNS-PVP Nanocomposites

Swarnalata Sunatkari

Physics Department, N. G. Acharya & D. K. Marathe College of Arts, Science and Commerce, Chembur,
Mumbai- 400071, India

ABSTRACT

ZnS nanoparticles co-doped with different concentrations of Li⁺ and Cs⁺ were synthesized by the chemical co-precipitation method using L-arginine as capping agent. The optical absorptive nonlinearity of the ZnS: PVP nanocomposite thin films was analyzed using an open and closed aperture Z-scan technique which shows nonlinearity due to the two photon absorption in ZnS. The values for nonlinear refractive index n_2 , nonlinear absorption β and nonlinear susceptibility χ for ZnS: PVP is calculated. Enhancements in the nonlinear optical properties with increase in doping concentration is reported that is attributed to the thermal effect due to strong linear absorption coefficient combined with increased thermo-optic coefficient.

1. INTRODUCTION

Semiconducting nanomaterial's are known to have peculiar shape and size-dependent physical, chemical, electrical and optical properties which can be engineered as per application requirements. Zinc sulfide is a II–VI compound semiconductor with direct and wide bandgap (3.6 eV) [1]. It has diverse applications such as field emitters, field effect transistors (FETs), p-type conductors, catalyzers, UV-light sensors, chemical sensors (including gas sensors), biosensors, nonlinear optic devices and Nano generators [2]. The luminescent property of the ZnS nanoparticles are highly dependent on the doped ions as doping effectively alters the optical and nonlinear properties of the host material. [3,4]. In the case of nanoparticles, a large number of surface defects are present, which act as a non radiative path way for the excited electrons and become unfavorable to the luminescent properties of the nanocrystals. In order to overcome this difficulty, one can use an organic or inorganic material to cap the surface of the nanoparticles [5, 6]. ZnS nanostructure materials have been prepared using various physical and chemical methods with a view of their commercial or potential applications. The chemical precipitation method is generally used for the synthesis of II–VI semiconductor nanostructures and this method has a number of advantages including easy process ability at ambient conditions, possibility of doping different kinds of impurities with high doping concentrations even at room temperature, good control over the chemistry of doping and easiness of surface capping with a variety of different steps involved in the synthetic process of nanoparticles [7].

1.1 Nonlinear Optical Response of Doped or Co-Doped Zns:

In the present work, we have synthesized ZnS nanoparticles thin films with different co-doping concentration embedded in PVP matrix by spin coating method. The ZnS thin films were characterized by Z Scan technique irradiated by He-Ne laser with continuous wavelength of 632.8 nm.

2. CHEMICALS AND EXPERIMENTAL PROCEDURE:

2.1 Chemicals:

Zinc chloride (ZnCl₂, 99 % purity), sodium sulfide (Na₂S), lithium chloride (LiCl), cesium chloride (CsCl₂), PVP and L-arginine purchased from Sigma-Aldrich (Germany) were analytical grade purity and used without further purification. De-ionized water used in the synthesis process.

2.2 Synthesis of L-arginine stabilized ZnS NPs:

ZnS NPs were synthesized by using chemical reduction method using L-arginine as capping agent, Na₂S as reducing agent. 1, 2 and 5 wt % solutions of Li⁺ and Cs⁺ were used as doping agent. The mixtures were stirred for 10 min continuously using magnetic stirrer. Colour of solutions turned to milky white that confirmed the formation of ZnS NPs. Stirring continued for 1 h to yield white precipitate. The precipitates were centrifuged for 25 min at 4800 rpm. Final product washed several times with methanol followed by de-ionized water and dried optically at a temperature 40°C for 20 h to remove water and other volatile organic by-products formed during synthesis process. The samples in powder form used for further characterizations.

2.3. Synthesis of ZnS-PVP Thin films:

For the preparation of nanocomposite thin film, synthesized doped ZnS nanoparticles were dispersed in double-distilled water separately and ultrasonicated for 10 h to achieve good stable suspensions. Solution of PVP was also prepared and mixed, amounting 10 wt%, with suspensions of doped ZnS nanoparticles. The solutions were stirred for 1 h, ultrasonicated for another 2 h and were used to prepare thin films on good optical quality glass

slides using spin coating technique. Thin films were dried in hot air oven and were used for characterization. Thickness of thin films was measured by ellipsometric method on Sentech ellipsometer (model no.: SEN research SE 850 DUV Variable angle), Germany. Table 1 shows average thickness of thin films of doped ZnS-PVP nanocomposites.

Table 1: Thin film thickness of nanocomposite thin films of different doping concentrations.

Nanocomposite thin film details	Thickness nm
ZnS-PVP (1% doping Li ⁺ -Cs ⁺)	190
ZnS-PVP (2% doping Li ⁺ -Cs ⁺)	212
ZnS-PVP (5% doping Li ⁺ -Cs ⁺)	215

3. Characterization and Discussion for Non Linear Optical Response on ZnS-PVP Co-Doped Nanoparticles:

The open and closed aperture Z-Scan experiment was used to measure the nonlinear optical properties of co doped ZnS nanoparticles suspended in PVP. Here the laser beam of wavelength 532 nm is used for sample excitation and its propagation direction is considered as the axis. The beam is focused using a convex lens of focal length 20 cm and the focal point is taken as z=0. The beam has maximum energy density at the focus, which symmetrically reduces towards either side of the z axis. In the experiment, the sample is placed in front of the beam at different positions with respect to the focus and corresponding transitions in case of an aperture in Closed and without aperture in Open aperture are measured. The position transmission curve obtained are known as closed aperture and open aperture Z scan curve. From these measurements, the nonlinear refractive index n₂, nonlinear absorption coefficient β and third order nonlinear susceptibility χ of the sample is calculated. [8]

Figure 1 is the closed aperture Z scan curves show a typical peak and valley. The difference between normalized peak transmittance and valley transmittance given by

$$\Delta T_{pv} = f [\Delta\phi_0] \text{ for } \Delta\phi_0 \leq \pi, \dots\dots\dots(2)$$

The phase shift Δφ₀ is related to n₂ by the relation,

$$\Delta\phi_0 = - (2\pi/\lambda)\Delta n L_{eff} = - (2\pi/\lambda)n_2 I_0 L_{eff} \dots\dots\dots (3)$$

In this equation, L_{eff} is the effective length of the sample, I₀ = 2P_{in}/π ω₀² is the incident illuminated intensity at the focal point and P_{in} is the laser input power.

From the ‘open-aperture’ Z-scan the variation in the normalized transmission T(z) [when no aperture is used (S-1)]:

$$T_{norm}(z) = \frac{Ln(1+q_0(z,t))}{q_0(z,t)} \dots\dots\dots (4)$$

In this equation q₀(z,t) = β I₀L_{eff}(1 + z²/z₀²), z₀ = kω₀²/2 is the diffraction length of the beam and k = 2π/λ is the wave vector[9,10].

By selecting appropriate values of I₀ = 3.768 x 10³ W/m², s = 0.5, ω₀ = 1.3 x 10⁻⁵ etc the values of n₂ for different doping concentrations is determined. The experimental values for β are obtained by fitting the Z-scan recording in the equation (4) for two photon process. It has a larger value due to thermally induced nonlinearities due to the use of cw laser.

A real and imaginary component of third order nonlinear susceptibilities and effective third order nonlinear susceptibility has been calculated using following relations:

$$Re[\chi^3] = 10^{-4} \frac{\epsilon_0 n_0^2 c^2}{\pi} n_2 \text{ esu} \dots\dots\dots(5)$$

$$Ie[\chi^3] = 10^{-2} \frac{\epsilon_0 n_0^2 c^2 \lambda}{4\pi^2} \beta \text{ esu} \dots\dots\dots(6)$$

$$\chi_{eff}^3 = [(Re[\chi^3])^2 + (Ie[\chi^3])^2]^{1/2} \text{ esu} \dots\dots\dots(7)$$

The calculated values of n₂, β and χ³ of ZnS-PVP thin films for different doping concentrations are given in the Table 2.

Table 2: Nonlinear optical co-efficients obtained for thin film samples:

Nanocomposite thin film details	n_2 cm^2/W ($\times 10^{-5}$)	B cm/W ($\times 10^{-6}$)	$\text{Re} [\chi^3]$ esu ($\times 10^{-2}$)	$\text{Im} [\chi^3]$ esu ($\times 10^{-9}$)	χ^3 esu ($\times 10^{-3}$)
ZnS-PVP undoped	1.86×10^{-8}	1.60×10^{-6}	3.26×10^{-2}	8.23×10^{-10}	3.26×10^{-2}
ZnS-PVP (1% doping Li^+ - Cs^+)	2.71×10^{-5}	3.56×10^{-6}	2.30×10^{-1}	3.55×10^{-8}	2.30×10^{-1}
ZnS-PVP (2% doping Li^+ - Cs^+)	3.29×10^{-5}	4.54×10^{-5}	2.79×10^{-1}	1.83×10^{-9}	2.79×10^{-1}
ZnS-PVP (5% doping Li^+ - Cs^+)	3.9×10^{-5}	6.90×10^{-5}	3.31×10^{-1}	2.34×10^{-8}	3.31×10^{-1}

In semiconductor nanomaterial, direct 3PA is not possible at the intensities available from 532 nm laser pulse. Therefore a more probable mechanism seems to be two photon absorption (2PA), which is a sequential process common in semiconductor nanomaterial. In addition surface defects and surface dangling bonds also contribute. Also, as one can see that, nonlinear refraction is negligible for the Pure ZnS-PVP sample. The nonlinear refraction is enhanced as Li^+ : Cs^+ doping concentration is increased in the thin film samples. A very narrow particle size distribution maximizes the possibilities of interaction of doping ions within the available cross-section of incident laser beam. In our present case it is observed that as doping concentration is increased, more number of doping ions are available for the absorption that causes the thermally induced NLO effects [11-15].

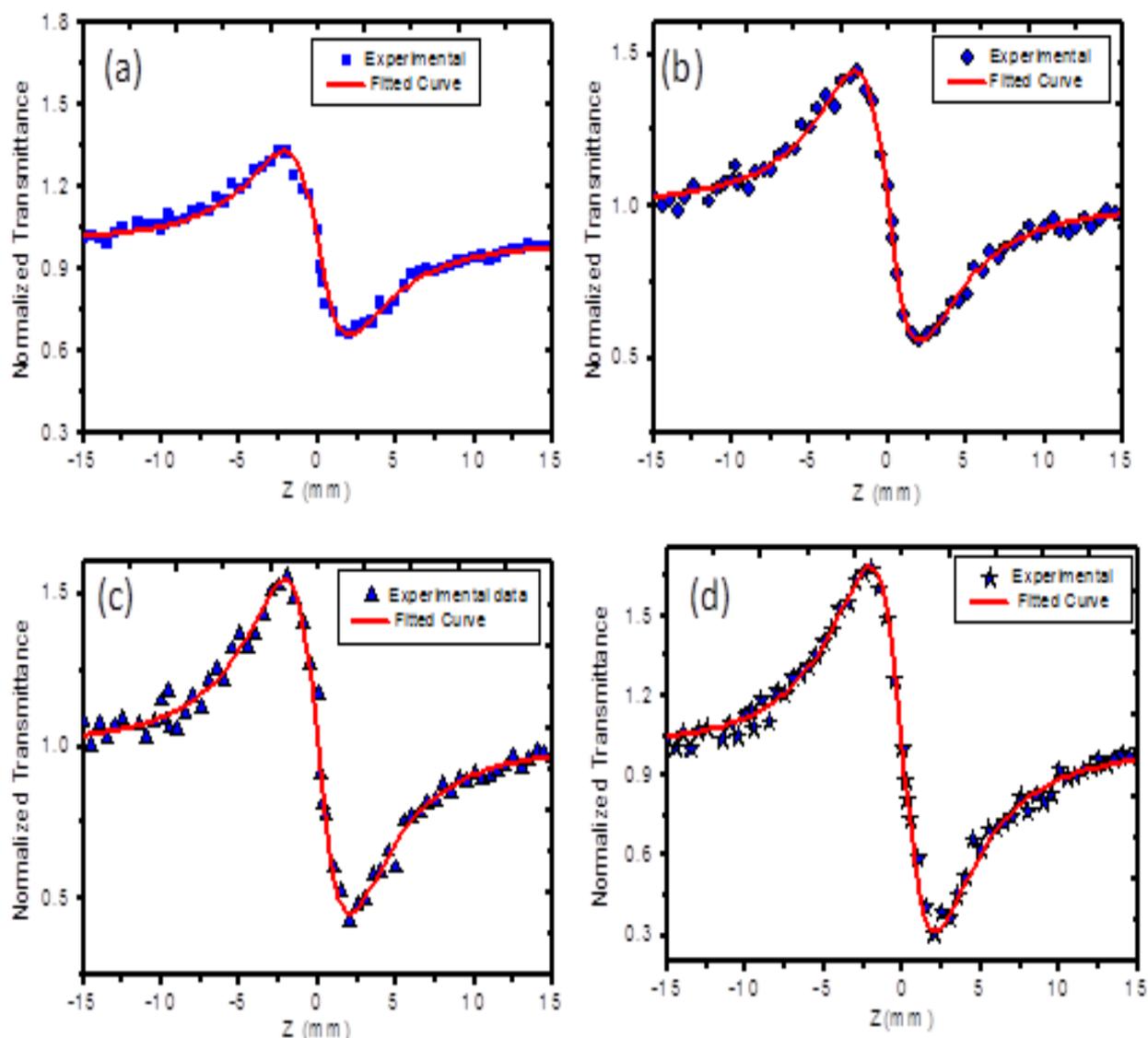


Figure 1: Closed aperture Z Scan of ZnS-PVP thin films co-doped with Li^+ and Cs^+

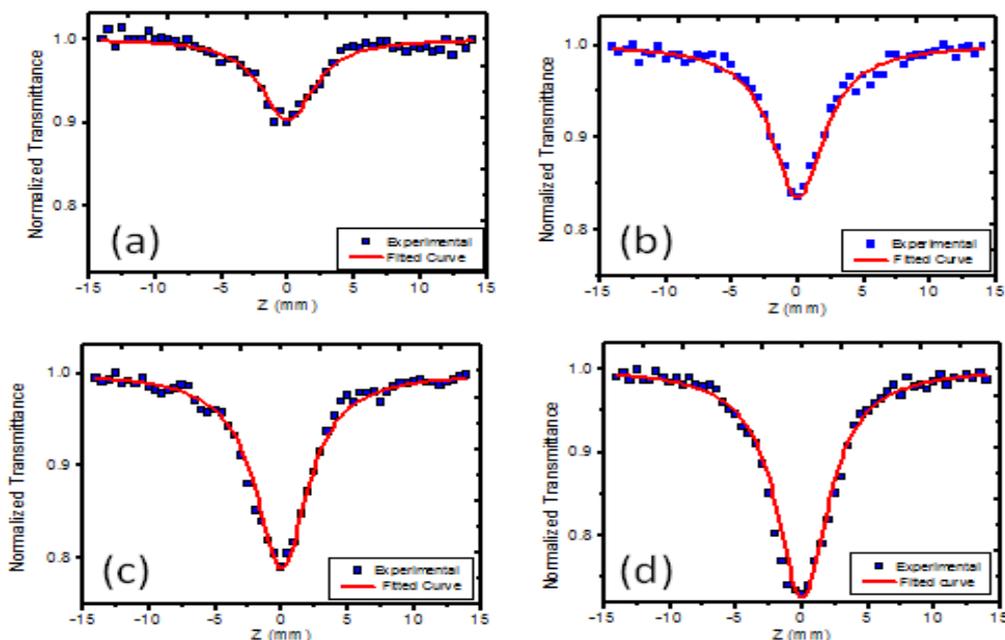


Figure 2: Open aperture Z Scan of ZnS-PVP thin films co-doped with Li^+ and Cs^+

4. CONCLUSION

In conclusion, we report the synthesis of ZnS nanoparticles co-doped with Li^+ and Cs^+ successfully by the chemical precipitation method using L-arginine as capping agent. The nanocomposite thin films fabricated by spin coating method were characterized by Z-scan technique under continuous wavelength He-Ne laser. Enhanced values of nonlinear refractive index n_2 , nonlinear absorption coefficient β and nonlinear susceptibility are obtained that can be attributed to the thermal effect due to strong linear absorption coefficient combined with increased thermo-optic effect.

5. REFERENCES

1. X. Fang, T.Zhai, U.K.Gautam, L.Li, L.Wu,etal., Prog. Mater.Sci. 56 (2011)175
2. P.Yang, M.L. ,D.Xu, D.Yuan, C.Song, S.Liu, etal., Opt. Mater. 24(2003)497
3. R.N. Bhargava, D.Gallagher, T.Welker, J.Lumin. 60–61 (1994)275
4. S. Wei, B.I.Lee, Z.Lin, W.Tong, B.K.Wagner, W.Park, J.Lumin. 92(2001)73
5. R. He, X.F.Qian, et.al, Coll. Surf. A Physicochem. Eng. Asp. 220(2003)151
6. Y.Yang, H.Chen, X.Bao, J. Cryst. Growth 252 (2003) 251
7. A.Firdous, D.Singh, M.M.Ahmad, Appl. Nanosci. 3 (2012) 13
8. M. Sheik-bahae, A.L.I.A.Said, T. H Wei, J.Quantum Electron. 26(1990)760
9. M. H Majles Ara, Z. Dehghani, S Saievar Iranizad, International Journal of Mordern Physics, B 22 (18 & 19) (2008) 3165
10. M. Sheik-bahae, A.L.I.A.Said, T. H Wei, D. J Hagan E.W.Van Stryland, IEEE Journal of Quantum Electronics. 26 (1990) 760
11. R.L. Sutherland, Handbook of Nonlinear Optics, 2nd edition, Marcel Dekker, New York, 2003
12. B. Karthikeyan, C.S.S. Sandeep, R. Philip, M.L. Baesso, J.Appl. Phys.106(2009) 14304
13. V.S. Muthukumar, J. Reppert, C.S.S. Sandeep, S.S.R. Krishnan, R. Podila, N. Kuthirummal, Opt.Commun.283(2010)4104
14. T.V. Vineeshkumar, D. Rithesh Raj, S. Prasanth, N. V. Unnikrishnan, R. Philip, C. Sudarsanakumar, Opt. Mater. 37(2014)439
15. Y.S Tamgadge, et.al. Applied Physics B, 120 (2) (2015) 373

The Emergence and Development of Legal Safegaurds against the Violence of Indian Women

Mahendra Kumar Sharma and Vinod Kumar Saroj
MATs School of Law, MATS University, Raipur, Chhattisgarh, India

ABSTRACT

As the Indian society includes a complex structure, due the complex structure and historically subordinated by the male dominated society Indian women faces violence. Violence against women is holistic challenge to the Indian society as well as legal system. Due to the cultural barriers and illiteracy violence against women is still exist in the society. Status of women is incredibly miserable in India. To emancipate the women from violence they need legal safeguards. This Article highlight the need and emergence of legal safeguards against the violence of Indian women and their development as well.

INTRODUCTION

The history of the mankind reveals that, the females are the foundation stone of civilization. If the basis is not properly maintained, the full building of the human life is found to bind. Over the Centuries, violence against women has come to be understood as a method of discrimination and a violation of women's human rights. During ancient period in India cases of violence against women were deal through the customary or religious law.

MEANING AND DEFINITION OF VIOLENCE AGAINST WOMEN

The United Nations defines violence against women as "Any act of gender-based violence that results in, or is probably going to result in, physical, sexual or psychological harm or suffering to women, including threats of such acts, coercion or arbitrary deprivation of liberty, whether occurring in public or in private life" Kofi Annan defined violence against the women as "Violence against women and girls is a problem of pandemic proportions. At least one out of each three women round the world has been beaten, coerced into sex, or otherwise abused in her lifetime with the abuser usually someone known to her."

FORMS OF VIOLENCE

To identify the forms of violence against women various reports has been prepared by the different institutions. One of them one is The Gender Equality Commission of the Council of Europe identifies total nine forms of violence against women which are happening day by day. They are as follows-

1. Violence within the family or domestic violence
2. Rape and sexual violence
3. Sexual harassment
4. Violence in institutional environments
5. Female gentile mutilation
6. Forced marriage
7. Violence in conflict and post conflict situations
8. Killing in the name of the honour
9. Failure to respect freedom of choice with regard to reproduction.

NEED AND EMERGENCE OF LEGAL SAFEGUARDS

There was a time in history when females were forced to live within the four walls and that they weren't even allowed to boost their opinion, accordingly. On one hand she is held high, worshiped, considered because the epitome of virtues and also the one who could just sacrifice everything for her family. But on the opposite hand she has been the victim of miseries, hardships, and atrocities that are cause because of the male dominating society. She had been victim of tyranny. To eliminate the violence against women legal safeguards are required.

DEVELOPMENTS OF LEGAL SAFEGUARDS AGAINST WOMEN

Historical oppression of women is responsible factor for emergence and development of legal protection against the violence of Indian women. The legal safeguards had been developed through the various phases-

ANCIENT PHASE

During ancient period in India cases of violence against women were tackled through the customary or religious law. To understand the legal safeguards it's required to analyze the position of females during ancient period. The position of females during the Vedic period was glorious. During this era, the females participated in every walk of life.

There was absence of Pardah system, right to choose life partners. The system of polygamy and dowry was only prevalent. There was no prohibition within the remarriage of widow and also no discrimination between a male and female. As a result, girls were permitted to undergo thread ceremony. These just like the status of female within the contemporary western world; the status of ladies in India was supported liberty, equality and cooperation. What, however, made them different was centred on spirituality and spiritual duty and co-operation in family life.

During the Post Vedic Period, the female had suffered drastic hardships and restrictions as propounded by Manu. He attempted to line up male dominated society by increasing the authority of man. Girls weren't allowed to undergo thread ceremony, during this era pre-puberty marriage system was originated thus the marriageable age of women was lowered to 9 or 10 yrs. The subservience of female is precisely summed up within the famous injunctions of Manu where it's stated that a woman should never be independent. As a daughter she is under surveillance of her father, as a wife, of her husband and as a widow of her son. It had been said that girls should be "loved" but added "protected" surprisingly in post Vedic period, the women's right to property was recognized and also the concept of Stridhan prevailed.

As Manu defined - Stridhan means "That which was given to her before the nuptial fire, in bridal procession, in token of love and which she has received from father, mother, brother and husband."

In ancient India an initiation was taken to grant women certain rights by calling her "Ardhangini". Later Vedic period started many abusive trends like sati system, Pradha system, Child marriage, Dasi System, Niyog Pratha so on. Garuda Puran stated that "Follows the laws of Vedas instead you may wrath in hell."

MIDDLE PHASE

The Medieval period in India was dark period for female. The 'Purdah' system, Child Marriage, Sati, Jauhar and restriction on girl education has introduced in society within the medieval era. It's considered the darkest period within the history of woman empowerment.

In this era, women had been given the title as temple dancers, Devdasi and then on. Pradha system, child marriage were still ongoing to oppress the ladies. During medieval age there was great potential importance for dowry system within the kind of "Varadakshina". Today, although there are laws governing the dowry system still many backward families believe dowry tradition and they demand dowry. Only making laws doesn't change the society, laws so made should be respected and followed by its people.

MODERN PHASE

India is traced for its historical diverse and will not leave its process of female oppression in history. During British Period the Position of female has undergone drastic changes mainly acknowledgements to western impact on the Indian socio cultural pattern. The newly emerging class, English language opens a door to the ideology of liberalism which has the values of liberty; equality etc. though in colonial India the appliance of those values was limited to the extent that it didn't harm the interest of rulers.

During the 19th century socio reforms movement revised the question of equal status of female. Social reformers were generally concerned regarding problems of Sati, prohibition on re-marriage, denial of right to property, child marriage and education to women. Swami Vivekananda Dayanand Saraswati and Annie Basant were of the opinion that Vedic period should be revived which was ideal for women's status.

LEGISLATIVE SAFEGUARDS AGAINST THE VIOLENCE

There are various legislations which deal directly or indirectly to the violence against the female. To deal the historical subjugation of female and eliminate the emerging trend of violence against the female many legislations have been passed. These legislations will be categorized general laws and special laws to guard the women's from violence. These are as follows -

1. GENERAL LEGISLATION

A. Indian Penal Code 1860

B. Indian Evidence Act 1872

C. The Child Marriage Restraint Act 1929

D. Criminal Procedure Code 1973

E. The Constitution of India 1950

F. The Hindu Marriage Act of 1955

2. SPECIAL LEGISLATION

A. Hindu Widow Remarriage Act 1856

B. The Hindu Women Right to Property Act of 1937

C. The Immoral Traffic (Prevention) Act, 1956

D. The Dowry Prohibition Act, 1961

E. The Indecent Representation of Women 1986

F. The Commission of Sati Prevention Act, 1987

G. Protection of Women from Domestic Violence Act, 2005

H. The National Commission for Women Act, 1990

I. The Sexual Harassment of women at workplace (Prevention, Prohibition and Redressal) Act, 2013

J. Criminal Law Amendment Act 2013

JUDICIAL ACTIVISM: SAFEGUARDS AGAINST VIOLENCE OF WOMEN

Time to time Indian judiciary plays vital role to eliminate the violence against women. To deals the violence against the women in case of in Madhu Keshav V. State of Bihar Justice K. Ramaswaray view of that, Women have always been discriminated against men and suffered denial and are suffering discrimination in silence. Although the discrimination is explicitly prohibited in Articles 15 and 16 of the Constitution. There's no discrimination of women regarding the fundamental rights guaranteed in Constitution of India.

Rape Violence

In a leading case of Delhi Domestic Working Women's Forum v. Union of India & Others fact of this case is that The Delhi Domestic Working Women's Forum was pursuing a case in which six girls belonging to a tribal community, travelling by train from Ranchi to New Delhi were molested and raped by a bunch of army men in their compartment. Though they were beaten and threatened by the culprits, the women did register First Information Report. However, because the investigations and trial dragged on for over six months, the women who worked in Indian capital as servant weren't able to actively assist to the prosecution, which was being committed in Aligarh, Uttar Pradesh. Concerned over unnecessary delays, particularly in the investigation and trial of rape cases, the Forum petitioned the Supreme Court to border guidelines for ensuring a speedy trial in order that rape victims aren't harassed and allowed to desire on with their lives.

The Supreme Court find out that speedy trial is one of the essential component of law, the Court asserted, in rape cases, the course of justice can't be frustrated by prolonged investigations carried by the investigating authorities. In view of the seriousness of the crime, the Supreme Court said that rape shakes the very foundations of victims' lives. For many, its effects are long-term and then sustained that they face difficulty in having personal relationships; their behavior and values are altered; and that they suffer from constant fear and anxiety.

In addition to the trauma of rape itself, victims must suffer further agony during legal proceedings as complaints are handled roughly and not given the value that they deserve. Victims are more often than not humiliated by the police and therefore the experience of giving evidence in Court is so distressing, that it puts severe psychological stress on them. Because, many of them feel re-victimized after reporting the crime, the Supreme Court laid down specific guidelines on the way to handle rape victims, which are given below.

1. The police should make arrangements of an advocate if she doesn't have access hire an advocate for her defence.
2. Every police station must maintain a listing of lawyers capable enough to clarify the character of proceedings to the victim; prepare her for the case; assist her in Court and police station; and ensure guidance on agencies and organizations that help in counselling and rehabilitation of rape victims.

3. The lawyer so chosen by the police to help the victim must be approved by the Court. However, so as to make sure victims are questioned without undue delay, the lawyer is also authorised to act at the police station before permission of the Court is taken.
4. In every rape trials, anonymity of the victim must be maintained.

Rape cases require extra sensitivity from the police. Care must be taken to determine that the victim isn't made to feel small or uncomfortable and her statement is recorded by a lady. Unnecessary references and spending of derogatory remarks that the victim contributed to the crime isn't permitted. A rape may be a rape regardless of what the reputation or profession of the victim is.

Violence of Custodial Death

In the case of Nilabati Behera v. State of Orissa The Hon'ble Supreme Court observed that "It is also mentioned straightway that award of compensation during a proceeding under Article 32 by this Supreme Court or by the state High Court under Article 226 of the Constitution may be a remedy available publically lens supported strict liability of contravention of fundamental rights to which the immunity doesn't apply; although it should be available as a defence privately law in an action supported tort."

Custodial Violence

In case of D.K. Basu v. State of West Benga The Hon'ble Supreme Court expressing his view that Custodial torture is a naked violation of human dignity. And the law does not permit the use of third degree methods or torture against the accused person.

In case of Sheela Barse v. State of Maharashtra the Hon'ble Supreme Court directed that to provide security to female person in police lock-up, a female judge should be appointed to make surprise visits to police stations to ensure that whether the legal safeguards which are available to the alleged person being implemented or not. The Hon'ble Supreme Court gave the subsequent directions-

1. Female suspects must be kept in separate lock-ups under the supervision of female constables.
2. Interrogation of females must be meted out within the presence of female police
3. An individual arrested without a warrant must be immediately informed about the grounds of arrest and also the right to get bail.
4. As soon as an arrest is made, the police should obtain from the arrested person, the name of a relative or friend whom s/he would like to informed about the arrest. The relative or friend must then to be informed by the police regarding the arrest.
5. The police must inform the closest Legal Aid Committee as soon as an arrest is formed and therefore the person is taken to the lock-up.
6. The Legal Aid Committee should take immediate steps to produce legal assistance to the arrested person at State cost, provided such person is willing to simply accept legal assistance.
7. The magistrate before whom an arrested person is produced shall inquire from the arrested person whether s/he has any complaints against torture and maltreatment under the police custody. The magistrate shall also inform such person of her/his right to be medically examined by the medical practitioner.

Harassment at Work Place

In case of Vishakha v. The State of Rajsthan &Ors the Hon'ble Supreme court find out that provisions of the civil and penal laws in India don't adequately provide for specific protection of ladies from harassment in work places which enactment of such legislation will take considerable time, it's necessary and expedient for employers in work places still as other responsible persons or institutions to look at certain guidelines to make sure the prevention of molestation of females. To protect the females from sexual harassment the Hon'ble Supreme court issued directions regarding Duty of the Employer or other responsible persons in work places and other institutions, Definition of harassment, Preventive Steps, Criminal Proceedings, disciplinary Action, Complaint Mechanism, Complaints Committee, Workers Initiative and Awareness of the rights of female employees. These directions would be binding and enforceable in law until suitable legislation is enacted by the legislature.

Violence of Honour Killing

To tackle the Violence of “honour killings” The apex court in Bhagwan Das v. State (NCT) of Delhi ruled that “the present case could be a case of circumstantial evidence, but, it's settled law that someone may be convicted on indirect evidence must established the links within the chain of circumstances connects the accused with the crime beyond reasonable doubt. In cases of indirect evidence motive is incredibly important, unlike cases of direct evidence where it's not so important. Within the present case, the prosecution case was that the motive of the appellant in murdering his daughter was that she was living in adultery with one Srinivas, who was the son of the maternal aunt of the appellant. The appellant felt humiliated by this, and to avenge the family honour he murdered his own daughter.”

In case of Lata Singh vs. State of U.P. & Anr The Supreme Court held that “This is completely illegal that, if someone isn't pleased of the activities of his daughter or other person, who is his relation or of his caste, the utmost he can do is to chop off social relations with her/him, but he cannot take the law into his own hands by committing violence or giving threats of violence.”

Violence of Acid Attack

In the case of Laxmi v. Union of India Laxmi, a Public Interest Litigation has been filed in 2006, a minor of 16 years old, an acid attack survivor who underwent mental and physical pain. The acid was thrown on her face because she denied marrying a person named Naeem Khan who grievously hurt her by doing such an offence among two other co-accused in capital of India. As her upper body suffered lots and was fully damaged, she couldn't get herself recovered back to the previous position. Even during this case the Supreme Court took cognizance over Acid attack cases and imposed some effective regulations prohibit the vending of acid and its distribution within the shops to stop easy availability. The crucial step from this case is that the amendment within the laws for acid attack offence within the Indian Penal Code by insertion section 326A and 326B referring to the laws and punishment of throwing acid offence and in Cr.P.C. section 357A and 357C was inserted which provides compensation to the acid attack survivors and treatment of acid attack victims to be freed from cost in both public and private sector of hospitals, respectively.

CONCLUSION

From ancient to till today violence against women can observe with the necked eyes. Violence against women occur every minutes in India. Women are not safe anywhere, whether it is in their houses, public places or at the workplace. On the above discussion it is found that there is many legislation to deal the violence against women but unfortunately they are not sufficient to tackle the problem. Society and law both are dynamic. Due to Changing scenario of violence need laws respectively. The Indian judiciary provide safeguards against the violence through judicial activism propounded various guidelines to deal the violence against women.

SUGGESTIONS

1. Law alone cannot stop the violence against women. It is cultural thinking awaking from education that are necessary for social transformation.
2. To stop violence against women the need of hour is co-operation instead of patriarchal dominance.
3. Feudal mind set of the people towards women must be change.
4. Women empowerment should not be tentative only it should be realised.

REFERENCES/FOOT NOTES

1. Declaration on the Elimination of Violence against Women Proclaimed by General Assembly resolution of 48/104 of 20 December, 1993. Available at https://www.un.org/en/genocideprevention/documents/atrocities-crimes/Doc.21_declaration%20elimination%20vaw.pdf (Last Visited on June 12, 2022).
2. Kofi Annan Secretary- General of the United Nations, declared in 2006 report posted on the United Nations Development Fund for Women. Available at https://en.wikipedia.org/wiki/Violence_against_women (Last Visited on June 12, 2022).
3. Akriti Sinha, “An Analytical Study on the Constitutional Safeguards of Women in India”, Legal Service in India E-Journal. Available at <https://www.legalserviceindia.com/legal/article-7674-an-analytical-study-on-the-constitutional-safeguards-of-women-in-india.html> (Last visited on June 9, 2022).
4. Veena Das, “The Mythological Film and Its Frameworks of Meaning” Indian International Centre Quarterly, Vol. 8. No. 1, March, 1981
5. A.S. Alteker, The position of women in Hindu Civilization (Motilal Banarasidass, Delhi 1962).

6. Available at <http://www.mapsofindia.com/culture/indian-women.html> (Last Visited on June 15, 2022).
7. Neera Desai and M. Krishvaraj Women and Society in India 38-41(Ajanta Publications India, 1987).
8. 1966) 5 SCC. 148
9. (1995) SCC 14
10. Section 155(4) of the Indian Evidence Act, 1872 which allowed admittance of the sexual history and reputation of the complainant in Court has been scrapped.
11. AIR 1993 SC 1960.
12. AIR1997 SC 610.
13. (1983) SCC 96
14. (1997) 6 SCC 241
15. AIR 2011 SC 1863
16. (2006) 5 SCC 475
17. (2014) 4 SCC 427

RP-HPLC Method for Simultaneous Estimation of (S)-Amlodipine Gentisate from Pharmaceutical Formula: Development and Validation

Parvez Shaikh, Pradeep Shimpi and Raj Badekar

Chemistry Department, Nirwan University, Jaipur, Rajasthan- 303305, India
Department of Chemistry, BNN College, Bhiwandi, Thane, Maharashtra, India
Riva Industries, Ambarnath MIDC, Ambarnath, Thane- 421 501, India

ABSTRACT

A reverse phase high performance liquid chromatography (RP HPLC) technique was developed and validated for the simultaneous estimation of (s)-Amlodipine gentisate in formulation. An acetonitrile:water (50:50v/v) mobile phase was used in the analysis, flowing at a rate of 0.5 ml/min through a HYPERSIL (250 x 4.6 mm, 5 m) column (UV detection at 325 nm). (s)-Amlodipine gentisate had a retention time of 11.017 minutes. In the 50-150 g/ml concentration range, (s)-amlodipine gentisate shown a linear response. For (s)-amlodipine gentisate, the correlation coefficient ('r' value) was 0.9996. In criteria of accuracy, linearity, robustness, selectivity, and precision the validated technique was found to be specific, accurate, linear, and precise. The approach was validated in accordance with ICH recommendations. The intraday and interday RSDs were less than 2%. The percentage recoveries obtained for (s)-amlodipine gentisate ranged from 99.92-102.22%, which was consistent with the indicated quantity in pharmaceutical formulations.

Keywords: (s)-Amlodipine gentisate, HPLC, linearity, robustness.

INTRODUCTION

Amlodipine is a chemical compound, when used either independently or in conjunction with other antihypertensive medications. It belongs to the third family of dihydropyridine compounds and is a strong calcium channel blocker. Because the molecule of amlodipine contains an asymmetric carbon atom in position 4, it has one chiral centre that naturally divides into two optical isomers. Pharmaceutical dose forms of amlodipine come in a racemic combination. The racemic mixture of the S(-) and R(-) isomers is known as amlodipine. In the bio-environment, two enantiomers of a racemic medication typically interact differently and can have various pharmacokinetic and pharmacodynamic characteristics¹⁻². Due to variations in affinities or intrinsic activities at receptor sites, enantiomers' pharmacological and pharmacokinetic properties are not identical.

Numerous spectroscopic³⁻⁸, RP-HPLC⁹⁻¹¹, and HPTLC¹²⁻¹³ approaches can be used to estimate (s)-Amlodipine both alone and according to a review of the literature, in conjunction with other medications. Similar to this, a review of the literature on gentisic acid analysis revealed techniques based on UV spectroscopy¹⁴, HPLC¹⁵⁻¹⁶ methods, both on their own and in combination with other medications¹⁷⁻²¹. The simultaneous determination of (s)-amlodipine gentisate has been demonstrated in the analytical literature using methods based on TLC-Densitometric and chemometric²², Capillary electrophoresis²³, HPLC for determination in Human Breast milk²⁴, and HPLC for determination in Human plasma²⁵⁻²⁶. However, no HPLC method for determining them in medicinal dose form has been disclosed. In this study, a reverse phase high performance liquid chromatographic (RP-HPLC) method for quantifying this component is developed and validated. The International Conference on Harmonization claims that the suggested method has been successful in identifying atenolol and chlorthalidone in pharmaceutical formulations (ICH).

MATERIALS AND METHODS

Chemicals and Reagents

The solvents fulfilled the HPLC/AR requirements. As a gift sample, (s)-amlodipine gentisate standard sample is obtained.

Chromatographic Conditions:

The experiment used an HPLC system and a 250 x 4.6 mm, 5 m HYPERSIL RP C18 column (Shimadzu, LC-20AD with PDA detector). For data processing, the HPLC instrument was equipped with Empower software. Using a 50:50 v/v combination of acetonitrile and water, the isocratic elution was carried out at a flow rate of 0.5 ml/min. 235 nm is the detecting wavelength.

Standard Stock Solution

To prepare a reference stock solution, we precisely weighed 100 mg of (s)-amlodipine gentisate standard and each drug is transferred to its own 20 ml volumetric flask.; adding 5ml of acetonitrile and sonicating for 10 minutes, then making up the volume to 20ml using acetonitrile (stock solution-I). Add 5 ml of the previously described solution to a 50 ml volumetric flask, fill to the top with acetonitrile, and label the resulting combination as stock solution-II.

Sample Stock Solution

50 mg of (s)-amlodipine gentisate was dissolved in 5ml of acetonitrile in a 10 ml volumetric flask. For 15 minutes, the suspension was sonicated. Finally, acetonitrile was used to make up the volume. A membrane filter paper with 0.45 μm pore size was used to filter the solution. Fill a 50ml volumetric flask halfway with acetonitrile and add 5ml of the aforementioned solution. to achieve a final concentration that is within the linearity range. The resulting clear solution was thinned out using the same solvent systems that were employed for the calibration graphs. The system was given an injection of 20 μL of each of these solutions, and the peak area from each chromatogram was recorded.

Calibration Curves

To prepare the volumetric solutions for each medicine, in a series of 20 ml volumetric flasks, pipette appropriate aliquots from each standard stock solution (I). The volume was adjusted with acetonitrile to get a set of solutions containing (s)-amlodipine gentisate at concentrations of 750, 625, 500, 375, and 250 $\mu\text{g/ml}$. Each concentration of (s)-amlodipine gentisate was synthesized in triplicate dilutions. Each drug concentration was injected into the RP-HPLC device in separate 20 μl injections, and the chromatography was performed in accordance with the conditions mentioned above A UV detector tuned at 235nm was used to analyses both drugs. Peak areas for each peak were measured and developed when standard calibration curves are plotted against concentrations.

Method Validation

Linearity, system suitability, precision, selectivity, accuracy, robustness, and limit of detection (LOD) and limit of quantitation (LOQ)²⁷ were the characteristics used to validate the method.

System Suitability

On freshly manufactured standard stock solution of (s)-amlodipine gentisate one, system suitability parameters were examined. (s)-Amlodipine gentisate was administered into the chromatographic apparatus five times under optimum chromatographic conditions. Parameters for system appropriateness. The following parameters were assessed: retention time, tailing factor, theoretical plates, %RSD, and similarity factor.

Linearity

Various quantities of the assay analyte (50, 75, 100, 125, and 150 $\mu\text{g/ml}$) were used to produce linearity test solutions from a stock solution for the assay method. The HPLC system was filled with each solution in increments of 20 l, and the ensuing chromatogram's peak area was recorded. The HPLC system was used to inject the extracted solutions from the commercial formulations, and the peak area of the chromatograms was noted. Three distinct times the analytical curve was studied. Least squares linear regression was used to examine the peak area vs. concentration data. The calibration curve's slope and y-intercept were reported.

Precision

Within the linear range of drug mixtures, six replicates of a fixed concentration were determined on the same day and to evaluate the suggested method's precision (both intra-day and inter-day precision), three additional days were needed.

Accuracy (Recovery Studies):

Recovery tests were used to determine the method's accuracy. The predetermined concentration of the pre-analyzed sample solution was combined with a known concentration of working standard. By contrasting the area before and after the working standard was added, the percentage of recovery was estimated. Both medications were recovered in the same manner. The recovery percentage was calculated after doing this conventional addition procedure at 50%, 100%, and 150% levels.

Robustness

The robustness analysis was carried out by making minor modifications to the optimum technique parameters, such as flow rate and column temperature. The retention time or tailing component had no noticeable effect.

Limit of Detection (LOD) and Limit of Quantitation (LOQ):

The limit of quantification (LOQ) and detection (LOD), in accordance with International Conference on Harmonization guidelines Q2 (R1)²⁷, were calculated using the standard deviation of the response and the slope of the generated calibration curve (n=3). The method's sensitivity was evaluated using the limits of detection (LOD) and limits of quantification (LOQ) for (s)-amlodipine gentisate. The slope technique was used to determine LOD and LOQ, as detailed below.

$$\text{LOD} = \frac{3.3 \times \text{standard deviation of } y\text{-intercept}}{\text{Slope of the calibration curve}}$$

$$\text{LOQ} = \frac{10 \times \text{standard deviation of } y\text{-intercept}}{\text{Slope of the calibration curve}}$$

by dosing each impurity six times at the predicted concentration, LOQ and LOD were experimentally verified.

Analysis of the Marketed Formulations

50 mg of (s)-amlodipine gentisate was dissolved in 5ml of acetonitrile in a 10 ml volumetric flask. For 15 minutes, the suspension was sonicated. Finally, acetonitrile was used to make up the volume. A 0.45µm membrane filter paper filter was used to filter the solution. Fill a 50ml volumetric flask halfway with acetonitrile and add 5ml of the aforementioned solution. To obtain a final concentration within the linearity range, the clear solution was diluted using the same solvent systems as for the calibration graphs. Each of these solutions was introduced into the system in 20 µL increments, and the peak area from each chromatogram was recorded.

Table-1: System suitability for (s)-amlodipine gentisate

Parameters	(s)-Amlodipine gentisate
Retention time (min)	11.017
Tailing factor	1.15
Theoretical plates	2037
Calibration range (µg/ml)	50-150
Correlation coefficient	0.9998
% RSD	0.20

Table-2: Linearity of (s)-amlodipine gentisate

Conc. (µg/ml)	*Mean area ± SD	*RSD (%)
50	2058796 ± 11098.33	0.33
75	2922598 ± 17358.21	0.75
100	3991878 ± 8462.78	0.16
125	501456 ± 21678.60	0.39
150	6019568 ± 37799.11	0.43

Table-3: Recovery studies of (s)-amlodipine gentisate using the standard-addition technique

Spike Level	Amount (µg/ml) added	Amount (µg/ml) found	% Recovery	Mean % Recovery
50 %	250.10	254.6078	103.11	102.77
50 %	249.97	260.1259	102.64	
50 %	249.75	256.2576	102.55	
100 %	493.11	506.0143	100.17	99.92
100 %	496.56	494.5998	99.62	
100 %	494.79	495.6733	99.98	
150 %	700.5	703.9395	100.49	101.68
150 %	699.75	715.2814	102.22	
150 %	700.25	716.6557	102.34	

Table-4: Robustness study of (s)-amlodipine gentisate

Parameter	Condition	R. T.	Tailing factor	% Assay	% RSD
Flow rate (mL/min)	0.45	11.94	1.44	99.98	0.63
	0.50	11.02	1.40		
	0.55	10.07	1.43		
Detection wavelength (nm)	320	10.00	1.48	99.90	0.98
	325	10.07	1.42		

	330	10.03	1.52		
Mobile phase composition (v/v)	48:52	10.01	1.45	99.85	1.01
	50:50	10.02	1.44		
	52:48	10.00	1.45		
Column oven temp. ±5°C	25	10.01	1.38	101.6	0.32
	30	10.02	1.39		
	35	10.07	1.40		

Table-5: Analysis of (s)-amlodipine gentisate commercial formulation

Labeled claim (mg)	Amount found (mg)	*Recovery (%)
100	99.92	99.92

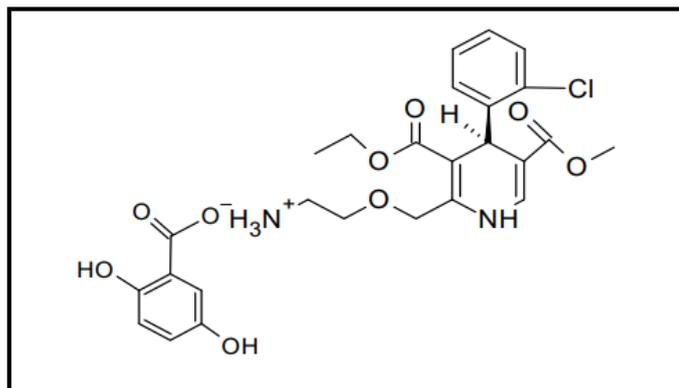


Figure 1: Chemical structure of (s)-amlodipine gentisate

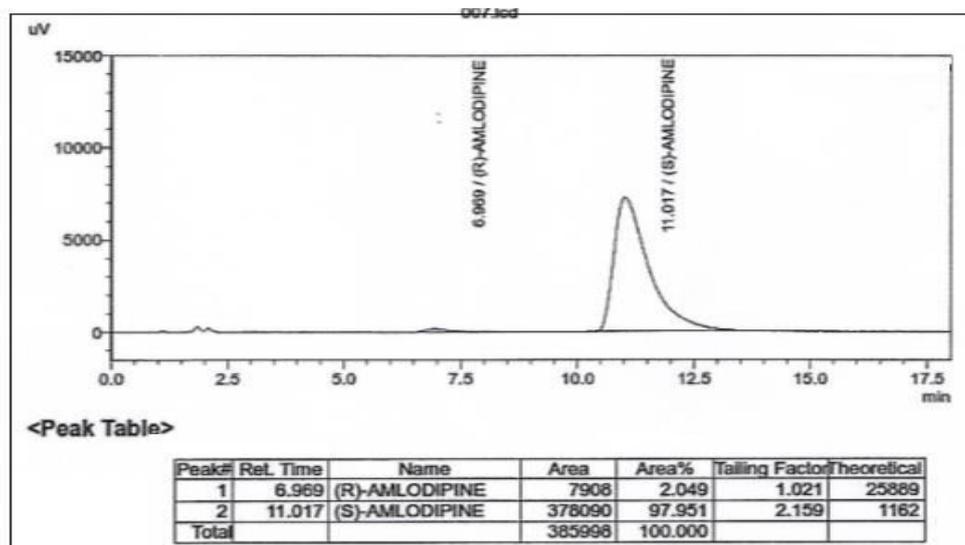


Figure 2: Representative chromatogram of (s)-amlodipine gentisate

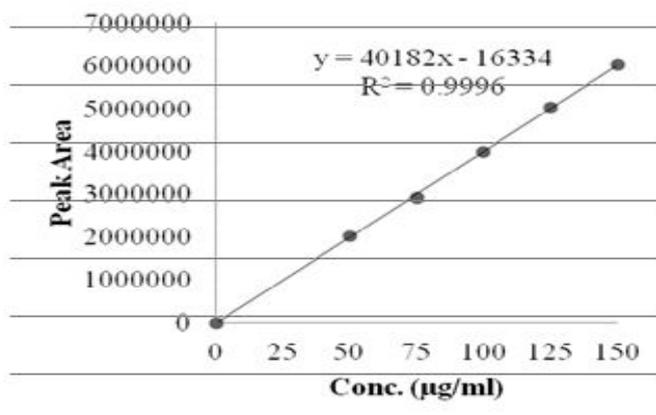


Figure-3: Calibration curve of (s)-amlodipine gentisate

RESULTS AND DISCUSSION

To quantify (s)-amlodipine gentisate in formulation, a reversed-phase chromatographic approach was devised. As shown in **Figure-2**, (s)-amlodipine gentisate was well resolved on a HYPERSIL (C18, 5.0 x 250 x 4.6mm) column using acetonitrile: water (50:50v/v). The flow rate was 0.5 ml/min, and the measurement wavelength was 325 nm. Overall, the results demonstrated the selectivity of the approach by demonstrating that the excipients had no effect on the (s)-amlodipine gentisate peak. The analytes were completely separated in less than 15 minutes.

HPLC Method Development and Optimization

The samples were originally tested using an acetonitrile:water (70:30, v/v) mobile phase at a flow rate of 0.8 mL/min. Under these circumstances, the peak symmetry and resolution were insufficient; Since the peaks were strong and well-resolved, With a flow rate of 0.5 mL/min, the mobile phase was switched to acetonitrile and water (50:50v/v). As a result, for the best chromatographic response throughout the investigation, acetonitrile and water were mixed in a mobile phase (50:50 v/v).

METHOD VALIDATION

System Suitability

It was established that the entire testing arrangement was appropriate for the planned application with the aid of the system suitability test. It measured peak area, retention time, tailing factor, and theoretical plates. The theoretical plates, 2658 and 2045 (more than 2000), the average retention time of 10.02 minutes, the peak area variation of less than 2.0 in all measurements, and the tailing factor of 1.44 are all shown in Table 1. (less than 2). The suggested method is highly sensitive and capable of pinpointing the peak. The (s)-amlodipine gentisate peak was well isolated from the excipients in this example.

Linearity

Figure-2 depicts a typical chromatogram for (s)-amlodipine gentisate. The (s)-amlodipine gentisate calibration curve was linear over the concentration range of 50-150 µg/mL. Figure 4 shows the regression equations for the calibration curve, with a correlation coefficient of 0.9996, which is very close to one, as $y = 40182x - 16334$ and $y = 26750x - 18411$. Analysis using linear regression was used to determine the relationship between the drug's peak area and concentration (Table-2).

Precision

The method's repeatability (intra-day precision) and intermediate precision (inter-day precision) were assessed using the (s)-amlodipine gentisate standard solutions. Six independent sample preparations from a single batch of formulation were analysed on the same day and three different days to determine repeatability and intermediate precision. The % RSD for intra-day and inter-day precisions being less than 2% demonstrated a good level of precision.

Accuracy

The recovery test verified the accuracy of the procedure. Table 3 shows how to add (s)-amlodipine gentisate standard in a known quantity to aliquots of sample solutions before dilution to the necessary concentrations. Three separate runs of the experiment were conducted. With a recovery rate of 99.92–102.77% for (s)-amlodipine gentisate, the resultant % RSD was less than 2.0.

LOQ and LOD

The slope of the calibration curve was divided by 10 and 3.3 times the response's standard deviation, respectively, to determine the LOQ and LOD. The LOD for (s)-amlodipine gentisate was determined to be 0.0002. The LOQ for (s)-amlodipine gentisate was determined to be 0.001.

Robustness

An analytical procedure's robustness, which indicates its suitability for routine analysis by remaining unaffected by small and intentional changes in technique parameters²⁷. By analyzing the same sample under several analytical circumstances that were purposefully altered from the initial condition, the robustness of the approach was assessed. The column oven was set to a temperature between 25 and 35 °C (± 5 °C). The acetonitrile-to-water ratio in the mobile phase was 48:52 and 52:48 ($\pm 2\%$ v/v), and the flow rate was 0.45 and 0.55 mL/min (± 0.05 mL/min). The detection wavelengths were chosen at 320 and 330 nm (± 5 nm). The results of the test solution assay, as reported in Table 4, were consistent with the results for the original circumstances and were unaffected by changing the settings. The devised method was robust because the % RSD value of the assay calculated for the same sample under original conditions and robustness conditions was less than 2.0%.

Solution Stability and Mobile Phase Stability

A %RSD for the (S)-amlodipine gentisate test from studies on solution and mobile phase stability was less than 2%. The solutions and mobile phases employed in the assays were found to be stable for up to 48 hours at room temperature and up to 3 months at 4°C, according to the results of the tests for solution and mobile phase stability.

Analysis of Commercial Formulations:

The (S)-amlodipine gentisate concentration was determined using the suggested approach, and the results showed that it was 99.92% accurate with a 2.0% RSD. The assay's results (Table-5) show that the method is selective for measuring (S)-amlodipine gentisate without being hampered by the excipients included in these formulations.

CONCLUSION

The (S)-amlodipine gentisate concentration in pharmaceutical formulations was determined using the proposed HPLC method, which was validated in accordance with ICH recommendations. The technique was discovered to be reliable, robust, and specific. The chromatographic elution process is carried out simultaneously and quickly (12 min). Pharmaceutical dosage form components did not cause any interference. In conclusion, the suggested approach is suited for simultaneous determination of (S)-amlodipine gentisate in pharmaceutical formulations due to its high sensitivity, good selectivity, accuracy, and reproducibility.

REFERENCES

1. Gharpure M.; United States Patent Publication numbers; 2008, US 2008/0262239 A1.
2. Huisman G. W. and Collier S. J.; On the Development of New Biocatalytic Processes for Practical Pharmaceutical Synthesis; *Current Opinion in Chemical Biology*; 2013, 17, 284-292.
3. Jae-Sun, K.; United States Patent Publication number; 2010, US 7772400 B2.
4. Kim BH, Kim JR, Kim MG, Kim KP, Lee BY, Jang IJ, Shin SG, Yu KS; Pharmacodynamic (hemodynamic) and pharmacokinetic comparisons of S-amlodipine gentisate and racemate amlodipine besylate in healthy Korean male volunteers: two double-blind, randomized, two-period, two-treatment, two-sequence, double-dummy, single-dose crossover studies; *Clinical therapeutics*; 2010, 1:32(1),193-205.
5. Swaminathan J and Bhardwaj S.; Analytical method development and validation of amlodipine besylate in dry powder injection using mixed solvency by HPLC;
6. Wang L, Liu W, Zhang Z, Tian Y; Validated LC-MS/MS method for the determination of amlodipine enantiomers in rat plasma and its application to a stereoselective pharmacokinetic study; *Journal of Pharmaceutical and Biomedical Analysis*; 2018, 5, 158:74-81.
7. Kaynak MS, Bogacz A, Stelmasinski M and Sahin S.; Bioavailability File: Amlodipine/Biyoyarlanım Dosyası: Amlodipin; *FABAD Journal of Pharmaceutical Sciences*; 2011, 1, 36(4), 207.
8. Wang L, Liu W, Zhang Z, Tian Y. Validated LC-MS/MS method for the determination of amlodipine enantiomers in rat plasma and its application to a stereoselective pharmacokinetic study. *Journal of Pharmaceutical and Biomedical Analysis*. 2018 Sep 5; 158:74-81.
9. Streel B, Laine C, Zimmer C, Sibenaler R, Ceccato A. Enantiomeric determination of amlodipine in human plasma by liquid chromatography coupled to tandem mass spectrometry. *Journal of biochemical and biophysical methods*. 2002 Dec 31; 54(1-3):357-68.
10. Yoo HH, Kim TK, Lee BY, Kim DH. Determination of S- and R-amlodipine in rat plasma using LC-MS/MS after oral administration of S-amlodipine and racemic amlodipine. *Mass Spectrometry Letters*. 2011; 2(4):88-91.
11. Haque MA, Bakshi V, Boggula N. Analytical method development and validation of amlodipine in human plasma by using liquid chromatography-mass spectrometry/mass spectrometry. *Asian J Pharm Clin Res*. 2018; 11(7):393-7.
12. Abdel-Megied A, El-Gizawy S, Abdelmageed O, Omar M, Derayea S, Aboul-Enein H. A validated enantioselective HPLC method for assay of S-amlodipine using crown ether as a chiral stationary phase. *Curr. Anal. Chem*. 2017; 13(2):117-23.

13. Zarghi A, Foroutan SM, Shafaati A, Khoddam A. Validated HPLC method for determination of amlodipine in human plasma and its application to pharmacokinetic studies. *Il Farmaco*. 2005 Sep 1; 60(9):789-92.
14. Sirikatitham A, Panrat K, Tanmanee N. Determination of amlodipine in human plasma by electrospray ionization LC-MS/MS method: validation and its stability studies. *Songklanakarin Journal of Science & Technology*. 2008 Jul 1; 30(4).
15. Suchanova B, Sispera L, Wsol V. Liquid chromatography–tandem mass spectrometry in chiral study of amlodipine biotransformation in rat hepatocytes. *Analytica chimica acta*. 2006 Jul 28; 573:273-83.
16. Bhatt J, Singh S, Subbaiah G, Shah B, Kambli S, Ameta S. A rapid and sensitive liquid chromatography–tandem mass spectrometry (LC-MS/MS) method for the estimation of amlodipine in human plasma. *Biomedical Chromatography*. 2007 Feb; 21(2):169-75.
17. Shentu J, Fu L, Zhou H, Hu XJ, Liu J, Chen J, Wu G. Determination of amlodipine in human plasma using automated online solid-phase extraction HPLC–tandem mass spectrometry: Application to a bioequivalence study of Chinese volunteers. *Journal of pharmaceutical and biomedical analysis*. 2012 Nov 1; 70:614-8.
18. Meyyanathan SN, Muralidharan S, Rajan S, Gopal K, Suresh B. A simple sample preparation with HPLC–UV method for estimation of amlodipine from plasma: Application to bioequivalence study. *The open chemical and biomedical methods Journal*. 2008 Aug 13;1(1).
19. Massaroti P, Marchioretto MA, Cassiano NM, Bernasconi G, Calafatti SA, Barros FA, Meurer EC, Pedrazzoli J. Development and validation of a selective and robust LC-MS/MS method for quantifying amlodipine in human plasma. *Analytical and bioanalytical chemistry*. 2005 Jun; 382(4):1049-54.
20. Kannappan V, Mannemala SS. Simultaneous enantioseparation and purity determination of chiral switches of amlodipine and atenolol by liquid chromatography. *Journal of pharmaceutical and biomedical analysis*. 2016 Feb 20; 120:221-7.
21. Momin MA, Islam MM, Rahman KH, Anisuzzaman SM. Development and Validation of assay method of Amlodipine Tablet by HPLC. *International Journal of Pharmaceutical and Phytopharmacological Research*. 2012; 2(2):109115.
22. Dossou KS, Edoth PA, Chiap P, Chankvetadze B, Servais AC, Fillet M, Crommen J. Determination of enantiomeric purity of S-amlodipine by chiral LC with emphasis on reversal of enantiomer elution order. *Journal of separation science*. 2011 Aug; 34(15):1772-80.
23. Zhang X, inventor. Resolution of the enantiomers of amlodipine. United States patent US 6,646,131. 2003 Nov 11.
24. Bahrami GH, Mirzaeei SH. Simple and rapid HPLC method for determination of amlodipine in human serum with fluorescence detection and its use in pharmacokinetic studies. *Journal of pharmaceutical and biomedical analysis*. 2004 Sep 21; 36(1):163-8.
25. Sharma A, Tailang M, Gupta B, Acharya A. RP HPLC determination of Amlodipine in its pharmaceutical dosage forms. *Asian Journal of Research in Chemistry*. 2010 Mar 28; 3(1):129-31.
26. Sharma A, Tailang M, Gupta B, Acharya A. RP HPLC determination of Amlodipine in its pharmaceutical dosage forms. *Asian Journal of Research in Chemistry*. 2010 Mar 28; 3(1):129-31.
27. Sah R, Arora SJ. Development and validation of an HPLC analytical assay method for amlodipine besylate tablets: a potent Ca channel blocker. *Advanced Pharmacy Education & Research*. 2012; 2(3):93-100.

The Development and Validation of the RP-HPLC Method for the Newly Synthesized (R)-Amlodipine-DI-P-Toluidine-L- Tartaric Acid

Chandrashekhar Kotkar¹, Parvez Shaikh² and Raj Badekar³

^{1,2}Chemistry Department, Nirwan University, Jaipur, Rajasthan 303305, India

³Riva Industries, Ambernath MIDC, Ambernath, Thane- 421 501, India

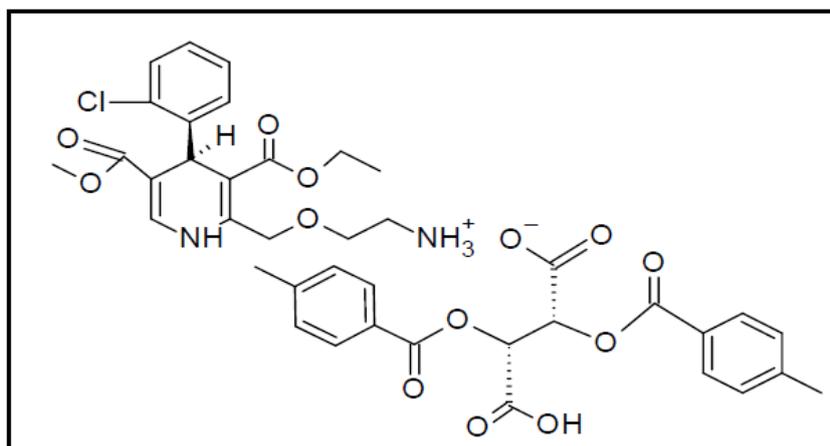
ABSTRACT

For (R)-amlodipine-di-p-toluoyl-l-tartaric acid (RADPLTA), the method was developed and verified using RP HPLC. The analysis was performed on a HYPERSIL (250 x 4.6mm, 5m) a mobile phase of acetonitrile:water (80:20v/v) column with a flow rate of 0.8 millilitres per minute (UV detection at 360nm). The retention time for RADPLTA is 6.812 minutes. A linear reactivity to RADPLTA was seen in the 4–24 ppm range. RADPLTA's correlation co-efficient (or "r" value) was 0.999. The developed approach was tested for linearity, accuracy, selectivity range, precision, force degradation research, and robustness and discovered to be specific, linear, accurate, and precise. The method has been validated in compliance with ICH standards. There was less than 2% RSD for intraday and interday precision, which means there was less than 2% RSD. There were a lot of recoveries for RADPLTA ranged from 98.74 to 101.11%, with an overall percent mean recovery of 99.59%, which agreed well with the amount specified in pharmaceutical formulations.

Keywords: (R)-Amlodipine-di-p-toluoyl-l-tartaric acid, HPLC and Pharmaceutical formulation.

INTRODUCTION

Analytical chemistry is a discipline of science that uses advanced technology to determine the composition of a substance using an analytical technique. We can obtain both qualitative and quantitative outcomes. Analytical instruments serve a critical role in achieving high-quality and trustworthy analytical data. As a result, everyone in the analytical laboratory should be concerned about equipment quality assurance. Analysis methods could be spectroscopic, chromatographic, electrochemical, hyphenated, or something else, depending on what you want to find out. Choosing an accurate way to figure out what's in a mixture is called "analytical method development". Proof that you should use an analytical method is what it's about appropriate for a certain situation measuring the concentration of future samples in a laboratory. Analytical techniques should be developed in GMP and GLP environments utilizing the methods and acceptance criteria described in Q2 of the ICH (R1).



MATERIALS AND METHODS

Chemicals And Reagents

HPLC/AR grade solvents were employed. In-house double purification is utilized for the standard sample of RADPLTA, and in-house preparation is used for the technical sample of RADPLTA.

Chromatographic Conditions

The study employed Shimadzu's LC-20AD with PDA detector HPLC system with HYPERSIL (C18, 250 mm x 4.6 mm x 5.0). For data processing, the HPLC instrument was outfitted with Empower software. The isocratic elution was performed with an 80:20 v/v mixture of acetonitrile and water, and the detection wavelength was 249 nm.

Solution from a Standard Stock

Two 20 ml volumetric flasks were filled with 50 mg of the RADPLTA standard after it had been weighed. Following this, 5ml of acetonitrile was added to each flask, which was then sonicated for 10 minutes before being built up to a final volume of 20ml with acetonitrile. The standard stock solution was then weighed to make sure it was accurate (stock solution-I). Fill a 50ml volumetric flask with 5ml of the aforementioned solution and the remaining volume with acetonitrile labelled as stock solution-II, commencing with the stock solution-I.

Sample Stock Solution

Using a 10 mL volumetric flask, the tablet powder containing 50 mg of RADPLTA was transferred and dissolved in 5 mL of acetonitrile to produce the desired result. The suspension was subjected to 15 minutes of sonication. Finally, acetonitrile was used to bring the volume up to the required level. The fluid was filtered via a membrane filter paper with a 0.4 micron pore size. Fill a 50mL volumetric flask with 5mL of the aforementioned solution and top up with acetonitrile to make up the difference.

Calibration Curve

To prepare RADPLTA, pipette out appropriate aliquots of the required concentrations, then pour a standard stock solution in a series of 100 mL volumetric flasks. The amount of acetonitrile was increased to the mark in order to obtain a set of solutions containing RADPLTA at concentrations ranging from 4, 8, 12, 16, 20, and 24 ppm. Separately made duplicate dilutions of each medication concentration were used to test the results. Following the preparation of duplicate solutions, 20 mL injections of RADPLTA at each concentration was separately; they were all injected into the RP-HPLC device and subjected to the same rules for chromatography as before. A UV detector that operates at 249 nm was used to determine RADPLTA. The standard calibration curve was developed by measuring the peak areas of all the peaks and plotting them against the peak concentrations.

Method Validation

A number of factors were tested and verified, including system appropriateness, linearity, precision and accuracy, selectivity and range, robustness, and force degradation tests. In all of these areas, the approach was proven to be accurate and exact.

Specificity

The specificity of an analyte is how well it can be assessed in the presence of other things that are predicted to be present in the sample. Contaminants, degradants, matrix, and other components are common examples. Scanning the RADPLTA diluent solution and the standard solution at concentrations of 20 g/ml, respectively, determined the specificity of the test. Derivatized¹⁶ solutions of the RADPLTA standard and sample were injected into the chromatographic system after injecting solvent blanks, reagent blanks, and sample blanks to demonstrate that there is no interference at the retention time of RADPLTA from any reagent or solvent (mobile phase) blank.

Linearity

A stock solution with differing quantities of the assay concentration was used to construct and test the assay technique's linearity test solutions (4, 8, 12, 16, 20 and 24ppm). The obtained chromatogram's peak area after each solution was injected into the HPLC apparatus in 20 milliliters was recorded. Using least squares linear regression, peak area and concentration data were correlated. Reports were made on the calibration curve's slope and y-intercept, respectively.

Precision

On separate days, different analyzers, different columns, etc., six duplicates of a fixed concentration of RADPLTA were determined to establish the precision (injector repeatability and intra-day precision) of the proposed method's linearity range.

Accuracy (Recovery studies)

Using recovery trials, we were able to determine the accuracy of the procedure. A working standard concentration required to be added to the pre-analyzed solution's predetermined concentration. The % of recovery was computed by comparing the region before and after the implementation of the operating standard. For both drugs used in the trial, recovery happened in the same way. This usual addition procedure was conducted at levels of 20%, 60%, 80%, 100%, and 120%, and at each of these levels, the % recovery was computed.

Robustness

The flow rates were varied in small increments to test the robustness. The retention time and tailing factor had no statistically significant difference.

RESULTS AND DISCUSSION

It was discovered that RADPLTA could be isolated using a reversed-phase chromatographic process. The RADPLTA was successfully resolved on the HYPERSIL RP C18 (250 x 4.6 mm, 5 m) column when acetonitrile:water (80:20v/v) was present. This experiment used a 0.8 mL/min flow rate and a 360 nm detecting wavelength. Overall, the results showed that the excipients had no effect on the RADPLTA peaks, demonstrating that the approach is selective for RADPLTA peak formation. The entire separation of the analytes was obtained in less than 10 minutes using this approach.

Development and Improvement of HPLC Methods:

The samples were passed through a mobile phase of acetonitrile and water (80:20, v/v) at a flow rate of 0.8mL/min for the first analysis. Peaks were nicely resolved under these conditions, and their symmetry and sharpness were excellent. As a result, the study's mobile phase was made up of 80:20 acetonitrile and water, which offered the best chromatographic response.

Method Validation System Suitability

The system suitability test was carried out to confirm that the entire testing system was suitable for the intended purpose. The peak area, retention period, tailing factor, and predicted plate thickness were all data points we gathered from this experiment. For the RADPLTA peak, all measurements showed a peak area variation of less than 2.0, an average retention time of 6.812 minutes, and theoretical plates of more than 2000. The proposed approach has a high sensitivity, and the peak may be detected with high accuracy using the proposed method. There was good separation between the RADPLTA peak and the excipient peaks in all of the cases.

Specificity

The fact that its retention time was 6.812 minutes and no peak from the blank interfered with this measurement of RADPLTA retention time demonstrated its specificity, indicating that the proposed approach is specific for determining RADPLTA retention time²⁰⁻²².

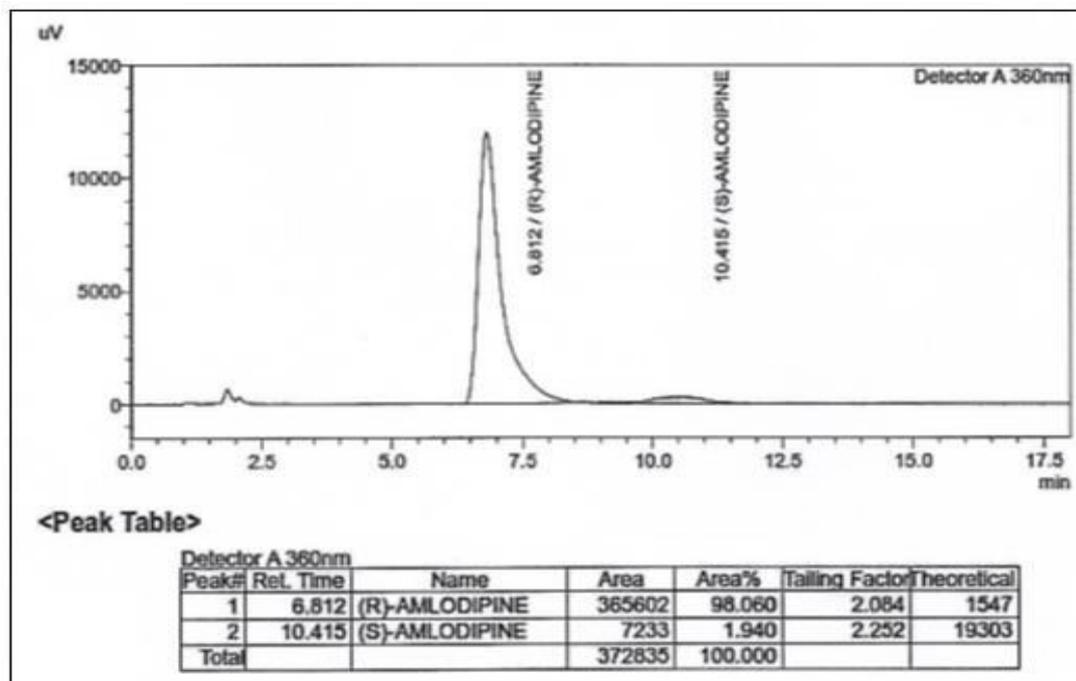


Figure-1: Specificity peak purity chromatogram of RADPLTA

Linearity

Since RADPLTA's calibration curve was linear over the concentration range of 4 to 24 ppm, the substance was stable. When the data for the RADPLTA peak area linear regression analysis was used to determine the concentration (Table-1), it was discovered that $y = 292132x - 52790$ (Figure-2) was the calibration curve regression equation, has a 0.9999 correlation coefficient, which is very close to the number one.

Table-1: Linearity data of RADPLTA standard²⁴

Linearity Solution Level	Replications	Peak Area Counts	Means Area
L1	R1	1154876	1768070
	R2	1150007	
L2	R1	2284211	3204605
	R2	2282960	
L3	R1	3465205	4630152.5
	R2	3464100	
L4	R1	4618858	5907154.5
	R2	4617509	
L5	R1	5833185	7179955
	R2	5817242	
L6	R1	7030736	8697638
	R2	7020357	

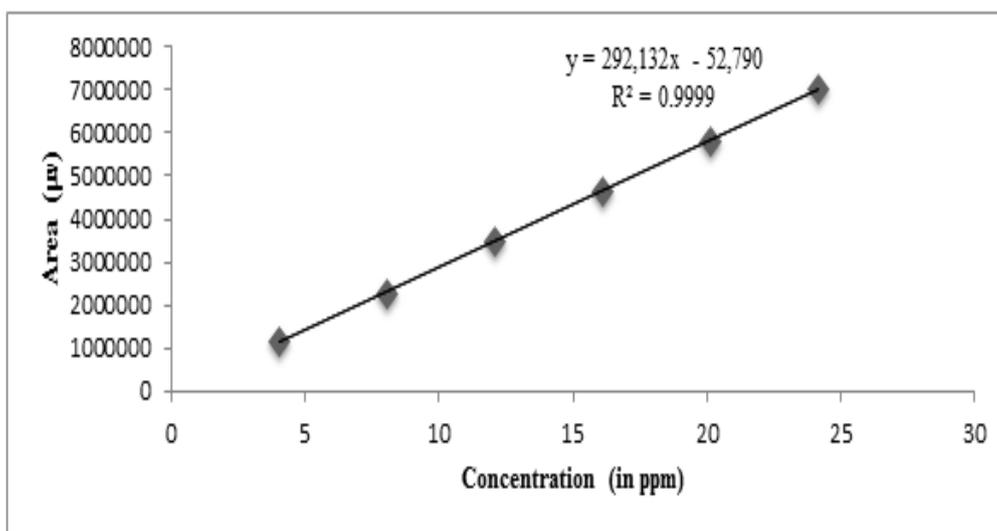


Figure-2: Standard RADPLTA linearity chart

Precision

The injector repeatability (intra-day precision) and intermediate precision (inter-day precision) of the RADPLTA reference solutions were used to compute the process precision. In order to establish repeatability and intermediate precision, six independent sample preparations from a single batch of formulation were assessed on the same and different days. The percent RSD for intra-day and inter-day precisions being less than 2% showed a good level of precision.

Table-2: Precision injection of RADPLTA.

Sample no.	Conc. in ppm	Area (mv)	% Content
Sample-1	20.32	5791853	99.93
Sample-2	20.36	5796396	99.81
Sample-3	20.42	5817114	99.88
Sample-4	20.40	5830713	100.21
Sample-5	20.30	5780994	99.84
Sample-6	20.40	5805699	99.78
Average	NA	NA	99.91
STDEV	NA	NA	0.16
% RSD	NA	NA	0.16

Table-3: Intraday precision data of RADPLTA technical.

Sample no.	Conc in ppm	Area (□v)	% Content
Sample-1	20.02	5854048	99.84
Sample-2	20.10	5878601	99.86
Sample-3	20.20	5869923	99.22
Sample-4	20.23	5894371	99.49
Sample-5	20.11	5832468	99.03
Sample-6	20.05	5867483	99.92
Average	NA	NA	99.56
STDEV	NA	NA	0.37
% RSD	NA	NA	0.38

Table-4: Analysts 1 and 2 are compared.

	Mean % Content	Absolute Difference
Analyst 1	99.91	0.35
Analyst 2	99.56	

Accuracy

The recovery test proved the method's accuracy. The required quantities of RADPLTA standard were created by adding it to aliquots of sample solutions and dilution, as described in Table 5. For RADPLTA, the consequent percent RSD was less than 2.0, with a recovery of 98.74 -101.11 percent and an overall percent mean recovery of 99.59. This indicates that there are no positive or negative interferences from the blank in the technique. The analyte recovery statistics are within the limit, which indicates that the suggested technique is sound, based on the aforementioned outcome.

Robustness

Robustness is a term used to describe an analytical procedure's ability to remain unaffected by small and deliberate adjustments to the technique parameters, and it denotes the procedure's fitness for routine analysis. Analyzing the same material in a range of analytical settings that differed from the starting condition was used to assess the method's robustness. The flow rates were 0.75 and 0.85 mL/min, respectively (0.05 mL/min). Changing the circumstances had no effect on the assay results, which were consistent with those obtained under the original conditions. The proposed method was robust, as shown by the percent RSD value of the test computed under original and robustness circumstances for the same sample being less than 2.0%.

CONCLUSION

The proposed HPLC technique was validated for the determination of RADPLTA according to ICH criteria. The technique was found to be precise, accurate, robust, and specific. The chromatographic elution phase is completed swiftly at the same time (less than 6 minutes). There was no influence from any medicinal dosage form components. In conclusion, the suggested approach is suitable for simultaneous detection of RADPLTA due to its high sensitivity, good selectivity, accuracy, and reproducibility.

REFERENCES

1. M.J. O'Neil; The Merck Index, Merck Research Laboratories, Whitehouse Station, NJ, 2006.
2. Sweetman SC. Martindale; The Complete Drug Reference. 34th edition, London: Royal Pharmaceutical Society of Great Britain. 2005; 996.
3. Sanjay B, Shital S, Pritam J, Sanjay S. Spectrophotometric method for simultaneous estimation of Atenolol in combination with Losartan potassium and Hydrochlorothiazide in bulk and tablet formulation. J.Pharm. Bio. Sci. 2010; 2: 372-375.
4. Bhatia N M, Mohite A S, Bhatia M S. Simultaneous spectrophotometric estimation of atenolol and Amlodipine besylate by multi-wavelength method. The Indian pharmacist 2007; 6:59-62.
5. Gurumurthy Venkatesh, Deveswaran Rajamanickam, Bharath Srinivasan, Basavaraj Basappa Veerbadraiah, Madhavan Varadharajan. Spectrophotometric estimation of Atenolol using mixed co-solvents. Inveti Rapid Pharm Ana and Qual Assur. 2012; 2: 287-291
6. Behera A K. Simultaneous Spectrophotometric Estimation of Atenolol and Hydrochlorothiazide in Tablet Dosage Forms. Int. j. Chem. Tec. Res. 2010; 2: 1901-1906.

7. Anish Vinnakota S N, Deveswaran R, Bharath S, Basavaraj B V, Madhavan V. Spectrophotometric estimation and validation of Atenolol in tablets by Hydrotropic Solubilisation. *Current Pharma Research*. 2011; 2: 385-388.
8. Kasture A V, Madhure Ramteke. Simultaneous UV-spectrophotometric method for the estimation of atenolol and amlodipine besylate in combined dosage form. *Indian J Pharm Sci*. 2006; 68: 394-396.
9. Miller RB. A validated high-performance liquid chromatographic method for the determination of atenolol in whole blood. *J Pharm Biomed Anal*. 1991; 9:849-53.
10. Ceresole R, Moyano M A, Pizzorno M T, Segall A I. Validated Reversed-Phase HPLC Method for the Determination of Atenolol in the Presence of Its Major Degradation Product. *J. Liq. Chr. Rel. Tech*. 2006; 29:3009-3019.
11. Tulja Rani G, Gowri Sankar D, Kadgpathi P, Satyanarayana B. A validated RP-HPLC method for simultaneous estimation of Atenolol and Indapamide in pharmaceutical formulations. *Journal of chemistry*. 2011; 8: 1238-1245.
12. Vidhya Bhusari K, Sunil Dhaneshwar R. Validated HPTLC method for simultaneous estimation of Atenolol and Aspirin in bulk drug and formulation. *ISNR Analytical chemistry*. 2012; 1: 226-229.
13. Madhuri R, Avinash K, Narendra D. Development of HPTLC method for simultaneous estimation of Atenolol and Nifedipine in combined dosage form. *Asian Journal of chemistry*. 2010; 22: 5951-5955.
14. Raval H.V, Patel DM, Patel C.N. Estimation of Metoprolol Tartrate and Chlorthalidone in Combined Dosage Form by UV Spectrophotometric Methods. *Research journal of pharmacy and technology* 2011;04:1132.
15. Bauer J, Quick J, Krogh S, Shada D. Stability-indicating assay for chlorthalidone formulation: Evaluation of the USP analysis and a high-performance liquid chromatographic analysis. *Journal of Pharmaceutical Sciences* 1983; 72:924-928.
16. Brijesh Singh, Patel D K, Ghosh S K. A Reversed phase high performance chromatographic method for determination of chlorthalidone in pharmaceutical formulation. *International journal of pharmacy and pharmaceutical sciences* 2009; 1: 43-45.
17. Stephen Walters M, Dalia Stonys B. Determination of Chlorthalidone and Clonidine hydrochloride in tablets by HPLC. *J Chromatogr. Sci*. 1983; 21: 43-45.
18. Madhu Babu K, Bikshal Babu k. Reverse Phase-HPLC Method Development and Validation for the simultaneous estimation of Azilsartan Medoxomil and Chlorthalidone in Pharmaceutical Dosage Forms *journal of Atoms and Molecules* 2012; 2: 117-126.
19. Mhaske R A, Garole D J, Mhaske A A, Sahasrabudhe S. RP-HPLC Method For Simultaneous Determination Of Amlodipine Besylate, Valsartan, Telmisartan, Hydrochlorothiazide And Chlorthalidone: Application To Commercially Available Drug Products. 2012;3: 141- 149.
20. Al Azzam KM, Saad B, Aboul-Enein HY. Development and validation of a reversed-phase high-performance liquid chromatographic method for the simultaneous determination of amiloride hydrochloride, atenolol, hydrochlorothiazide, and chlorthalidone in their combined mixtures. *Journal of AOAC International*. 2011; 92: 404-409.
21. Sa'sa' S I, Jalal I M, Khalil H S. Determination of Atenolol Combinations with Hydrochlorothiazide and Chlorthalidone in Tablet Formulations by Reverse-Phase HPLC. *Journal of Liquid Chromatography* 1988; 11: 1673-1696
22. Nada. S. Abdelwahab. Determination of atenolol, chlorthalidone and their degradation products by TLC-densitometric and chemometric methods with application of model updating. *Anal. Methods* 2010; 2:1994-2001.
23. Al Azzam KM, Abdalla A. Elbashir, Mohammed A. Elbashir, Saad B, Abdul Hamid S. Simultaneous Determination of Atenolol and Chlorthalidone in Pharmaceutical Preparations by Capillary-Zone Electrophoresis. *Analytical Letters* 2009; 42: 1458-1470.

24. El-Gindy A, Sallam S, Abdel-Salam RA. HPLC method for the simultaneous determination of atenolol and chlorthalidone in human breast milk. *J. Sep. Sci.* 2008; 31:677-82.
25. Mohamed S. Elgawish, Samia M. Mostafa, Abdalla A. Elshanawane. Simple and rapid HPLC method for simultaneous determination of atenolol and chlorthalidone in spiked human plasma. *Saudi Pharmaceutical Journal* 2011; 19:43-49.
26. Claudio G, Anna T, Sergio C, Giovanni Z. Simultaneous determination of atenolol and chlorthalidone in plasma by high-performance liquid chromatography application to pharmacokinetic studies in man. *J. Chrom. B: Bio.Sci. App.* 1997; 698:187-194.
27. ICH Validation of analytical procedures: Text and methodology Q2 (R1), International Conference on Harmonization, Geneva, Switzerland. 2005.

HR Analytics to Training Analytics: A Systematic Literature Review

Ashutosh Shukla and Ankita Nagpal

Lingayas Vidyapeeth Deemed University, Faridabad, Haryana

ABSTRACT

This review article focuses on exploring the current research available in the area of HR analytics and learning or training analytics and how it can be helpful for the HR department of an organisation or to a learner in an institute or company. The introduction will mention about the major research work which has been the focus in HR analytics or learning analytics and various researchers who have contributed to this topic. The article starts with defining the HR analytics and its utility in various aspects to HR functioning and the business. The article mentions the findings from the different research available, the history of the HR analytics and its usage in decision making and strategic role. We then will discuss the challenges faced by the HR professionals while adopting HR analytics in their organisation, with the help of research available. The paper will also look into the various requirements of skills and various other factors which are required while implementing the HR analytics. We will also try to see the research available in training or learning and its benefits to all the stakeholders involved and the learners. We will also look into the various theories, models and processes which point out at the importance of learning/training analytics and how the different aspects and objectives of learning analytics could be differentiated from HR analytics.

Keywords: HR analytics, Training, Organisational success, strategy

INTRODUCTION

This review is an attempt to look into all the work which is available in the field of HR, learning or training analytics and how the research has progressed in this area. Research in HR analytics has been existing for more than 20 yrs. now and a lot of work has been done by researchers like Fitz Enz (2000, 2009 & 2010); Davenport, T. H., Harris, J., & Shapiro, J.(2010; 2017) ; Boudreau and Ramstad (2005,2006, 2007 & 2017); Cascio and Boudreau (2010); Boudreau and Jesuthasan 2011; Bassi, L. (2011); Angrave, D., Charlwood, A., Kirkpatrick, I., Lawrence, M., & Stuart, M. (2016) and Rasmussen and Ulrich(2015). Caudron (2004) has mentioned that “In 1978—in this publication—Jac Fitz-enz proposed a radical, anti-establishment idea. Human resources activities and their impact on the bottom line could—and should—be measured. The reaction was apathy, disagreement, and disbelief”. Authors have talked about the usage of HR analytics in various areas of HR, leading to better outcomes and organisational success. Some of them also mention about the significance of HR being strategic with the accurate analysis by the usage of HR analytics. HR managers can utilise this strategic approach using HR analytics to make better decisions and also to convince the senior leadership using the data and the outcomes.

The papers also mention about how the better understanding of data, its context and generating meaningful insights by the usage of HR analytics. Research is available has mentioned about the HR analytics and discusses the “model and systems, relationship and patterns, business application, forecasting and predicting and performance valuation”. The research mentions that analytics ensures insights into the HR data and helps in human capital decisions. Papers also mention that analytics provides a major way to link the decision framework with the scientific findings connected to the organisational resources and talent. The costs and the benefits analysis help the HR to make better decisions. The metrics which can be generated using the HR analytics can also help in analysing performance and identify the employees who are contributing the most to the organisation. Decisions which are taken based on data starting from the careful analysis empirically and using econometric or other statistical techniques which move above the analysis to making correlations between variables and to see the impact of human capital on the performance of the organisation.

Similarly we found various research articles which are available on learning analytics and will look into some of the major researchers who have contributed in this direction. Kolb's theory, Schön's theory and Laurillard's theory has laid the foundation for the emergence of Learning or Training analytics. Some of the researchers who have contributed a lot in the learning analytics research is Bersin, J. (2008); Campbell, J. P., DeBlois, P. B., & Oblinger, D. G. (2007); Boudreau, J. W., & Ramstad, P. M. (2005, 2006); Cascio, W., & Boudreau, J. (2010); Clow, D. (2012, 2013); Davenport, T. H., Harris, J., & Shapiro, J. (2010); Harris, J. G., Craig, E., & Light, D. A. (2011); Romero, C., & Ventura, S. (2007,2010); Siemens, G. (2010, 2103). We will also discuss various learning models which are available and the processes followed in the area of learning analytics.

METHODOLOGY

Methodology adopted was a systematic literature review with data which being used for this paper consists of articles published in management and business journals; and some of the landmark work published in the books.

Initial Search Done: Google Scholar

Databases Used: EBSCO, Proquest, Jstor and Science Direct (Elsevier)

As stage wise search for the articles was done using Google Scholar and to read the full text sources like EBSCO, Proquest, Jstor and Science Direct (Elsevier) were used. The stage wise approach is described below:

Stage 1: Google scholar was searched the with words anywhere like “HR Analytics”: “Training Analytics” and “Learning Analytics” which gave us results with 129000 articles on HR analytics, 973000 on Learning analytics and 809000 with Training analytics.

Stage 2: As the data was huge it was further refined by doing advanced search of having these three words in the Title of the article, which decreased the data to

HR Analytics (exact): 208 articles

Training Analytics (anywhere in title): 130 articles

Learning Analytics (exact): 3670

Stage 3: Reading the abstract of all shortlisted articles and also looking into citations and relevance following number of articles were selected

HR Analytics (exact): 67 articles

Training Analytics (anywhere in title): 26 articles

Learning Analytics (exact): 42

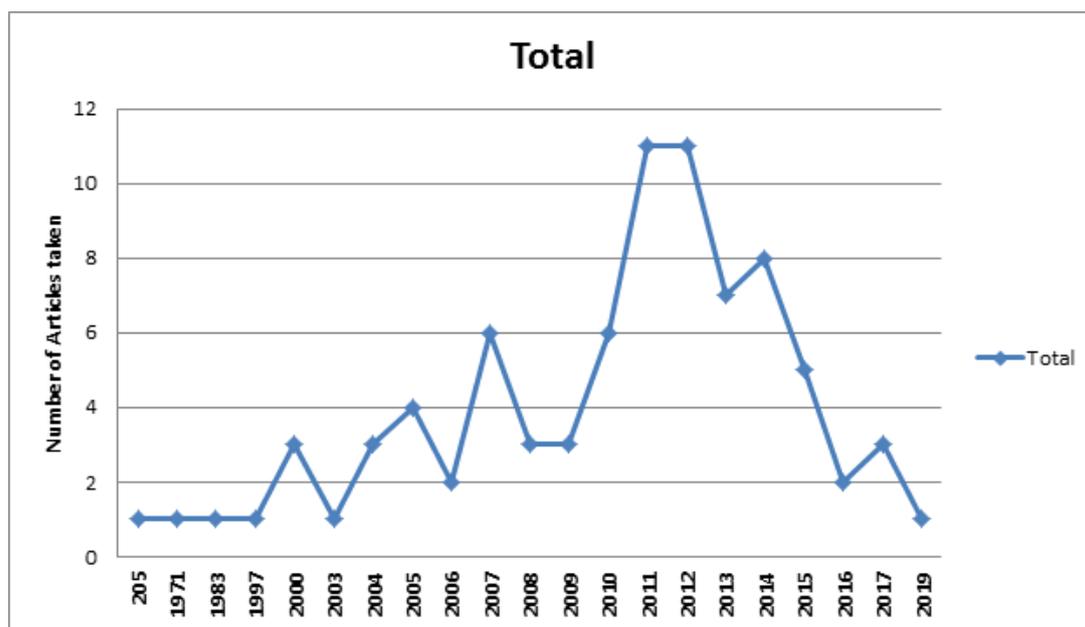
Stage 4: In this stage all the articles were read a shortlisted to a final list of below:

HR Analytics (exact): 42 articles

Training Analytics (anywhere in title): 5 articles

Learning Analytics (exact): 37

Overall articles we found after going through the various article were less in number for “Training Analytics” in comparison to “HR Analytics” or “Learning Analytics”.

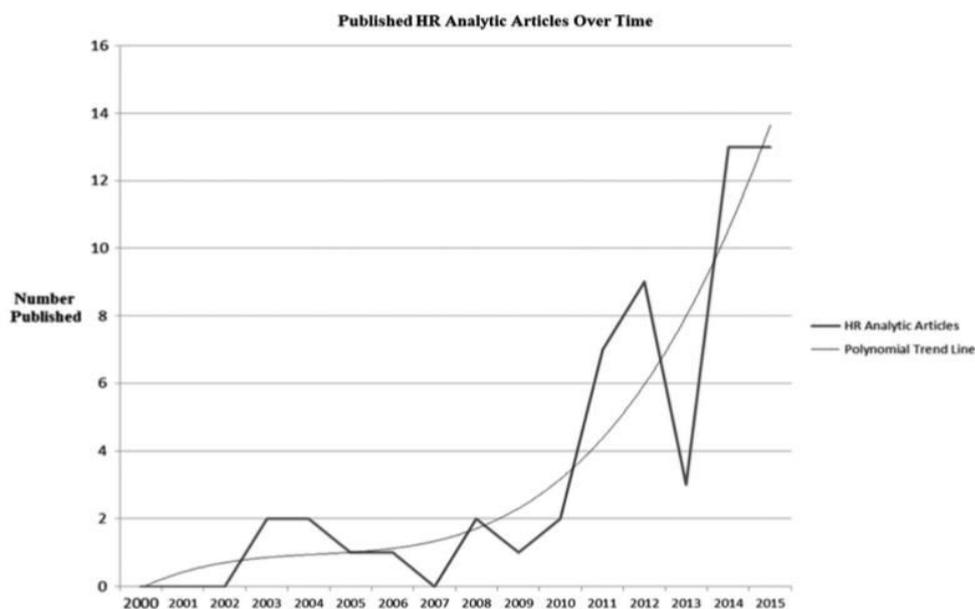


If we look into the years from which the articles have been taken into account, very few articles are being taken before 2003 and most of the articles are from 2009 onwards till 2019. 2010-2014 is the period from which the maximum articles have been taken into account.

HR Analytics

As per Mortensen et al (2015) “analytics is the discipline, which has developed at the intersection of engineering, computer science, decision-making and quantitative methods to organise, analyse and make sense of the increasing amounts of data being generated by contemporary societies”. Analytics has also been used in the HR as well and it has been well documented in the various researches available. Cooper (2012b) gave definition analytics as “the process of developing actionable insights through problem definition and the application of statistical models and analysis against existing and/or simulated future data”. Lawler et al. (2005) defined HR Analytics is a statistical technique and experimental approaches which could be used to see the effect of HR activities and are not just simple measures being used.

Barends et al (2014) has defined “evidence-based management” as a tool in taking decisions by the use of data and evidence available from different sources and by converting a practical problem to the question which can be answered and then search for evidence and data, evaluating the evidence available and taking it into consideration while making a decision. Lawler, Levenson and Boudreau(2004) has classified “HR Analytics” different from “HR metrics” where metrics is more about the key outcomes of Human Resource Management which is determined by “effectiveness, efficiency and impact” and the definition of HR analytics by Lawler et al. (2004) has been mentioned above. As per CIPD (2013), analytics is explained well as a “must-have capability for the HR profession, a tool for creating value from people and a pathway to broadening the strategic influence of the HR function”. Human resource has been using analytics for many years, some of the imprints are even available from the year 1900, as mentioned in Kaufman(2014). A major researcher in this direction known as Fitz-enz has done ample work in this direction and has written books and one of his first was “How to Measure Human Resources Management”. Davenport et al., 2010 talks about the “six uses of Talent Analytics like human capital facts, Analytical HR, Human capital investment analysis, workforce forecast, talent value model and the talent supply chain”.



*The International Journal of Human resource Management, 2017 Vol. 28, no. 1, 3–26

When we look into the history of HR analytics research available with published articles it started in the year 2000 and then kept on increasing slowly till 2008 but when we look into the published articles after 2008, there has been a huge increase in the numbers with time. In the recent year from 2013 we have even further seen a fast increase in the number of articles published.

Fitz Enz has worked a lot in this area and published various books, one of the first in 1984 was "How to measure human resources management" where author talked about providing the methodology and tools for developing a system of collecting data and generating reports which convey about human resource activities which will make the HR managers to get to higher productivity levels. Author also wrote another book in 2000 on 'ROI of Human Capital' where author discussed 'Human Capital Analytics: The Leading edge of measurement'. In 2010 author again came up with a book which was titled itself as "The New HR Analytics-predicting the value of your company's human capital investments" where author talked about power to predict,

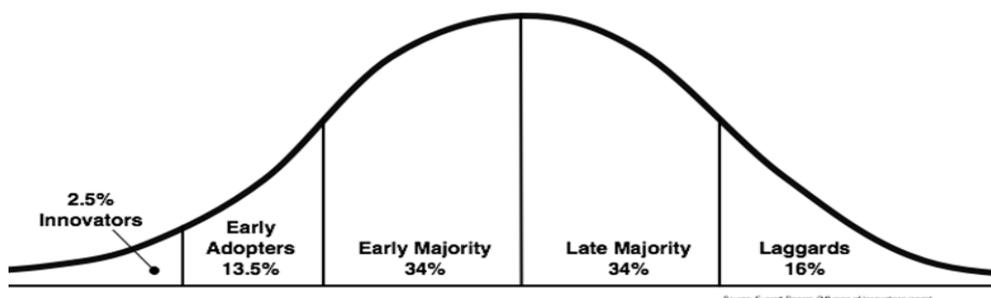
use of analytics, why analytics is important, turning data into business intelligence, interpreting data and using all of it in making a decision about human capital.

Boudreau and Ramstad (2005) mentions that “Organizations cannot succeed without effective decisions and professional practices for operating in the financial and customer markets, and they also increasingly require effective decisions aligned with professional practices in the talent market”. In 2006 author came with “Talentship and HR measurement and analysis from ROI to strategic, human resource planning”. In 2007 Boudreau and Ramstad also came with a book ‘Beyond HR’ in which author mentioned about LAMP model which stand for “logic, analytics, measures and processes”. In the book author also talks about the logical connection between the talent and organisational decisions.

Cascio and Boudreau in 2010 came with a book “Investing in People: Financial Impact of Human Resource Initiatives” where author mentioned about LAMP framework of “logic, analytics, measures and process” and also discussed various analytical framework. In 2017 in his paper on “Human Capital Analytics- why are we not there” again discusses potential reasons why Human capital analytics is more pushed than being pulled by the HR professionals. Boudreau and Jesuthasan (2011) have discussed “segmentation, logic-driven analytics, risk leverage, synergy, integration and optimisation”.

Rasmussen and Ulrich, 2015 has mentioned that technology has been moving rapidly and under this scenario, HR analytics is amongst the parts of end to end business and can make the findings in business more relevant and impactful. Aral et al. (2012) has provided “triangulated evidence” for an establishing a connect among “business impact and use of HR Analytics”. Angrave, et al(2016) mentions that HR professionals should not miss the opportunity of developing the strategic decision process and also improve organisational performance but failure to do so may result in problem fr the society where employee and their opportunities of employment may get impacted negatively.

When we look into the Diffusion of Innovation (DOI) Theory which was conceptualised by E.M. Rogers in 1962 and is amongst the earliest theories in social science. It conveys about how with the time a product or idea or service gains the acceptance and penetrates through a particular population or social system. How the people accept this new idea, product or service and this adoption lead to doing things in a different manner than before.



E.M. Rogers in 1962

In the researches available before HR analytics has been identified in the early majority stage but now it may have moved into early majority stage where many of the corporate and HR managers are understanding the importance of the analytics in HR. Falletta (2014) mentions that “results of the study suggest that the landscape for using data and information has shifted dramatically, and that leading companies are building strategic capabilities and competitive advantage through advanced HR analytics practices”. Rogers (2003) has mentioned about the decision-making process in innovation where a person wants to gather more information and decrease the unpredictability about the innovation. During this step, he wants to know “what the innovation is, and how and why it works”.

Harris, Light and Craig (2011) talks about the “specific analytics” where the focus is on certain areas and drawing interpretation out of the analysis. Authors have discussed the major companies which are using the six tools of analytics to make a better link between the investments in HR and returns from business are “employee databases; segmentation of talent; targeted investments; customization of the employee value proposition; long-term workforce planning; and talent supply chains”. Bassi, 2011 has also given definition talks about “evidence-based approach’ to making decisions on the ‘people side of the business”. She also mentions about the usage of various tools and technologies from a simplified depiction of HR metrics to “predictive modelling”. She mentions that HR analytics has the capability of increasing the HR profession status and also offering competitive advantage if a company is using it in an efficient way, which will also involve gaining expertise

over HR analytics at the individual and organisational level. One of the articles says “The proper implementation of analytics is a key initiative for making HR a strategic function in any organization”(Mondare, Douthitt, and Carson 2011). Rasmussen and Ulrich (2015) talks about “Human resource (HR) analytics is touted to have the potential to bring great value to general managers’ and HR leaders’ decision-making on human and organization capital by supplementing intuition and experience with evidence”.

Also mentioned that analytics is helping the HR department in the organisations to develop ‘must-have capability’, which will help HR to become stronger in the strategic management role (Angrave et al. 2016). He also raises an issue if the HR analytics is not taken by the HR function than “If HR is not fully involved in the modelling process, there is significantly greater scope for models to be constructed in a way which fundamentally misunderstands the nature of human capital inputs into the processes of production and service delivery. Instead of recognizing the flexibility of labour; that productivity and performance change with skills, motivation and design of people-processes interactions, labour is modelled as a fixed cost that needs to be controlled. Unless analytics is embedded in a full and comprehensive analytical model, the more limited information available in dashboard formats may be misinterpreted by operational and financial managers with limited patience for or understanding of HR”.

Boudreau (2010, 2012); Rousseau & Boudreau (2011); Cascio & Boudreau (2011) point out that if the HR leaders and the other experts of the function like engineering, finance, operations and marketing can also collaborate in developing the framework for HR analytics which can influence the decision-makers and relate in an effective way to organizational outcomes

Challenges in HR Analytics

With the rise of focus on HR analytics there are various challenges which need to be looked at and faced to gain the momentum in accepting and getting benefited from the features of HR analytics. Chartered Institute for Personnel and Development, CIPD (2013) mentions about HR functionalities may be lacking the skills to get to the correct questions which can be asked from the HR data and this can lead to not a very effective use of HR analytics. One researcher talks about the “inside out” and centric to HR an approach which is more academic than being closer to the business(Rasmussen and Ulrich, 2015). Author says that there should be a shift towards the ‘outside-in’ approach and keeping the focus on high impact and actionable analysis which can gain speed through the use of technology. This will enable the HR analytics to get into the mainstream and become part of the Business analytics leading to important findings and impactful interventions.

Aral et al (2012) talks about evidence have been their in organisations in which performance is measured and rewarded through the use of various dashboards, metrics etc but there is less evidence to suggest that this HR analytics results in performance improvement. Falleta (2014) has done a survey to find out the utility of “HR analytics” across the Fortune 1000 firms and with the 220 respondents, author “reported that only 15 % claimed HR analytics played a central role in determining or implementing a strategy in HR”. Some researches have reported that over 100 fortune 500 companies mentioned that only one-third of the organisations have HR analytics which can measure the connection between the HR processes and its impact on the people and the business of the organisation(Lawler et al,2004 and Boudreau & Lawler 2015). Rasmussen and Ulrich (2015) have observed that there is a high chance of rejecting the data which can contradict the existing beliefs.

Sturdy (2011) also talks about problems with the consultancy driven approaches as well, as most of the times consultancy activities are more driven by selling their products than finding solutions to customer problems. O’Mahoney et al. (2013) in his research says that involvement of consultants, services are more into the generic best practices than the in depth engagement with the company and its needs. Harris, et al. (2011) that savings of the cost at HR processes or any other efficiency outcomes can only impact administrative cost which is a very small part of the company’s overall cost and may not have a very huge impact on the company’s business performance.

CAHRS (2014a,b) describes that developing the queries and dashboard as per the old systems of the company which have been legacy which is dependent on different hardware and software product may increase the cost and too much time may be required for the implementation of this HRIS system. Sparrow et al. (2015) discusses that the HRIS packages being sold many times, do not have the capability of many types of analysis and the manner in which these software packages are being sold is leading to a miss of the major objective of bringing the data and software together.

Marler (2009) talks about the general nature of the HRIS products which are being sold are not giving any advantage to the organisation interims of competitive advantage as mentioned in the resource-based theory that

focuses on the significance of unique and not imitable capabilities. DiMaggio and Powell (1983) mentions the high-level adoption of certain software just because of the hyped campaigns of sales from the consultancies and big IT companies. Bersin (2015b) points out at the change of focus from the talent to the people and procuring software which can assess the real-time engagement of the employees and their monitoring. Bassi (2012) conveys that the lack of required IT awareness of using analytic software and also the skills required to connect with business outcomes will finally give up the responsibility to IT or finance functions.

The Requirement for HR Analytics

Levenson (2011) and Levenson, Lawler, & Boudreau (2005) have mentioned very particular competencies required by the HR professionals like “data analyses, intermediate data analyses, basic multivariate models, advanced multivariate models, data preparation, root cause analysis, research design, survey design, and quantitative data collection and analysis” to deliver on the HR analytics efficiently. Authors also mention that these skills are not much in demand and only one-third of professionals in HR analytics have “competency in multivariate statistics” and this further goes down to 3% when we are taking into account HR professionals who are not specific to analytics.

Douthitt & Mondore, 2014 states about various HR leaders showing interest in HR analytics and asking about a few questions like “ What HR metrics should be included in the balanced scorecard, Given all the HR data they have available how can they use it to identify priorities and build an integrated talent strategy, how can they show the impact of their investments in talent and how do they execute a plan to improve their HR analytics “

Rasmussen and Ulrich(2015) have observed that there is a high chance of rejecting the data which can contradict the existing beliefs. HR professionals to get successful by pushing the Analytics in their organisation needs to collaborate with other department and involve them in the process. HR professional should also be able to establish credibility between the senior managers who do not show faith in results derived from data analytics.

Falleta (2014) also points out that besides the competencies and skills getting HR Analytics into an organisation may involve accepting the fact of a hindrance to change and decreasing the role of intuition in the decision making process by managers. Harris et al.(2011) has provided various examples from a case study where Authors mention Google using HR analytics in predicting the performance of employee using the database; Sysco tries to make connect amongst “work climate surveys, employee satisfaction and high revenue”.

So when we conclude from the various researches available there are 3 important requirements for the success of HR analytics are

1. Analytical skills of the HR professionals as mentioned by various researchers like Mondare et al. (2011); Giuffrida (2014); Angrave et al. (2016); Bassi,(2011); Rasmussen & Ulrich(2015) and Levenson, (2011)
2. Having Information Technology support and skills mentioned in various articles by Douthitt & Mondore, (2014); Angrave et al(2016) and Aral et al(2012)
3. Convincing the Senior leadership as mentioned in Giuffrida,(2014); Coco et al. (2011); Levenson(2011); Rasmussen & Ulrich(2015)

Learning Theories

Kolb's Theory

Miettinen, R. (2000) mentions “Kolb's Learning Cycle-takes concrete experience as its starting point; reflective observation on this experience, in turn, builds abstract conceptualisation, which feeds through into active experimentation, the source of further concrete experience”.

The first step is that the learners generate data which helps in the formation of metrics and these metrics are further used to help in deciding interventions and this is known as “Concrete experience, Observation, Abstract conceptualisation, Active experimentation”.

Another effect is observed at an individual level where learning analytics can help in looking into the metrics available to an individual can also attempt to make changes in his learning the behaviour to get more benefited.

Schön's Theory

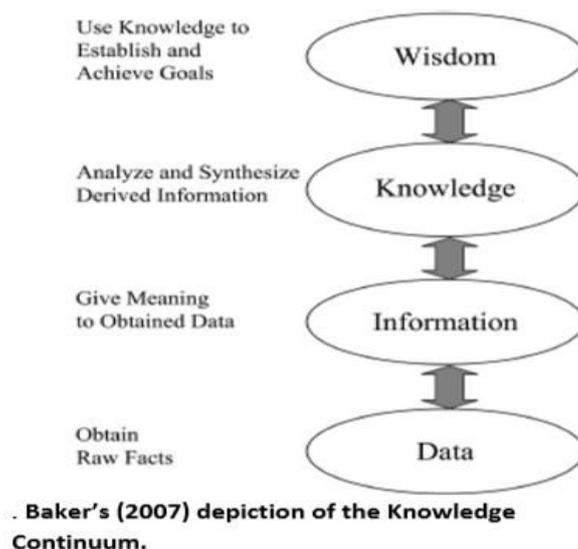
Kinsella, E. A. (2006) mentions about Donald Schön's theory on “reflective practice” where author has emphasised on the “reflection-in-action and reflection-on-action” which comprises of the actions taken during the learning event or after the event has occurred.

Laurillard's Theory

Laurillard, D. (2013) gave a theory where learning is said to take place by the interactions “between a teacher and a student (and with other students), underpinned by reflection and adaptation” These interactions occur at two levels “the level of action, and at the level of conception or description.”. Learning analytics helps in the conversation between student and the teacher, providing information to the teacher as well as the student.

Analytics in Training or Learning

Knowledge continuum explained by Baker(2007) has developed an actionable knowledge conceptual framework where author talks about data which gets converted into information and this information can answer the questions of who, when, what and how. And finally, this information gets transferred into wisdom through its application. Knowledge continuum targets into the data which helps in the transformation of the data into something meaningful.



Analytics in Training in Organisations

Scholz, 2017 mentions that “Design, deployment and analysis of each investment being made is assessed and measured before any training programs. can also be well addressed by utilising the tools that are statistically preferred and most efficient tools for learning various level of skills and expertise”. Josh Bersin(2008) talks about analytic tools making the filtering, drilling and aggregation of data are simplified. Author also talks about more and more organisations are deciding to develop or purchase systems for their training analytics. Still, more research work can be done in this area to see the utility of analytics into training & development in various corporate.

John R. Mattox II, Jean Martin, Mark Van Buren(2016) Learning Analytics: Innovations in Measurement to Support Employee Development discusses about in his book about the availability of the database, the four levels of evaluation, impact measurement framework and performance-based evaluations. Author also talks on the use of technology, running L&D like a business, aligning L&D through need assessment, benchmarking to take a decision and moving beyond learning analytics to talent analytics.

Learning Analytics in Institutions

As per G Siemens, P Long(2011) talks about higher education and how “learning analytics” can support in developing clarity and bring a rational change for administrators, educators and students. For educators, it can be useful as it can provide real-time information about learner’s performance and help in planning of student activities. For students, it can be helpful as it can provide information in relations to their peers and can be motivating in regard to their personal goals. When it comes to administrators can help them to get out of the uncertainty of allocating resources, improving the quality of learning and developing a competitive advantage.

Norris et al. (2008b) mentioned "the emergence of a new generation of tools, solutions, and behaviours that are giving rise to more powerful and effective utilities through which colleges and universities can measure performance and provoke pervasive actions to improve”. Siemens (2010) also gave an early definition “learning analytics is the use of intelligent data, learner-produced data, and analysis models to discover information and social connections, and to predict and advise on learning” Siemens also focused on differentiating between

learning analytics which benefits learners and faculty focusing on the department and level of courses; whereas academic analytics can benefit all stakeholders like those funding, administrators and intuitional level marketing person; also governments and education authority at the national or international levels.

Similarly, Baepler and Murdoch (2010) have looked into the difference in institutional systems between data mining, audit and academic analytics. Stiles, Jones, & Paradkar (2011) mentions that an increased number of universities are implementing data warehousing infrastructure see analytics as a strategic asset. Clow, Doug (2013) talks about the strength of learning analytics in enabling the teacher and students to conceptualise the strength of data which can enrich their learning.

G Siemens(2012) Learning analytics has impacted the current models of education and to drive new insights to take decisions in teaching and learning. These outcomes in today's education system can be transformative in nature. S Slade, P Prinsloo (2012) has highlighted "the role of power, the impact of surveillance, the need for transparency, and an acknowledgement that student identity is a transient, temporal, and context-bound construct. Each of these affects the scope and definition of learning analytics ethical use".

F Kalota(2015) mentions learning Analytics (LA) in context to the institutions where its usage in academic institutions may help in understanding learners needs and help them to address; so to understand the big data and its applications becomes even more relevant. As per Dringus and Ellis, 2005 there is a difficulty to evaluate and interpret the participation and learning of the people when there are hundreds of students which are involved and the learning has happened for many weeks.

As per Campbell et al. (2007), there is an increased requirement "for educational institutions to measure, reflect and improve performance "of the learners. Campbell and Oblinger (2008) has mentioned academic analytics having "five steps: capture, report, predict, act and refine" which can be helpful in making decisions and guiding action. Tinto (1997) published his studies from his data which author gathered over 20 yr over various institutions and students to showcase the factors affecting the persistence of students.

Educational Data Mining(EDM) comes under this field and found the importance of EDM as "turning learners into effective better learners" (Romero and Ventura, 2007). EDM is into developing the various methods to find out the unique type of data which emerges from the education context and helps in understanding students and settings where they are learning (Romero et al.2010a).

Analytics in e-learning/LMS usage

Mazza and Dimitrova (2007) talks about LMS data which can help the instructors understand online class happening and identify learners who need extra attention. As per Ferguson and Buckingham Shum (2012) are based on the learning theory and becomes important when there is an online culture participatory in nature.

Mitchell and Costello (2000) was amongst the first to use the term 'learning analytics' which was in regard to e-learning business intelligence. Kay and Kummerfeld (2011) talks about building a detailed view of learner activities which may be beyond the LMS and provides accurate analytic results. This will enable to have lifelong learning model. "Campbell and Oblinger (2007) gave a definition of academic analytics as 'Academic analytics marries large datasets with statistical techniques and predictive modelling to improve decision making', with the educational, 'academic analytics has the potential to improve teaching, learning, and student success"

Some researchers have mentioned "four objectives" which are having significance in achieving the effectiveness of using web analytics in field education: "define the goals or objectives, measure the outputs and outcomes, use the resulting data to make improvements, and share the data for the benefit of others"(Hendricks, Plantz and Pritchard, 2008).

Models or Processes involved in Learning Analytics

It has been mentioned that learning analytics happens in "three major steps : (1) data collection and pre-processing, (2) analytics and action, and (3) post-processing"(M.A.Chatti, A.L.Dyckhoff, U.Schroeder and H.Thüs, 2012).

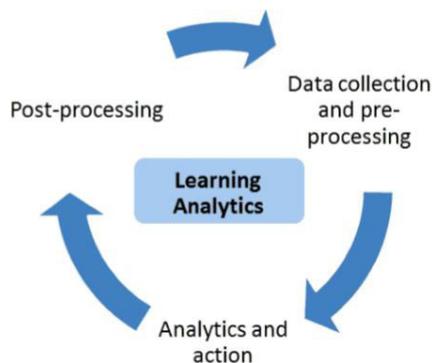
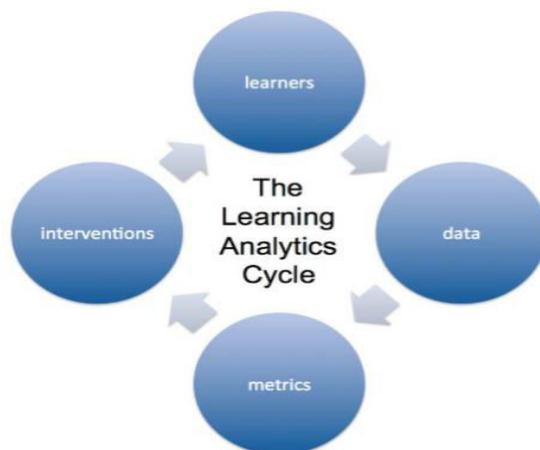


Figure 1. Learning Analytics Process

*taken from “M.A.Chatti, A.L.Dyckhoff, U.Schroeder, and H.Thüs International Journal of Technology Enhanced Learning” (2012)

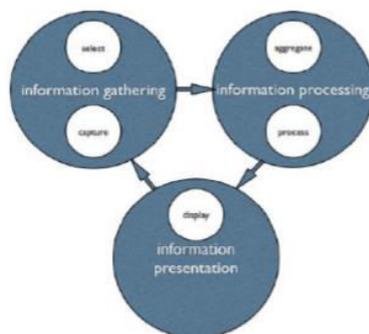
D Clow (2012) mentions about the Learning analytics cycle which has learners who are enrolled in the program, data which emerges out of the interactions, metrics which are formed from the data and the interventions which are planned based on the data available.



Learning Analytics Cycle.

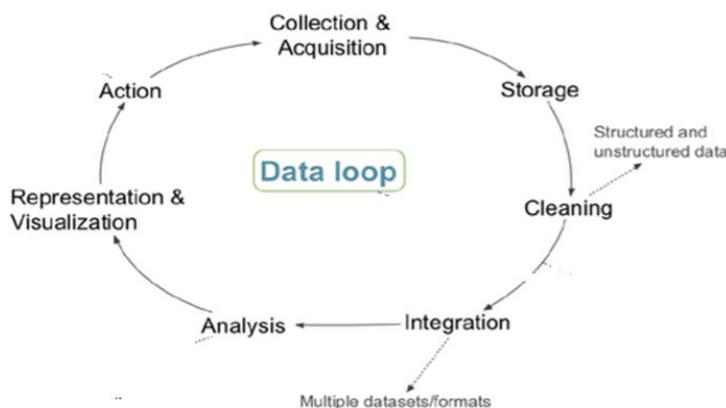
*D Clow (2012) The Learning Analytics Cycle: Closing the loop effectively

Dron and Anderson(2009) talk about a model which is useful in explaining the learning processes and its analytics. This model is comprising of three different phases and to get to the changes at the institutional level learning analytics is not only sufficient. To achieve this change institution, data of learning analytics need to be “presented and contextualised in ways that can drive organisational development” (Macfadyen and Dawson 2012).



Collective Application Model (Dron and Anderson, 2009)

George Siemens(2013) has mentioned about the data analytics as a data loop having following steps as: “Collection and acquisition, storage, cleaning(structured & unstructured data), integration, analysis, representation, action and visualisation” in terms of planning learning interventions.



*George Siemens (2013)

Norris et al (2008) has put forward the significance of utilising educational data to take action forwards in deciding learning interventions and what is known as Action analytics which included the deployment of “academic analytics to produce actionable intelligence, service-oriented architectures, planning of information/content and services, proven models of course/curriculum reinvention, and changes in faculty practice that improve performance”

K Verbert, E Duval, J Klerkx (2013) describes the Process Model having four stages in data analytics

1. Awareness. In this stage, we are focussed only with data which could be presented in various ways like tables and other visuals.
2. Reflection. Data may not be useful on its own but user will have questions and evaluating the importance and usefulness of data.
3. Sensemaking. This stage tries to answer the queries which have been raised in the reflection process and developing new insights from it
4. Impact. This the last step is to look for changing the behaviour or search for new meaning to it, as per the assessed utility by the user.

A Pardo, J Jovanovic, S Dawson(2019) describes the available data in the current scenario “with detailed accounts of student interactions offers the possibility of exploring how technology can augment human intelligence to provide personalised feedback at scale for large student cohorts”.

CONCLUSION AND LIMITATIONS

This review article has focused on exploring the current researches available in the area of HR analytics and learning or training analytics and how it can be helpful for the HR department of an organisation or to a learner in an institute or company. The article mentions the findings from the different researches available in both HR and Learning/Training analytics. The article also talks about the challenges faced by HR professionals in gaining acceptance of HR analytics. The paper also looked into the various requirements in terms of skills and other factors which are required while implementing the HR analytics or learning analytics. It also describes the benefits of using HR analytics to an organisation or an institute and it also highlighted the various models and processes involved in learning/training analytics. My article starts from the HR analytics from the corporate perspective, its usage, challenges, requirement and benefits but then gets more into the learning analytics from the institutional or academic setup, as more research is available there than the training analytics/learning analytics in the corporate. A lot of research papers are available on HR analytics and learning analytics in institutions, but still, more research can be done in the field of using the learning analytics in corporate or organisations. Much of the challenges faced in HR analytics have been well described in the papers but on similar grounds, the challenges faced in learning analytics can be explored further.

REFERENCES

- 1 Angrave, D., Charlwood, A., Kirkpatrick, I., Lawrence, M., & Stuart, M. (2016). HR and analytics: why HR is set to fail the big data challenge. *Human Resource Management Journal*, 26(1), 1-11.
- 2 Aral, S., & Walker, D. (2012). Identifying influential and susceptible members of social networks. *Science*, 337(6092), 337-341.

- 3 Aral, S., Brynjolfsson, E., & Van Alstyne, M. (2012). Information, technology, and information worker productivity. *Information Systems Research*, 23(3-part-2), 849-867.
- 4 Baepler, P., & Murdoch, C. J. (2010). Academic analytics and data mining in higher education. *International Journal for the Scholarship of Teaching and Learning*, 4(2), 1-9.
- 5 Baker, C. J., & Cheung, K. H. (Eds.). (2007). *Semantic web: Revolutionizing knowledge discovery in the life sciences*. Springer Science & Business Media.
- 6 Bassi, D., Iryu, Y., & Nebelsick, J. H. (2012). To be or not to be a fossil rhodolith? Analytical methods for studying fossil rhodolith deposits. *Journal of Coastal Research*, 28(1), 288-295.
- 7 Bassi, L. (2011). Raging debates in HR analytics. *People and Strategy*, 34(2), 14.
- 8 Bersin, J. (2008). *The training measurement book: Best practices, proven methodologies, and practical approaches*. John Wiley & Sons.
- 9 Bersin, J. (2014). *The Talent Agenda 2015*, "What comes after Integrated Talent Management".
- 10 Boudreau, J. W., & Jesuthasan, R. (2011). *Transformative HR: how great companies use evidence-based change for sustainable advantage*. John Wiley & Sons.
- 11 Boudreau, J. W., & Ramstad, P. M. (2005). Talentship, talent segmentation, and sustainability: A new HR decision science paradigm for a new strategy definition. *Human Resource Management: Published in Cooperation with the School of Business Administration, The University of Michigan and in alliance with the Society of Human Resources Management*, 44(2), 129-136.
- 12 Boudreau, J. W., & Ramstad, P. M. (2006). Talentship and HR measurement and analysis: From ROI to strategic, human resource planning. *Human Resource Planning*, 29(1), 25-33.
- 13 Boudreau, J. W., & Ramstad, P. M. (2007). *Beyond HR: The new science of human capital*. Harvard Business Press.
- 14 Boudreau, J., & Cascio, W. (2017). Human capital analytics: why are we not there?. *Journal of Organizational Effectiveness: People and Performance*.
- 15 CAHRS (2014b). CAHRS Working Group on HR analytics summary report part 2. Ithaca NY: Cornell University Centre for Advances Human Resources. Available at <http://cahrs.ilr.cornell.edu/CentersofExcellence/data.aspx?n=HR%20Analytics/Metrics#Research> (accessed 31 October 2014).
- 16 Campbell, E. G., Weissman, J. S., Ehringhaus, S., Rao, S. R., Moy, B., Feibelman, S., & Goold, S. D. (2007). Institutional Academic– Industry Relationships. *JAMA*, 298(15), 1779-1786.
- 17 Campbell, J. P., DeBlois, P. B., & Oblinger, D. G. (2007). Academic analytics: A new tool for a new era. *EDUCAUSE review*, 42(4), 40.
- 18 Cascio, W., & Boudreau, J. (2010). *Investing in people: Financial impact of human resource initiatives*. Ft Press.
- 19 Caudron, O. (2014). U.S. Patent Application No. 13/615,576.
- 20 Chartered Institute for Personnel and Development (CIPD). (2013). *Talent analytics and big data—The challenge for HR*.
- 21 Chatti, M. A., Dyckhoff, A. L., Schroeder, U., & Thüs, H. (2012). A reference model for learning analytics. *International Journal of Technology Enhanced Learning*, 4(5-6), 318-331.
- 22 Clow, D. (2012, April). The learning analytics cycle: closing the loop effectively. In *Proceedings of the 2nd international conference on learning analytics and knowledge* (pp. 134-138).
- 23 Clow, D. (2013). An overview of learning analytics. *Teaching in Higher Education*, 18(6), 683-695.
- 24 Cooper, A. (2012). What is analytics? Definition and essential characteristics. *CETIS Analytics Series*, 1(5), 1-10.
- 25 Davenport, T. H., Harris, J., & Shapiro, J. (2010). Competing on talent analytics. *Harvard business review*, 88(10), 52-58.

- 26 Davenport, T., & Harris, J. (2017). *Competing on analytics: Updated, with a new introduction: The new science of winning*. Harvard Business Press.
- 27 De Liddo, A., Shum, S. B., Quinto, I., Bachler, M., & Cannavacciuolo, L. (2011, February). Discourse-centric learning analytics. In *Proceedings of the 1st international conference on learning analytics and knowledge* (pp. 23-33).
- 28 DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American sociological review*, 147-160.
- 29 Douthitt, S., & Mondore, S. (2014). Creating a business-focused HR function with analytics and integrated talent management. *People and Strategy*, 36(4), 16.
- 30 Dringus, L. P., & Ellis, T. (2005). Using data mining as a strategy for assessing asynchronous discussion forums. *Computers & Education*, 45(1), 141-160.
- 31 Dron, J., & Anderson, T. (2009). Lost in social space: Information retrieval issues in Web 1.5.
- 32 Falletta, S. (2014). In search of HR intelligence: evidence-based HR analytics practices in high performing companies. *People and Strategy*, 36(4), 28.
- 33 Fitz-Enz, J. (2000). The ROI of human capital: Measuring the economic value of employee performance. AMACOM Div American Mgmt Assn.
- 34 Fitz-enz, J. (2009). Predicting people: From metrics to analytics. *Employment Relations Today*, 36(3), 1-11.
- 35 Fitz-Enz, J. (2010). THE NEW HR ANALYTIC Predicting the Economic Value of Your Company's Human Capital Investments.
- 36 Giuffrida, M. (2014). Unleashing the power of talent analytics in federal government. *Public Manager*, 43(3), 7.
- 37 Harris, J. G., Craig, E., & Light, D. A. (2011). Talent and analytics: new approaches, higher ROI. *Journal of Business Strategy*.
- 38 Davenport, T. H., Harris, J., & Shapiro, J. (2010). Competing on talent analytics. *Harvard business review*, 88(10), 52-58.
- 39 Hendricks, M., Plantz, M. C., & Pritchard, K. J. (2008). Measuring outcomes of United Way-funded programs: Expectations and reality. *New Directions for Evaluation*, 2008(119), 13-35.
- 40 Kalota, F. (2015). Applications of big data in education. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, 9(5), 1602-1607.
- 41 Kaufman, M. (2014). *Inductive Fuzzy Classification in Marketing Analytics*, *Fuzzy Management Methods*. DOI 10.1007/978-3-319-05861-0_3. Springer International Publishing, Switzerland.
- 42 Kay, J., & Kummerfield, B. (2011). Adaptive Technologies for Training and Education, chap. Lifelong learner modelling.
- 43 Kinsella, E. A. (2006). Constructivist underpinnings in Donald Schön's theory of reflective practice: echoes of Nelson Goodman. *Reflective Practice*, 7(3), 277-286.
- 44 Kovner, A. R. (2014). Evidence-based management: Implications for nonprofit organizations. *Nonprofit Management and Leadership*, 24(3), 417-424.
- 45 Laurillard, D. (2013). *Teaching as a design science: Building pedagogical patterns for learning and technology*. Routledge.
- 46 Lawler III, E. E., & Boudreau, J. W. (2012). Effective human resource management. *People and Strategy*, 35(2), 58.
- 47 Lawler III, E. E., & Boudreau, J. W. (2015). *Global trends in human resource management: A twenty-year analysis*. Stanford University Press.
- 48 Lawler III, E. E., Levenson, A., & Boudreau, J. W. (2004). HR metrics and analytics—uses and impacts. *Human Resource Planning Journal*, 27(4), 27-35.

- 49 Lawler III, E. E., Ulrich, D., Fitz-Enz, J., & James Madden, V. (2004). Human resources business process outsourcing: Transforming how HR gets its work done. John Wiley & Sons.
- 50 Levenson, A. (2011). Using targeted analytics to improve talent decisions. *People and Strategy*, 34(2), 34.
- 51 Levenson, A., Lawler III, E. E., & Boudreau, J. W. (2005). Survey on HR Analytics and HR transformation: Feedback report. Center for Effective Organizations, University of Southern California.
- 52 Macfadyen, L. P., & Dawson, S. (2012). Numbers are not enough. Why e-learning analytics failed to inform an institutional strategic plan. *Journal of Educational Technology & Society*, 15(3), 149-163.
- 53 Marler, J., & Floyd, B. (2009). Database concepts and applications in HRIS. *Human Resource Information Systems. Basics, Applications, and Future Directions*, California: SAGE Publications INC, 25-44.
- 54 Mattox II, J. R., Van Buren, M., & Martin, J. (2016). *Learning Analytics: Measurement Innovations to Support Employee Development*. Kogan Page Publishers.
- 55 Mazza, R., & Dimitrova, V. (2007). CourseVis: A graphical student monitoring tool for supporting instructors in web-based distance courses. *International Journal of Human-Computer Studies*, 65(2), 125-139.
- 56 Miettinen, R. (2000). The concept of experiential learning and John Dewey's theory of reflective thought and action. *International journal of lifelong education*, 19(1), 54-72.
- 57 Mitchell, J., & Costello, S. (2000). International e-VET market research report: A report on international market research for Australian VET online products and services. Sydney, Australia: John Mitchell & Associates and Education Image.
- 58 Mondore, S., Douthitt, S., & Carson, M. (2011). Maximizing the impact and effectiveness of HR analytics to drive business outcomes. *People and Strategy*, 34(2), 20.
- 59 Mortenson, M. J., Doherty, N. F., & Robinson, S. (2015). Operational research from Taylorism to Terabytes: A research agenda for the analytics age. *European Journal of Operational Research*, 241(3), 583-595.
- 60 Norris, D., Baer, L., Leonard, J., Pugliese, L. & Lefrere, P. (2008b). Framing Action Analytics and Putting Them to Work. *EDUCAUSE Review* 43(1).
- 61 Norris, D., Baer, L., Leonard, J., Pugliese, L., & Lefrere, P. (2008). Action analytics: Measuring and improving performance that matters in higher education. *EDUCAUSE review*, 43(1), 42.
- 62 O'Mahoney, J., & Markham, C. (2013). *Management consultancy*. Oxford University Press.
- 63 Pardo, A., Jovanovic, J., Dawson, S., Gašević, D., & Mirriahi, N. (2019). Using learning analytics to scale the provision of personalised feedback. *British Journal of Educational Technology*, 50(1), 128-138.
- 64 Prinsloo, P., Slade, S., & Galpin, F. (2012, April). Learning analytics: challenges, paradoxes and opportunities for mega open distance learning institutions. In *Proceedings of the 2nd International Conference on Learning Analytics and Knowledge* (pp. 130-133).
- 65 Rasmussen, T., & Ulrich, D. (2015). Learning from practice: how HR analytics avoids being a management fad. *Organizational Dynamics*, 44(3), 236-242.
- 66 Rogers, E. M., & Shoemaker, F. F. (1971). *Communication of Innovations; A Cross-Cultural Approach*.
- 67 Rogers, E. M., & Singhal, A. (2003). Empowerment and communication: Lessons learned from organizing for social change. *Annals of the International Communication Association*, 27(1), 67-85.
- 68 Romero, C., & Ventura, S. (2007). Educational data mining: A survey from 1995 to 2005. *Expert systems with applications*, 33(1), 135-146.
- 69 Romero, C., & Ventura, S. (2010). Educational data mining: a review of the state of the art. *IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews)*, 40(6), 601-618.
- 70 Scholz, T. M. (2017). *Big data in organizations and the role of human resource management: A complex systems theory-based conceptualization*. Frankfurt a. M.: Peter Lang International Academic Publishers.

- 71 Sesil, J. C. (2013). *Applying Advanced Analytics to HR Management Decisions: Methods for Selection, Developing Incentives, and Improving Collaboration* (Paperback). FT Press.
- 72 Shum, S. B., & Ferguson, R. (2012). Social learning analytics. *Journal of educational technology & society*, 15(3), 3-26.
- 73 Siemens, G. (2010). What are learning analytics. *ELEARNSPACE: learning, networks, knowledge, technology, community*.
- 74 Siemens, G. (2013). Learning analytics: The emergence of a discipline. *American Behavioral Scientist*, 57(10), 1380-1400.
- 75 Siemens, G., & Baker, R. S. D. (2012, April). Learning analytics and educational data mining: towards communication and collaboration. In *Proceedings of the 2nd international conference on learning analytics and knowledge* (pp. 252-254).
- 76 Siemens, G., & Long, P. (2011). Penetrating the fog: Analytics in learning and education. *EDUCAUSE review*, 46(5), 30.
- 77 Siemens, G., Gasevic, D., Haythornthwaite, C., Dawson, S., Shum, S. B., Ferguson, R & Baker, R. S. J. D. (2011). *Open Learning Analytics: an integrated & modularized platform* (Doctoral dissertation, Open University Press).
- 78 Sparrow, M. K. (2015). Measuring performance in a modern police organization. *Psychosociological Issues in Human Resource Management*, 3(2), 17-52.
- 79 Sparrow, P., Hird, M., & Cooper, C. L. (2015). Strategic talent management. In *Do We Need HR?* (pp. 177-212). Palgrave Macmillan, London.
- 80 Stiles, R., Jones, K. T., & Paradkar, V. (2011). Analytics rising: IT's role in informing higher education decisions. *ECAR Research Bulletin*, 7.
- 81 Straub, D., Boudreau, M. C., & Gefen, D. (2004). Validation guidelines for IS positivist research. *Communications of the Association for Information systems*, 13(1), 24.
- 82 Sturdy, A. (2011). Consultancy's consequences? A critical assessment of management consultancy's impact on management. *British Journal of Management*, 22(3), 517-530.
- 83 Tinto, V. (1997). Classrooms as communities: Exploring the educational character of student persistence. *The Journal of higher education*, 68(6), 599-623.
- 84 Verbert, K., Duval, E., Klerkx, J., Govaerts, S., & Santos, J. L. (2013). Learning analytics dashboard applications. *American Behavioral Scientist*, 57(10), 1500-1509.

Cloud Data Verification Using the Merkle Hash Tree

Dharavath Nagesh¹, Harsh Lohiya² and Laxmaiah Mettu³

^{1,2}Department of Computer Science and Engineering, Sri Satya Sai University of Technology and Medical Sciences, Sehore Bhopal-Indore Road, Madhya Pradesh, India

³Department of Computer Science and Engineering, CMR Engineering College, Kandlakoya (V), Medchal, Hyderabad

ABSTRACT

In the cloud storage environment, consumers will lose the control over their re-appropriated data when they remotely store their data on cloud storage suppliers. There is a significant increase in risk of unapproved acceptance of the information. Perhaps the most important problems in cloud storage are to ensure the consistency of the revised data. In particular, we have to guard against unapproved activities; furthermore, after surprising modifications, we have to recognize and recover customer information. This paper then presents a new technique for safe storage of cloud information with the help of Merkle Hash Tree (MHT) with an advanced Hash Mark for providing honesty and privacy of re-appropriate cloud information using a privately-owned security approach. In addition, the Advanced Encryption Standard (AES) is used to change the information confidentiality and protection before the data is placed in the cloud. The effects of replication show improved results in terms of data recovery time, processing time and individual productivity.

Keywords: Merkle Hash Tree, Advanced Encryption Standard, Cloud, Data security.

INTRODUCTION

Cloud storage is a mechanism for organized capacity properties, which keeps data in a group of outsiders' capacities, known as cloud service providers (CSPs). CSPs virtualize their assets as required and reveal them as an all-inclusive phase of storage in which customers can re-appropriate their information on-demand [1]. Cloud computing aims to allow customers to benefit from these improvements, without the need for in-depth knowledge or mastery of each. The cloud plans to cut costs and allows customers to focus their company instead of IT snags. Virtualization is the main advancement that enables cloud computing. The virtualization software isolates a computer gadget into at least one "virtual" device, which can be easily used and how computing companies can be performed [2]. Inactive computing assets can be designed and used much more productively with working machine-level virtualization that essentially makes a suitable system of various autonomous computing devices. Virtualization provides the skill needed to speed up the operations and lowers costs by extending the system application [3]. Autonomous computation computes the loop in which the customer may organise assets on demand. Computerization reduces the loop, decreases job costs and reduces the risk of human error by restricting the customer association. Cloud computing uses utility computer ideas to send the administrations used measurements. Cloud computing works on the quality problems of other matrix model QoS (administration's nature) and unexpected quality issues [4].

A document or collection of records which contain references to other records that have references to information within their hashes. The hashes of their specific children are hubs up in the tree. In the image hash 0, for instance, the relation between hash 0-0 and hash 0-1 has been hacked. In other words, hash 0 = hash (0-0) + hash (0-1) where + is a link [5]. Most hash trees (two youth hubs below any hub) are parallel executions except that far more kid hubs are similarly used under each hub. For instance, SHA-2 is normally used for hashing a cryptographic power. If the hash tree is unlikely to meet any unintended harm, unstable inspections, for example, may be used for CRCs [6].

The topmost layer of a hash consists of the hashes, the rows (or root hash or expert hash). Before making a p2p public, the highest quality hash comes from a source such as a confided-in partner or a well-known site that has good recommendations for records to download. It's possible to find the highest branch of the hash tree from any non-controlled systems, like any other non-competitor systems. Then the verified against the stored top secret hash, and if the original top secret's secret is corrupted, another key from another location will be produced until the programme finds one that does not affect the execution of the programme.

The difference between a hash list is that one item can be downloaded and reviewed in isolation while the entire structure is still intact, despite the fact that certain parts are not. For instance, say for example, that the knowledge block L2 has H0 and H1 and hashes them to 0 and 1, then look at the final hash and see whether it contains either 0 or 1 to see if the other one was a lie [7]. One way to do this is to assess the readability of

knowledge block L3 is to see if the tree has hash 1 or not. Probing is beneficial as it will isolate fine details that could have been missed, because more data would not be loaded into the resume than it is warranted. In the event the hashed document happens to be exceptionally huge, it will turn out to be an unusually huge list of hashed documents. Although it is true that one small branch on a tree, one must test the tree's trustworthiness before allowing it to download the details [8]. The Merkle root doesn't explain the empowerment tactic, which empowers a second-presumption attack where the root already has an archives. This enables the aggressor to make another log, with hash 0 for block 1 and hash 1 for block 1. When computing leaves, a zero is appended to the hash value; when computing hubs, a zero is inserted.

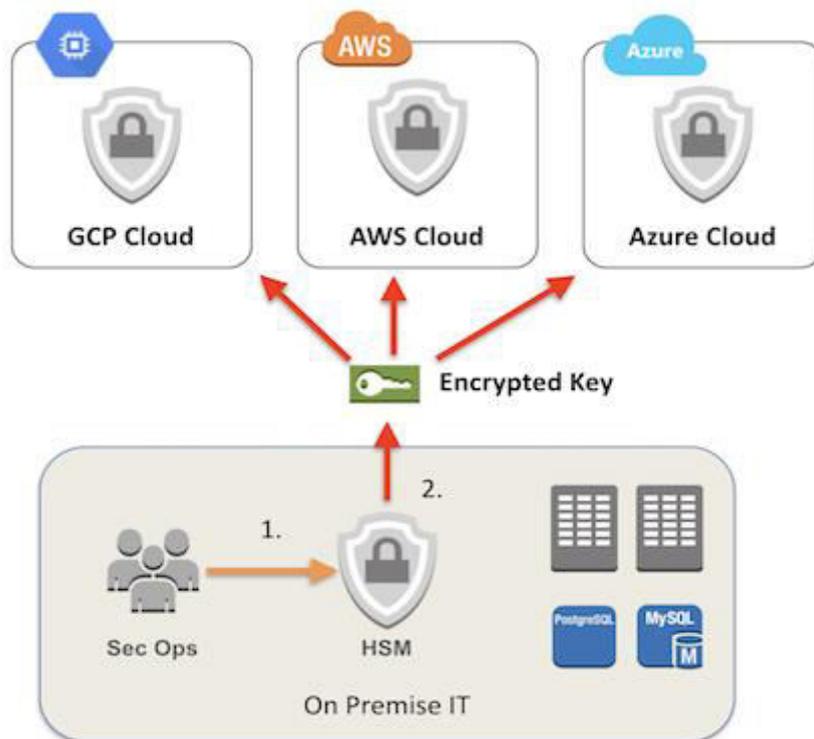


Figure 1.1 Cloud Key Management Service

Restricting the hash tree size is an essential of some proper security confirmations, and helps in making a few evidences more tight. A few executions limit the tree profundity utilizing hash tree profundity prefixes before hashes, so any separated hash affix is characterized to be legitimate just if the prefix diminishes at each progression is as yet certain when the leaf is reached. The utilization of cloud administrations is basic these days in endeavors, schools, governments and even families for private documents, and the proposed MTFS could give an elective answer for private record stockpiling/trade dependent on the block chain innovation. We outline the utilization instance of the block chain based private record stockpiling/trade in the protection business for instance: People buy protection to cover coincidental misfortune throughout everyday life. An insurance agency requests that an individual give certain data to safeguard him/her through hazard assessment. Be that as it may, on the grounds that those submitted documents are just stayed with on the protection's private worker, it isn't feasible for the safeguarded to confirm the accommodation of those records later except if the guaranteed kept the first gathering as proof. Block chain based private document stockpiling can give shared trust to both back up plan and safeguarded. At the point when the protected solicitations for protection benefits, all upheld materials are given in a limited organization space, which are unchanging and dependable.

LITERATURE REVIEW

According to Sehgal et al [9]. (2018), Data Movement: data travel from customer to worker, but protection originates on both sides. When the information is shared around the Internet, one must worry about control. When products are divided among multiple clients, issues concerning their overall impression can arise It is difficult to differentiate between authentic and fake characters and hackers on a network because of the number of hostile responses. Recognition of fallacy: it becomes apparent if cloud co-ops dox providers fail to update their resources. Service refusal: It is entirely conceivable that cloud establishments might not be updated if digital assaults are not recognized and guarded. It is vital if cloud cooperatives are part of the knowledge of the

people. As many cloud companies have a free service, it is possible that they are collecting their clients' private information and then sharing it with one another.

Yousef et al [10]. (2019), presents an amazing array of current conventions. Security risks arising from asset imperative systems are also include device theft, data intercept, and listening in on non-existent networks, so additional steps are implemented across the network to alleviate them. creative analogy: If the total security achievable by using symmetric cryptography is considered to be strong, that makes it one of the more well-known encryption strategies. Two hubs that attempt to link must use a common encryption key. It has had effectively been selected and traded by the masters of the message. several administration plans, one for each model, were stated by Mohammad Sadegh and his colleagues. Hubs have a macro-systemic and micro-biotic vision. In the Hierarchical model, the hubs are branches and the non-root branches form the trunk.

RESEARCH METHODOLOGY

Our proposed proficient confirmation plot, which comprises of three stages: system instatement, report age, neighborhood door validation. Prior to depicting them, we first audit the Merkle hash tree strategy, which will fill in as the premise of the proposed verification plot. There are three elements, specifically: the client, the capacity cloud specialist co-op gives the key administration cloud specialist co-op (encryption with cloud worker supplier), as explained in the underneath design graph.

KEY MANAGEMENT SERVER

We present the block chain idea in this segment, which plans to improve on the disseminated key administration in huge heterogeneous security areas. Block chain assists with accomplishing a lightweight and versatile key exchange plot. The regular multi-worker handover steps are delineated before the block chain thought is illustrated.

Client: A client is an element that necessities to re-appropriate information stockpiling to the capacity cloud worker supplier and access the information later on. To save the transfer transmission capacity, the client just transfers remarkable information however doesn't transfer any copy data, which might be claimed by similar client or various clients. They give the information rethinking administrations and stores information to users. To lessen the capacity cost, the capacity cloud worker supplier decrease the capacity of similar duplicates of information utilizing deduplication method and keeps just unique information. An encryption with cloud worker supplier keeps up merged keys for clients, and which furnishes clients with least the measure of capacity and calculation of administrations to encourage key management. Designed for adaptation to internal failure of key administration, we consider an encryption cycle in cloud worker suppliers, each being an individual element. All focalized key are appropriated across different encryption in cloud administration.

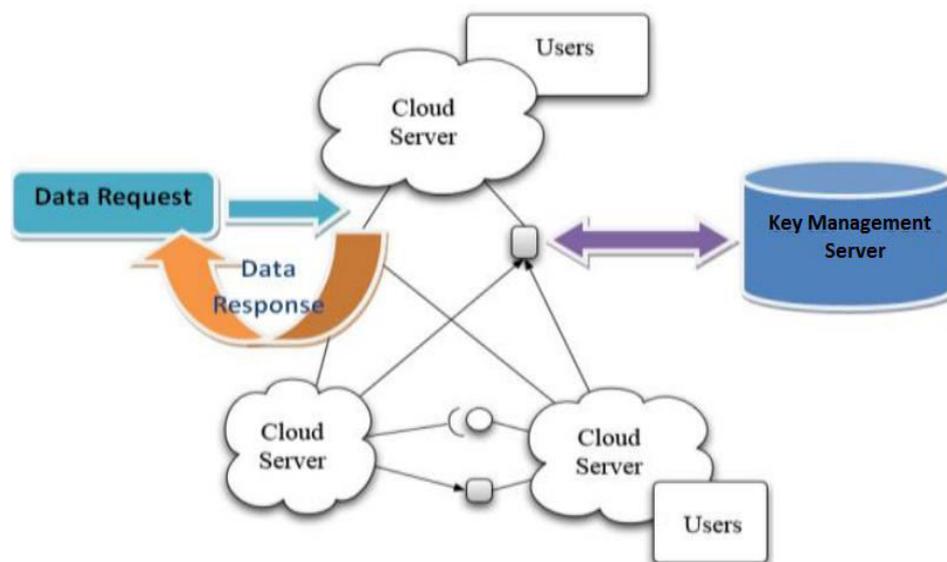


Figure 1.2 System Architecture

In this interaction, we present an information copy to be either an entire document or a more modest size square, and this keeps an eye on two kinds of deduplication: 1) record level deduplication, which decrease the capacity of any indistinguishable records, and 2) block-level deduplication, what isolates a document into more modest fixed-size or variable-size obstructs and lessen the capacity of any indistinguishable squares.

By utilizing fixed-size impedes that simplify it for the calculations of square limits, when utilizing variable size blocks gives improved deduplication viable. We coordinate our deduplication interaction in both document and square levels. Mainly to transfer a record, a client as a matter of first importance plays out the record level copy confirmation. In the event that the record is a copy, every one of its squares should be copied too; something else, the client further plays out the square level copy check and recognizes the extraordinary squares to be transferred. Every information duplicate (i.e., a record or a square) is related with a tag for the copy check. Every single duplicate of information and labels will be put away in the cloud stockpiling. The proposed convention permits the verifier to haphazardly choose the verification length paying little mind to the Merkle tree structure. In the proposed plot, the verifier sends a uniform irregular worth as a component of the test and the prover acquires the list estimation of the leaf hub by taking the rest of separating the worth by the quantity of squares definitely known. This keeps the enemy from construing the upper bound of the leaf hub list during a reshaped confirmation measure as long as the verifier picks diverse uniform irregular difficulties with every execution, not at all like regular Merkle tree-based verification. Further, the kin way created utilizing the Merkle tree is diminished or developed by the mentioned confirmation length, which is likewise picked consistently at arbitrary by the verifier as another segment of the test. Accordingly, there is no connection between the size of the last confirmation and the size of the genuine Merkle tree, making it unimaginable for the foe to induce the size of the fundamental information by computing how the verification size compares to the quantity of leaf hubs in the tree.

RESULTS & DISCUSSION

We conduct experiments to evaluate the overall presentation of the text (32 MB) for different square sizes (i.e., diverse measure of the record blocks). The results illustrate the relationship between the pre-handling period, confirmation age time, and check time cost on the server side and the client side.

Table 1 Computation time of client and server

File Size (MB)	Block Size (KB)	Generation proof (ms)	Verification proof (ms)
32	1	30.8	295.5
32	2	55.40	297.8
32	4	110.5	294.5
32	8	212.2	299.3
32	16	410.5	307.4
32	32	820.8	298.4
32	64	1680.4	296.5

As shown in Figure 1.3 the check time on the customer's side is around 300 ms steady and the confirmation age is equal to the obstruction dimension, as shown in Table 1. As the amount of the paper blocks increases, the calculations period of mark age at the customer side increases. It is a future work that distinguishes between pre-preparation and verification age activities the ideal quadrangle to adjaust the overall presentation. We have carried out studies to evaluate the adequacy and contrast the intensity of our approach and various methods. All tests are carried out in a 1 GB memory virtual machine. Figure 1.3 shows the time costs on the server side compared to the customer side search.

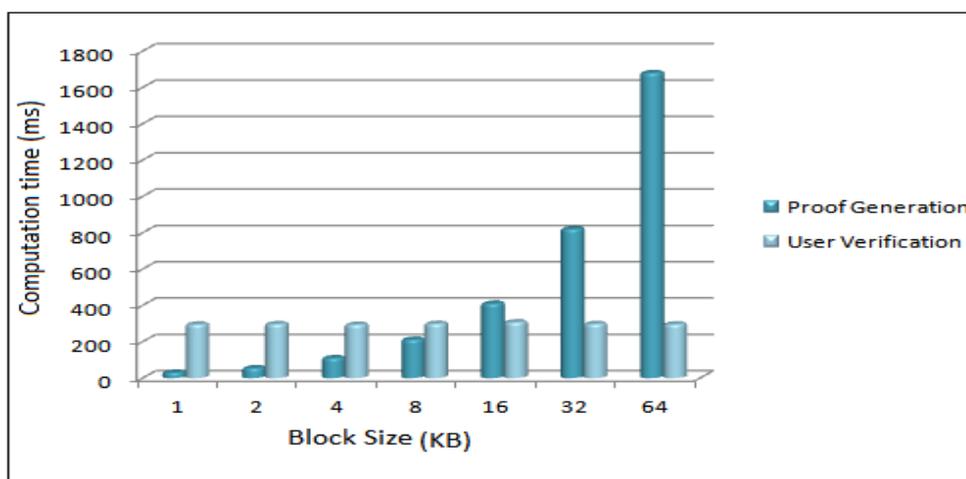


Figure 1.3 Comparison Graph

CONCLUSION

In this paper, we suggest a freely understandable approach to dynamic cloud understanding that incorporates the concept of position awareness. The hub of the Merkle tree, which records the situation of the related hub, is characterised by a 3-fold number. The customer will directly compute root value and prevent the possible attack from being viable, which will validate the accuracy of the test reaction block. This document presents a new technique for safe cloud data storage, supported by MHT with advanced hash marking, which offers re-evaluated cloud data integrity and safety through the private key security approach. But some drawback has been caused by past intermediate reencryption steps such as information encryption measurement that takes a long time to cause a tedious loop. In this work, MHT with a computerised hash signature with an AES method offers another approach. The results of recreation show better results respectively in terms of data recovery time, treatment time, and productivity. In addition, AES to change the information classification and safety before the information is placed into the cloud for security measures.

REFERENCES

1. H. Yuan, X. Chen, J. Wang, J. Yuan, H. Yan, W. Susilo Blockchain-based public auditing and secure deduplication with fair arbitration Inform. Sci. (2020)
2. Banerjee S, Chunka C, Sen S, Goswami RS (2019) An enhanced and secure biometric based user authentication scheme in wireless sensor networks using smart card. WirelPersCommun 107(1):1–28
3. Kan, J., Chen, S., & Huang, X. (2018). Improve Blockchain Performance using Graph Data Structure and Parallel Mining. arXiv preprint arXiv:1808.10810.
4. N. Z. Aitzhan and D. Svetinovic, "Security and privacy in decentralized energy trading through multi-signatures, blockchain and anonymous messaging streams," IEEE Transactions on Dependable and Secure Computing, vol. PP, no. 99, pp. 1–1, 2016
5. G. Zyskind, O. Nathan, and A. .Pentland, "Decentralizing privacy: Using blockchain to protect personal data," in Security and Privacy Workshops (SPW), 2015 IEEE, May 2015, pp. 180–184.
6. X. Huang, R. Yu, J. Kang, N. Wang, S. Maharjan, and Y. Zhang, "Software defined networking with pseudonym systems for secure vehicular clouds," IEEE Access, vol. 4, pp. 3522–3534, 2016.
7. E. Baccarelli, P. G. V. Naranjo, M. Shojafar, and M. Scarpiniti, "Q*: Energy and delay-efficient dynamic queue management in tcp/ip virtualized data centers," Computer Communications, vol. 102, pp. 89 – 106, 2017.
8. Mehmood, M. M. Umar, and H. Song, "Icmds: Secure inter-cluster multiple-key distribution scheme for wireless sensor networks," Ad Hoc Networks, vol. 55, pp. 97–106, 2017.
9. N.K. Sehgal, P.C.P. Bhatt, J.M. Acken Additional security considerations for cloud Cloud Computing with Security, Springer (2020), pp. 193-215
10. Yousefpoor MS, Barati H (2019) Dynamic key management algorithms in wireless sensor networks: a survey. ComputCommun 134:52–69

A Study of Perceptions of E-Library Use as Academic Library Services

Ritesh kumar and Arun Modak

Department of Library & Info.Science, Sri Satya Sai University of Technology and Medical Sciences, Sehore
Bhopal-Indore Road, Madhya Pradesh, India

ABSTRACT

By means of the topic approached in the present paper we would like to highlight the crucial role of the university library for a better access to the electronic resources, from the perspective of the new information and communication technologies. In this context, we shall try to identify the factors leading to the need to use electronic resources, we shall analyze the role played by the university library in increasing the efficiency of the access to this type of resources (implicitly, instructing the users), we shall suggest ways of collaboration between academics and librarians etc. From a managerial perspective, we shall analyze a few important aspects that one needs to consider when making the decision of buying or not an electronic resource: selection, type of acquisition, legality, monitoring the usefulness etc.

Keywords: electronic resources, information management, information literacy, university library

INTRODUCTION

Nowadays the dynamics of the library have changed by adding a relational aspect to all its processes. In this way, modern libraries are moving away from focusing on transactional services, while libraries of the past were defined by transactional (issuing and returning of books) services. The first change to happen to the academic library was a change in the way collections were curated and developed. Computer and Internet have played an important role in the development of the library, through which users have become easier to use library resources. Technology has been game changer here and the developments in Information and Communication Technologies (ICT), computing and networking that have paved the way.

By the topic of the present paper we aim to highlight the crucial role of the university library for a better access to the electronic resources, from the perspective of the new information and communication technologies. The value of a library, regardless of its type, consists not just in the richness and diversity of its collections, but also in the professional use of their informational potential, as the mission of any library is to permit the users' rapid and efficient access to information on any kind of support. In the knowledge society, the informative function of the library has become one of the most important, information becoming the main development factor in all the knowledge domains. (1) In the present context, when increasingly important changes are taking place, on the level of education, in general, and especially of higher education, and the need to master information is becoming a more and more stringent demand, an essential role in its evaluation going to the university libraries, which, transforming the traditional services and processes through the adoption of the new information and communication technologies, have turned their main function, of repository of knowledge, into one of transmitter of knowledge via the new means.

E-RESOURCES

An electronic resource, also known as an e-journal, e-book, and online databases in varied digital formats, webpages (.html, .asp, etc.), adobe acrobat documents (.pdf), etc. Eresource is a book publication made available in digital form, consisting of text, images, or both readable on the flat-panel display of computers or other electronic devices. Users are subscribed to e-resources (e-books, e-journals, and databases, etc.) by the higher educational institution to provide current information within the stipulated time. Most major publishers prefer to publish e-editions before the print edition arrives. In the case of journals, the e-edition is published one month before the publisher of the print edition. The abundance of URLs and web sites on library portals and library sites makes it difficult for information professionals to manage them. Currently, many different access models are being offered by publishers for e-resources.

E-Databases

1. EMBASE
2. Web of Science
3. Science Direct
4. Wikipedia

5. Springer Link
6. J-Gate
7. Capital Line
8. EBSCO
9. Info Track
10. SCOPUS
11. UpToDate
12. Clinical Key
13. Jaypee Digital
14. DOAJ
15. Nature
16. Mathscinet, etc.

E-resources mainly include e-books, e-journals, e-reference works, scholarly databases, online e-book libraries, valueadded information portals, etc. (Fig. 1).

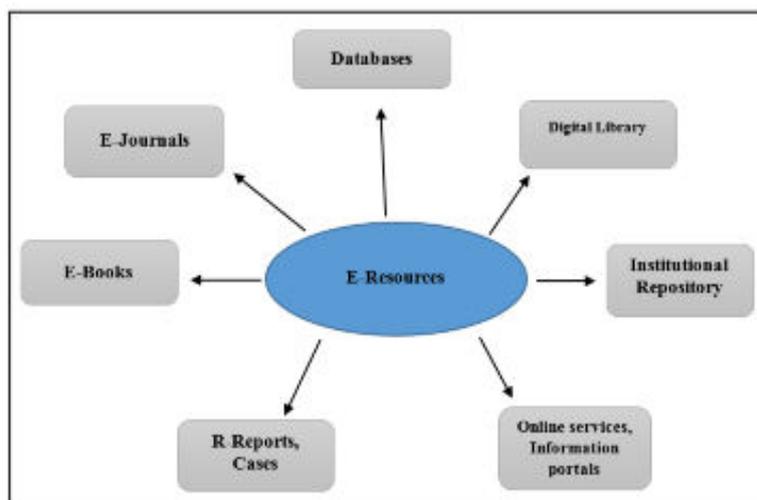


Fig. 1: E-Resources and Services

Type of E-Resources: E-resources are basically divided into two parts:

1. Online electronic resources: E-books, E-journal, ENewspaper, E-Magazines, E-Image Collection, EThesis, E-Clipping, Online databases, etc.
2. Other electronic resources: CD ROM, Diskettes, Other portable computer databases, etc.

Access to E-Resources

- 1- IP (Internet Protocol) Based Access to E-resources: When subscribing to e-resources through internet protocol, you can access e-resources on all computers, iPad, etc., connected on that internet protocol.
- 2- Remote access to E-resources: When you are out off campus, whether at home or abroad, you can access library e-resources (electronic journals, e-books, databases, etc.) through remote access from a computer.
- 3- Mobile access to E-resources: Many library resource providers, such as UpToDate, EBSCO, Westlaw, Clinical Key, Science Direct, Ref Works, etc. have mobile apps or mobile sites that can provide more wired users

Selections of E-Resources: In the present times, e-resources are getting expanded day by day, due to which academic libraries are moving towards the use of e-resources in which e-journals are the main ones. While selecting e-resources, care should be taken that the selection is made according to the need and demands of the users. As a librarian, the following considerations should be taken into consideration when choosing e-resources.

1. To get information about the content and scope of resources.
2. To find out the need of users.
3. Checking the quality of e-resources and search facilities.
4. To evaluate educational support and training.
5. Technical and compatibility testing check.
6. Subscription based or web checking at the time of purchase.
7. Maintaining cost-effectiveness.
8. Verify the license copy.

Factors Influencing the Use of the Electronic Resources in the Library

Electronic resources represent the logistic support needed to provide electronic services, which are offered via the communicational technologies. The advantages coming from the provision of these services are intrinsically related to the rapid access to information, by the elimination of the barriers related to space and time. The electronic services that can be provided by a university library are: access to online catalogues, access to online databases, e-mail reference services, Internet access, etc. The role played by the university library in an increased efficiency of the access to this type of resources is a very important one. Yet, we also need to have in view the influence of certain factors that lead to the efficient use of the electronic resources: technology, costs, management, training, content, and information support. As far as the technology is concerned, the Internet connection needs to be a very good one, as the electronic resources require easy accessing (rented line, satellite connection, Wireless connection, sufficient digital bandwidth). This can only be achieved through investments in the infrastructure and technology. Often, these aspects mentioned above are ignored and, in this situation, the people responsible need to be informed of the need of such investments. The hardware equipments (computers, printers, scanners, etc.) need to be updated, the recommendation being 1 computer for every 10 students. So, the costs involve infrastructure investments: network, hardware, software; maintenance expenses: repairs, supplies, replacements, updates; subscriptions to online databases; personnel salary expenses (keeping technical personnel often means paying more), training for personnel and users (computer literacy, information literacy, library literacy). All these expenses need to be foreseen in the budget in order not to be faced with the unpleasant situation of lacking the necessary funds. For example, when we think about buying a computer, we need to be aware that it has a purchase price, to which repairs and updates should be added. At the same time, computers should be replaced for good every five years. The management problems refer to the selection and purchase procedure for electronic resources, to the legal implications and the organization of the information. At present, diverse ways of access for electronic resources are available, so the situation is no longer as simple as in the case of traditional documents, as there are different editors and aggregators. The access may be full text (online or when the document is delivered) or through annual subscription, on mention that the subscription needs to be re-evaluated each year. The legal implications refer to copyright and license aspects limiting the access. In this sense, we have in view that there are users who have no copyright and so we need to consider a way of access, and also the fact that some editors forbid the download of the whole paper. As far as the organization of the information is concerned, first of all we need to know what is available on the information market and what is relevant for our information needs. The existence of user guides for the information would be a plus point able to convince us to buy the respective resource; just as important is the way of maintaining the access, if we decide to no longer buy the respective resource (archiving). The statistics of the use of the electronic resources can provide important information for a good management, in the sense that we can appreciate what is more convenient to buy or if an inter-library loan or the buying of distinct papers would be more economical.

Impact of E-Resources on Library and Information Services: At the present time, Information Technology (IT) has undergone rapid changes in the field of education. Traditional teaching and learning is moving towards online. The development of electronic resources is providing many benefits not only to libraries but also to writers, editors, users, publishers and collectors. As the use of electronic resources increased, so did the concept of digital library, virtual library and electronic library. Electronic services have changed the process of information handling with the help of Information and Communication Technologies (ICT). The required information can be used easily and immediately by using e-service facilities. This is to enable libraries in its scope so that the user can access the information required for knowledge enhancement and provides a special opportunity.

The Role of the University Library in Providing Solutions

For a long time, it has been considered, even in the academic environment, that the Internet shall replace the library, and that it will no longer be necessary to spend important sums of money to buy information resources. This opinion has not been confirmed during the last few years, as it has been demonstrated that not all the information accessible on the Internet is free and pertinent and that the users need to possess certain abilities related to the information literacy in order to be able to master the information and to use it efficiently. The idea of information literacy has in view (3):

IT habits, which refer to knowledge and abilities allowing an individual to find his way in the search systems of the databases and to be able to receive a search result. At the same time, they refer to the knowledge and the use of a calculation system;

library use habits in the sense of abilities of efficiently finding the information via the tools provided by the library: classical catalogues, online catalogues, databases, web sources etc. ;

information habits. This concept is equated, more often than not, to information literacy. It mainly relies on the intellectual process of the use of information. Yet, the habits in this sense are not applicable only in the library; they are rather oriented towards the information than towards the library. The most representative taxonomy of the information-related habits is the so-called "Big 6 Skills" (4): Defining the problem (determining the nature of the problem); Research strategies (determining the types of sources and strategies for finding information); Locating and accessing the information (finding the sources and detecting the necessary information); Using the information; Synthesizing it (structuring, integrating the information to better meet the information needs); Evaluating it. For instance, the use of the electronic sources available on the Internet is not at all risk-free. The responsible use of the new information environments requires the possession of adequate tools and knowledge for the users to be able to select and filter the information.

The university library is the department assisting the educational and research activity on the university level, yet a series of technological problems cannot be covered by the library, but only in collaboration with the Information Technology Department. The access to Internet and to computers is essential and the number of computers and peripherals needs to be sufficient. The facilities have to do with the computer use schedule, which needs to allow plentiful access. Concerning the authentication, it is necessary to restrict the access to certain materials by using passwords, and to preserve the bandwidth. In case of bandwidth limitations, preserving the bandwidth is necessary to obtain good performances and to have efficient costs (reduce the random search techniques by taking information search courses, reduce file dimensions, not share too many files, download files at night).

Advantages of E-Resources

The use of electronic resources in academic libraries is constantly increasing, which is generally accepted due to readability, accessibility, and affordability. The advantages of e-resources are:

1. The library saves storage space.
2. Eliminates binding, printing and postage costs.
3. Saves time by providing easy and quick access without wasting time.
4. Can be used from anywhere anytime with the help of remote access.
5. The cost of publishing and distribution is less than the cost of print editions.
6. Can provide multi access on a network product.
7. Electronic resources are readily available in remote areas.

CONCLUSION

According to Dr. S.R. Ranganathan, in his fifth law- Library is a growing organism. Digital technology has made this law very easy. Digital technology has contributed significantly to the development of libraries, making it easy for users to access the library. Digital information sources are being made by digitalizing print sources. The access to electronic resources costs, it is a complex process, and the library plays an essential role in their implementation and use. Yet, in this sense, the library needs funds, specialized personnel and the support of the tutelary authority in order to accomplish its role of informational mediator in the knowledge society.

REFERENCES

1. Sreekumar M.G, Strategies on e-resources management for smart information system. *Ann Libr Inf Stud* 2012; 59.
2. Mogens V. Blog Newsletter, Modern libraries libraries: Moving from a transactional to a relational library.
3. Kumar D. Effective usage of e-resources.
4. Kenchakkanavar AY. (2014), Type of e-resources and its utilities in library, *International Journal of Information sources and services*, 2014;1(2).
5. Sharma C, Use and impact of E-Resources at Guru Gobind Singh Indraprastha University (India): A case Study. *Electronic J Acad Spec* 2009;10(1).
6. Anasane MB, The impact of electronic library services on libraries. *Int J Adv Res* (1)
7. Alexandria Manifesto on Libraries, the Information Society in Action. [Online] [Accessed: 09.12.2013]. Available at: <http://www.ifla.org/publications/alexandriamanifesto-on-libraries-the-information-society-in-action>
8. The access to scientific journals from Latin America.
9. BRUCE, Christine. *The seven faces of Information Literacy*. Adelaide Auslib Press, 1997, p. 21
10. The Big Six Skills. [Online] [Accessed: 09.12.2013]. Available at: [http:// www. crlsresearchguide. org/Big_Six_Steps.asp](http://www.crlsresearchguide.org/Big_Six_Steps.asp)
11. The complexity of a web portal offers a strong presence and a better positioning on the Internet.
12. EISENBERG, M. B.; LOWE, C. A. & SPITZER. K. L. *Information Literacy: Essential Skills for the Information Age*. 2nd ed. Westport, CT: Libraries Unlimited, 2004, passim. *Computer Sci*, 2012; 3(3).

Cancer Prediction Using Asom Based Datamining Technique

Prasad Bobbillapati¹, Narendra Sharma² and Laxmaiah Mettu³

^{1,2}Department of Computer Science and Engineering, Sri Satya Sai University of Technology and Medical Sciences, Sehore Bhopal-Indore Road, Madhya Pradesh, India

³Department of Computer Science and Engineering, CMR Engineering College, Kandlakoya (V), Medchal, Hyderabad

ABSTRACT

Cancer is the main source of death for the both men and women. The early detection of cancer can be useful in relieving the disease totally. So the requirement of techniques to distinguish the event of cancer nodule in beginning phase is expanding. Lung cancer research is quite possibly the most disturbing zone of interest in medical field. The early analyze of cancer can help in expanding the death rate of humans. Lung cancer is usually an infection which happens due to the element connected with unhampered cell or advantageously progress in zones present in lung region it is important for the much more extensive arrangement of diseases upsetting tuberculosis, Silicosis and Interstitial Lung Disease (ILD), which are totally known as diffuse parenchymal lung disease

INTRODUCTION

Medical Databases today can go in size into a huge number of terabytes. Inside these masses of data lies covered up data of strategic significance. Because of these huge measures of data, it at that point makes one wonder, "How would you make significant determinations about this data?" Data mining addresses this inquiry.

Albeit computational, the utility of data mining calculations can be utilized as a subjective device to investigate quantitative data, especially the enormous, complex databases being made by the wellbeing informatics local area, Young (2012). Lloyd-Williams (2013), Data put away in medical clinic stockrooms range from quantitative to simple to subjective data; anyway very much organized, these data hide certain examples of data which can't promptly be identified by ordinary examination techniques. The arrangements data distribution centers likewise differ and adding up to data blast inside the medical care field. The issue nonetheless, is tracking down the privilege methodological devices to mine this new data given its tremendous assortment, size and intricacy.

Data mining is the investigation of enormous datasets to separate covered up and already obscure examples, connections and information that are hard to identify with customary factual strategies. Data mining is quickly developing fruitful in a wide scope of uses like examination of natural mixtures, monetary determining, medical care and climate estimating. Data mining in medical services is an arising field of high significance for giving forecast and a more profound comprehension of medical data.

Data mining applications in medical care incorporate examination of medical services communities for better wellbeing strategy making and avoidance of clinic blunders, early detection, counteraction of diseases and preventable clinic deaths, more incentive for cash and cost reserve funds, and detection of false protection claims. Specialists are utilizing data mining techniques in the finding of a few diseases like diabetes, stroke, cancer, and heart disease. Heart disease is the main source of death on the planet in the course of recent years. The European Public Health Alliance announced that heart attacks, strokes and other circulatory diseases represent 41%, all things considered.

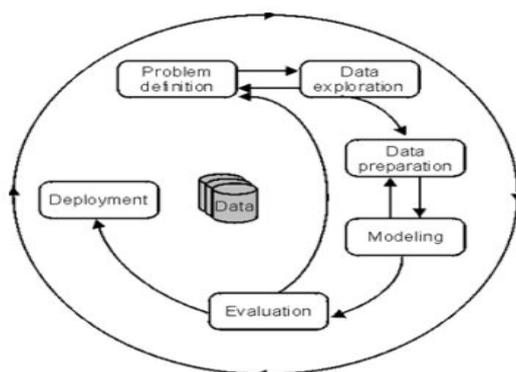


Fig 1: Data Mining Process

LITERATURE REVIEW

Ritu Chauhan et al centers around clustering calculation like HAC and K-Means in which, HAC is applied on K-intends to decide the quantity of groups. The nature of group is improved, if HAC is applied on K-implies.

Dechang Chen et al calculation EACCD created which a two stage clustering method. In the initial step, a disparity measure is learnt by utilizing PAM, and in the subsequent advance, the learnt difference is utilized with a progressive clustering calculation to get bunches of patients. These groups of patients structure a premise of a prognostic framework.

Ada et al made an endeavor to identify the lung tumors from the cancer pictures and steady instrument is created to check the ordinary and unusual lungs and to anticipate endurance rate and long periods of a strange patient with the goal that cancer patients' lives can be saved.

S M Halawani et al proposes that probabilistic clustering calculations performed well than various leveled clustering calculations in which practically all data focuses were bunched into one group, might be because of wrong decision of distance measure.

V.Krishnaiah et al built up a model lung cancer disease forecast framework utilizing data mining order techniques. The best model to foresee patients with Lung cancer disease has all the earmarks of being Naïve Bayes observed by the IF-THEN standard, Decision Trees and Neural Network. For Diagnosis of Lung Cancer Disease Naïve Bayes notices preferred outcomes and fared better over Decision Trees.

PROPOSED SYSYTEM

The analysis process of Cancer forecast framework adequacy are 2ly: one is cancer expectation framework and two is investigation of cancer forecast framework. Data mining made cancer expectation framework is utilized to gauge the lung cancer.

PREPROCESSING

The input data are given into the pre-preparing stage for data cleaning to eliminate the commotion and superfluous data. Data pre-preparing burned-through the greatest bit of this examination. In this stage, every data are checked and put away from these pre-handled data to extricate appropriate data.

Investigational Result	Gold Standard	
	Positive	Negative
Positive	True Positive	False Positive
Negative	False Negative	True Negative

Table 1: Confirmation Test

LUNG CANCER

Lung cancer is the uncontrolled development of peculiar cells that begins in one or the two lungs; consistently in the cells that line the air sections. The unusual cells don't venture into solid lung tissue; they partition rapidly and structure tumors. Two sorts of lung cancer are SCLC and NSCLC. SCLC represents Small Cell Lung Cancers NSCLC represents Non-Small Cell Lung Cancers Risk factors for lung cancer Smokings, aloof smoking, openness to asbestos fibers, openness to radon gas, familial inclination are remembered for hazard factors for lung cancer.

- Lung cancer symptoms:
- The following are the generic lung cancer symptoms.
- A cough that does not go away and gets worse over time
- Coughing up blood (heamoptysis) or bloody mucus.
- Chest, shoulder, or back pain that doesn't go away and often is made worse by deep Hoarseness
- Weight loss and loss of appetite

- Wheezing
- Increase in volume of sputum
- Fatigue and weakness
- Repeated problems with pneumonia or bronchitis
- Repeated respiratory infections, such as bronchitis or pneumonia
- Fatigue and weakness Shortness of breath
- New onset of wheezing
- Swelling of the neck and face
- **Age at Diagnosis:** Numeric age of the patient at the time of diagnosis for lung cancer.
- **Birth place:** The place of birth of the patient.
- **Cancer Grade:** A descriptor of how the cancer cells appear and how fast they may grow and spread.
- **Diagnostic Confirmation:** The best method used to confirm the presence of lung cancer.
- **Extension of Tumor:** The farthest documented extension of tumor away from the lung, either by contiguous extension (regional growth) or distant metastases (cancer spreading to other organs far from primary site through bloodstream or lymphatic system).
- **Node involvement:** The most noteworthy explicit lymph hub chain that is included by the tumor. Cancer cells can spread to lymph hubs close to the lung, which are important for the lymphatic framework (the framework that produces, stores, and conveys the contamination battling cells. This can frequently prompt metastases.
- **Surgery Performed:** The surgical procedure that removes and/or destroys cancerous tissue of the lung, performed as part of the initial work-up or first course of therapy.
- **Reason for No Surgery:** The reason why surgery was not performed (if not).
- **Radiation Therapy:** The order in which surgery and radiation therapies were administered for those patients who had both surgery and radiation.
- **Scope of Regional Lymph Node Surgery:** It describes the removal, biopsy, or aspiration of regional lymph node(s) at the time of surgery of the primary site or during a separate surgical event.
- **Stage of Cancer:** A descriptor of the extent the cancer has spread, taking into account the size of the tumor, depth of penetration, metastasis, etc.
- **Past Tumors:** An integer denoting the number of malignant tumors in the patient's lifetime so far.
- **Total Regional Lymph Nodes Examined:** An integer denoting the total number of regional lymph nodes that were removed and examined by the pathologist.

ASOM

The Advanced self-organizing map (ASOM) is an excellent tool in exploratory period of the data mining. It projects input space on models of a low-dimensional customary network that can be successfully used to envision and investigate properties of the data. At the point when number of ASOM units is enormous, to encourage quantitative investigation of the map and the data, comparable units should be assembled, for example bunched. In this paper, we investigate various ways to deal with clustering of the ASOM are thought of. The two-stage strategy first utilizing ASOM to deliver the proto kinds then that are bunched in the subsequent stage, that is found to perform well when contrasted and direct clustering of the data and to decrease the calculation time.handle commotion, huge dataset and huge info spaces. The fundamental thought of SVM can be depicted as follows: I) Initially, the sources of info are detailed as highlight vectors. ii) Then, by utilizing the part work, these component vectors are mapped into highlight space. iii) Finally, a division is processed in the element space to separate the classes of preparing vectors.

ASOM as a Data Mining Tool

The self-organizing maps (ASOM) presented by Teuvo Kohonen] are considered as being profoundly successful as a representation tool for imagining high dimensional, complex data with intrinsic connections between the different highlights involving the data. The ASOM's yield underscores the remarkable highlights of the data and hence prompts the programmed development of bunches of comparable data things. We contend that this specific attribute of ASOMs alone qualifies them as a possible possibility for data mining undertakings that include order and clustering of data things.

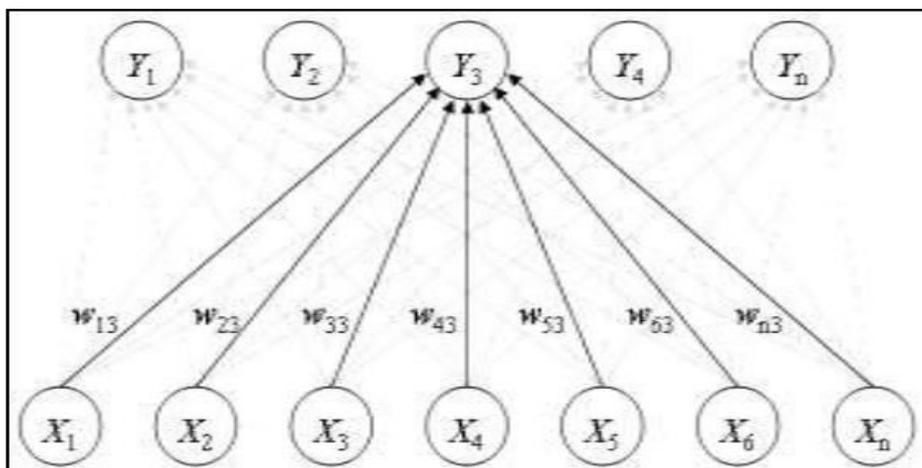


Fig 2: Example of ASOM

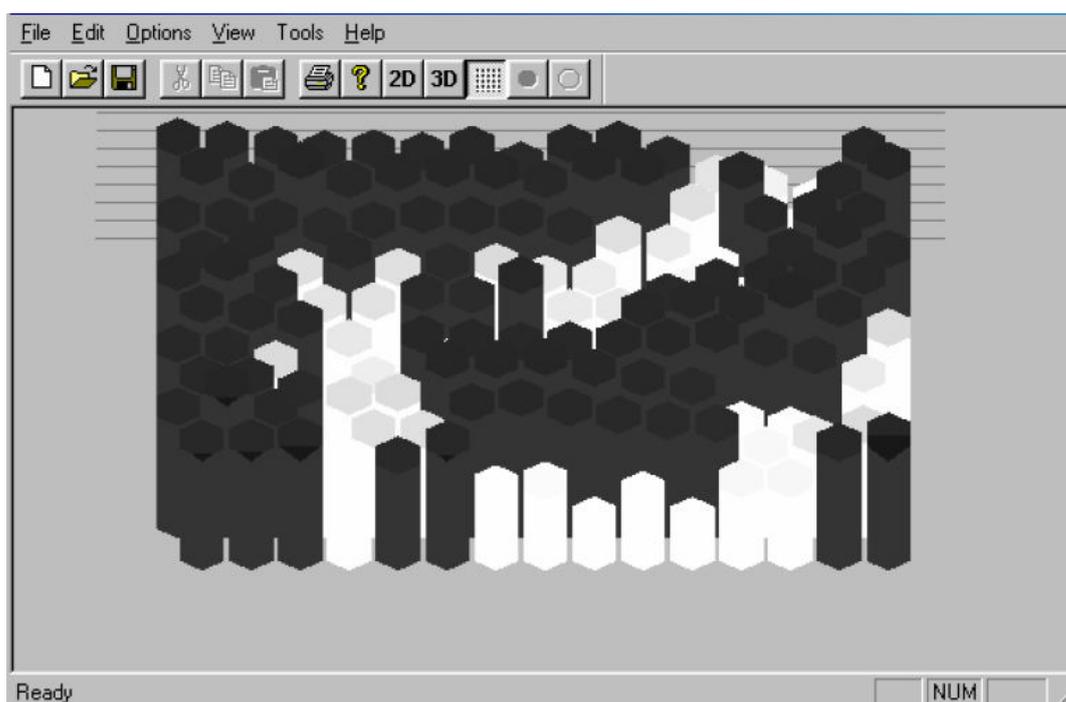


Fig2: A U-matrix representation of the ASOM

ASOM as Data Visualization and Reduction

ASOM can be utilized as a significant representation help as it gives a total image of the data. Comparative data things are consequently gathered. Notwithstanding, for useful objects is as yet wanted to the yield layer of the ASOM into noticeably particular groups of comparable data things. Generally, this is an adhoc exercise and specialists will in general draw limits partitioning 'unmistakable' bunches. We disagree with this impromptu practice and propose the utilization of the U-Matrix method for drawing formal limits between various groups. The U-Matrix method that utilizes the distances between the units in an ASOM as a limit characterizing rules. These distances would then be able to be shown as statures giving a U-grid scene. Understanding of the U-lattice is follows, elevations or the high puts on the U-framework will encode data that they are disparate, while the data falling in similar valleys will address input vectors that are comparable. Hence, data inside a similar valley would then be able to be assembled to address a group.

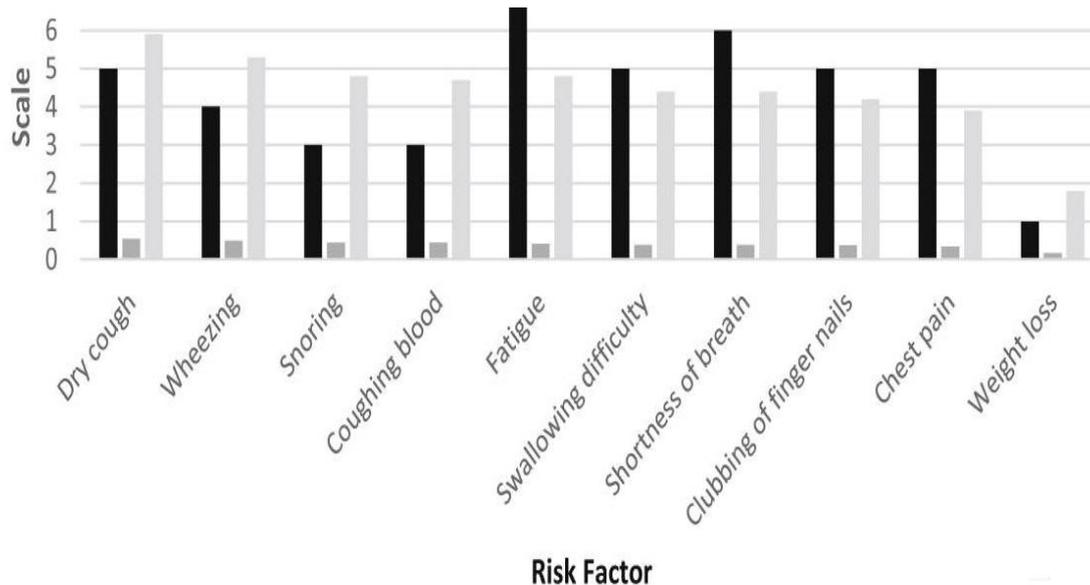


Fig 3: Occurrence through ASOM

CONCLUSION

A model lung cancer disease forecast framework is created utilizing data mining arrangement techniques. The framework extricates concealed information from a recorded lung cancer disease database. The ASOM is an excellent tool in exploratory period of data mining. It projects input space on models of a low-dimensional ordinary network that can be successfully used to envision and investigate properties of the data. At the point when the quantity of ASOM units is enormous, to encourage quantitative examination of the map and the data, comparative units should be assembled.

The two-stage methodology first utilizing ASOM to create the models that are then bunched in the subsequent stage-is found to perform well when contrasted and direct clustering of the data and to lessen the calculation time. Sometimes even in the high level Lung cancer patients doesn't show the manifestations related with the Lung cancer Prevalence of Lung cancer disease is high in India, particularly in provincial India, didn't get seen at the beginning phase, on account of the absence of mindfulness. The accentuation of this work is to discover the objective gathering of individuals who needs further evaluating for Lung cancer disease, with the goal that the pervasiveness and death rate could be cut down. Lung cancer expectation framework can be additionally upgraded and extended.

REFERANCES

1. Fatma Taher, "Rule Based Classification of Sputum Datas for Early Lung Cancer Detection", In Proceedings of IEEE International Conference on Electrical, circuit and Systems (ICECS), pp. 29-32, 2015.
2. Summrina Kanwal Wajid, "Lung Cancer Detection using Local Energybased Shape Histogram (LESH) Feature Extraction and Cognitive Machine Learning Technique", In Proceedings of IEEE 15 International Conference on Cognitive Information & Cognitive computing, pp. 359- 366, 2016.
3. Fatma Taher, "A Thresholding Approach For Detection Of Sputum Cell For Lung Cancer Early Diagnosis", In Proceedings of IEEE Conference on Data Processing, pp. 1-6, 2012.
4. R.Thriumani, "A Preliminary Study on In-Vitro Lung Cancer Detection using E-nose Technology", In Proceeding of IEEE International conference on Control System, Computing and Engineering (ICCSCE), pp. 601-605, 2014.
5. Jan Ehrhardt, "Statistical Modeling of 4D Respiratory Lung Motion Using Diffeomorphic Data Registration", In Proceeding of IEEE Transaction on Medical Imaging, pp. 251-265, Vol. 30, No. 2, 2011.
6. Hasseeb Azzawi, "Lung cancer prediction from microarray data by gene expression programming", In Proceedings of IET Syatems Biology in Engineering and technology, pp. 168-178, 2016.
7. Niloofar Arshadi, "Data Mining for Case-Based Reasoning in HighDimensional Biological Domains", In Proceedings of IEEE Transaction on Knowledge and Data Engineering, Vol. 17, No. 8, pp. 1127-1137, Aug 2005.

8. Dechang Chen, "A Clustering Approach in Developing Prognostic Systems of Cancer Patients", In Proceedings of IEEE Seventh International Conference on Machine Learning and Application, 723- 728.
9. Lee, I.-N., S.-C. Liao, M. Embrechts,"Datamining techniques applied to medical information", Med. inform, 2000. [3] Obenshain, M.K., "Application of Data Mining Techniques to Healthcare Data", Infection Control and Hospital Epidemiology, 2004. [4] Sandhya, J., et al., "Classification of Neurodegenerative Disorders Based on Major Risk Factors Employing Machine Learning Techniques", International Journal of Engineering and Technology, 2010. Vol. 2, No. 4. K.Rama Lakshmi and S.Prem Kumar (2013) Utilization of Data mining Techniques for Prediction and Diagnosis of Major Life Threatening Diseases Survivability Review International Journal of Scientific & Engineering Research, Vol 4, Issue 6.
10. Juliet R.Rajan, Jefrin J Prakash Early Diagnosis of Lung Cancer using a Mining System IJETTCS.
11. E.Barati, M.Saraee, A.Mohammadi, N.Adibi and M.R.Ahamadzadeh (2011) A Survwy on Utilization of Data mining Approaches for Dermatological (Skin) Diseases Prediction Cyber Journals: Multidisciplinary Journals in Science and Technology, Journal of Selected Areas in Health Informatics.
12. Charalampos Mavroforakis Data mining with WEKA a use-case to help you gets started.
13. Jiawei Han and Micheline Kamber Data mining Concepts and Techniques, Second Edition.
14. V.Kroshnaiah, Dr.G.Narsimha, Dr.N.Subhash Chandra (2013) Diagnosis of Lung Cancer Prediction System Using Data mining Classification Techniques International Journal Of Computer Science And Information Technologies, Vol 4(1), 39-45.
15. L. A. Gloeckler Ries, M. E. Reichman, D. R. Lewis, B. F. Hankey, and B. K. Edwards, "Cancer Survival and Incidence from the Surveillance, Epidemiology, and End Results (SEER) Program," Oncologist, vol. 8, no. 6, pp. 541–552.
16. A. Agrawal, S. Misra, R. Narayanan, L. Polepeddi, and A. Choudhary, "A lung cancer outcome calculator using ensemble data mining on seer data," in Proceedings of the Tenth International Workshop on Data Mining in Bioinformatics, ser. BIODDD '11, 2011, pp. 5:1–5:9.
17. R. Agrawal, T. Imielinski, and A. Swami, "Mining asso- ´ ciation rules between sets of items in large databases," in Proceedings of the 1993 ACM SIGMOD international conference on Management of data, ser. SIGMOD '93, 1993.
18. M. Hall, E. Frank, G. Holmes, B. Pfahringer, P. Reutemann, and I. H. Witten, "The weka data mining software: An update," SIGKDD Explorations, vol. 11, no. 1

A Study of Efficient Algorithm of Artificial Intelligence Used Towards Smart Machine Tools

Snehasis Dey*¹, Prabodh Khampariya² and Manish Jain³

^{1,2}Department of Electronic and Communication Engineering, Sri SatyaSai University of Technology and Medical Sciences, Sehore Bhopal-Indore Road, Madhya Pradesh, India

³Department of Electronic and Communication Engineering, Mandsaur University, Mandsaur, Madhya Pradesh, India

ABSTRACT

This paper offers a review of the artificial intelligence (AI) algorithms and applications presently being used for smart machine tools. These AI methods can be classified as learning algorithms (deep, meta-, unsupervised, supervised, and reinforcement learning) for diagnosis and detection of faults in mechanical components and AI technique applications in smart machine tools including intelligent manufacturing, cyber-physical systems, mechanical components prognosis, and smart sensors. A diagram of the architecture of AI schemes used for smart machine tools has been included. The respective strengths and weaknesses of the methods, as well as the challenges and future trends in AI schemes discussed. In the future, we will propose several AI approaches to tackle mechanical components as well as addressing different AI algorithms to deal with smart machine tools and the acquisition of accurate results.

Keywords: Artificial Intelligence; Smart Machine Tools; Learning Algorithms; Intelligent Manufacturing; Fault diagnosis and prognosis

INTRODUCTION

We believe that a new epoch of the “Industrial Internet of Things (IIoT) plus artificial intelligence (AI)”, characterized by big machinery data, data-driven techniques, ubiquitous networks, mass innovation, automatic intelligence, cross-border integration, and shared services, has arrived [1–3]. The fast development and combination of new AI and energy technologies, for materials, bioscience, the Internet, and new-generation information exchange, is a fundamental part of this new epoch. This will, in-turn, permit game-changing transformation of models, ecosystems, and means in the light of their application to national security, well-being, and the economy. The main objective is a review and summary of recent achievement in databased techniques, especially for complicated industrial applications, offering reference for further study from both an academic and practical point of view.

Yin et al. [1] describes a brief evolutionary overview of databased techniques over the last two decades. Recent development of modern industrial applications presented mainly from the perspectives of monitoring and control. Their methodology, based on process measurements and model–data integrated techniques, will be introduced in the next study. Jeschke et al. [2] developed the core system science needed to enable the development of complex IIoT/manufacturing cyber-physical systems (CPS). Moreover, readers can learn the current state of IIoT and the concept of cyber manufacturing from this book. In 2014, Lund et al. [3] described the central issues contributing to, and characterizing, the worldwide and regional growth of the IoT. Besides, researchers can utilize the trend analysis of IoT their region markets in the future.

There are many AI algorithms for machine health monitoring and other machine tool applications: The second-order recurrent neural networks (RNN) method for the learning and extraction of finite state automata [4], the continuous time RNN approach to dynamical systems [5], the RNN scheme for long short-term memory (LSTM) [6,7], The echo state network (ESN) approach to RNN training [8], the RNN algorithm for the learning of precise timing [9], the RNN encoder-decoder for learning phrase representations [10], the gated RNN method for sequence modeling [11], an overview of deep learning (DL) methods [12], the RNN scheme for machine health monitoring [13], machine health monitoring using convolutional bi-directional LSTM networks [14], the convolutional neural networks (CNN) method for handwritten digit recognition [15], the gradient-based learning approach to document recognition, the CNN scheme for object recognition, the CNN algorithm for large-scale hierarchical image databases, the CNN method for house number digit classification, the deep CNN approach to Image net classification, a CNN scheme for a hybrid nn-hmm model for speech recognition, the CNN approach to sentence classification, a deep residual learning algorithm for image recognition, the DL method for imbalanced multimedia data classification, a region-based CNN scheme for real-time object detection, a deep CNN based regression scheme for the estimation of remaining useful life.

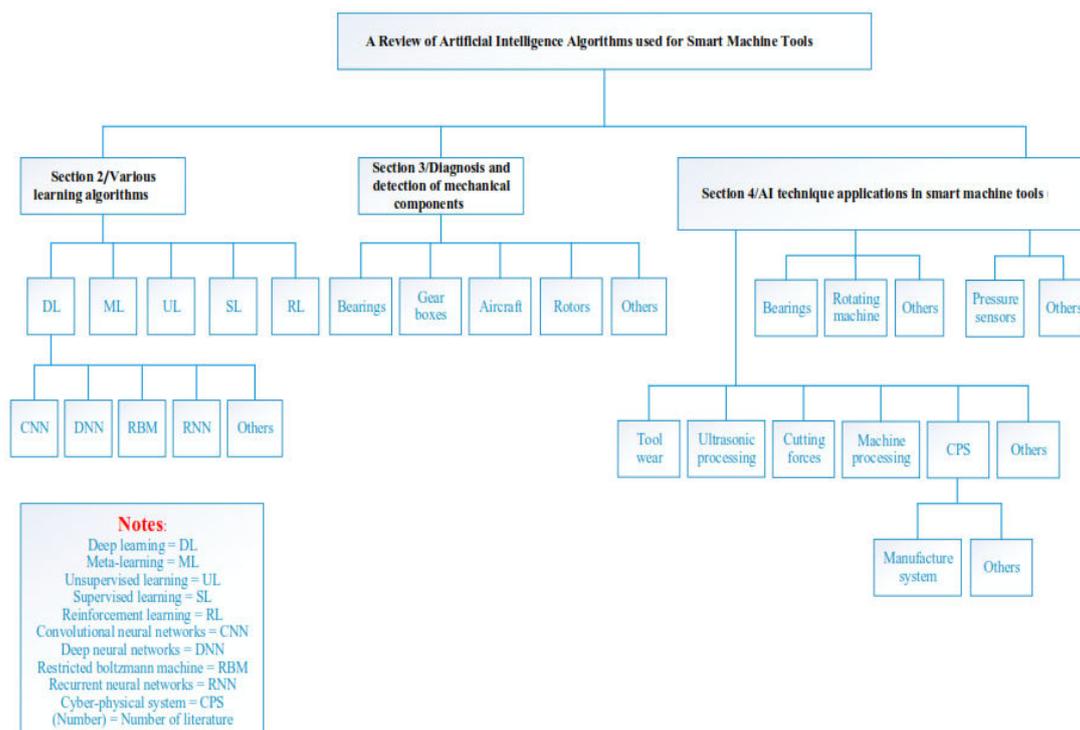


Figure 1: The architecture of artificial intelligence (AI) schemes used for smart machine tools

A deep CNN approach to automated feature extraction in industrial inspection, a CNN method for imbalanced classification, a deep neural networks (DNN) algorithm for natural language processing, a t-stochastic neighbor embedding method (t-SNE) for the visualization of high-dimensional data, a DNN method for acoustic modeling in speech recognition, a DNN approach to deep visualization, a DNN scheme for fault diagnosis, a restricted Boltzmann machine (RBM) method for failure diagnosis, an RBM approach to the regularization of prognosis and health assessment, an RBM scheme for the estimation of remaining useful life, a fast learning algorithm for deep belief nets, a deep multi-layer NNs for deep architecture, a deep Boltzmann machine (DBM) method for three-dimensional (3-D) object recognition, the introduction of a sparse auto-encoder learning algorithm, a review and new perspectives of representative learning methods, the introduction of extreme learning machine (ELM) methods, a deep auto-encoder (AE) approach to anomaly detection and fault disambiguation in large flight data, fault diagnosis using a denoising stacked auto-encoder, a continuous sparse auto-encoder (CSAE) approach to transformer fault diagnosis, a survey of transfer learning methods, the DL approach to tissue-regulated splicing code, the methods and applications of DL algorithms, the introduction of DL methods, a survey of the application of DL to machine health monitoring, an overview of DL approaches, an introduction to the learning of multiple layers of representation.

A denoising AE for the extraction and composition of robust features, a large-scale deep unsupervised learning (UL) scheme for graphics processors and the building of high-level features, unsupervised learning of video representations using LSTM, the introduction of a constructive meta-learning (ML) method, an ML approach to automatic kernel selection, the ML method and search technique used to select parameters, an ML approach to the Bayesian optimization of hyper parameters, a clustering algorithm for new distance-based problems. Taxonomy and empirical analysis in a supervised learning (SL) scheme, a weakly SL algorithm and high-level feature learning for object detection in remotely sensed optical images.

The introduction of an off-policy reinforcement learning (RL) method, a deep RL method for the augmentation of these models to exploit game feature information, a deep RL algorithm for robots to be learned directly from camera inputs in the real world, and the introduction of Q-learning approach. Besides, our motivation is to organize and analyze those literatures and find out the future research of smart machine tools. Giles et al. [4] showed that a recurrent, second-order NN method using a real-time, forward training algorithm readily learned to infer small regular grammar samples from the positive and negative strings used for training. All simulations performed with random initial weight strength and usually converged after about a hundred training epochs. They also discussed a quantization algorithm for dynamically extracting finite state automata during and after training. Some of the extracted automata outperformed the trained NN scheme for the classification of unseen strings.

LITERATURE REVIEW

YuXiuGuo(2021):In order to restore mechanical and electrical equipment, it is critical to perform primary fault diagnosis and removal throughout the repair process. Without previous information, traditional mechanical fault detection modules are unable to extract very sensitive feature characteristics for mechanical fault categorization. The use of data-driven approaches for fault diagnosis is on the rise as smart manufacturing and problem detection techniques based on deep learning make significant strides. In order to cope with intelligent machine tools, a combination of feature selection and an AI algorithm is given in this paper for mechanical defect identification. Feature extraction and feature vector decomposition using Empirical Mode Decomposition (EMD) and deep neural networks (DNN) are used in conjunction in this paper to offer a CNN-based fault identification and classification framework for rotating machinery failure states. It is possible to extract comprehensive fault information by picking the sensitive features from a large number of defective feature characteristics using this combination of EMD, feature selection module, and Convolutional Neural Network (CNN). There is a 99.01 percent accuracy rate with an entropy loss of 0.325% and time complexity of 18 minutes and 31 seconds for the suggested fault identification and classification technique. A comparison of the suggested fault recognition approach to other widely used mainstream models and current state-of-the-art methodologies demonstrates a maximum improvement in accuracy of 12.29%. The proposed technique is resilient in terms of network size reduction, enhancement of mechanical defect identification, and classification accuracy.

JihongChen (2019): There are new potential for the development of intelligent machine tools with the advancement of current information technology and the new generation of artificial intelligence (AI) technologies (IMT). The idea, features, and systemic structure of the IMT are provided in this work, based on the three fundamental paradigms of intelligent manufacturing specified by the Chinese Academy of Engineering. IMT, NCMT, and SMT are considered as three phases in the evolution of machine tools from manual to computer-controlled machines, which are referred to as the "three tiers of machine tool evolution." Also covered in depth are the IMT's four intelligent control principles: self-sensing and connection, learning and modelling, optimization and decision-making, and self-control and implementation. Using the IMT's core characteristic of knowledge acquisition and accumulation through learning, this study introduces novel key enabling technologies such as an instruction-domain-based analytic approach, a theoretical and big-data-based hybrid modelling technique, and a double-code control method. Intelligent numerical control (INC) systems and industrial IMT prototypes are created on the basis of this study. To show that the integration of new AI technology with modern manufacturing technology is a practical and convenient technique to develop machine tools towards the IMT, three intelligent practices are carried out.

Chang (2018): This article provides an overview of the AI methods and applications currently employed in smart machine tools. They can be classified as learning algorithms for diagnosis and detection of mechanical component faults and AI technique applications in smart machine tools (intelligent manufacturing, cyber-physical systems and mechanical components prognosis), as well as in AI technique applications in smart sensors (smart machine tools). AI techniques used in smart machine tools are depicted in a diagram. Each AI approach has its own strengths and shortcomings and the problems and future trends in AI schemes are examined. To handle mechanical components and smart machine tools in the future, we'll provide a variety of AI methodologies and algorithms, as well as the acquisition of correct findings.

METHODOLOGY

Bearings play a significant role in all motors and other rotating systems. Many issues arising in motor operations linked to bearing behavior. In many cases, the accuracy of the devices and instruments used to control and monitor the motor system is dependent on the dynamic performance of the motor bearings. This makes fault diagnosis a vital part of the management of all machines containing bearings. Bearing vibration frequency for motor bearing fault diagnosis is discussed. They proposed a method for motor rolling bearing fault diagnosis using time/frequency-domain bearing vibration analysis and NNs. Later, investigated fault diagnosis of rolling element bearings using ANN. The characteristic features of time-domain vibration signals from rotating machinery with normal and defective bearings were used as inputs to ANN consisting of input, hidden, and output layers.

ANN trained using a back propagation algorithm with a subset of experimental data from known machine conditions. The results displayed the effectiveness of ANN for the diagnosis of bearing condition. The proposed procedure needed only a few features extracted from the measured vibration data either directly or with simple preprocessing. The ANN approach to deal with gear and bearing faults in a typical gearbox system and fault conditions in equipment and machine components. A multimodal deep support vector classification (MDSVC)

scheme using separation–fusion, based on a DL method, for fault diagnosis in gearboxes. Because different modalities can describe the same object, multimodal homologous features of the gearbox vibration measurements were first separated in the time, frequency and wavelet modalities.

A Gaussian-Bernoulli deep Boltzmann machine (GDBM) without final output was subsequently used to study the pattern representations for features in each modality. A support vector classifier was then applied to fuse GDBMs in different modalities to establish an MDSVC model. The “deep” representations from “wide” modalities improve fault diagnosis capacity. After that, Chen et al. proposed multiple classifiers on the basis of multi-layer neural networks (MLNN) to implement vibration signals for fault diagnosis in gearboxes. They presented an MLNN-based learning architecture utilizing a deep belief network (MLNNDBN) for gearbox fault diagnosis. ANNs or connectionist systems, which have the ability to integrate multiple sensor information, can function in real-time, have effective knowledge representation and can learn or adapt. A short survey of different ANN structures and learning algorithms was also given, as well as some common applications of NN techniques in fields other than intelligent manufacturing. The most popular back propagation learning procedures, and most important acceleration techniques, the competitive learning approach which has good prospects for future applications, were all highlighted. In addition, they also surveyed the known NN applications and perspectives in intelligent manufacturing. Chang and Chang devised an integrated artificial intelligent (IAI) system for dynamic computer-aided process planning (CAPP). The system, IAI-CAPP, integrates fuzzy logic and ANN to perform dynamic work piece recognition and adaptive-learning tasks as well as process plans. The concept included a pivotal feature for evaluating the suitability of existing process plans for incoming product design, the expert systems (ES) technique was also used. The system combined variant and generative CAPP and was able to generate plans suitable for new work pieces or work pieces that were similar to existing ones.



Figure 2. (Left) Eight ILSVRC-2010 test images and the five labels considered most probable

The system was realized in a computer prototype program. The major aim of the real time analysis of the position of a product on a moving conveyor, the position data was sent to a Selective Compliance Assembly Robot Arm (SCARA) robot controller, which moved the product from the conveyor to a palletizing system. Real time data was acquired by three high resolution cameras. This reduced robot operation time, which was the slowest part of the system. An AI system was developed to reduce the time delay and ANNs were used in a pattern recognition system that has a very short time response. Addressed prognosis, classification and fault diagnosis in rotating machines. The vibration data for classification and fault diagnosis was acquired from Western Reserved University. The signals were processed for feature extraction and selection in a pre-processing stage before the diagnosis and classification model was built. The acoustic emission and vibration signals were used as input signals for fault prognosis. The model can be used as a tool for the diagnosis of failure in rotating machinery. ANNs to study rotating machinery and obtained good results. Li et al. constructed a stochastic defect-propagation model with a lognormal random variable in a deterministic defect-propagation rate model. The resulting stochastic model was calibrated online using recursive least-squares without the need for a priori knowledge of bearing characteristics. An augmented stochastic differential equation vector was

developed with the contemplation of model uncertainties, parameter estimation errors, and diagnostic model inaccuracy.

This scheme was suitable for online monitoring, remaining life prediction, and decision making for optimal maintenance scheduling. Developed a system for progression-based prediction (PPRL) to estimate remaining bearing life. The basic idea was to utilize different anticipation schemes for different bearing running stages using online measurements and then using PPRL through a compound model of neural computation. The process included on-line modeling of the bearing running state via NNs and logic rules. This not only tackled the boundary issue of remaining life but could also automatically adapt to changes in environmental factors. This improved the traditional expectation algorithms of remaining bearing life. Deutsch and He established a deep learning-based method for the estimation of RUL of rotating components using big data.

The proposed scheme was examined and validated utilizing data gathered from a gear exam rig and bearing run-to-failure test results and was compared with existing prognostic and health management (PHM) algorithms. The test results showed the performance of the deep learning-based method to be promising. An ANN scheme using an intelligent capacitive pressure sensor in which a switched-capacitor circuit (SCC) converts changes of capacitance into equivalent voltage. Changes in environmental conditions cause the output from the SCC to become non-linear and this is especially true for changes in ambient temperature, making it necessary to use complex signal processing to acquire the correct readout. Patra and van den Bos found that ANN (FLANN) was a computationally efficient nonlinear network capable of doing the complicated nonlinear mapping needed between the input and output pattern space.

EXPERIMENT RESULT

Nonlinearity was introduced into the FLANN by passing the input pattern through a functional expansion unit. Three different polynomial, Legendre, and power series, have been used in FLANN, which provides computational merit over a multilayer perceptron (MLP) for similar performance in modeling of CPS. The proposed model, based on rough set and neural networks, can provide calibrated response characteristics irrespective of change in the sensor characteristics due to fluctuating ambient temperature. It uses rough set theory and compensates for the nonlinearity in response using neural networks. Later, used fabricated porous silicon based micro-machined Piezo-resistive pressure sensors that were tested between 0 and 1 bar and over a temperature range of 25 to 80 °C. The dependence of pressure sensitivity on the variation of ambient temperature studied, and an intelligent online temperature compensation scheme using ANN delineated.

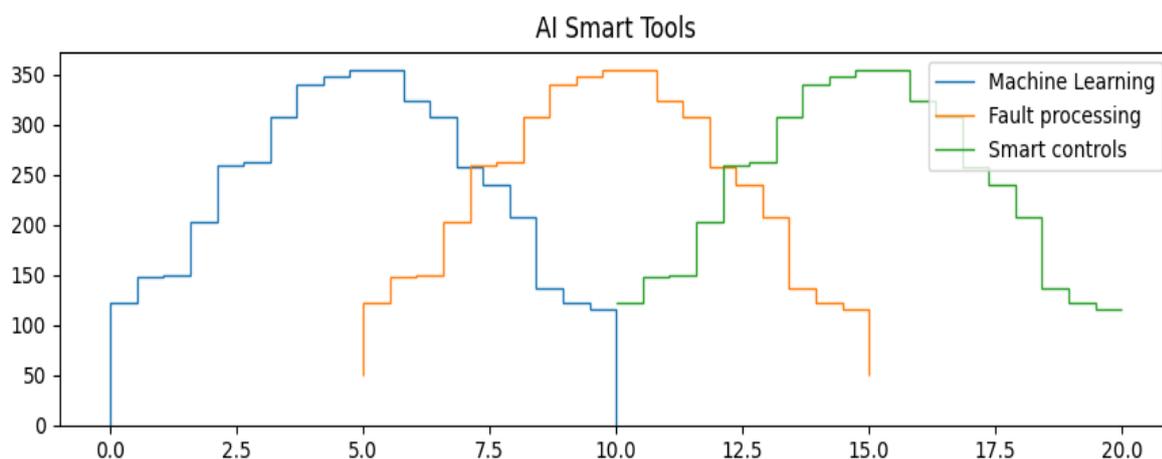


Figure 3 AI smart Tools

The error reduction achieved was a 98% improvement over the uncompensated value. Proved that any finite time trajectory of a given dimensional dynamical system can be approximated by the internal state of the output units of a RNN approach with an output unit, some hidden units, and an appropriate initial condition. They also demonstrated that any continuous curve can be approximated by the output of an RNN method. A novel, efficient, gradient-based method called long short-term memory (LSTM) to solve the complex and artificial long time-lag tasks. The LSTM is local in space and time; its computational complexity per time step and weight is $O(1)$. Their experiments with artificial data involved local, distributed, real-valued, and noisy pattern representations. LSTM had more successful runs, and learns much faster, than real-time recurrent learning, back propagation through time, recurrent cascade correlation, Elman nets, and neural sequence chunking. However, identified a weakness in LSTM networks processing continual input streams that were not a priori segmented

into subsequences with explicitly marked ends where the internal state of the network could be reset. Without resets, the state could grow indefinitely and eventually cause the network to break down. Their remedy was a novel, adaptive “forget gate” that enabled an LSTM cell to learn to reset itself at appropriate times to release internal resources. They also reviewed the illustrative benchmark problems in which standard LSTM outperforms other RNN algorithms. Some different types of RNNs were used to evaluate the tasks of polyphonic music and speech signal modeling.

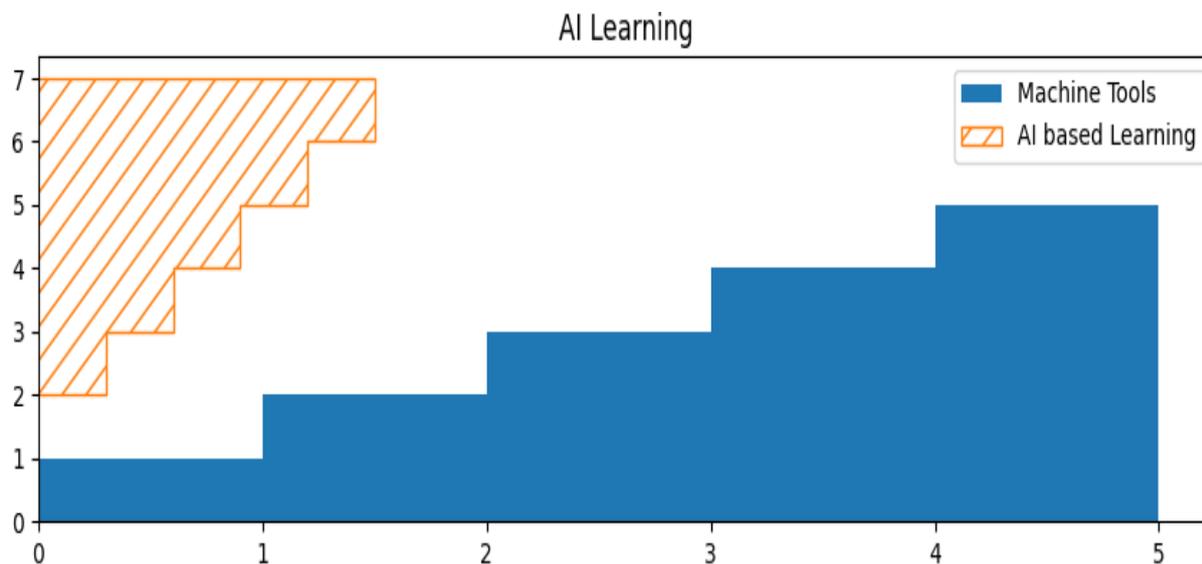


Figure 4 AI Learning

This study revealed that these advanced recurrent units were indeed better than more traditional recurrent units such as tanh units. Recently, the deep ANNs (including recurrent ones) have won numerous contests in pattern recognition and machine learning. This historical survey compactly summarized relevant work, much of it from the previous millennium. The author reviewed the deep supervised learning (also recapitulating the history of back propagation), UL method, RL schemes and evolutionary computation, and indirect search for short programs encoding deep and large networks. After that, with the development of deep learning methods in the last few years, the representation learning from raw data has been redefined. Among DL models, the LSTMs are able to capture long-term dependencies and model sequential data. Thus, the LSTMs were able to work on the sensor data about machine condition. The basic and deep LSTMs were designed to predict the actual tool wear on the basis of raw sensor data. Experimental results show that these models, especially deep LSTMs, could outperform several state-of-the-art baseline schemes.

CONCLUSION

The literature study carried out as the basis of this research revealed that there was a significant trend toward the development of AI algorithms. Moreover, it was quite obvious that many other articles had been directed to accomplish this goal. Most of these displayed the current related issues that are required to be solved before the different mechanical problems could be tackled. This was especially so for complex smart machine tools. In this paper, we have also discussed diverse algorithms for several different mechanical devices. In the near future, we will integrate condition feedback, voice communication and motion, smart manufacture, self-diagnosis and self-detection of smart machine tools into an AI machine tool.

REFERENCES

1. Yin, S.; Li, X.; Gao, H.; Kaynak, O. Data-based techniques focused on modern industry: An overview. *IEEE Trans. Ind. Electron.* 2015, 62, 657–667.
2. YuXiuGuo 2021 "Ensembled mechanical fault recognition system based on deep learning algorithm" Volume 23, pp 1318-1331
3. JihongChen 2019 "Toward Intelligent Machine Tool" Volume 5, Issue 4, August 2019, Pages 679-690" Volume 14
4. ParagParashar 2019 "Analytics-statistics mixed training and its fitness to semisupervised manufacturing"
5. Chang, Chih-Wen & Lee, Hau-Wei & Liu, Chein-Hung. (2018). A Review of Artificial Intelligence Algorithms Used for Smart Machine Tools. *Inventions*. 3. 41. 10.3390/inventions3030041.

6. Jeschke, S.B.C.; Song, H.; Rawat, D.B. *Industrial Internet of Things: Cyber manufacturing Systems*; Springer: Berlin, Germany, 2016.
7. Lund, D.; McGillivray, C.; Turner, V.; Morales, M. *Worldwide and Regional Internet of Things (Iot) 2014–2020 Forecast A Virtuous Circle of Proven Value and Demand*; Technical Report; International Data Corporation (IDC): Framingham, MA, USA, 2014.
8. Giles, C.L.; Miller, C.B.; Chen, D.; Chen, H.H.; Sun, G.Z.; Lee, Y.C. Learning and extracting finite state automata with second-order. *Neural Comput.* 1992, 4, 13. [CrossRef]
9. Funahashi, K.-I.; Nakamura, Y. Approximation of dynamical systems by continuous time recurrent neural networks. *Neural Netw.* 1993, 6, 801–806. [CrossRef]
10. Hochreiter, S.; Schmidhuber, J. Long short-term memory. *Neural Comput.* 1997, 9, 1735–1780. [CrossRef] [PubMed]
11. Gers, F.A.; Schmidhuber, J.; Cummins, F. Learning to forget: Continual prediction with LSTM. *Neural Comput.* 2000, 12, 2451–2471. [CrossRef] [PubMed]
12. Jaeger, H. *Tutorial on Training Recurrent Neural Networks, Covering BPPT, RTRL, EKF and the Echo State Network Approach*; GMD Report; German, National Research Center for Information Technology: St. Augustin, Germany, 2002.

Machine Learning Techniques to Extract the Information from Scientific Articles

Sumanlatha G¹, Pankaj Kawadkar² and Laxmaiah Mettu³

^{1,2}Department of Computer Science and Engineering, Sri Satya Sai University of Technology and Medical Sciences, Sehore Bhopal-Indore Road, Madhya Pradesh, India

³Department of Computer Science and Engineering, CMR Engineering College, Kandlakoya (V), Medchal, Hyderabad

ABSTRACT

The field of information extraction has its beginning in the natural language processing community where the essential impetus came from rivalries fixated on the recognition of named substances like individuals names and association from news stories. As society turned out to be more data-arranged with simple online access to both structured and unstructured data, new utilizations of design extraction came around. Presently, there is interest in converting our own work areas to structured databases, the information in logical distributions to structured records, and outfitting the Internet for structured actuality discovering queries. Subsequently, there are a wide range of networks of analysts acquiring techniques from machine learning, databases, information retrieval, and computational etymology for different parts of the information extraction issue.

INTRODUCTION

Information Extraction alludes to the automatic extraction of structured information like entities, relationships among entities, and properties depicting entities from unstructured sources. This empowers a lot more extravagant types of queries on the bountiful unstructured sources than conceivable with catchphrase look through alone. At the point when structured and unstructured data exist together, information extraction makes it conceivable to incorporate the two kinds of sources and posture queries crossing them. The extraction of construction from uproarious, unstructured sources is a difficult errand that has drawn in a genuine community of specialists for more than twenty years now. With establishes in the Natural Language Processing (NLP) community, the subject of construction extraction presently draws in various networks spreading over machine learning, information retrieval, database, web, and record examination. Early extraction errands were concentrated around the ID of named entities, similar to individuals and friends names and relationships among them from natural language text. The extent of this exploration was firmly affected by two rivalries, the Message Understanding Conference (MUC) and Automatic Content Extraction (ACE) program. The approach of the Internet impressively expanded the degree and variety of utilizations relying upon different types of information extraction. Applications, for example, examination shopping, and other automatic entryway creation applications, lead to a furor of exploration and business movement on the subject. As society turned out to be more data-arranged with simple online access to both structured and unstructured data, new utilizations of construction extraction came around.

Most current IE frameworks apply etymological techniques for text pre-processing and utilize empiric strategies to automatically find morpho-syntactic extraction rules. This consolidated plan produces good outcomes in any event, when the normal blunders at the pre-processing stage force a boundary at the yield precision. It encourages the space compactness however muddles the broad utilization of the IE advancements in different languages than English that absence of powerful natural language processing assets.

LITERATURE REVIEW

The utilization of machine learning (ML) techniques in IE applications is principally centered around the automatic obtaining of the extraction designs. These examples are utilized to extricate the information applicable to a specific assignment from each single archive of a given assortment. Current IE draws near, upheld on regulated ML techniques, are partitioned in the accompanying three classes:

Rule Learning. This methodology depends on an emblematic inductive learning measure. The extraction designs address the preparation models as far as properties and relations between literary components. Some IE frameworks use propositional learning (for example zero request rationale), for example, Auto Slog-TS and CRYSTAL, while others play out a social learning (for example first request rationale), for example WHISK and SRV. This methodology has been utilized to gain from structured, semi-structured and free-text reports. Our strategy is identified with the SRV framework in that it models the IE task as an arrangement issue. Nonetheless, it applies Inductive Logic Programming and uses information about negative models.

Straight Separators. In this methodology the classifiers are learned as scanty organizations of direct capacities (for example straight separators of positive and negative models). It has been ordinarily used to extricate information from semi-structured reports (see for example Snow-IE). It has been applied in issues, for example, connection distinguishing proof and reference parsing, extraction of data from work promotions, and location of an email address change. All in all, the IE frameworks dependent on this methodology present a design upheld on the speculation that taking a gander at the words blends around the fascinating information is sufficient to get familiar with the necessary extraction designs. Their primary benefit is that a profound etymological investigation isn't required; rather grouping techniques are utilized to track down the ideal information.

Our strategy is like every one of these frameworks. It depends on a similar theory. Be that as it may, it is appropriate for extricating more broad and assorted sorts of information. In some degree our examination endeavors to exactly decide the constraints of this methodology when managing a mind boggling area and free messages rather than semi-structured archives.

Factual Learning. This methodology is centered around learning Hidden Markov Models (HMMs) as valuable information to remove applicable parts from archives. For example, presents a strategy for learning model design from data to separate a bunch of fields from semi-structured writings. This technique is like our own in that it thinks about the lexical information of writings.

METHODOLOGY

Automatic proposal of scientific articles comprises on many sub-errands, specifically: data assortment, text processing, data division, highlights extraction, include determination, data portrayal, classifier preparing, applying the classification model, and execution assessment. Beginning with data assortment, we need to oversee gathering the important references from referred to databases, like writing archives or other specific approach to get records. With this data, text pre-processing should eliminate unwanted information that address commotion. Stop words are eliminated and the subsequent words are steamed. Highlight extraction reflects the terms we need to remove from the content. It very well might be identified with the content (catchphrases) or not (creator name, distribution date, and so forth), contingent upon data mining objectives. At this progression, the data is put away as a framework that match the chose highlights with their weighting in the content. The estimation of the weighting can be acquired utilizing measurable strategies, like the recurrence on the archives (supreme or relative).

Data set utilized in tests was fabricated utilizing the looking through queries in every vault remembered for the past Table 1, and formed by 575 perceptions (in the wake of eliminating 24 copied references), and 4 factors (id, Title, Abstract, and Priority). The examined variable is text data, the Abstract, and its unstructured data. Unstructured data has variable length, one perception contains a scientific text, it has variable spelling utilizing solitary and plural types of words, accentuation and other non-alphanumeric characters, and the contents are not predefined to hold fast to a set of qualities, it requires converting it to structured data for additional processing. The pre-processing steps, given by Text Mining techniques, are mindful to make everything lowercase, eliminate accentuation and spaces, extricate words from the data, supplant equivalents, plural and different variations of words with a solitary term, diminish words to their stem, and eliminate regular English stop-words, finally, make the structured data in table arrangement where each word turns into a variable with a numeric incentive for each record.

Repositories	Publication	
	Searched Queries	Papers
Science Direct	"medical image" AND ("high performance computing" OR "parallel computing" OR "parallel programming")[Journals(Computer Science, Engineering)]	320
Engineering Village	(((((medical imag*) WN KY) AND ((high NEAR/0 performance NEAR/0comput*) WNKY))AND((parallel NEAR/0 comput*) WN KY)) AND ((parallel NEAR/0 programm*) WN KY)), Journal article only, English only	18
Web of Science	((("high performance comput*") OR ("parallel comput*") OR ("parallel programm*")) AND ("medical imag*"))	62
IEEE Explore	((((medical imag*) AND ("high performance	58

	comput*" OR "parallel programm*" OR "parallel comput*"))	
ACM Portal	("medical image") and ("high performance computing" or "parallel computing" or "parallel programming") and (Published As: journal) and (Ft Flag: yes) and (Abstract Flag: yes)	18

As an overall classification model, we group the scientific papers utilizing a Naive Bayes classification calculation. As a novel technique we improve over it by stretching out the model to assemble a positioning model over the classification model as demonstrated in Figure 1. This model uses the word list from the prepared model and the as of now classified model utilizing Naive Bayes Classifier. At that point creates a positioning model which can be utilized as a suggestion framework for future inquiries.

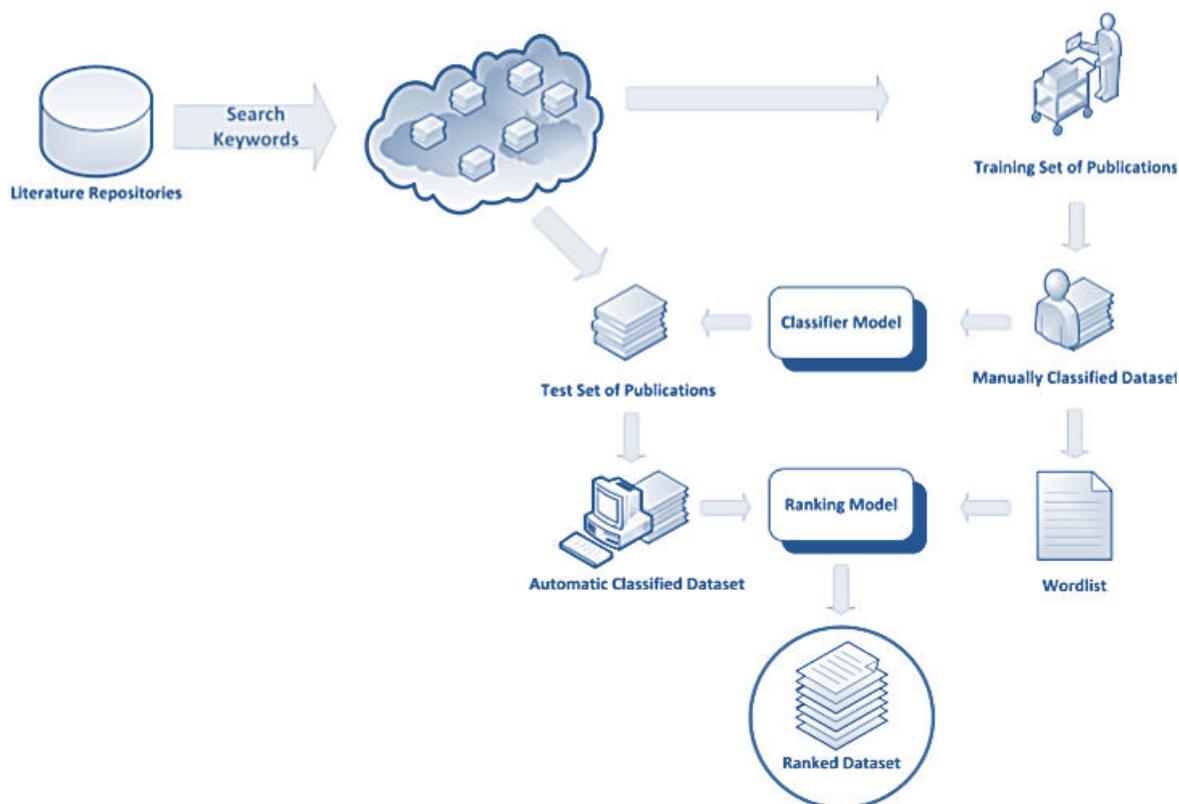


Figure 1: Proposed Architecture

Naive Bayes algorithm isn't viewed as the most exact, in any case is easy to work with and to configure. Utilizing a formerly recovered data set, a human master in a specific space has investigated every single one of the perceptions and classified the need of the references with respect to two fundamental rules: pertinence of the reference and sufficiency to the intrigued scientific area. Its investigation comprised in characterizing the reference into three need classes:

Prio1: References that are very relevant and adequate to the expected search;

Prio2: References that are not so relevant but still adequate;

Prio3: References that somehow interesting to the new research, but not the main source of knowledge.

A Naive Bayes model could at that point, be prepared utilizing the classification given by the master. The classifier Naive Bayes is a managed learning algorithm dependent on the Bayes hypothesis, which has solid autonomy highlights. Naive Bayes can be utilized with different models and assume the part of vectorizer, getting mixture models that best fit in certain classifications.

The interaction of automatic characterizing distributions begins at that point, with a chose set of watchwords that address the specific situation and the region of interest. We make an inquiry in writing databases searching for the references that coordinates with our filtering rules (defined by our deliberate survey convention). This set of references is the primary data set we need to dissect, at that point it's partitioned into two sections: preparing

and test. The preparation set compares to a more modest part of references that will be submitted to the client (master in that area) so it ought to be classified physically. All the while, in view of the main ideas introduced on the examined set, is made a word reference of terms.

RESULTS

A Naive Bayes model is made and learns the classification designs utilized by the area master. At the point when this classifier model is applied to test the reference data set, the outcome is an automatic classified set of references. The significance of the Naive Bayes model made here is to manage the configuration of new models for different study fields. We have utilized K Fold Cross Validation for assessing the exhibition of the classifier. In k crease cross approval now and again considered turn assessment the data set D is arbitrarily part into k totally unrelated subsets the folds D1,D2.....Dk of roughly equivalent size. The inducer is prepared and tried k occasions; each time $t \in \{1,2...k\}$, it is prepared on $D \setminus D_t$ and tried on D_t . The cross approval gauge of accuracy is the general number of right classifications partitioned by the quantity of occurrences in the data set. Officially let $D(i)$ be the test set that incorporates occurrence $x_i = (v_i, y_i)$ at that point the cross-approval gauge of accuracy.

$$acc_{cv} = \frac{1}{n} \sum_{(v_i, y_i) \in D} \delta(I(D \setminus D(i), v_i), y_i)$$

For some techniques for text examination, specifically the supposed "sack of-word" approaches, we made a typical data structure for the content (Document Term Matrix – DTM) [14, 21, 9]. This is a lattice wherein the lines address references and sections address terms. The qualities address how frequently each word happened in each reference. Not all terms are similarly enlightening of the basic semantic designs of writings, and a few terms are fairly futile for this reason. To deliver text statistics, for example, the most widely recognized terms in the content, we utilized the Term Frequency Inverse Document Frequency.

TFIDF, is a numerical statistic that demonstrates how significant a term is to a reference in our assortment. It is regularly utilized as a weighting factor in text mining. The TFIDF esteem expands relatively to the occasions a term shows up in the reference, however is offset by the recurrence of the term in the assortment, which helps control the way that a few terms are by and large more normal than others. Varieties of the TFIDF weighting plan are frequently utilized via web indexes as a focal apparatus in scoring and positioning a reference's significance given a client question. TFIDF was effectively utilized for stop-words filtering and classification. One of the most straightforward positioning capacities is registered by adding the TFIDF for each question term; a lot more modern positioning capacities are variations of this basic model.

$$TFIDF(i) = \frac{\text{Frequency}(i) * N}{df(i)}$$

$$R = (\alpha * \frac{1}{prio}) * (\frac{\text{wordsinwordlist}}{\text{totalwords}})$$

where words in wordlist is the recurrence of words altogether records, and absolute words are the quantity of words in the assortment. Here, we apply the word reference based approach and make a positioning instrument to acquire an importance score (R) for each paper. The importance score R is determined in the above Equation, here is viewed as more significant relying upon its need and the level of the most pertinent terms are available in its theoretical. At long last, we prune the positioned distributions set suggesting the main 10 most applicable references for a specific search.

CONCLUSION

We proposed a model for prescribing scientific articles to clients dependent on unique content utilizing an individual assortment of references. All in all, assembling a lot of named preparing data for text classification is a work concentrated and tedious assignment. Our examination showed that this methodology functions admirably considering our underlying reason and make great forecasts on suggesting scientific articles dependent on references assortment. We accept that our methodology have promising outcomes, primarily on the grounds that it's reasonable to be applied taking all things together spaces.

REFERENCES

1. Abdelmagid, M., Himmat, M., & Ahmed, A. (2014). Survey on information extraction from chemical compound literatures: Techniques and challenges. *Journal of Theoretical and Applied Information Technology*, 67(2), 284–289.

2. Adefowoke Ojokoh, B., Sunday Adewale, O., & Oluwole Falaki, S. (2009). Automated document metadata extraction. *Journal of Information Science*, 35(5), 563–570.
3. Alam, H., Kumar, A., Werner, T., & Vyas, M. (2017). Are cited references meaningful? Measuring semantic relatedness in citation analysis. In *BIRNDL@SIGIR (1)* (Vol. 1888, pp. 113–118). CEUR-WS.org.
4. An, D., Gao, L., Jiang, Z., Liu, R., & Tang, Z. (2017). Citation Metadata Extraction via Deep Neural Network-based Segment Sequence Labeling. In *Proceedings of the 2017 ACM on Conference on Information and Knowledge Management* (pp. 1967–1970). New York, NY, USA: ACM.
5. Anzaroot, S., & Mccallum, A. (2013). A new dataset for fine-grained citation field extraction. In *ICML Workshop on Peer Reviewing and Publishing Models*, 2013.
6. Bird, S., Dale, R., Dorr, B. J., Gibson, B., Joseph, M. T., Kan, M.-Y., & Tan, Y. F. (2008). The acl anthology reference corpus: A reference dataset for bibliographic research in computational linguistics. In *Sixth International Conference On Language Resources And Evaluation (LREC'08)*, 2008, pp. 1755–1759.
7. Blei, D. M., Ng, A. Y., & Jordan, M. I. (2001). Latent dirichlet allocation. In *Advances in neural information processing systems* (pp. 601–608).
8. Borah, R., Brown, A. W., Capers, P. L., & Kaiser, K. A. (2017). Analysis of the time and workers needed to conduct systematic reviews of medical interventions using data from the PROSPERO registry. *British Medical Journal Open*, 7(2), e012545. <https://doi.org/10.1136/bmjopen-2016-012545>.
9. Britz, D. (2015). Recurrent neural network tutorial, part 4—implementing a GRU/LSTM RNN with python and theano. Retrieved August 16, 2017, from <http://www.wildml.com/2015/10/recurrent-neuralnetwork-tutorial-part-4-implementing-a-grulstm-rnn-with-python-and-theano/>.
10. Ceurws/lod. (2014). Retrieved August 6, 2018, from <https://github.com/ceurws/lod>.
11. Chang, M.-W., & Yih, W. (2013). Dual coordinate descent algorithms for efficient large margin structured prediction. *Transactions of the Association for Computational Linguistics*, 1, 207–218.
12. Chen, C.-C., Yang, K.-H., Chen, C.-L., & Ho, J.-M. (2012). BibPro: A citation parser based on sequence alignment. *IEEE Transactions on Knowledge and Data Engineering*, 24(2), 236–250.
13. CiteSeerX. (2007). Retrieved January 20, 2018, from <http://citeseerx.ist.psu.edu/index>.
14. Collins, M. (2002). Discriminative training methods for hidden markov models: Theory and experiments with perceptron algorithms. In *Proceedings of the ACL-02 conference on empirical methods in natural language processing-volume 10* (pp. 1–8). Association for Computational Linguistics.
15. Hanyurwimfura, D., Bo, L., Njogu, H., & Ndatinya, E. (2012). An automated cue word based text extraction. *Journal of Convergence Information Technology*, 7(10), 421–429. <https://doi.org/10.4156/jcit.vol7.issue10.50>.
16. Harkema, H., Roberts, I., Gaizauskas, R., & Hepple, M. (2005). Information extraction from clinical records. In *Proceedings of the 4th UK e-science all hands meeting*.
17. Kavila, S. D., & Rani, D. F. (2016). Information extraction from research papers based on statistical methods. In S. C. Satapathy, K. S. Raju, J. K. Mandal, & V. Bhateja (Eds.), *Proceedings of the second international conference on computer and communication technologies* (Vol. 381, pp. 573–580). New Delhi: Springer. Retrieved from April 20, 2018, http://link.springer.com/10.1007/978-81-322-2526-3_59.
18. Kennedy, J., & Eberhart, R. (1995). Particle swarm optimization (Vol. 4, pp. 1942–1948). In *Proceedings of IEEE international conference on neural networks*. Piscataway, New Jersey: IEEE.
19. Lin, J., Karakos, D., Demner-Fushman, D., & Khudanpur, S. (2006). Generative content models for structural analysis of medical abstracts. In *Proceedings of the workshop on linking natural language processing and biology: Towards deeper biological literature analysis* (pp. 65–72). Association for Computational Linguistics.

20. Lin, S., Ng, J.-P., Pradhan, S., Shah, J., Pietrobon, R., & Kan, M.-Y. (2010). Extracting formulaic and free text clinical research articles metadata using conditional random fields. In Proceedings of the NAACL HLT 2010 second Louhi workshop on text and data mining of health documents (pp. 90–95).
21. Stroudsburg, PA, USA: Association for Computational Linguistics. Retrieved December 4, 2017,

Detection of Cyber Attacks Using Voice Recognition Technique

Vijaya Babu Kuchipudi¹, Harsh Pratap Singh² and Laxmaiah Mettu³

^{1,2}Department of Computer Science and Engineering, Sri Satya Sai University of Technology and Medical Sciences, Sehore Bhopal-Indore Road, Madhya Pradesh, India

³Department of Computer Science and Engineering, CMR Engineering College, Kandlakoya (V), Medchal, Hyderabad

ABSTRACT

A framework for voice recognition is designed to recognize a voice administrator. The voice administrator can be authenticated by using MATLAB software to encrypt voice recognition. It is necessary to convert the speaker waveform for further analysis and processing into a type of parametric representation. Biometrically, since it uses the physical features and characteristics to identify people, biometrics are becoming common as security measures to minimize cases of fraud and theft. Fingerprint and handwriting are the earliest types of biometric authentication, although ones that are more recent include iris/eye scanning, facial scanning, voice printing and hand printing. Biometric voice recognition and identification technology focuses on systems training to identify a specific voice feature (i.e., their voiceprint). The technology is well suited to a range of applications, including mobile phone security access control. The developed voice recognition programme has successfully enabled the door opening system using a voice command that works only for the authenticated person. The device is proven capable of providing medium-security access control and has an adjustable level of security to account for one-person voice variance any time a voice recognition takes place.

1. INTRODUCTION

More and more devices are now using command-performing voice recognition technology that enables access to stored information and transmits audio to a written document. In automated phones, car entertainment systems or operating systems, for example, "Windows" and "iOS" voice recognition technologies are introduced. However, as voice recognition technologies are in infancy, hackers can experience a wide range of safety vulnerabilities to access sensitive information unauthorized. One of the main weaknesses of voice authentication devices is that voice information, such as fingerprints, can be more accessible than other biometric information. For example, in order for you to collect information about an individual's fingerprints, it might not be sufficient to have access to vocal information, since one has to be physically near items touched by a person. Today many people openly use many online platforms, such as YouTube, Snap Chat and Facebook to make their voice accessible to all. The technology used for voice recognition includes hardware and accompanying software that can decode human voices for different functions (e.g., transcribing voice to text, executing software applications, and verifying the identity of an individual).

In 1952, the first automatic voice recognition system. Although the system was not computerized, the human voice could identify single digits. Xuedong Huang, one of the founders of Microsoft's speech recognition community, was the first developer of a modern voice recognition device, Sphinx-II. The technology was able to perform voice recognition in real time and was ideal for use in modern software applications.

In addition to the advancement of computer technology, other devices have been widely used in different areas, including health care, customer service, avionics, military, automotive security and telecoms. For example, voice recognition technologies enable the immediate processing of voice in medical records in the field of health care. In the area of avionics, pilot training and air traffic, controller technology is used in voice recognition. In the area of car safety, technology used for voice recognition improves safety for passengers in cars, since it allows the driver to make telephone calls without having to use hands. Many businesses have automated menu systems in their service hotlines in the area of customer care. When a customer phones a service hotline, a registered question from a device he or she can hear. After the voice recognition programme processes the customer's response, the device will transfer the customer to an appropriate department.

1.1. Dynamic Time Warping Based Voice Recognition

The HMM-based technique was once widely used for speech recognition, but has fallen out of favour due to the widespread success of dynamic time warping. Variation in time or speed of dynamic time warping is an algorithm for measuring similarity between two sequences. Similarities in walking style can be found, even if the person is going slowly and if they are accelerating or decelerating during a single step. A component of DTW has been used in film, audio, graphical data, and even non-linear applications. Automatic speech recognition is commonly used for various speaking speeds. Nonlinear smoothing is a technique that relaxes the

given constraints (e.g., restrictions) to find an optimal fit to the given sequences (i.e., for example, time series). This can be best understood as the early sequences being "warped" to fit each other. Hidden Markov models are commonly benefit from this form of positional weighting.

In contrast to hand-made or label-based Hidden Markov models, neural network models make less explicit assumptions about feature properties and are therefore easier to be used for speech recognition. Neural networks are excellent for training discriminative speech classifiers, but in a non-introutrage way. However, in spite of their relative effectiveness for tasks such as individual phonemes and isolated phrases, neural networks had difficulty modelling the time dependencies of continuous recognition, and as a result were seldom applied to longer problems.

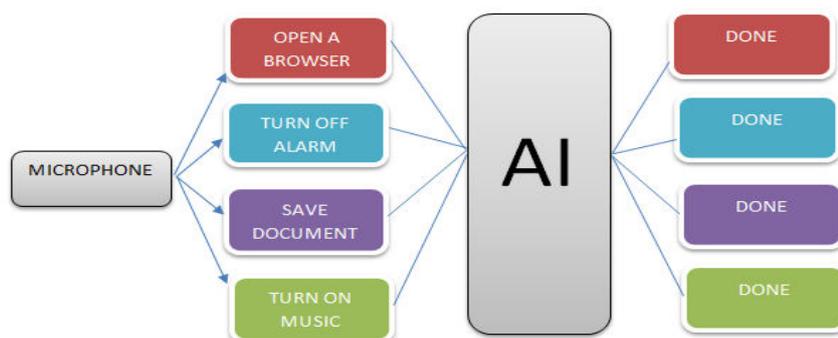


Figure 1: Voice Recognition

1.2. End-to-End Automatic Speech Recognition

Since 2014, ASR "ends to end" has received much attention for the earlier (e.g., all earlier) models needed different components and preparation for the pronunciation, each was based on a separate sound-based system (e.g., HMMs). The end-to-end models learn more about the speech recognition part of the system. It simplifies the training and deployment process, since it shortens both. Due to this, an HMM-based framework necessitates an n-gram model and sometimes consumes many gigabytes of memory rendering them unfeasible for mobile devices; an n-gram language model is sometimes employed instead. ASR systems made by Google and Apple are on the cloud, so a network connection is essential.

The first ASR attempt to apply temporal and connectionist techniques was made by Graves and Navas in 2014 with the introduction of CTC-based systems by Google DeepMind and the University of Toronto. The model employed recurrent neural networks and a CTC (convolutional transcendental complex network) layers. The RNN-C model can both encode the language, but it cannot do so because of the conditional independence assumptions just like an HMM. However, as they learn speech acoustics directly, CSL models can make several spelling errors but the clean transcript approach would use a separate language model.

We favour a system-focused model over CTC (Closed-loop total care). Smart mirror therapy, developed by Carnegie Mellon University and Google Brain in 2016, was pioneered by Bahdan et al. Listen, track, and transcribe signal characters one character at a time. CTCST-based models cannot distinguish dependent voices and learn all of the components of a speech recognizer, including the pronunciation, acoustic model, and language model, instead, rather than being able to learn solely on attention. This means that during deployment, a reduced memory model is needed.

2. LITERATURE SURVEY

Human voice is an amazing tool. Every person has a distinct sound, rhythm, pace, and pitch to identify, which differs depending on where they are in the sentence. Since the voice of each person is special, it should be obvious that the average male's voice is lower than the average female's. Human beings do not only have distinct personalities, but also notable speech patterns. There are several different ways to express even the simplest idea. At its peak frequency, the human voice is about 10 kilohertz; at its lowest, it is about the note C below middle C.

Chakrabarti, et al. use many features to present common acoustic characteristics of speech (2020). Although the MFCCs have performed admirably in the past, this feature extraction has also improved the speech recognition system in environments with background noise. Power-normalized Cepstral Coefficients (the most frequently cited method) and Cepstral normalization (a method popular in many works) are most common, because they deal with noise resulting from the products of convolution. Voice recognition is the method by

which a machine determines what was said by analyzing spoken words. In principle, they have the capacity to be further subdivided into text-based and non-text dependent. Text-dependent is about the keywords or phrases, whereas non-specific text is more versatile for voice recognition.

The majority of the published studies found that the wavelet feature extraction demonstrated improvement over conventional Cepstral (Cepstral et al., 2020). The multivariable PWP already depend on various frequency sub-specific extracted features, which have been combined to form a unique feature vector for each component the speaker recognition framework has been designed and is being implemented computationally Modeling of the unwanted noises and the Gaussian distribution composes the HMM. The spectrum has been calibrated to the way it is in the set. It will have Caprices.

Wavelets provide a tool for visualizing time-frequency content. Generally, it has been applied to the process of decomposing complex messages into high and low frequency components. Its wavelet coefficients represent a given signal's frequency content compared to that of a selected wave function. These signal and wavelet coefficients are determined by a convolution of the wave function that is using an extended band-pass filter; it can be considered as a scaled convolution describe how universal leadership model enables global organizing (2020). As a result, subsequent warped waves are then separated and used as a filter bank called Perceptual Wavelet (PWP). "Undantical" filtering provides better spectral and spatial localization than "Non-red" filtering".

3. RESEARCH METHODOLOGY

This paper is intended for use in a home or office setting where a group of people has been granted access. This project can also be extended. Using VBS, we can protect any software document/file. VBS can be accessed solely and exclusively from the user's conscious state. In addition, if the user is in an unusual state (frightened, concerned, etc.), the voice features that do not match the stored voice will be sampled automatically. As a result, no permission to access the system will be given. The proposed project establishes a mechanism for notifying the primary owner of the system of any actions taken with it. The plan is to send a message to the owner through the GSM network. This can occur in two instances: a) when an approved user is granted entry to the system; and b) when an intruder attempts to crack the door lock.

The architecture for the framework consists of following parts.

- Microphone circuit
- Fingerprint/Voiceprint analysis
- Filters (digital filter)
- Function written in code

3.1. Microphone Circuit

This circuit can accept an input and output a few millivolts. Thus, in order to facilitate further processing, the output should be amplified. This amplification is accomplished by the use of three op-amp levels. Additionally, low pass and high pass filters are introduced to aid in the op-amp configuration.

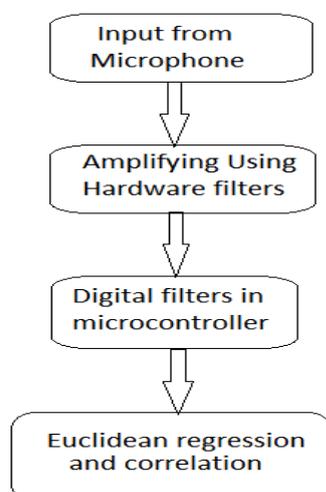


Figure 2: Voice Recognition Security System

3.2. Digital Filters

The digital filters are designed using MATLAB 6.5. The bandwidth of the filter is used to calculate the coefficient of the respective filters. In MATLAB, a Chebyshev fourth order high pass filter is used in place of two-second order high pass filters.

3.3. Fingerprint/Voiceprint Analysis

The voiceprint and fingerprint would be a combination of the results of the digital filters. It is a well-known fact that the voiceprint of even two identical words results in two distinct speech spectrums. In addition, if a single person says a word twice as accurately and similarly as possible, the resulting range would be different. Thus, the difference is fed to the microcontroller in this project to determine if it is capable of detecting a shift in both voice samples. Euclidean distance is known as the summation of the squares of the difference between two phrases/words.

3.4. Function Written in Code

Timer 0 is set to use a feature in the microcontroller is programmed. After processing the samples via the analogue to digital converter, the resulting digital data will be filtered using a digital filter. Now the model would use a voiceprint or fingerprint for each word to determine an analysis. The comparator will equate the current voiceprint with the previously stored one.

In order to biometrically authenticate users, this is used. Accepting or denying a speaker's argument is the opposite of speaker verification. It is used to seal an argument's claim of credibility. The Speaker's protocol is commonly referred to as the open mode. Identity verification system, which uses voice recognition on service-specific speakers, is the most important feature of any voice recognition system. The voice recognition is affected by separation of structure and independent voice recognition. This is what the speaker refers to when making the point in the text.

If the words used by the speaker are identical to those that are inputted into the Text Retrieval Software, they are known as the speech data. Instead, it can be argued that a random set of words is called the Voice-independent set of words. There are three basic ways to tell if a voice recognition system is successful: You will find an answer in the text. The Text Collection and the Metaphor are each on their own, while Open Voice and Closed Voice and Closed Statement each seek acknowledgement. The sound of speaking was digitally transformed into an electrical signal using a microphone. Function of a sound card serves to take analogue signal and make it digital with this speech signal, the sound card is able to store and play.

Biometric authentication is now available as an API, so developers can use it as a means of ensuring protection. In this case, biometric authentication means an additional security measure to ensure that only the users' smartphones can access their data. To monitor the smart home, you must register fingerprints on each screen.

4. RESULTS & DISCUSSION

The two voice recognition tests are set up to see how well it works. One of the experiments will measure my speech, and another will use other people's as a guide. At any given moment, his/her voice will create a pattern and referred to as a voice waveform. Every voice has a distinct sound. The verification experiments therefore use the two different experiment procedures, the first to test the validity of the analysis, and the second to improve it.

In audio recording, the microphone picks up the user's voice. The voice sample rate is 10000 Hertz and the time is one second. See how the word "HELLO" is said from the microphone in Figure 1.3.

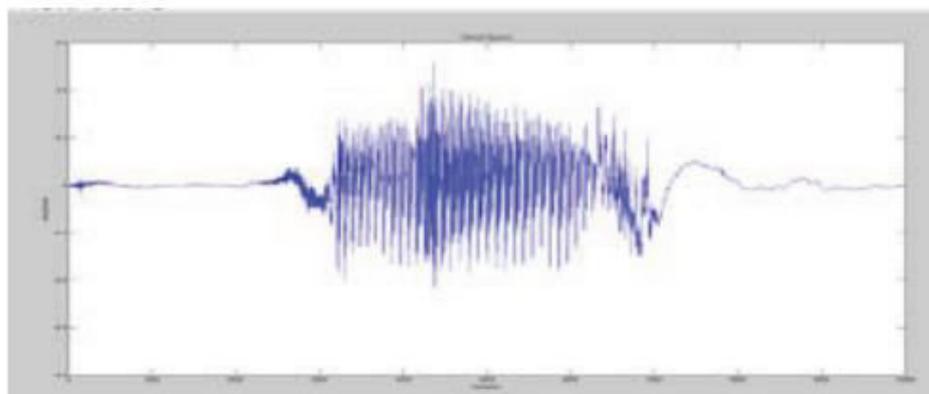


Figure 3: The word "HELLO" as voice input signal.

The input signal is one second of silence, in which the output signal will extract only the actual voice. If the noise is detected in Figure 1.4, ignore it and move on to Figure 1.5

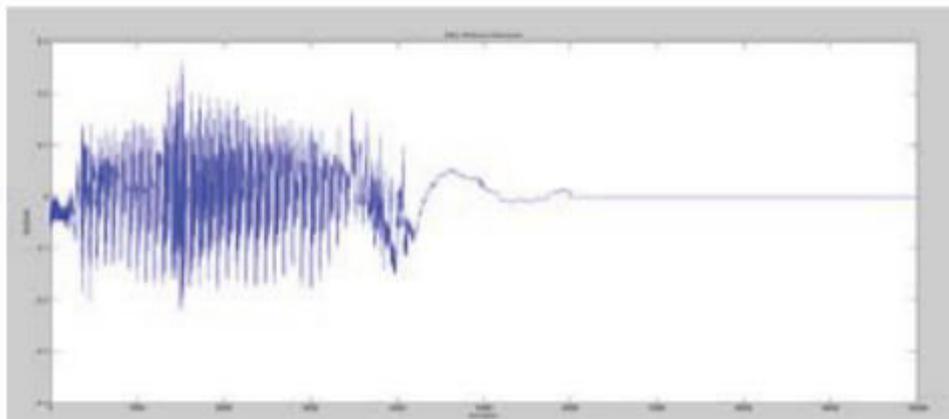


Figure 4: The word “HELLO” after silence detection.

The Hamming window is used to smooth out the input voice signal after extracting the real signal by silence detection. The term "HELLO" after the Hamming window is shown in Figure 1.5. The signal is on the time domain after it smooths the input voice signal. The Fast Fourier Transform (FFT) changes the voice input from the temporary field to the frequency field. The term HELLO in the frequency domain is shown in Figure 1.6.

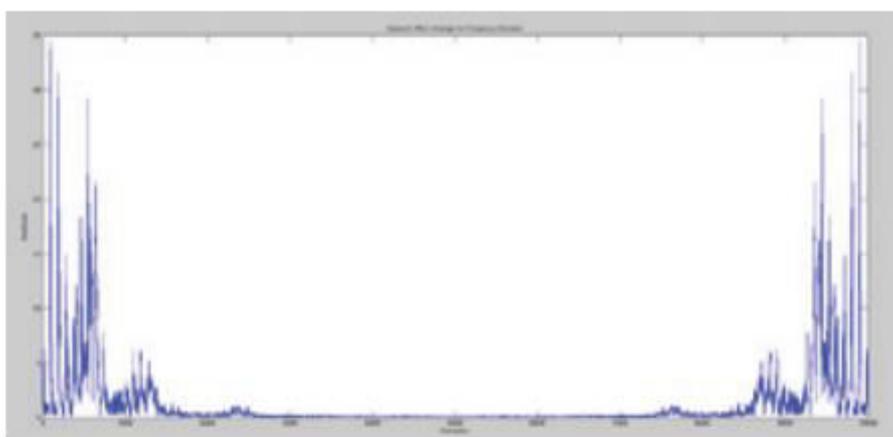


Figure 5: The word “HELLO” after Fast Fourier Transform

This experiment is done with ten separate users, the authenticated user is one person and the other persons are other persons. The voice recognition system recognizes the admin's voice correctly among ten people of different sex or age with the authenticated user. The difference between sex and age is whether the exactness of speech recognition can be affected.

CONCLUSION

This paper discusses the fundamentals and investigates their recent development. This paper compares different ways of creating a voice recognition system based on a changed functional translation mechanism and language recognition system. Voice recognition is a human voice machine processing, primarily designed to translate both terms, sentences, and regularly identify the speaker because of the information contained in the speech wave. This method allows the presenter's voice to be used and makes personality easy to check. It offers access to control services such as speech, e-commerce, recognition of window speakers, m-commerce, automation, home automation and management of protection, etc. The goal of this research is to identify speech signals using three different feature extractions: Hardware filters, Digital filters, and Euclidean regression. To remove the two traditional voice enhancement technique, Hardware and Digital Filter, the speech signals are tainted by noise. After removing noise from speech signals, digital filters are used to enhance them, and speech features are extracted using the proposed feature extraction techniques and Speech Recognition techniques to find the best recognition accuracy for both stored templates and real-time speech to recognize digits. The outcomes of the experiments suggest that this concept is effective in moving toward global optimum while maintaining the system accuracy.

REFERENCES

1. R. Chakroun and M. Frikha, "Efficient text-independent speaker recognition with short utterances in both clean and uncontrolled environments," *Multimedia Tools and Applications*, vol. 79, no. 29, pp. 21279–21298, Aug. 2020, doi: 10.1007/s11042-020-08824-7.
2. O. Mamyrbayev, A. Toleu, G. Tolegen, and N. Mekebayev, "Neural architectures for gender detection and speaker identification," *Cogent Engineering*, vol. 7, no. 1, p. 1727168, Jan. 2020, doi: 10.1080/23311916.2020.1727168.
3. A. Rinoshika and H. Rinoshika, "Application of multi-dimensional wavelet transform to fluid mechanics," *Theoretical and Applied Mechanics Letters*, vol. 10, no. 2, pp. 98–115, Jan. 2020, doi: 10.1016/j.taml.2020.01.017.
4. N. Holighaus, G. Koliander, Z. Průša, and L. D. Abreu, "Characterization of Analytic Wavelet Transforms and a New Phaseless Reconstruction Algorithm," *IEEE Transactions on Signal Processing*, vol. 67, no. 15, pp. 3894–3908, Aug. 2019, doi: 10.1109/TSP.2019.2920611.
5. W. Helali, Z. Hajaiej, and A. Cherif, "Automatic Speech Recognition System Based on Hybrid Feature Extraction Techniques Using TEOPWP for in Real Noisy Environment," *IJCSNS - International Journal of Computer Science and Network Security*, vol. 19, no. 10, pp. 118–124, Oct. 2019.
6. A. Mnassri, M. Bennis, and C. Adnane, "A Robust Feature Extraction Method for Real-Time Speech Recognition System on a Raspberry Pi 3 Board," *Engineering, Technology & Applied Science Research*, vol. 9, no. 2, pp. 4066–4070, Apr. 2019.
7. S. N. Truong, "A Low-cost Artificial Neural Network Model for Raspberry Pi," *Engineering, Technology & Applied Science Research*, vol. 10, no. 2, pp. 5466–5469, Apr. 2020.
8. A. Koduru, H. B. Valiveti, and A. K. Budati, "Feature extraction algorithms to improve the speech emotion recognition rate," *International Journal of Speech Technology*, vol. 23, no. 1, pp. 45–55, Mar. 2020, doi: 10.1007/s10772-020-09672-4.
9. S. Zhu, C. Xu, J. Wang, Y. Xiao, and F. Ma, "Research and application of combined kernel SVM in dynamic voiceprint password authentication system," in *2017 IEEE 9th International Conference on Communication Software and Networks (ICCSN)*, May 2017, pp. 1052–1055, doi: 10.1109/ICCSN.2017.8230271.
10. Q. Li et al., "MSP-MFCC: Energy-Efficient MFCC Feature Extraction Method with Mixed-Signal Processing Architecture for Wearable Speech Recognition Applications," *IEEE Access*, vol. 8, pp. 48720–48730, 2020, doi: 10.1109/ACCESS.2020.2979799.

Preparation, Optimization and Evaluation of Clobetasol-17- Propionate Loaded Carboxymethyl Chitosan Nanoparticle

Mamta Yadav*, Pankaj Aggarwal, Anand Singh and Deepika Yadav

School of Pharmacy and Medical Science Singhania University, Pachari Bari, District Jhunjhunu -333515, Rajasthan (India)

ABSTRACT

Psoriasis is a chronic skin disorder caused due to the autoimmune factors. It has a detrimental psychological and physiological impact on patients owing to the emergence of apparent skin. The systemic therapy with anti-psoriatic drugs such corticosteroids, immunosuppressant, and gene suppressors causes severe side effects. As a result, increasing the effectiveness and safety of the aforementioned medicines when applied topically would be extremely useful in avoiding the side effects associated with the systemic route of administration. Chitosan (CS) has not been widely used in the clinic applications but due to its limited solubility and poor mechanical characteristics. CS on the other hand, is chemically changed to form Carboxymethyl Chitosan (CMC), which is soluble at both neutral and basic pH. Chemical modifications can also be used to attach different functional groups and control hydrophobic, cationic, and anionic properties. CMC is a promising carrier that might possibly traverse the thick scales of psoriatic skin since it is a penetration enhancer that allows drug diffusion via either the transcellular or paracellular pathways. Comparative study is done using CMC as a polymer and CD as a polymer. CP loaded CMC nanoparticles shows better result results than CP-loaded CD polymer.

Keywords: Psoriasis, skin, topical drug delivery, CMC, Nanoparticles.

INTRODUCTION

Psoriasis, an immune-mediated inflammatory dermatosis, has been widely viewed as an autoimmune disease in recent years, in light of psoriasis flare-ups being triggered by bacterial microbiota via molecular mimicry, such as between streptococcal and keratin proteins, the presence of homologous peptides between these proteins, and CD8 + T cells' response to these homologous peptides. Psoriasis is a chronic skin disorder caused due to the autoimmune factors. It has a detrimental psychological and physiological impact on patients owing to the emergence of apparent skin disfigurement expressed as erythematous plaques coated in silvery scales, as well as impairment of the skin's barrier function. As a result, it has a significant impact on patient's quality of life. Clobetasol propionate is a corticosteroid used to treat skin conditions such as eczema, contact dermatitis, seborrheic dermatitis, and psoriasis. It is applied to the skin as a cream, ointment, or shampoo. In the United States, Clobetasol propionate is the most often used topical treatment for psoriasis. Ointment preparations, according to conventional dermatological wisdom, have the maximum efficacy (because to their occlusive nature and moisturising capabilities) and are best suited for psoriasis. Patients, on the other hand, frequently find the administration of ointment to be unpleasant, creating concerns about both short- and long-term therapy adherences. So in order to bypass the problems associated with current drug delivery technologies, newer drug delivery for Clobetasol propionate is need of the hours.¹⁻⁵

CS has long been utilised in topical as well as transdermal preparations in the form of gel formulations to treat a variety of skin diseases, including burns, wounds, fungal and microbial infections. However, its application has been restricted due to insolubility at neutral and basic pH. The use of CS alone in gelling system is having number of limitations due to the solubility issues associated with it. CS on the other hand, is chemically changed to form Carboxymethyl Chitosan (CMC), which is soluble at both neutral and basic pH. Chemical modifications can also be used to attach different functional groups and control hydrophobic, cationic, and anionic properties. Progress is being made fast in this area, and the CMC generated has nearly infinite application possibilities in a wide range of industries.⁶⁻⁹

CMC is a promising carrier that might possibly traverse the thick scales of psoriatic skin since it is a penetration enhancer that allows drug diffusion via either the transcellular or paracellular pathways. Because of the cationic character of the polymer and the polyanionic nature of skin cells' surface, CMC containing nano/microparticles are recommended for dermal application because they provide adequate retention in the skin via bioadhesion. As a result, employing CMC as a carrier to bypass the stratum corneum (SC) and enhance drug delivery to the epidermal skin layer with low systemic absorption in the treatment of psoriasis seems promising, especially when produced as nanoparticles. The above results may be due to the fact that polymeric nanoparticles have been shown to have higher retention in the SC^{layer} than lipidic systems, making them better candidates for topical treatment of skin diseases, especially when using lipophilic drugs, as they act as drug reservoirs to

regulate skin permeation and allow for drug retention in the upstream. Small polymeric nanoparticles (100 nm or fewer) would selectively aggregate and have a longer retention period on inflamed skin than on healthy skin, especially when positively charged. The gelling system has already been widely utilised in the topical as well as transdermal drug delivery applications due to numerous advantages in comparison to other dosage forms. The use of various bioadhesive polymers in gelling system would increase the contact time with the skin leading to the better therapeutic effect in psoriatic treatment. As a result, it's thought that loading polymeric CMC nanoparticles with an efficient antipsoriatic drug in suitable gelling system developed with suitable bioadhesive polymers will increase their therapeutic efficacy in the treatment of psoriatic plaques.¹⁰⁻¹⁴

MATERIAL AND METHOD

Material

Clobetasol propionate is obtained as a gift sample from Dermocare laboratory, India. All the other ingredient's used are of analytical grade.

Method

Preparation of Carboxymethyl Chitosan¹⁵

Chitosan (0.640 g) was added to 10 M aqueous NaOH (10 mL) with stirring. The mixture was kept for several hours at room temperature and was stirred every 30 min to avoid aggregation of chitosan. After treatment with base, the chitosan mixture was transferred into an Erlenmeyer flask and 7 M aqueous chloroacetic acid was added dropwise over 5 min. Then, while stirring 1 M aqueous acetic acid was added dropwise into the mixture until the solution reached the correct pH. The reaction mixture flask was then placed into the water bath in the microwave oven and the temperature was adjusted by the recycling thermostated bath water. The reaction mixture was heated for some minutes under microwave irradiation. After cooling and filtering, the solution was concentrated and adjusted to the neutral pH by adding chloroacetic acid. Acetone was added to the solution, which resulted in the formation of a white precipitate, which was filtered and washed with a 3:1 solution of MeOH/water. White CMC was obtained after drying.

Preparation of Nanoparticles by Ionotropic Gelation Method¹⁶

The drug-loaded nanoparticles will be prepared by using the ionic gelation method as per the reported method. Briefly, 10 mg of CMC or cyclodextrin will be dissolved in 5 ml 10 mM HEPES buffer (pH 7.4), and drug solutions will also be prepared in the same buffer at a definite concentration. The drug solution will be added to the CMC or cyclodextrin solution achieving a final concentration ranging from 0.1 to 0.5 mg/ml under constant stirring. While continuous stirring 1 ml to 2 ml of the crosslinking agent, TPP solution (1.7-2.0 mg/ml) will be added to the CMC or cyclodextrin-drug solution drop by drop to induce ionic complexation. An opalescent dispersion formed after TPP addition will indicate the formation of nanoparticles. The nanoparticles will be collected by centrifugation at 12,000 rpm for 15 min on a 10 µl glycerol bed. The particles will be stored at -20°C until further use.

CHARACTERIZATION OF NANOPARTICLES

For further characterization, nanoparticles was performed to access interaction if any between the drug and polymer and also to find out what properties of polymer make them an effective material for solubility and bioavailability enhancement.

1. Particle Size Measurement:

The sizes of particles are maintained during polymerization for the formation of free-following powders having fine aesthetic attributes. Particle size analysis of loaded and unloaded nanoparticles performed. Cumulative graph is maintained or plotted as particle size against time to study effect of particle size on drug release.¹⁷

2. Drug Content:

To calculate the drug content, accurately weighed quantity of nanoparticles (10mg) with 5 ml of methanol in a volumetric flask was shaken for 1min using vortex mixer. The volume was made upto 10 ml. Then the solution was filtered and diluted and the concentration of CP was determined spectrometrically.¹⁸

$$\% \text{ Drug Content} = \frac{\text{Actual drug content}}{\text{Theoretical drug content}} \times 100$$

3. In Vitro Release Studies

In Vitro Drug Release In vitro drug release studies of the nanoparticles were carried out using modified Franz diffusion cell during 24 h. Mixture of PBS pH 7.4:ethanol (70:30) was used as receptor medium and sink condition was determined. The receptor phase was kept at a constant temperature of 37°C and stirred by a

magnetic stirrer. At appropriate time intervals, 0.5 ml of samples were collected and replaced by an equal volume of fresh receptor medium. The clobetasol propionate content was analysed by UV at a wavelength of 242 nm.¹⁹

4. Surface Morphology:

Scanning electron microscopy (JSM-5200, Tokyo Japan) was used to analyze particle size and surface topography was operated at 30kV acceleration voltage. A concentrated aqueous suspension was spread over a slab and dried under vacuum. The sample was shadowed in a cathodic evaporator with a gold layer 20nm thick. Photographs were elaborated by an image processing program and individual NP diameters were measured to obtain mean particle size.²⁰

5. Encapsulation Efficiency and Drug Loading Capacity:

For the determination of encapsulation efficiency accurately weighed NPs (10 mg) were added to 10 mL of distilled water and after the equilibrium solubility was attained, clear supernatant after centrifugation was filtered and 1 mL of the filtrate was mixed with 4 mL of methanolic HCl. Resulting sample was analyzed on UV visible spectrophotometer at 242 nm.²¹

For the determination of drug loading capacity, NPs (5 mg) were dissolved in 5 mL of methanolic HCl and the solution was filtered through 0.2 µm filter (Axiva syringe filter). VCZ concentration in the sample was determined using UV visible spectrophotometer at 300 nm. The percentage drug loading capacity was determined using the following formula:

$$\% \text{ Drug loading} = (\text{Mass of drug in NP} / \text{Mass of NP recovered}) \times 100$$

Table 1: Formulation of CP loaded – CMC or Cyclodextrin Nanoparticles

Batch	Drug solution	CMC	CMC Solution	TPP solution	Cyclodextrin	Cyclodextrin solution
CMCF1	10	0.50	5	1.70	-	-
CDF1	10	-	-	1.70	0.50	5
CMCF2	10	0.50	5	1.85	-	-
CDF2	10	-	-	1.85	0.50	5
CMCF3	10	0.50	5	2.00	-	-
CDF3	10	-	-	2.00	0.50	5
CMCF4	10	1.25	5	1.70	-	-
CDF4	10	-	-	1.70	1.25	5
CMCF5	10	1.25	5	1.85	-	-
CDF5	10	-	-	1.85	1.25	5
CMCF6	10	1.25	5	2.00	-	-
CDF6	10	-	-	2.00	1.25	5
CMCF7	10	2.00	5	1.70	-	-
CDF7	10	-	-	1.70	2.00	5
CMCF8	10	2.00	5	1.85	-	-
CDF8	10	-	-	1.85	2.00	5
CMCF9	10	2.00	5	2.00	-	-
CDF9	10	-	-	2.00	2.00	5

RESULT AND DISCUSSION

UV-SPECTROSCOPIC ANALYSIS

Determination of λ max of CP in dissolution media

The standard solution (100µg/ ml) of pure drug (CP) was prepared in freshly prepared Mixture of PBS pH 7.4:ethanol (70:30). The prepared solution was scanned between 200-400 nm by UV- visible spectrophotometer.

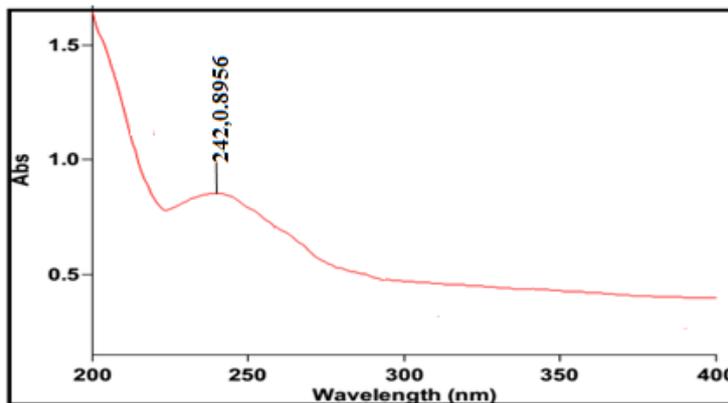


Fig.1: UV- Spectra of pure CP in Mixture of PBS pH 7.4: ethanol (70:30)

FOURIER TRANSFORM INFRA- RED (FTIR) SPECTROSCOPY

The FTIR spectra was taken on IR Spectrophotometer using KBr pellet technique. The scanning range was 4000-400 cm^{-1} . The peaks were interpreted for the confirmation of various functional groups.

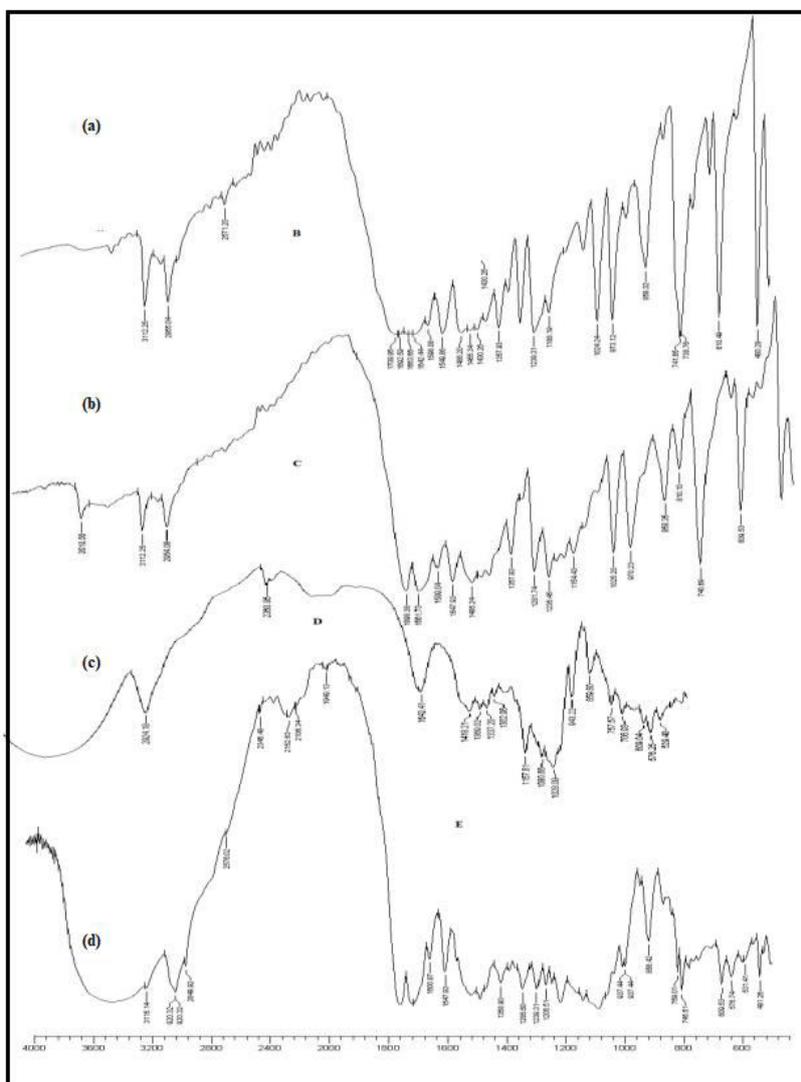


Fig.2: FTIR spectra of (a)Drug, (b) CMC, (C) Physical mixture of drug and CMC and (d) Nanoparticles

Nuclear Magnetic Resonance (NMR)

H-NMR is the technique used to identify hydrogen content and their positioning. A small amount of the sample was dissolved in CDCl_3 in a narrow glass vial and positioned in the sample holder of the instrument. NMR was recorded and interpreted for the validation of the compound.

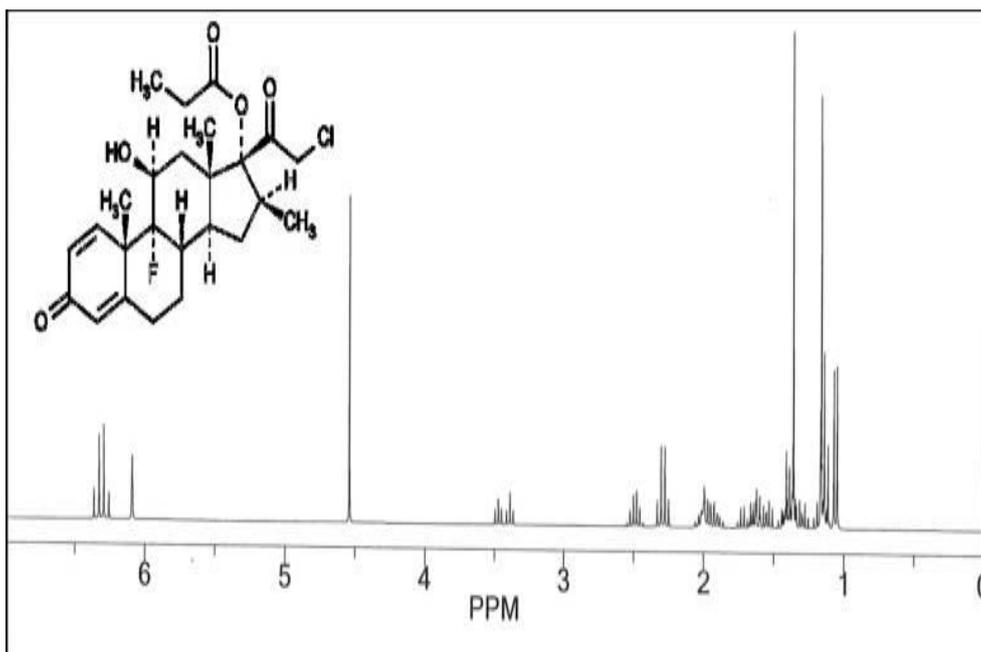


Fig.3: H-NMR spectra of Drug

XRD

The XRD measurements were carried out using Bruker D8 Advance X-ray diffractometer. The x-rays (Cu K-alpha) were produced using a sealed tube and the samples were scanned over a 2θ range of 2° – 50° with a scanning rate of 5° /minute. The x-rays were detected using a fast counting detector based on silicon strip technology (Bruker Lynx Eye detector). The XRD spectrum of VCZ exhibited sharp peaks at 6.9° , 12.6° , 13.8° , 15.9° , 16.5° , 17.4° and 19.8° at 2θ -scattered angles, which indicates the crystalline nature of the drug.

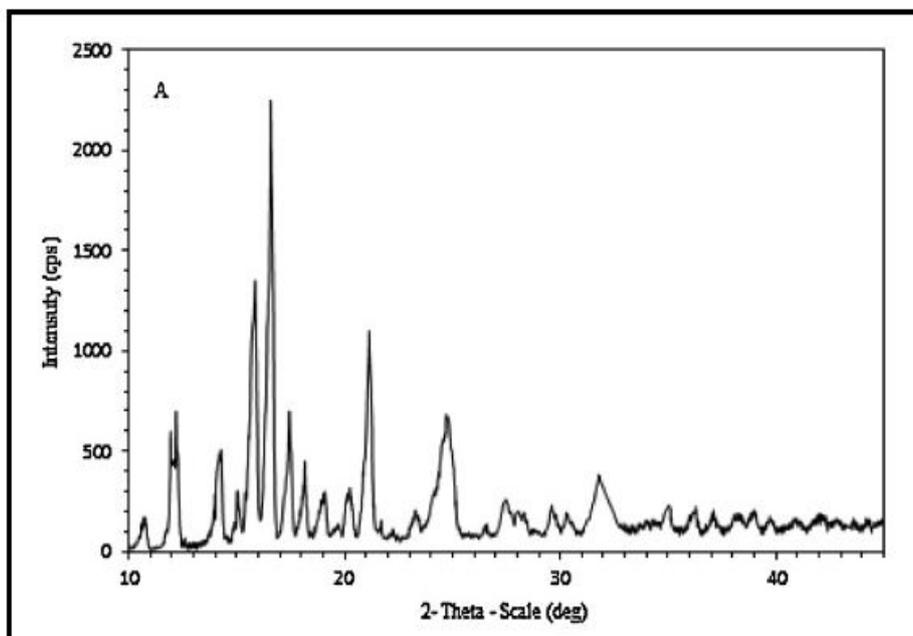


Fig. 4: XRD spectra of CP

Differential Scanning Calorimeter (DSC)

Small amount of sample (2 mg) was placed in the DSC aluminium pan and sealed. It was then heated under nitrogen flow at scanning rate of $10^\circ\text{C}/\text{min}$ in the temperature range of 20 to 250°C . An empty aluminium pan was placed as a reference. Endothermic peaks were recorded. A sharp peak was observed at 132°C , indicative of its melting point this was near the reported melting point of the drug i.e. 128 – 130°C . The DSC thermogram confirmed the crystalline nature of the drug.

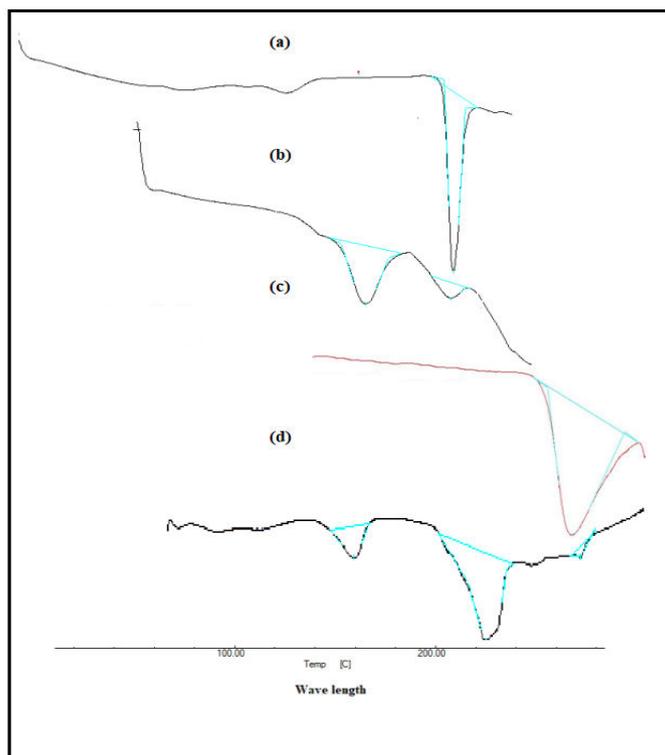


Fig.5: DSC thermogram of (a)Drug, (b) CMC, (C) Physical mixture of drug and CMC and (d) Nanoparticles

Solubility Studies

Solubility studies were performed to analyze the solubility enhancing properties of Nanoparticles. Solubility studies provided the basis for selection of the best ratio that was to be forwarded for formulation.

Table 2: Solubility study of drugs in different solvent.

Sr. no.	Media	Solubility (mg/ml)
1	Water	2 µg/ml
2	Ethanol	10 mg/ml
3	Ether	1 in 1000
4	Acetone	1 in 10
5	Dichloromethane	1 in 10

SYNTHESIS OF CARBOXYMETHYL CHITOSAN

Carboxymethyl chitosan (CMC) can be made through the alkylation process by using sodium hydroxide (NaOH) and reacted with the monochloroacetic acid (ClCH₂COOH) as depicted in Fig., thus forming carboxymethyl groups on the chitosan polymer chain. Some factors that influence CMC forming are the ratio of water: isopropyl alcohol, the degree of deacetylation (DD), temperature reaction and alkaline concentration (NaOH). The increase of the ratio water: isopropyl alcohol decrease the fraction of carboxymethylation. The increase of the temperature reaction will increase the fraction of carboxymethylation. The degree of substitution (DS) carboxymethyl groups strongly dependent on NaOH concentration used. NaOH aqueous solution as a catalyst. The employment of high NaOH concentration promoted side reaction between NaOH and chloroacetic acid and the available chloroacetic concentration for the reaction decreased accordingly.

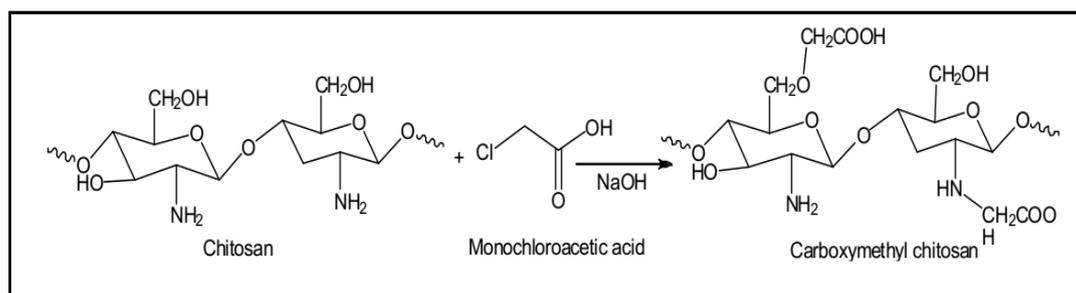


Fig.6: Synthesis of CMC

Evaluation of Nanoparticles

Percentage Yield

The percentage yield of different batches using CMC and Cyclodextrin as a polymer was determined by weighing the Nanoparticle after drying and as shown in below table.

Zeta potential

The zeta potentials of CP formulation is sufficient enough (-10 to -30 mV) to stabilize the formulation.

Particle Size Analysis:

The particle size of CP-loaded CMC nanoparticles and CP-loaded CD nanoparticle are shown below. The Change in the concentration of polymer results in variation of particle size of Nanoparticles.

Table 3: Evaluation of different batches of Nanoparticle

S.N.	Batch	Yield (%)	Particle size	Zeta potential
1	CMCF1	87.56	87.65	-18
2	CDF1	75.56	101.42	-25
3	CMCF2	95.68	59.87	-14
4	CDF2	81.53	132.35	-21
5	CMCF3	75.68	68.69	-20
6	CDF3	69.84	84.65	-19
7	CMCF4	84.89	75.65	-17
8	CDF4	80.45	84.56	-16
9	CMCF5	94.65	95.62	-16
10	CDF5	73.56	87.65	-18
11	CMCF6	79.68	105.36	-12
12	CDF6	65.32	98.65	-30
13	CMCF7	83.54	129.67	-19
14	CDF7	76.45	101.32	-24
15	CMCF8	92.65	118.65	-13
16	CDF8	78.95	145.65	-24
17	CMCF9	89.55	84.65	-15
18	CDF9	77.01	132.32	-17

Drug Content Determination

The various batches of the Nanoparticle were subjected for drug content analysis. The powdered Nanoparticle (10mg) were dissolved in adequate quantity (10ml) of Methanol. The UV absorbance was measured using a UV spectrometer at 251 nm.

Table 4: Drug content values of different batches of Nanoparticle.

Batch	Drug content (%)	Drug loading (%)	Batch	Drug content (%)	Drug loading (%)
CMCF1	84.56	86.54	CDF1	75.65	84.65
CMCF2	98.85	97.65	CDF2	84.62	89.65
CMCF3	83.21	80.65	CDF3	70.32	78.95
CMCF4	79.65	82.65	CDF4	89.84	85.62
CMCF5	94.56	94.56	CDF5	77.86	88.56
CMCF6	86.65	90.54	CDF6	80.32	82.65
CMCF7	93.65	88.45	CDF7	81.23	84.65
CMCF8	96.65	97.54	CDF8	79.85	87.65
CMCF9	89.65	89.65	CDF9	73.65	92.32

Comparative study of CMC and cyclodextrin polymer:

Nanoparticles are prepared by using ionic gelation method. The comparative study was done between polymer CMC and polymer cyclodextrin.

Then the prepared nanoparticles are evaluated. The nanoparticles prepared by using CMC shows better results than the nanoparticles prepared using cyclodextrin. The results are as shown below:

Table 5: Results of Comparative study

Batch	Particle size	Zeta potential	Drug content
F2 (using CMC)	59.87	-14	98.85
F4 (using CD)	84.56	-16	89.84

From the above mentioned results, the CP-loaded CMC nanoparticles shows good drug content with minimum particle size than CP-loaded CD nanoparticles. So, CMC polymer is better than the cyclodextrin polymer.

In-Vitro Drug Release Study

In vitro drug release for drug loaded nanoparticles for a period of 24 hrs was carried out by using Mixture of PBS pH 7.4:ethanol (70:30) at $37 \pm 5^{\circ}\text{C}$. From the dissolution profile of formulations F1 to F9, it is concluded that formulation batch F2 shows better drug release profile than other formulations. Cumulative % release has been shown for average of three preparations. Cumulative % drug release for all the formulations are depicted in the table below.

Table 6: In- vitro drug release studies of different batches of Nanoparticle

Time (hrs)	% Drug release of Nanoparticle								
	F1	F2	F3	F4	F5	F6	F7	F8	F9
0	0	0	0	0	0	0	0	0	0
2	5.45	5.98	4.32	6.01	3.25	5.46	6.45	4.51	4.56
4	14.32	19.65	12.35	18.65	14.65	24.32	25.36	14.65	20.6
6	24.65	24.65	28.65	26.65	31.23	29.68	24.65	20.65	27.65
8	33.25	36.65	38.95	34.56	39.65	40.35	30.32	37.65	31.65
10	41.42	47.65	44.35	50.32	49.56	51.56	39.56	40.23	39.45
12	49.56	58.65	50.65	55.62	51.65	64.56	48.65	49.62	45.35
14	54.62	64.62	58.65	64.32	59.56	69.56	54.35	60.56	51.62
16	64.65	66.52	64.62	69.25	69.01	75.65	64.23	68.56	64.65
18	69.51	76.56	70.32	72.36	75.65	79.56	69.56	76.65	72.65
20	72.65	81.26	79.65	79.65	81.56	84.65	75.62	84.65	84.65
22	84.65	88.62	89.65	91.32	89.65	90.24	84.65	89.62	89.45
24	92.32	99.32	98.65	96.35	97.65	98.45	95.62	97.86	95.62

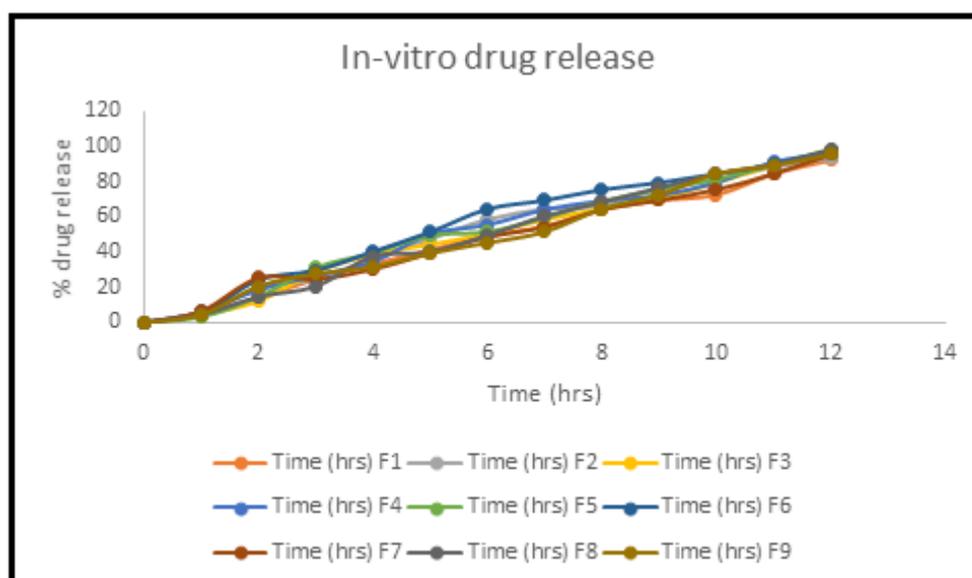


Fig.7: Graphical presentation of comparative drug release profile for F1 to F9 formulations.

OPTIMIZED BATCH:

From the above results, F2 batch was found to be optimized.

Table 7: Results of optimized batch

Batch	Particle size	Zeta potential	Drug content	Drug release
F2	59.87	-14	98.85	99.32

Surface Morphology:

The surface Morphology is done by using scanning electron microscopy.

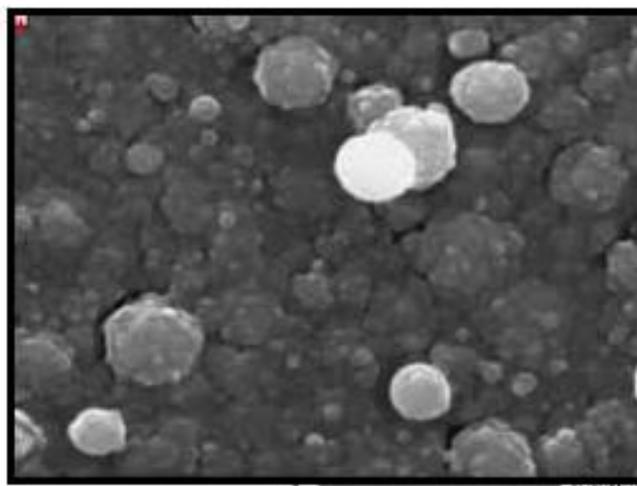


Fig.8: SEM image of optimized batch

OPTIMIZATION

EFFECT ANALYSIS ON PARTICLE SIZE

Counter plot

Figure show the counter plot of TPP Solution and CMC is actual factor. It shows as TPP Solution concentration increases the particle size decreases. CMC concentration increases, particle size was found to be increased.

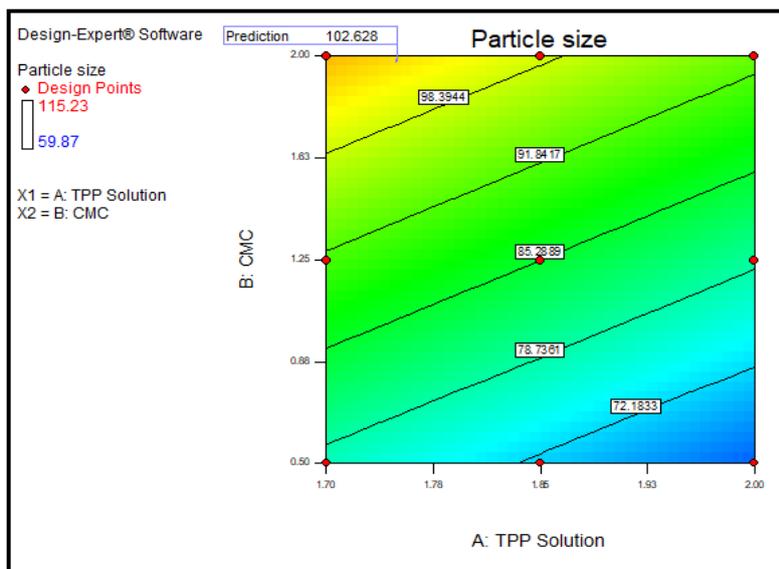


Fig.9: Countour plot the effect of TPP Solution and CMC on particle size

Three Dimensional Graphical Presentations 3D surface

The 3D in figure shows that as increase in concentration of TPP Solution, particle size decreases while as CMC Concentration increases particle size also increases. It was concluded from the graph that the factor A have significance effect on the particle size.

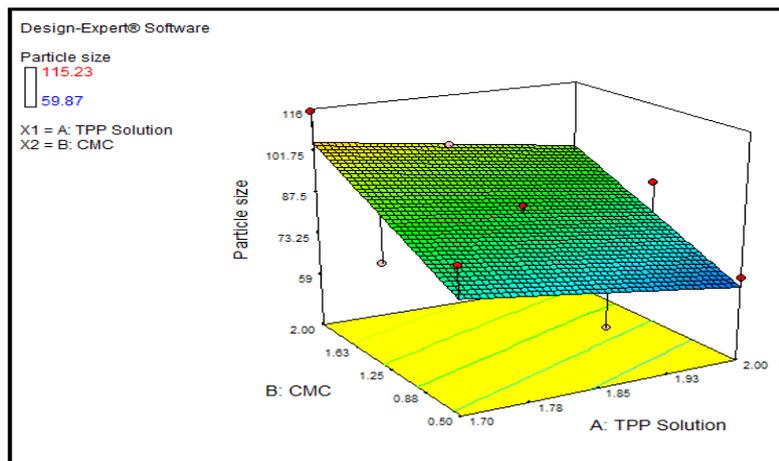


Fig.10: 3D Surface Plot of particle size of CP with Respect to TPP Solution and CMC

EFFECT ANALYSIS ON DRUG CONTENT

Counter Plot

Figure show the counter plot of TPP Solution and CMC is actual factor. It shows as TPP Solution concentration increases the drug content increases at some point then there is decrease in drug content. Also, as CMC concentration increases, drug content was found to be decreased initially then there is increase in drug content.

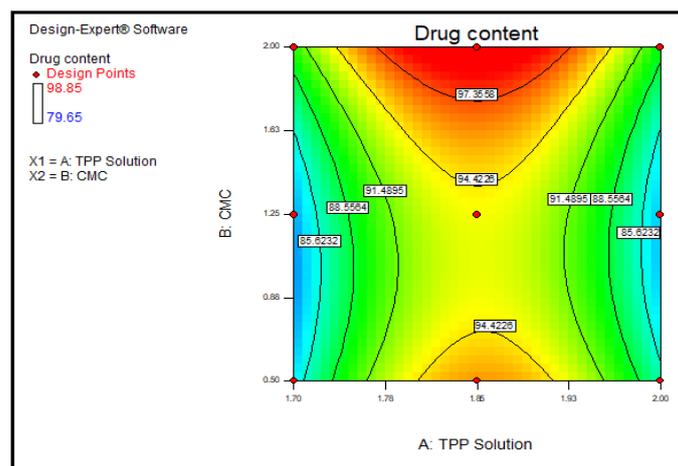


Fig.11: Countour plot the effect of TPP Solution and CMC on drug content

Three Dimensional Graphical Presentations 3D surface

The 3D in figure shows that as increase in concentration of TPP Solution and CMC Concentration it shows increase in drug content. It was concluded from the graph that the factor A have significance effect on the drug content.

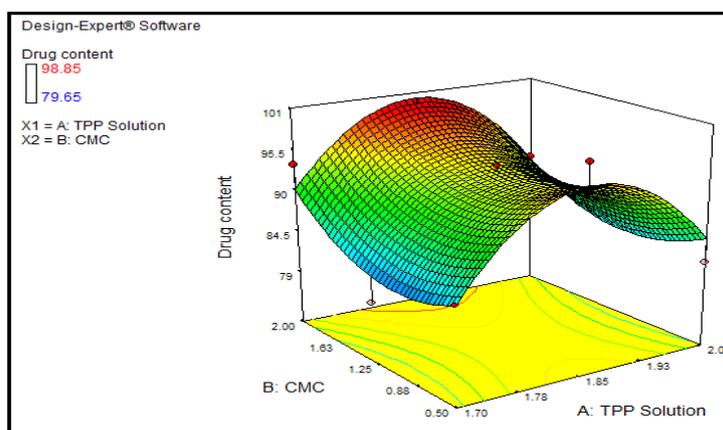


Fig.12: 3D Surface Plot of drug content of CP with Respect to TPP Solution and CMC

EFFECT ANALYSIS ON DRUG RELEASE

Counter Plot

Figure show the counter plot of TPP Solution and CMC is actual factor. It shows as TPP Solution and CMC concentration increases the drug release also increases initially then there is decrease in drug release.

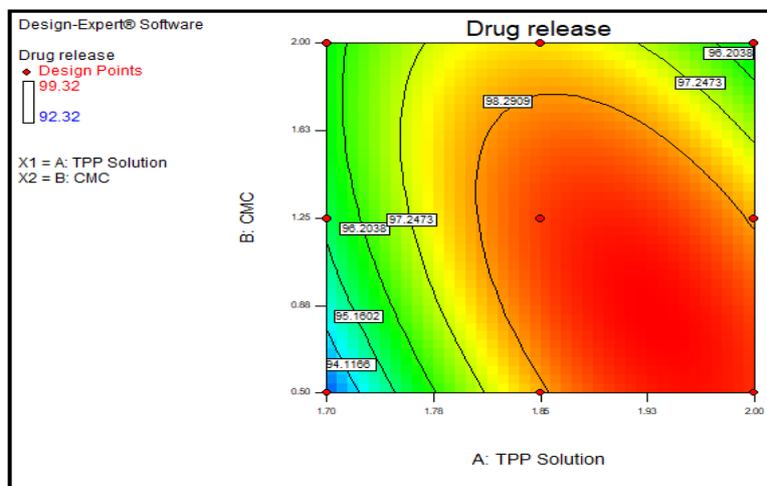


Fig.13: Countour plot the effect of TPP Solution and CMC on drug release

Three Dimensional Graphical Presentations 3D surface

The 3D in figure shows that as increase in concentration of TPP Solution and CMC Concentration it shows increase in drug release at some point then there is decrease in drug release. It was concluded from the graph that the factor A have significance effect on the drug release.

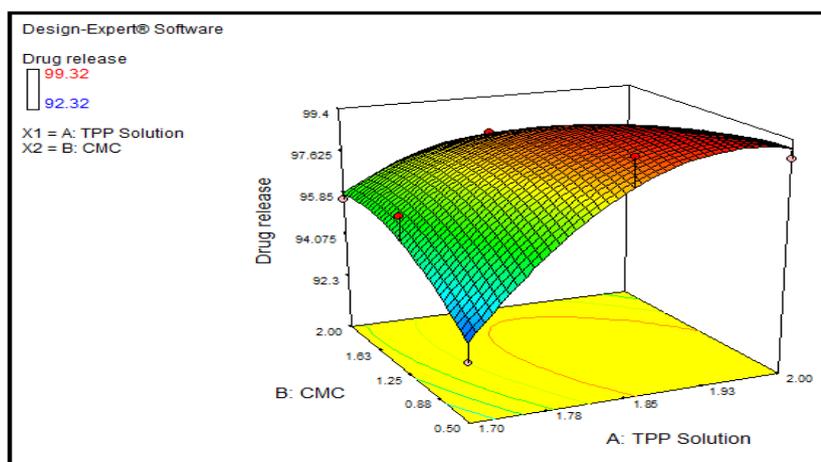


Fig.14: 3D Surface Plot of drug release of CP with Respect to TPP Solution and CMC

KINETIC TREATMENT TO DISSOLUTION DATA

The release rate date obtained was subjected to zero order, first order, higuchi and korsmeyer'speppas given in table.

Table 8: The release data obtained

Zero order Equation line Y=	R2	First order Equation line Y=	R2	Higuchi equation line Y=	R2	Korsmeyers peppas Equation line Y=	R2
7.4328x+0.4229	0.995	0.0827x+1.0379	0.9214	34.826x-35.297	0.9775	1.1263x+0.8333	0.9866

From result shown in table, we can conclude that overall order of release data of drug after fitting in different mathematical model shows following results

F2 BATCH

Zero order >Korsmeyerspeppas>Higuchi > first order

Table 9: Model fitting of optimize batch of CP formulation

Run (R ²)	Zero order	1st order	Higuchi	Korsmeryspeppas
	0.995	0.9214	0.9775	0.9866

Discussion: From the R² value it was concluded that the drug releases profile of optimize batch followed zero order kinetics & release pattern respectively.

STABILITY STUDIES

Optimized formulation was subjected to stability studies as per ICH guidelines. Various parameters such as drug content, and in vitro drug release were measured before and after 30, 60, 90 days of stability. Results of stability studies are shown in following table. Results of stability studies showed there is no significant change in above mentioned parameter after 1 from the stability studies that the prepared formulation is stable and not much affected by elevated humidity and temperature conditions.

Table 10: Stability study of Optimized formulation

Time(day)	Drug content (%)	In vitro drug release (%)
0	98.658	99.884
30	96.52	96.522
60	95.61	94.548
90	89.32	92.365

CONCLUSION

Psoriasis often reoccurs and is rarely cured, and hence patients may receive therapy periodically over many years. Hence developing efficient vehicles for delivering clobetasol to treat psoriasis is especially important. CP-loaded CMC nanoparticles formulations were developed in this study to achieve this aim. Enhanced permeation and sustained release of Clobetasol were obtained with Nanoparticle. Enhanced permeation can be useful for improving the skin absorption of drugs, while sustained release is important for drugs with irritating effects at high concentrations or to supply the skin with drugs over a prolonged period of time. The comparative study using both polymers i.e. CMC and CD was done. From the obtained results, CP-loaded CMC nanoparticles shows better results. However, optimised CP-Nanoparticles exhibited better stability.

REFERENCE

1. Hardy A, Seguin C, Brion A, Lavalle P, Schaaf P, Fournel S, Bourel-Bonnet L, Frisch B, De Giorgi M. β -Cyclodextrin-functionalized chitosan/alginate compact polyelectrolyte complexes (CoPECs) as functional biomaterials with anti-inflammatory properties. *ACS applied materials & interfaces*. 2018 Aug 14;10(35):29347-56.
2. Prabakaran M. Review Paper: Chitosan derivatives as promising materials for controlled. *Drug Deliv J Biomat Applicat*. 2008;23(1):5-36.
3. Kean T, Thanou M. Biodegradation, biodistribution and toxicity of chitosan. *Advanced drug delivery reviews*. 2010 Jan 31;62(1):3-11.
4. Diebold Y, Jarrín M, Sáez V, Carvalho EL, Orea M, Calonge M, Seijo B, Alonso MJ. Ocular drug delivery by liposome–chitosan nanoparticle complexes (LCS-NP). *Biomaterials*. 2007 Mar 1;28(8):1553-64.
5. Gupta KC, Ravi kumar MN. An overview on chitin and chitosan applications with an emphasis on controlled drug release formulations. *Journal of Macromolecular Science, Part C: Polymer Reviews*. 2000 Nov 20;40(4):273-308.
6. Wang Y, Li B, Xu F, Han Z, Wei D, Jia D, Zhou Y. Tough magnetic chitosan hydrogel nanocomposites for remotely stimulated drug release. *Biomacromolecules*. 2018 Jul 11;19(8):3351-60.
7. Liu D, Li J, Pan H, He F, Liu Z, Wu Q, Bai C, Yu S, Yang X. Potential advantages of a novel chitosan-N-acetylcysteine surface modified nanostructured lipid carrier on the performance of ophthalmic delivery of curcumin. *Scientific reports*. 2016 Jun 28;6(1):1-4.
8. Ammar M, Souissi-Bouchlaka C, Gati A, Zaraa I, Bouhaha R, Kouidhi S. Psoriasis: physiopathology and immunogenetics, *Pathol. Biol. (Paris)*. 2014; 62: 10–23.
9. Ortonne JP. Recent developments in the understanding of the pathogenesis of psoriasis. *Br.J. Dermatol* 1999; 54: 1–7.

10. Liu Y, Krueger JG, Bowcock AM. Psoriasis: genetic associations and immune system changes. *Genes Immun* 2007; 8: 1–12
11. Ansel JC, Tiesman JP, Olerud JE, Krueger JG, Krane JF, Tara DC. Human keratinocytes are a major source of cutaneous platelet-derived growth factor. *J. Clin. Invest.* 1993;92: 671–678.
12. Viac J, Palacio S, Schmitt D, Claudy A. Expression of vascular endothelial growth factor in normal epidermis, epithelial tumors and cultured keratinocytes. *Arch. Dermatol. Res.* 1997; 289: 158–163.
13. Lowes MA, Bowcock AM, Krueger JG. Pathogenesis and therapy of psoriasis. *Nature*. 2007; 445: 866–873.
14. Johnson-Huang LM, Lowes MA, Krueger JG. Putting together the psoriasis puzzle: an update on developing targeted therapies. *Dis. Model. Mech.* 2012; 5: 423–433.
15. Wrono-Smith T, Nickoloff BJ. Dermal injection of immune cells induces psoriasis. *J. Clin. Invest.* 1996; 98: 1878–1887.
16. Austin LM, Coven TR, Bhardwaj N, Steinman R, Krueger JG. Intraepidermal lymphocytes in psoriatic lesions are activated GMP-17(TIA-1) +CD8+CD3+ CTLs as determined by phenotypic analysis. *J. Cutan. Pathol.* 1998; 25: 79–88.
17. McKenzie BS, Kastelein RA, Cua DJ. Understanding the IL-23-IL-17 immune pathway. *Trends in Immunology* 2006; 27: 17–23.
18. McManus R. Mechanisms of steroid action and resistance in inflammation and disease. *Journal of Endocrinology* 2003; 178:1–4.
19. Hebbar PB, Archer TK. Chromatin remodeling by nuclear receptors. *Chromosoma* 2003; 111: 495–504.
20. McKay LI, Cidlowski JA. Molecular control of immune/inflammatory responses: interactions between nuclear factor- κ B and steroid receptor signaling pathways. *Endocrine Reviews* 1999; 20: 435–459.
21. De Bosscher K, Berghe WV, Haegeman G. The interplay between the glucocorticoid receptor and nuclear factor- κ B or activator protein-1: molecular mechanisms for gene repression. *Endocrine Reviews* 2003; 24: 488–522.

Validation of the ‘DICE Test’ as a Measure of Information Processing Speed in People with Traumatic Brain Injury

Srinivasan Jayaraman¹, R. Neelakandan², R. Rajendran³ and Jonathen Evans⁴

¹Clinical Psychology, SRM Medical College Hospital and Research Centre

²Department of Psychology, Annamali University

³Applied Psychology, National Institute of Technical Teachers Training & Research

⁴Applied Neuropsychology, University of Glasgow

ABSTRACT

Information processing speed (IPS) refers to the speed by which individuals perform cognitive tasks. IPS is distinguished from motor speed although speeds of cognitive and motor processes are often conflated in clinical assessment tools. The BIRT Memory and Information Processing Battery Speed of Information Processing (BMIPB SoIP) test controls for motor responses when evaluating speed of cognitive processing. However this test is not suitable for use with people who are illiterate, which represents a significant proportion of the population in India. This study evaluated the validity of a version of the BMIPB SoIP designed for use with people with low literacy skills (referred to as the DICE test). The study examined the correlation in performance between the original and adapted forms of the BMIPB SoIP, the WAIS-IV-Symbol Search, and WAIS-IV-Coding. Thirty literate people with head injuries ranging in severity from mild to severe, from two hospitals in Tamil Nadu, India, participated in the study. Performance on the Dice test correlated significantly with performance on the BMIPB and the other speed test scores. A negative correlation was found between length of post-traumatic amnesia and performance on all the four tests. There is no significant effects of age and education were observed. This study provides initial evidence that the Dice test may be a useful alternative for the assessment of IPS in people with low literacy.

INTRODUCTION

The concept of information processing speed (IPS) is frequently used within clinical neuropsychology although it is often not clearly defined. DeLuca (2008) proposed the following definition, “The time required execute a cognitive task or the amount of work that can be completed within a finite period of time”. It is difficult to separate speed of information processing from the content of information processing since speed can only be measured while performing some form of mental task. Furthermore, the concepts of speed of processing, working memory and attention often appear to be commutable (DeLuca 2008).

Processing speed indicates how efficiently information is processed. It involves processing the input before it decays or before some other incoming input interferes with it (Miller & Vernon, 1996). Information processing speed may be viewed as a universal concept that affects a range of perceptual, motor and cognitive tasks (Fry & Hale, 2000). Moreover, research findings show that developmental changes in speed of processing can be detected through several different tasks (Hale, 1990).

Sheppard and Vernon (2008) found that measures of mental speed or information processing speed on different task paradigms correlated consistently albeit moderately, with measures of intelligence (generally but not always relatively more correlated with fluid intelligence rather than crystallized intelligence). Further they observed that on some tasks there was a trend for the strengthening of this correlation with increasing complexity of the tasks. Hence, it can be said that though processing speed may appear to be a basic cognitive skill, it is also closely associated with the construct of intelligence, though does not explain all variance in intelligence.

As noted, the concept of speed of information processing is also closely related to that of attention. Attention could be perceived as a quality of processing information: when the attentional system is well focused and when the essential level of attention is present, processing speed, perception and storing of information are at peak levels (Spikman and Van Zomeren, 2010).

Information processing speed has been shown to be highly vulnerable to ageing (Salthouse, 2000) and brain damage. For instance, slowing of speed of processing has been confirmed in traumatic brain injury (TBI), stroke, Multiple Sclerosis, Parkinson’s diseases, and schizophrenia (Kalmar and Chiaravalloti, 2008).

In terms of explaining decreased IPS in neurological conditions, several different mechanisms have been proposed, including changes in intelligence, white matter pathology and motivation (Sweet, 2011). For example, Leskela et al. (1999) suggested that frontal stroke in elderly people seems to result in a slowing of

simple mental processing. One of the most stable cognitive deficits In Multiple Sclerosis (MS) is reduced IPS (Whelan et al., 2010). Many researchers have argued that white matter pathology plays a major role in MS and subcortical dementias in relation to slowing of speed of processing (Kalmar and Chiaravalloti, 2008).

Speeds of information processing and memory dysfunction are very commonly reported after Traumatic Brain Injury (TBI; Dacey et al., 1991; Dikmen, Machamer, Powell, and Temkin, 2003). There is a reliable evidence for reduced information processing speed when TBI is moderate to severe, though the picture in mild TBI picture is much less clear (Kinsella, 2008). It has been suggested that speed of information processing is an important mediator between brain injury severity and functional consequence 12 months post-injury (Rassovsky et al., 2006), although others dispute this relationship (Green et al., 2008).

The assessment of Information processing speed is problematic because test scores on any measure of performance speed might be influenced, of confounded, by individual ability in the domains of visuospatial, attention, perception, immediate memory, and language along with motor speed /coordination and the reliability of the sensory system (Gontkovsky and Beatty, 2006).

No neuropsychological tests are a pure test of particular cognitive function as there may be other cognitive skills which might be contributing to the performance on the test. Most of the IPS test tests require intact motor and visual functions and may need executive functions such as decision making (Martin and Bush, 2008). Many different ways of measuring IPS have been developed, including paper and pencil tasks and computerized tasks. The latter have the advantage of carrying quite exact timings for response times to both simple and complex reaction time tasks. They have been shown to have robust concordance with traditional paper and pencil formats (Martin and Bush, 2008). In clinical practice amongst the most commonly used IPS tests include the Digit Symbol Substitution Test (a subtest of the Wescher Adult Intelligence Scale; Wechsler, 2008), the Paced Auditory Serial Addition Test (PASAT; Gronwall, 1977), the Trail Making Test (Reitan, 1955), the Speed and Capacity of Language Processing test (Baddeley, Emslie, & Nimmo Smith, 1992) and various forms of reaction time assessments. In the UK one test available is the Speed of Information Processing subtest of the BIRT Memory and Information Processing Battery (BMIPB; Coughlan, Oddy, & Crawford, 2007). The BMIPB Speed of Information Processing Test (SoIP) has the additional benefit over some other tests in that it controls for basic psychomotor speed. Participants look at a row of five two-digit numbers and must select the second highest number, completing as many items within a time limit. The test also has a motor speed task involving a simple cancellation of boxes with the number 11 in them. The main Speed of Processing measure can then be adjusted taking into account motor speed. A limitation is that individual must be able to identify written numbers.

Rates of literacy are often lower in developing countries and tests such as the BMIPB SoIP and many of the others discussed earlier cannot be used with a considerable proportion of the population. It is important that low-cost test materials are available that do not need use of costly technology. In India there is very small number of published research studies on tests of information processing speed in adults and no published data on the assessment of speed of information processing in neurological populations in India. The field of neuropsychology is growing in India and there is a need for new suitable test for information processing.

AIM

The purpose of the study was to test whether an adapted version of the BMIPB Speed of Information Processing Test, known as the 'Dice Test' (Sumransub and Evans, Personal Communication) may provide a valid assessment as an alternative to the BMIPB (Speed of Information Processing) and WAIS-IV (Processing Speed Scale- Symbol search and Coding) in the assessment of speed of information processing in people with traumatic brain injury.

The Dice Test was initially developed by Sumransub and Evans for use in people with low literacy skills in Thailand. Adaptation involved replacing written numbers with 'Dice', with different numbers of dots ranging from 1 to 9. The format for the task remains the same, being to cancel the dice with the second highest number of dots. There is also a basic psychomotor speed task that uses dice with just a single dot in the corresponding place to the target in the main task.

The present study involved a preliminary investigation of the test in a sample of literate participants with head injury in Tamil Nadu, India. The aim of the study was to investigate whether performance on the Dice Test correlates with performance on several other tests of information processing speed. If there is a significant correlation between these tests, this would provide preliminary evidence that the Dice Test is a valid assessment of speed of information processing, before moving to study its use in people who are illiterate.

Hypothesis

Patients' performance on the Dice Test will be significantly correlated with the performance on the BMIPB Speed of Information Processing subtest and the WAIS- IV Symbol Search and Coding sub-tests.

Method of Data Collection

The study was approved by SRM Medical College Hospital and Research center, Sri Ramachandra Medical College Hospital Research Institute and College of Medical, Veterinary and Life Science Research Ethics Committee.

Samples

Participants were literate adults (over 16 years) who were undergoing treatment for head injury in the Neurology inpatient and outpatient departments within the Sri Ramachandra Medical College Hospital and Research Institute, Sri Ramachandra University, Porur, Tamil Nadu India.

Inclusion Criteria

- Patients who have the capacity to give consent to participate in research.
- Patients who have been diagnosed as having suffered a head injury (mild, moderate or severe) by a medical practitioner.
- Patients (including post-operative patients) must have sufficient ability to attend to a task lasting 4 minutes.

Exclusion Criteria:

- Patients who are illiterate.
- Patients with acquired language disorders judged severe enough to prevent understanding of task instructions.
- Patients with emotional or behavioral difficulties judged severe enough to prevent engagement with tasks.
- Patients judged not to have sufficient ability to attend to a task lasting 4 minutes.

Design & Procedure

The present research study was a correlational study. Tests were administered in a counterbalanced order.

Measures

Demographic details include gender, age, level and years of education, and severity of head injury (length of Post-Traumatic Amnesia) were collected. Then the following tests were administered:

BMIPB Speed of Information Processing Test

The BMIPB was developed by Coughlan, Oddy, & Crawford, (2007). In this study the speed of Information Processing Test was used. The examinee is presented with a sheet of paper containing rows of five 2-digit numbers and is required to work through cancelling the second highest number in each row as quickly as possible for a period of four minutes. A motor speed test was also administered in order that allowance can be made for the effect of motor speed on task performance. The examinee is presented with a sheet of paper containing 11s laid out in a spatial distribution similar to that of the target in the information processing task. The examinee is required to cancel as many 11s as possible in 25seconds. The primary outcome measure is an adjusted speed of information processing measure calculated based on the following equation: $(9.6 * \text{SoIP Total} * \text{Motor Speed}) / [(9.6 * \text{Motor Speed}) - \text{SoIP Total}]$.

WAIS-IV Symbol Search and Coding Tests

The Symbol Search and Coding subtests were administered, which combine to produce the WAIS IV Processing Speed Index. In the Symbol Search, working within a specified time limit (120s), the examinee scans an array of symbols and points out whether one of two target symbols is present in the array. In addition to processing speed, the subtest involves short-term visual memory, visual motor coordination, cognitive flexibility, visual discrimination, psychomotor speed, speed of mental operation, attention and concentration.

In the Coding subtest, the examinee copies symbols that are paired with numbers within a specified time limit (120s). In addition to processing speed, the subtest measures short-term visual memory, visual scanning ability, cognitive flexibility, attention, concentration, and motivation. It may also involve visual sequential processing and fluid intelligence.

Dice Test

In this task examinee is presented with a sheet of paper containing rows of five dice, with different numbers of dots ranging from 1 to 9. The format for the task remains the same as the original, being to cancel the dice with the second highest number of dots. There is also a basic psychomotor speed task that uses dice with just a single dot in the corresponding place to the target in the main task. As for the BMIPB test, the outcome measure is the adjusted speed of information processing score.

Data Analysis and Sample Size

Descriptive statistics were used for the analysis of demographic details. The present study was a correlation study. Analysis examined whether there was a correlation between scores on the Dice Test and the BMIPB (Speed of Information Processing) and the WAIS- IV (symbol search and coding) total scores

If the Dice test is a good alternative to the Digit Symbol Coding test (WAIS-IV) and Speed of Information processing test (BMIPB), then it should show a high correlation with both tests. Whilst one might expect two tests that assess exactly the same construct to have correlations that are at least greater than 0.7, in this study we took a more conservative approach and use an estimated correlation of 0.5. Using G Power 3 (Faul et al., 2009), the number of participants that would be required to detect an effect size of $r=0.5$ with power at 0.8 and alpha error 0.05 is 29. We aimed to recruit around 30 participants from mild to severe level. Severity was defined as follows: Mild (GCS 13-15; PTA < 1day; LoC 0-30 mins); Moderate (GCS 9-12; PTA >1day to < 7days; LoC >30 mins to <24 hours); Severe (GCS <9; PTA > 7 days; LoC >24 hours).

Statistical Analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences, Version 22. Descriptive statistics were used for the analysis of demographic details. The data was not normally distributed and showed non-linear relationship, and so the non- parametric Spearman correlation was computed to analyses the correlation among the BMIPB Adjusted total score, Symbol search, Coding and Dice Adjusted total score. In addition, Spearman correlations were computed to explore the effects of demographic factors such as age, education and length of PTA on the performances of Dice Test, BMIPB Adjust total score, Symbol search, coding.

RESULTS

Participants

Thirty adult patients undergoing treatment in SRMMCH&RC (N=21) and SRMC (N=9) neurosurgery department participated. Their mean age was 39.63 years (s.d. 8.72; n=30). There were 28 men (93.3%) and two women (6.7%). In terms of level of education, 19 people (63.3%) were High School education, eight people were (26.7%) and three people were postgraduates (10%).

Results from the Tests of Information Processing Speed.

Table 1 provides descriptive statistics for the four tests of information processing speed.

Table 1: Results from the Dice Test, BMIPB, Symbol search and Coding

Test	Mean	Median	SD	Minimum	Maximum
Dice Test	32.86	31.97	13.02	9.25	55.12
BMIPB	21.67	15.72	14.10	3.16	42.97
Symbol Search	13.13	13	5.19	5	21
Coding	12.96	12	6.50	4	33

We used Q-Q plots and histograms to examine the distributions of the data to determine whether the data were distributed normally. Moreover, we used the Shapiro Wilk test to measure normality in the present study data (Dice Test, BMIPB, Symbol search, Coding). We obtained scores for the Dice test $W=0.966$, $p=0.438$ for BMIPB, $W=0.855$, $p=0.001$ for the Symbol search $w=0.933$, $p=0.059$ and coding test $w=0.932$, $p=0.054$. These suggested that the BMIPB data were not normally distributed and the data for the Symbol search and Coding tests were close to being significant (not normally distributed) and therefore nonparametric analyses were used. Table 2 presents the result of the correlation analyses. Given that it was predicted apriority that all tests would significantly correlate with each other and given this was a preliminary study, no adjustment for multiple comparisons was made.

Table 2: Correlation between Dice, BMIPB, Symbol search, Coding.

	Dice	BMIPB	Symbol search	Coding
Dice	-	.943**	.812*	.813*
BMIPB	.943**	-	.809*	.816*
Symbol search	.812*	.809*	-	.889*
Coding	.813*	.816*	.889*	-

** Correlation is significant at the <0.01 level.

The relationship between age and performance on Dice test, BMIPB, Symbol search and Coding total scores was examined using Spearman correlation. Their respective correlation coefficient values were: Dice test ($\rho=0.020$, $p=0.915$); BMIPB ($\rho=0.024$, $p=0.900$); Symbol search ($\rho=-0.122$, $p=0.520$) and Coding ($\rho=-0.051$, $p=0.719$). There was no correlations were found between age and performances on all three tests.

The relationship between education and performance on Dice test, BMIPB, Symbol search and Coding total scores was examined using Spearman correlation. Their respective correlation coefficient values were: Dice test ($\rho=0.089$, $p=0.641$); BMIPB ($\rho=0.016$, $p=0.933$); Symbol search ($\rho=-0.222$, $p=0.239$) and Coding ($\rho=-0.174$, $p=0.358$). There was no correlations were found between education and performances on all three tests.

The relationship between length of PTA and performance on Dice test, BMIPB, Symbol search and Coding total scores was examined using Spearman correlation. Their respective correlation coefficient values were: Dice test ($\rho=-0.918$, $p<0.01$); BMIPB ($\rho=-0.928$, $p<0.01$) Symbol search ($\rho=-0.779$, $p<0.01$) and Coding ($\rho=-0.784$, $p<0.01$).

DISCUSSION

The Dice test was designed to measure the same function of information processing speed to those assessed with the BMIPB Speed of Information Processing test (BMIPB-SoIP) and WAIS-IV Processing speed measures. The Dice Test achieves this without the requirement to read numbers (unlike the BMIPB SoIP), but includes an adjustment for motor speed (unlike Symbol Search or Coding). The aim was to provide an alternative to the BMIPB-SoIP for illiterate or low education populations. The Dice test requires four minutes for complete. The test is easy to administer and does not involve any extensive training for the individual who is administering the test. There is little chance of harm to the patient. Compared to other computerized IPS tests, which require expensive equipment, the Dice test uses just paper and pencil.

There were significant correlations between the Dice test and the BMIPB SoIP, Symbol Search and Coding tests. These results suggest that the Dice test is sensitive to differences in speed of information processing that are assessed in the BMIPB and other speed tests. Moreover, the size of the correlation was particularly strong between the Dice test and the BMIPB SoIP, with correlations with the other tests being slightly lower, though still highly significant.

There were no significant correlations between the Dice test (or other tests) and age or education. However, the study revealed that there was relationship between lengths of PTA and performance on Dice test, BMIPB, Symbol search and Coding test. Significant negative correlations were found between length of PTA and the performance on all the four tests. This is to be expected given that increasing length of PTA is associated with increasing severity of Injury and greater reductions in speed of processing have been associated with increasing severity of brain injury, which is evident from previous studies by De Monte et al. (2006) and Wilson et al. (1999).

LIMITATIONS

The study sample size was relatively modest and whilst the number required based on an a priori power calculation was recruited, it would be useful to examine performance of the test in a larger sample. Related to this, although there was good evidence of strong correlations, it should be noted that there was a wide range of brain injury severity amongst the sample. Whilst on the one hand this enhances the generalizability of the results, on the other hand people who are severely injured will be poor on almost any test given to them and people who are mildly injured will be relatively good at almost every test given them. So it is possible that the strength of this study correlation is exaggerated by the nature of our collected sample. So in future studies it would be good to have a bigger sample with more people from for example the middle levels of severity would enable to see more clearly how strong the correlation is between the tests. A limitation of study is that at this stage we have only included literate people with a minimum of high school education so it is not possible to determine whether the test will be feasible for people who are illiterate to do. A further limitation is that

although the test does not require the ability to read numbers it does require an appreciation of relative number of items and the ability to count to nine, as well as the ability to hold in mind the concept of the second highest number.

IMPLICATIONS

This study suggests that the Dice test correlates strongly with the BMIPB SoIP test and the other speeds tests and therefore this suggests that it may provide clinicians with a good assessment of speed of processing in people who are illiterate. So, further research is needed to evaluate whether the task does work for people who are illiterate. This might involve comparing the Dice test with symbol search, which does not require literacy skills (though does not adjust for motor speed). Also we would need to collect normative data for illiterate groups. It would be interesting to compare a patient group with a healthy control group, within the illiterate population.

CONCLUSIONS

The dice test was not complicated to administer, with easy to understand instructions. Participants do not need the ability to read numbers so illiterate people may be able to perform without any barrier, though this needs to be examined. Only simple motor skills are required. Results suggest that the Dice test could potentially be used as an alternative to the BMIPB SoIP and other speed tests. It appears to capture similar cognitive domains to the BMIPB-SoIP. In our sample, length of PTA was negatively correlated with performance of the test, suggesting that the test was sensitive to severity of injury, which is known to be related to reductions in speed of processing. Overall this study provides strong initial evidence that the Dice Test may be a useful tool for investigating speed of processing in people who are illiterate but further research is needed to determine whether this is the case.

REFERENCES

1. Baddeley, A., Emslie, H., & Nimmo Smith, I. (1992). *The Speed and Capacity of Language-Processing test*. Suffolk, England: Thames Vally Test Company.
2. Coughlan, A. K., Oddy, M. J., & Crawford, J. R. (2007). *BIRT Memory and Information Processing Battery (BMIPB)*. London: Brian Injury Rehabilitation Trust.
3. Dacey, R., Dikmen, S., Temkin, N., McLean, A., Armsden, G., & Winn, H.R. (1991). Relative effects of brain and non-brain injuries on neuropsychological and psychosocial outcome. *Journal of Trauma-Injury Infection and Critical Care*, 31, 217–222.
4. DeLuca, J. (2008). Information processing speed: How fast how slow, and how come? DeLuca, J., and Kalmar, J.H., (Eds.), *Information Processing Speed in Clinical Populations*. (pp.265-273). New York: Psychology Press.
5. De Monte, V.E., Geffen, G.M., & Massavelli, B.M, (2006). The effects of post-traumatic amnesia on information processing following mild traumatic brain injury. *Brain Injury*, 20:13-14, 1345-1354.
6. Hale, S. (1990). A global developmental trend in cognitive processing speed. *Child Development*, 61, 653–663.
7. Dikmen, S.S., Machamer, J.E., Powell, J.M., & Temkin, N.R. (2003). Outcome 3 to 5 years after moderate to severe traumatic brain injury. *Archives of Physical Medicine and Rehabilitation*, 84, 1449–1457.
8. Faul, F., Erdfelder, E., Buchner, A., and Georg Lang, A. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behaviour Research Methods*. 41 (4), 1149-1160.
9. Fry, A.F., Hale, S. (2000). Relationships among processing speed, working memory, and fluid intelligence in children. *Biological Psychology*. 54, 1–34.
10. Green, R.E., Colella, B., Hebert, D.A., Bayley, M. Kang, H.S., Till, C., Monette, G. (2008). Prediction of Return to Productivity After Severe Traumatic Brain Injury: Investigations of Optimal Neuropsychological Tests and Timing of Assessment. *Arch Phys Med Rehabil*. 89 (2), S51-S60.
11. Gronwall, D.M.A. (1977). Paced Auditory Serial Addition Task: A measure of recovery from concussion. *Perceptual and Motor skills*, 44, 367-373.
12. Miller, L. T., & Vernon, P. A. (1996). Intelligence, reaction time and working memory in 4- to 6-year-old children. *Intelligence*, 22, 155–190.

13. Martin, T.A., and Bush, S.S., (2008). Assessment tools and research methods for human information processing speed. DeLuca, J., Kalmar, J.H., (Eds.), *Information Processing Speed in Clinical Populations* (pp. 29-51). New York: Psychology Press.
14. Gontkovsky, ST., Beatty, W.W. (2006). Practical Methods for the Clinical Assessment of Information Processing Speed. *Intern. J. Neuroscience*, 116:1317–1325.
15. Kalmar, J.H., and Chiaravalloti, N.D. (2008). Information processing speed in multiple sclerosis: A primary deficit? DeLuca, J., and Kalmar, J.H., (Eds.), *Information Processing Speed in Clinical Populations*. (pp.152-172). New York: Psychology Press.
16. Kinsella, G.J. (2008) Traumatic brain injury and processing speed. DeLuca, J., and Kalmar, J.H., (Eds.), *Information Processing Speed in Clinical Populations*. (pp.173-194). New York: Psychology Press.
17. Leskela, M., Hietanen, M., Kalska, H., Ylikoski, R., Pohjasvaara, T., Mantyla, R., & Erkinjuntti, T. (1999). Executive functions and speed of mental processing in elderly patients with frontal or nonfrontal ischemic stroke. *Eur J Neurol*, 6(6), 653-661.
20. Rassovsky, Y., Satz, P., Alfano, M.S., Light, R.K., Zaucha, K., McArthur, D.L., And Hovda, D. (2006). Functional Outcome in TBI II: Verbal Memory and Information Processing Speed Mediators. *Journal of Clinical and Experimental Neuropsychology*, 28:581–591.
21. Reitan, R. M. (1955). The relation of the trail making test to organic brain damage. *Journal of Consulting Psychology*, 19, 393-394.
22. Salthouse, T.A., (2000). Aging and measures of processing speed. *Biological Psychology*. 54: 35–54.
23. Sheppard, L. D., & Vernon, P. (2008). Intelligence and speed of information-processing: A review of 50 years of research. *Personality and Individual Differences*, 44, 535–551.
24. Spikman J, Van Zomeren E. (2010). Assessment of attention. In: Gurd, JM., Kischka, U., Marshall, JC. (eds.), *The handbook of clinical neuropsychology*. (pp.81–96). New York: Oxford University Press.
25. Sweet, L.H., (2011) Information Processing Speed. In, Kreutzer, J.S., DeLuca, J., Caplan, B., (Eds.), *Encyclopedia of Clinical Neuropsychology*. (pp. 1317-1319). New York: Springer.
26. Wechsler, D. (2008). *Wechsler Adult Intelligence Scale, Fourth Edition*. Pearson: London.
27. Whelan, R., Lonergan, R., Kiiski, H., Nolan, H., Kinsella, K., Hutchinson, M., Tubridy, N., Reilly, R.B. (2010). Impaired information processing speed and attention allocation in multiple sclerosis patients versus controls: A high-density EEG study. *Journal of the Neurological Sciences*. 293, 45–50.
28. Wilson BA., Evans JJ., Emslie H., Balleny H., Watson PC., Baddeley AD. (1999). Measuring recovery from post-traumatic amnesia. *Brain Injury*.13, 505–520.

Self-Esteem and its Impact on Academic Achievement among DDU Gorakhpur University Student (U.P.) India

Rajesh Kumar Sharma and Sanad Kumar Gautam*

Department of Education, Faculty of Social Science and Humanities, AKS University Satna (M.P.) India

ABSTRACT

What is Self Esteem and academic achievement? What is the role of it in development of Adolescents? Many teens, their teachers, their parents, and others think so, and many adults recall adolescence as a time of increasingly heightened self-scrutiny and greatly fluctuating self-esteem. But the answer is not entirely clear, as self-esteem is a subjective state, and therefore very hard to measure. Academic achievement describes academic outcomes that indicate the extent to which a student has achieved their learning goals. Academic achievement was inferred from the school performance records. Academic achievement may refer to completing educational benchmarks such as a bachelor's degree. Academic achievement is often measured through examinations or continuous assessments. An adolescent may have different levels of self-esteem in different domains such as social, scholastics, athletics, appearance, and general conduct and actions. This research study done to measures Self Esteem and Academic Achievement in Adolescents of in and around DDU UNIVERSITY GORAKHPUR Uttar Pradesh. 100 Adolescents age group 17-22 years from different DEPARTMENT of DDU UNIVERSITY GORAKHPUR were taken for the assessment. Study was done with the help questioners having four different informative sections including personal data sheet and few major parameters to conclude the research. The findings are discussed and implications for practice and further research given.

Keywords: Academic achievement, Adolescents, Self-esteem, academic achievement

1. INTRODUCTION

The word adolescence is coined from the Latin verb 'adolescere' which means 'to grow in to maturity'. Therefore, adolescence is a phase where in an individual grows to be a responsible adult. Peterson (1988) has described adolescence as a phase of life beginning in biology and ending in society. Adolescence, thus is a very important phase where in the experiences and learning of an individual form a base for what an individual will be like when he grows up to be an adult.

1.1. Self - Esteem

The "self" part of self-esteem pertains to the values, beliefs and attitudes that we hold about ourselves. The "esteem" part of self-esteem describes the value and worth that one gives to oneself. Self-esteem is typically viewed as a continuous dimension ranging from high to low people with high self-esteem feel very positive about themselves, whereas those with low self-esteem feel ambivalent or uncertain about themselves. Truly negative self-evaluations or self-hatred are unusual and typically found only in clinical populations (Brown et al., 2001; Leary and MacDonald, 2003). This global evaluation is the most common definition of self-esteem, and is considered relatively stable (i.e., an individual can be said to have a dispositional level of self-esteem). It is also sometimes referred to as self-worth, self-regard, or self-evaluation – all of which have the same essential meaning. The construct of self-esteem has a long and checkered history within the discipline of psychology. At its highest potential, academic achievement involves a student's psychological investment in learning, comprehending, and mastering knowledge (Suh & Suh, 2006). However, the most overt, public, visible indicators of academic achievement are school marks or grades. These are greatly valued as a determinant of one's success in academics (Rosenberg et al., 1985). The ultimate lowest measure of academic achievement is that of a "drop-out" (Suh & Suh, 2006). Crocker and Luhtanen (2003) gave self-esteem an ambiguous definition. For some, it could be dependent on being attractive, loved, or good at school, while for others it could be based on being virtuous, powerful, or self-reliant. These beliefs may determine how much time is spent on certain behaviors based on the importance these behaviors may hold. For example, students in their freshmen year at college who value academics most spend more time studying, while students who base their self-esteem on appearance spend more time exercising and grooming (Crocker & Luhtanen). Self-Esteem in adolescents is important as it allows them to try new things, take healthy risks and solve problems. In turn, their learning and development will be productive and will set them up for a healthy and positive future. A young person with healthy self-esteem is more likely to display positive behavioral characteristics, such as acting independent and mature

- Taking pride in their accomplishments/achievements

- Accepting frustration and dealing with it responsibly
- Trying new things and challenges
- Helping others when possible

Academic achievement describes academic outcomes that indicate the extent to which a student has achieved their learning goals. Academic achievement is commonly measured through examinations or continuous assessments but there is no general agreement on how it is best evaluated or which aspects are most important—procedural knowledge such as skills or declarative knowledge such as facts. Furthermore, there are inconclusive results over which individual factors successfully predict academic performance, elements such as test anxiety, environment, motivation, and emotions require consideration when developing models of school achievement. Now, schools are receiving money based on its student's academic achievements. A school with more academic achievements would receive more money than a school with less achievement. Academic achievement: In a number of ways, academic achievement is measured. The most widely used, the rate of high school completion is the measure cited. Statistics on grades, standardized test results, absenteeism, suspensions and expulsions, and the number of students who were kept back are also available. (Lynn Magdol).

2. REVIEW OF LITERATURE

Ashra, B. K. & Jogsan, Y. A. (2013). Study on “locus of control and self-esteem among youth male and female.” Result show that there was no significant difference in locus of control and self-esteem with respect to both youth male and female. While the correlation between locus of control and self-esteem reveals 0.54 positive correlation. Bagheri, M. S. & Faghin, M. (2012) study on “the relationship between self-esteem, personality type and reading comprehensive of Iranian EFL students.” Result of the study revealed that there was a positive relationship between overall self-esteem and reading comprehension, and overall self-esteem and personality type, in general. Likewise, positive relationship between situational and task self-esteem with reading comprehension were shown but there wasn't a significant relationship between global self-esteem and reading comprehension. Also the relationship between personality type and reading comprehension was insignificant.

Dudhatra, R. & Jogsan, Y. A. (2012) study on “self-esteem and academic achievement among P.G. and U.G. students.” Result show that significant difference in self-esteem and academic achievement among U.G. and P.G. students. U.G. student have high self-esteem and academic achievement as compare P.G. students. While correlation between self-esteem and academic achievement is 0.82 positive correlation.

Hosogi, M., Okada, A., Pujil, C., Watanable, K. and Noguchi, K. (2012) study on “importance and usefulness of evaluating self-esteem in children.” They show that the development of children's self-esteem is heavily influenced by their environment, that is, their homes, neighborhoods and schools. Child with damaged self-esteem are at risk of developing psychological and social problems, which hinders recovery from low self-esteem. Thus, to recover low self-esteem, it is important for children to accumulate a series of successful experiences to create a positive concept of self. Evaluating children's self-esteem can be an effective method for understanding their past and present circumstances and useful to treat for children with psychosomatic disorder.

Bhattacharjee, A. (2011) study on “impact of gender and community on locus of control and self-esteem among undergraduate students.” Findings revealed significant impact of gender and community on locus of control and self-esteem of the study subjects which further showed that male students were more internally oriented and they possessed high self-esteem in comparison to female students. Again, tribal students were externally oriented as well as they possessed low self-esteem than their non-tribal counter parts.

Sahu, K. & Singh, D. (2011) study on “psychological well-being and self-esteem in professional college students.” Result denoted that these professional students shoved above average level of psychological well being and self-esteem. Further, there was not any significant gender difference regarding the self-esteem and psychological well-being of these professionals. Both male and females exhibited above average level of psychological well being and self-esteem. Income has significant effect on the psychological well-being as well as self-esteem of the subjects.

High income group showed high self-esteem and better psychological well-being. In addition the subjects of service class group indicated better psychological well-being in comparison to business class group. But there was not any remarkable differences regarding self-esteem of business group and service group. Joshi, S. and Srivastava (2009) study on “self-esteem and academic achievement of

Adolescents.” The result indicated that there were on significant difference with regard to selfesteem

of rural and urban adolescents. There were significant differences with regard to academic achievement of rural and urban adolescents. Urban adolescents scored higher in academic achievement as compared to rural adolescents. Boys would score significant higher on self-esteem as compared to girls. Significant gender differences were found in academic achievement. Girls were significantly higher on academic achievement as compared to boys.

Dong, Q., Koper, R. J. and Collaco, C. M. (2008) study on “social intelligence, self -esteem and intercultural communication sensitivity.” They examined relationship between self-esteem and intercultural communication sensitivity. Result support hypothesized relationships and indicate a statistically significant relationship between social intelligence (SI) and intercultural communication sensitivity (ICS), with SI accounting for more than 10% of the variance in ICS. In addition, both dimensions of self-esteem i.e. self worth and self efficacy. Were significantly related to ICS, accounting for a additional 4% of the variance.

Diaman topoulou, Rydell & Henricsson (2008) study on “self-esteem in children.” Result showed that both low levels of global self-worth and exaggerated but disputed self-esteem were related to aggression. The findings indicate that, depending on low self-esteem in conceptualized aggressive children may appear to have both a low and a high self-esteem. Regarding gender differences, exaggerated self-esteem was more strongly related to aggression in boys than girls.

3. METHODOLOGY

The study was conducted in 100 adolescent (50 Boys and 50 girls) within the age group of

17-22 years. The sample was collected from Four Faculties in and around DDU UNIVERSITY GORAKHPUR Uttar Pradesh (U.P.).

The Schools are as follows :

- Faculties OF ART
- Faculties OF EDUCATION
- Faculties OF COMMERCE
- Faculties OF LAW

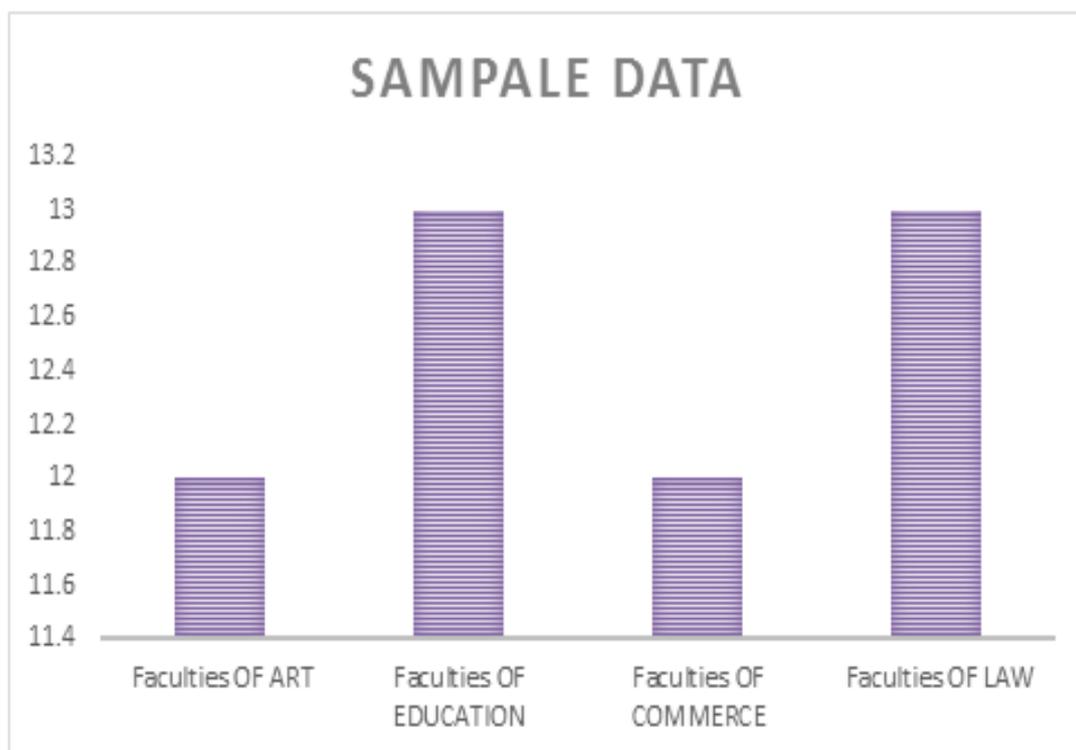


Figure 1

The sample size was 100 adolescence, all of them were adolescents and were in the age group of 17-22. Out of 100 students 50 boys and 50 girls were chosen for the study.

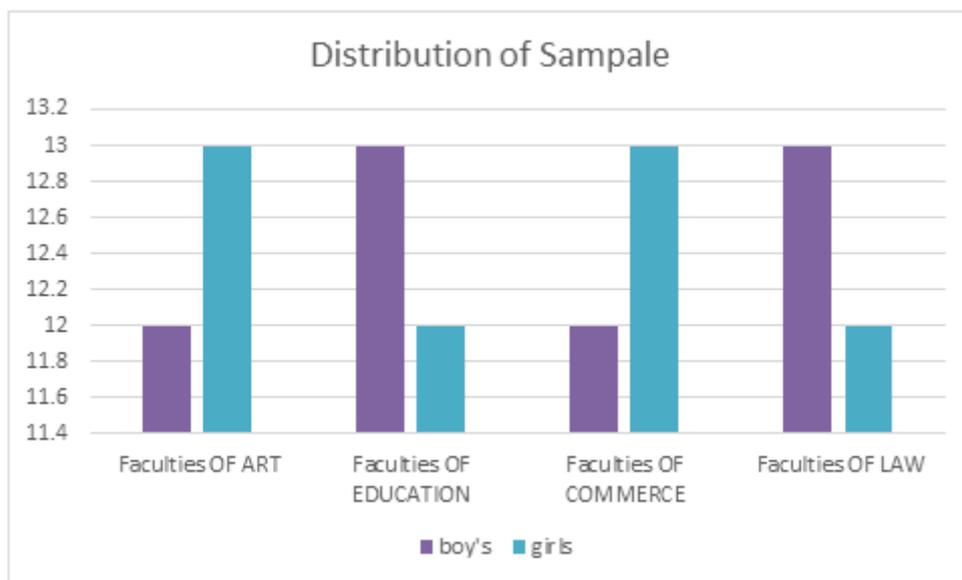


Figure 2

An introductory session was carried out for all the students to emphasize the need of academic achievement or flexibility, as it represents students' ability to deal effectively with setbacks, challenges and pressures in school setting. A 'Participatory Appraisal Method' was adopted, in which adolescent respondents were made to interact freely without any apprehension and to discuss about their academic pressure and the importance of scholastic performance. As a result of changing socio-economic environment in the Indian society, adolescents are exposed to various emotional issues. Academic performance of adolescents is considered to be a key to seek entry into numerous professional and vocational programmes, leading to a career choice. The competitive world is putting additional pressure on academic performance since academic scores open possible doors for further professional pursuits and realization of goals and ambitions. While some students cope with the adversities with achievement, many students do not have the necessary achievement attributes to overcome adversities. Students were introduced with several concepts of academic achievement, so that they better participate in the interaction.

Test and Tools

Following standardized tests and tools were used:

1. Self-esteem scale (Rosenberg, 1985)
2. Academic scores and grades of adolescents.

The Parameter of the study is as follows:

INSTRUCTIONS: "Read each statement carefully and then assign a number depending upon whether you strongly agree, agree, disagree and strongly disagree with what is said:

3= Strongly Agree, 2= Agree, 1= Disagree, 0 = Strongly Disagree.

1. I feel that I am a person of worth, at least on an equal plane with others. _____
2. I feel that I have a number of good qualities. _____
3. All in all, I am inclined to feel that I am a failure. _____
4. I am able to do things as well as most people. _____
5. I feel I don't have much to be proud of. _____
6. I take a positive attitude towards myself. _____
7. On the whole, I am satisfied with myself. _____
8. I wish I could have more respect for myself. _____
9. I certainly feel useless at times. _____
10. At times I think I am no good at all. _____

Phase II

For Phase II- 62 respondents found low on Trait Meta Mood and who were willing to be a part of intervention plan were taken.

4. RESULTS & DISCUSSION

The Result of the Study is as follows:

Self Esteem

T –Test

self_esteem_total	Post Test	62	15.9242	3.30557	.41981	1.683
	Pre Test	62	15.0000	2.78756	.35402	

* $p < .05$ level of significance

** $p < .01$ level of significance

During the assessment T test was calculated. In case of self-esteem, it is not giving a significant T-test result. Approximately Similar values were occurred. There were minimal changes occurred.

Academic Achievement

Group Statistics

	Experimental Condition	N	Mean	Std. Deviation	Std. Error Mean	t
AAS	Post test	62	70.8548	12.55394	1.59435	2.101*
AAS	Pre test	62	67.4839	9.81838	2.00894	

* $p < .05$ level of significance

** $p < .01$ level of significance

Significant differences have occurred on the variables among the pre and post test scores of the experimental group. Therefore, we can conclude that the intervention is successful.

5. CONCLUSION

During the study, a major problem inherent in the measures of self-esteem is the extent to which self-reports are influenced by self-presentational concerns. The available measures seem to be contaminated with social desirability. Student are guided by a strong, fundamental desire for self-esteem. People claim credit for success but deny blame for failures. They exaggerate and overestimate their abilities. Students, systematically choose to compare themselves with others who are less gifted or worse off than themselves. They deny or conceal their shortcomings and advertise their virtues and positive traits. They identify themselves with successful groups and distance themselves from failing or stigmatized groups. It is suggested to administer a social desirability scale along with the self-esteem questionnaire. Then, it is hopeful to reach a statistical formula to add a score of the social desirability scale to the self-esteem measure to suppress the participant's attempt to make favorable impression.

- Adolescents, who have high self-esteem are socially at ease, more confident of their own opinions and judgments. They are more ambitious, more academically successful
- Adolescents with low self-esteem view interpersonal relationship as threatening, feel less positively toward others and are easily hurt by criticism, lack confidence in their own judgments and opinions, expect others to reject them and their ideas, and have little faith in their ability to achieve, they have lower goals, less active, appear more depressed and unhappy, more frequently manifest symptoms of anxiety, poor adjustment.
- Low self-esteem as a key factor in the development of various psychological problems i.e. loneliness, anxiety, depression and aggression.
- There is significant positive relationship between Self -esteem and academic achievement suggesting that high Self -esteem is important factor and strengthen the prediction of academic achievement in Adolescents. Adolescents spend a lot of time and energy on academic performance, thus it is necessary for them to have high self -esteem

6. SUGGESTIONS

- Identify the core factors that cause low self-esteem and simultaneously identify the domains of competence that are important to the adolescence.
- Focus on sources of emotional support and social approval that exist in the adolescent's world.
- Increase self-esteem through emphasizing achievement of specific skills and goals, and by encouraging initiative.
- Support coping with difficult situations and trying to overcome them, rather than avoiding them.

REFERENCES

1. Anwar, E. (2013). A correlational study of academic achievement and study habits: Issues and concerns. *Excellence International Journal of Education and Research*, 1(2), 46-51.
2. Bagongon, C.K. and Edpalinanad, C.R. (2009). Research Proposal on the Effect of Study Habits on the Academic Performance of Freshmen Education Students in Xavier University, CaGayan Deoro City.
3. Deb, M. and Grewal, H. P. (1990). Relationship between Study Habits and Academic achievement of undergraduate home science final year students. *Indian Educational Review*, 25 (3), 71-74.
4. Dr. Umender Malik. A Comparative Study of Job Satisfaction among Government and Private Secondary School Teachers in relation to Educational Qualifications, *Paripex Indian Journal Of Research*, Vol:2, Issue:11. 2013.
5. Baumeister, R.F. (1982). Self-esteem, self presentation and future interaction: A dilemma of reputation. *Journal of personality*, 50, 29-45.
6. Baumeister, R. F. (1993). Understanding the inner nature of self esteem. In R.F. B a u m e i s t e r (Ed.), *Self - esteem: the puzzle of low self regard* (pp. 201-218). New York: Plenum. Carlson, C., Uppal, S., & Processer, E. C. (2000). Self-Esteem and its Impact on Academic Achievement among Adolescents in and around Lucknow (U.P.) India <https://iaeme.com/Home/journal/IJM> 3437 editor@iaeme.com
7. Ethnic differences in processes contributing to the self-esteem of the early adolescents girls. *Journal of early adolescence*, 20, 44-67.
8. 38 Self-Esteem and Academic Achievement Devi , T. K. & Prasanti (2004). Self concept of adolescents in urban and rural areas.
9. *Indian Psychological Review*, 62, 202-206 Dornbusch, S. M., Ritter, P. L., Leiderman, P. H., Roberts, D. F. & Fragligh, M.J. (1987).
10. The relation of parenting style to adolescent school performance. *Child Development*, 58, 1244-1257. DuBois, D. L., Burk- Braxton, C., Swenson, L. P., Tevendale, H. D., & Hardesty, J. L., (2002).
11. Race and gender influences on adjustment in early adolescence: Investigation of an iterative model. *Child development*, 73, 1573-1592. Devi T Kayani & Prasanti. (2004).
12. Self concept of adolescents in urban and rural areas. *Indian Psychological Review*, 62, 202-206. Eccles, J. S. (1987).
13. Gender roles and achievement pattern : an expectancy value perspective. In J. N. Reinisch L.A. Rosenblum & S. A. sanders (Eds.), *Masulinity/ Femininity: Basic Perspective* (pp. 240-280).
14. New York:Oxford University Press. Gecas, Viktor. (1982).
15. The self-concept. *Annual Review of Sociology*. 1-33. Good, C.V. (1973).
16. *Dictionary of education*. II edition, Mc Graw Hill Book company. INC, New York. Grewal, H.P., & Dunteman, G.H. (1964).
17. Relationship of achievement motivation and academic performance of rural and urban high school students. *Indian Psychological Review*, 32, 1-5. Harter, S. (1986).
18. Processes underlying the construction, maintainers, and enhancement of self-concept in children. In J. Suls & A. G Greenwald (Eds.), *Psychology Perspectives of self*, (pp. 136-182), Hillsdale, NJ : Erlbaum. Harter, S. (1996).

19. Historical roots of contemporary issues involving self concept. In B. A. Bracken (Ed.), *Handbook of self – concept* (pp.1-37).New York: Wiley.
20. Housley, K., Martin, S., McCoy, H., & Greenhouse, P. (1987).
21. Self-esteem of adolescents males related to race economic status and area of residence. *Perceptual and Motor skill*, 64, 559-566.Huitt, W. (2004).
22. *Becoming a Brilliant Star: An introduction*. Presentation at the Forum for Integrated Education and Educational Reform sponsored by the Council for Global Integrative
23. Education, Santa Cruz, CA. Available on at <http://chiron.valdosta.edu/~whuitt/brilstar/chapters/BrilStarintro.pdf> Keltikangas- J. L. (1990).
24. The stability of selfconcept during adolescence and early adulthood: a 6-year follow-up study. *Journal of General Psychology*, 11, 361–368.Kling, K. C., Hyde, J. S., Showers, C. J. & Buswell, B. N. (1999).
25. Gender differences in selfesteem, a meta-analysis. *Psychological Bulletin*, 125, 470- 500.Manning, M. A., Bear, C. G. & Minke, K.M. (2006).
26. Self-concept and self-esteem. In G.G. Bear & K.M. Minke (Eds.), *children’s need III: Development, prevention and intervention* (pp.341-356). Washington, DC: National association of school psychologist. Markstrom, C. A., Marshall, S.K., & Tryon, R. J.(2000).
27. Resiliency, social support and coping in rural low income Appalachian adolescents from two racial groups. *Journal of adolescence*, 18, 145-172.Nathaniel, B.(1994).
28. *The Six Pillars of Self-Esteem*, New York: Bantam, Nathaniel, B. (1992). Vijay Rana, Pragyam Dangwal <https://iaeme.com/Home/journal/IJM> 3438 editor@iaeme.com
29. “What Is Self-Esteem?” in *Student Self-Esteem: A Vital Element of School Success*, Volume 1, ed. Garry R. Walz and Jeanne C. Bleur (Ann Arbor, Michigan: Counseling and Personnel Services, Inc.,1992), p. 18.O’Brien, E. J., & Epstein, S. (1998).
30. *The Multidimensional Self-esteem Inventory*. Odessa, FL: Psychological Assessment Resources, Inc.Prashant, A. & Arora, M. (1988).
31. Psychological stress in adolescents: a study of depression, self esteem and physical symptoms Unpublished. Ph.D Thesis. Banaras Hindu University.Reasoner, R.(2005).
32. The true meaning of selfesteem. Retrieved November 4th from international council for selfesteem. Robins, R. W., Trzesniewski, K. H., Tracy, J. L.,Gosling, S. D., & Potter, J. (2002).
33. Global selfesteem across the life span. *Psychology and Aging*, 17, 423-434.Shobhna Joshi and Rekha Srivastava 39 Rosenberg, M. (1965).
34. *Society and adolescents self image*. Princeton, NJ: Princeton University press. Rosenberg, M. (1979).
35. *Conceiving the self*. New York: Basic Books. Rosenberg, M (1985).
36. Self-concept and psychological well – being in adolescence. In R. L. Leahy (eds.), *The Development of the self* (pp. 205-246). Orlando, FL Academic Press.Rosenberg, M. (1986).
37. Self-concept to middle childhood to adolescence. In J. Suls (eds),*Psychological perspectives on the self*,(pp.107-136). Hillsdale, NJ : Erlbaum. Rosenberg, M. (1990).
38. The self-concept: Social product and social force. *Social Psychology: Sociological Perspectives*, 593-624.Rosenberg, M., Carmi, S., & Carrie, S. (1995).
39. Global self-esteem and specific self-esteem. *American sociological Review*, 141-156. Roscigno, V. J., & Crowley,J. L. (2001).
40. Rurality, institutional disadvantage, and achievement /attainment. *Rural Sociology*, 66, 268- 298. Sekaran, U. (1983).
41. Factors influencing the quality of life in dual career families. *Journal of Occupational Psychology*, 56, 161-174 Singh, D. (1970).

42. Academic achievers and non achievers: An analysis of some factor associated with success and failures in university education. Allahabad: United Publishers. Tinku, A. N. & Biswas, P. C. (1994). Student's involvement in studies to prolonged Deprivation. *Psychologic: An International*
43. Self – esteem, academic selfconcept and academic achievement : how the learning environment moderate thy dynamics of self concept. *Journal of Personality & Social Psychology*, 90, 334-349. Uma Devi, Sudha Devi & Venkatramaiah (1988).
44. Selfesteem: its conceptualization and measurement. Sage. Wylie, R.C. (1979).

Association Rule Mining and its Improved Approaches of Retail Sector: Data Mining Techniques

¹Ashfaq Ahmed Khan and ²S Krishna Mohan Rao

¹Department of Computer Application, Mewar University, Chittorgarh (Raj), India

²Siddhartha Institute of Engineering & Technology, Hyderabad, India

ABSTRACT

Various studies on consumer purchasing behaviors have been presented and used in real problems. Data mining techniques are expected to be a more effective tool for analyzing consumer behaviors. However, the data mining method has disadvantages as well as advantages. Therefore, it is important to select appropriate techniques to mine databases. The objective of this paper is to know consumer behavior, his psychological condition at the time of purchase and how suitable data mining method apply to improve conventional method. Moreover, in an experiment, association rule is employed to mine rules for trusted customers using sales data in a super market industry. Apriori algorithm has been vital algorithm in association rule mining. Main idea of this algorithm is to find useful patterns between different set of data. It is a simple algorithm yet having many drawbacks. Many researchers have been done for the improvement of this algorithm. This paper does a survey on few good improved approaches of Apriori algorithm. This will be really very helpful for the upcoming researchers to find some new ideas from these approaches.

Keywords: component Apriori algorithm, frequent pattern, association rule mining. Support, minimum support threshold, multiple scan. FP Growth algorithm, regression technique. Super market, retail sector

1. INTRODUCTION

Association rule learning is a method for discovering interesting relations between variables in large databases. An example of an association rule would be "If a customer buys a dozen eggs, he is 80% likely to also purchase milk." Association rule mining (ARM) has become one of the core data mining tasks. Association rules are created by analyzing data for frequent if/then patterns and using the criteria support and confidence to identify the most important relationships. Support is an indication of how frequently the items appear in the database. Confidence indicates the number of times the if/then statements have been found to be true. In data mining, association rules are useful for analyzing and predicting customer behavior. They play an important part in shopping basket data analysis, product clustering, and catalog design and store layout. ARM is an undirected unsupervised data mining technique which works on variable length data, and produces clear and understandable results [1]. Association analysis has been broadly used in many application domains. One of the best known is the business field where the discovering of purchase patterns or associations between products is very useful for decision making and for effective marketing. In the last years the application areas have increased significantly. Some examples of recent applications are finding patterns in biological databases, extraction of knowledge from software engineering metrics or obtaining user's profiles for web system personalization. Traditionally, association analysis is considered an unsupervised technique, so it has been applied in knowledge discovery tasks. Recent studies have shown that knowledge discovery algorithms, such as association rule mining, can be successfully used for prediction in classification problems [2]. Most of the research efforts in the scope of the association rules have been oriented to simplify the rule set and to improve the algorithm performance. But these are not the only problems that can be found when rules are generated and used in different domains.

The main drawbacks of the association rule algorithms are the following:

- Obtaining non interesting rules
- Huge number of discovered rules
- Low algorithm performance

2. RELATED WORKS

Association rule mining is a data mining task that identifies relationships among items in a transactional database. Association rules have been widely investigated in the literature for their role in several application domains such as Market Basket Analysis (MBA), recommender systems. Diagnosis decisions support, telecommunication, intrusion detection, etc. The competent discovery of such rules has been a key focus in the data mining research community. The standard apriori algorithm has been modified for the improvements of

association rule mining algorithms. Association rule mining for Recommender Systems. The author examined the usage of association rule mining as a fundamental technique for collaborative recommender systems. Association rules have been used with sensation in other domains. Nevertheless, most currently existing association rule mining algorithms were designed with market basket analysis in mind. They described a collaborative recommendation technique based on a novel algorithm distinctively designed to excavate association rules for this rationale. The main advantage of their proposed approach is that their algorithm does not require the minimum support to be specified in advance. To a certain extent, a target range is specified for the number of rules, and the algorithm alters the minimum support for all customers with the intention of acquiring a rule set whose size is in the desired range. Moreover they employed associations between customers as well as associations between items in making recommendations. The experimental evaluation of a system based on their algorithm revealed that its performance is significantly better than that of traditional correlation-based approaches.

Shyue-Liang Wang et al. [2] proposed an effective data-mining approach for discovering Adaptive-Support Association Rules (ASAR) from databases. Adaptive-support association rules are constrained association rules with application to collaborative recommendation systems. To find out association rules for recommendation systems, a particular value of target item in association rules is normally assumed and no minimum support is specified in advance. Depending on the size monotonicity of association rules, specifically the number of association rules reduces when the minimum support increases, an effective algorithm using variable step size for determining minimum support and as a result adaptive-support association rules is generated.

The primary task in any associative classification approach is mining of the association rules. Many investigations have revealed that the minimum support measure plays an important part in constructing a perfect classifier. With no information regarding the items and their frequency, user provided support measures are unsuitable, not often may they coincide. Kanimozhi Selvi & Tamilarasi [2] developed a technique called Dynamic Adaptive Support Apriori (DASApriori) to compute the minimum support for obtaining class association rules and to construct an uncomplicated and perfect classifier. The association rules characterizes a significant class of knowledge that can be revealed from data warehouses. Present research attempts are concentrated on discovering well-organized ways of determining these rules from huge databases. At the same time as these databases develop, the discovered rules are required to be confirmed and it is necessary to discover new rules to the knowledge base. As mining afresh each time the database develops is incompetent, approaches for incremental mining are being studied. Their main objective is to reduce scans of the older database by exploiting the intermediary data built during the previous mining activities. Sarda & Srinivas [2] used large and candidate itemsets and their counts in the older database and examined the growth to discover which rules maintain to overcome and which one is not succeeded in the complex database. It is also found that new rules for the incremental and updated database. The algorithm is adaptive in nature, as it concludes the nature of the increment and avoids altogether if possible, multiple scans of the incremental database. Another salient feature is that it does not need multiple scans of the older database [4].

3. TYPES OF ASSOCIATION RULE

3.1 Positive Association Rule Mining

By K. Pazhani Kumar et.al [3] describes the classical association rules consider only items enumerated in transactions of the dataset. The positive relationship can be found between the set of items. The rules are generated from the positive related items. These rules are referred to as positive association rules. Most of the algorithms were developed for generating positive associations between items. These are useful to decision making. The positive rules are classified as follows:

1. **Boolean Association Rule:** - It is a rule that checks whether an item is present or absent. There are three types of Boolean association rule:

- a. Quantitative
- b. Constrained rules
- c. Sequential rules

2. **Qualitative association rule:** - It describes associations between quantitative items or attributes. Generally, quantitative values are partitioned into intervals.

Example: Age (X,"30...39") \wedge income (X,"80K..100K") \rightarrow buys(X, High Resolution TV)

3. **Spatial Association Rule:** - Spatial association rule is a **rule** indicating certain **association** relationship among a set of **spatial** and possibly some non spatial predicates.

4. **Temporal Association Rule:** - Temporal association rule mining is to discover the valuable relationship among the items in the temporal database.

3.2 Negative Association Rule Mining

By K. Pazhani Kumar et.al [3] describes Negative association rules also consider the same items, but in addition the item also considers which were absent from transactions. The negative rules are generated from infrequent itemsets. These rules play some important role in decision-making. These are useful in market basket analysis to identify products that conflict with each other or products that complement each other. This is a difficult task, due to the fact that there are essential differences between positive and negative rule mining.

3.3 Constraint based Association Rule Mining

By K. Pazhani Kumar et.al [3] describes the constraints were applied during the mining process to generate only those association rules that are interesting to users instead of all the rules. By doing this lots of cost of mining those rules that turned out to be not interesting can be saved. Usually constraints are provided by users. The constraints are classified as follows:

- Knowledge based constraints
- Data constraints

3.4 Multilevel Association Rule Mining

Association rule generated from mining data at multiple abstraction levels are called **multilevel association rules**. It can be mined efficiently under the support confidence framework. A variety of ways include for maintaining min support at each level. Some of them are: -

- Uniform min support for all level
- Reduced min support at each level
- Item or group based min support

4. FREQUENT PATTERN MINING

Patterns are set of item, sequences, graph or structures that appear in a dataset. The frequency of pattern is no less than a user-specified threshold that is called frequent pattern or item set. Finding frequent patterns plays a fundamental role in association rule mining, classification, clustering, and other data mining tasks. Frequent pattern mining was first proposed by Agarwal for market basket analysis in the form of association rule mining. The fundamental frequent pattern algorithms are classified into three ways as follows:

- Candidate generation approach (E.g. Apriori algorithm)
- Without candidate generation approach (E.g. FP-growth algorithm)

4.1 Candidate Generation Approach

1. Apriori Algorithm

It was proposed by R AGRAWAL AND R SRIKANT in 1994 for mining frequent item sets. The name of this algo is based on the fact that algo uses prior information of frequent item set properties.

This algo works on iterative approach or level wise approach i.e., the frequent item set of size $lk+1$ can be form using lk . It is used to find the frequent item sets among the given number of transactions. The search proceeds level-by-level as follows:

- a. First determine the set of frequent 1-itemset; L_1
- b. Second determine the set of frequent 2-itemset using L_1 ; L_2
- c. Etc.

The complexity of computing L_i is $O(n)$ where n is the number of transactions in the transaction database. Reduction of search space:

- a. In the worst case what is the number of item sets in a level L_i ?
- b. Apriori uses "Apriori Property":

EXAMPLE:

Transaction-Id	Items- Bought
1	A,B,C
2	A, C
3	A, D
4	B,E,F

Frequent Pattern	Support
A	75%
B	50%
C	50%
A, C	50%

2. Apriori Property

All non empty subsets of a frequent item set are frequent it means if {A,B,C} is frequent then its subset should be frequent. Apriori algo works on two steps-

1. Join step:

- C_k is generated by joining L_{k-1} with itself

$$L_{k-1} \times L_{k-1}$$

- Given l_1 and l_2 of L_{k-1}

$$L_i = l_{i1}, l_{i2}, l_{i3}, \dots, l_{i(k-2)}, l_{i(k-1)}$$

$$L_j = l_{j1}, l_{j2}, l_{j3}, \dots, l_{j(k-2)}, l_{j(k-1)}$$

Where L_i and L_j are sorted.

- L_i and L_j are joined if there are different (no duplicate generation). Assume the following:

$$l_{i1} = l_{j1}, l_{i2} = l_{j2}, \dots, l_{i(k-2)} = l_{j(k-2)} \text{ and } l_{i(k-1)} < l_{j(k-1)}$$

- The resulting itemset is:

$$l_{i1}, l_{i2}, l_{i3}, \dots, l_{i(k-1)}, l_{j(k-1)}$$

- Example of Candidate-generation:

$$L_3 = \{abc, abd, acd, ace, bcd\}$$

Self-joining: $L_3 \times L_3$

Abcd from **abc** and **abd**

Acde from **acd** and **ace**

2. Prune Step:

Any (k-1)-itemset that is not frequent cannot be a subset of a frequent k-itemset

- C_k is a superset of $L_k \rightarrow$ some itemset in C_k may or may not be frequent.
- L_k : Test each generated itemset against the database:
 - a) Scan the database to determine the count of each generated itemset and include those that have a count no less than the minimum support count.
 - b) This may require intensive computation.
 - Use Apriori property to reduce the search space:
 - Any (k-1)-itemset that is not frequent cannot be a subset of a frequent k-itemset.
 - Remove from C_k any k-itemset that has a (k-1)-subset not in L_{k-1} (itemsets that are not frequent)

- Efficiently implemented: maintain a hash table of all frequent itemset.

Example of Candidate-Generation and Pruning:

L₃ = {abc, abd, acd, ace, bcd}

Self-joining: L₃ ∞ L₃

Abcd from abc and abd

Acde from acd and ace

Pruning:

Acde is removed because Ade is not in L₃

C₄ = {abcd}

EXAMPLE:

Min support=2

T_Id	Itemsets
1	A,C,D
2	B,C,E
3	A,B,C,E
4	B,E

Step 1:-Find C1

ITEMSE	SUPPOR
T	T
{A}	2
{B}	3
{C}	3
{D}	1
{E}	3

Step 2:-Find L1

ITEMSE	SUPPOR
T	T
{A}	2
{B}	3
{C}	3
{E}	3

Step 3:-Find C2

ITEMSET	SUPPORT
A,B	1
A,C	2
A,E	1
B,C	2
B,E	3
C,E	2

Step 4:- Find L2

ITEMSET	SUPPORT
{A,C}	2
{B,C}	2
{B,E}	3
{C,E}	2

Step 5:- Find C3

ITEMSET	SUPPORT
{B,C,E}	2

Step 6:- Find L3

ITEMSET	SUPPORT
{B,C,E}	2

3. Advantages and Disadvantages of Candidate Generation Approach

ADVANTAGES

1. It significantly reduces the size of candidate sets using the Apriori principle.
2. It uses large itemset property.
3. It is easily parallelized.
4. It is easy to implement with all kind of real datasets.
5. The Apriori Algorithm calculates more sets of frequent items.

DISADVANTAGES

1. It generates huge number of candidate sets.
2. When the longest frequent itemsets is k, Apriori needs k passes of database scans. So it will have low efficiency.
3. Repeatedly scanning the database and checking the candidates by pattern matching.
4. The computation time is very intensive at generating the candidate itemsets and computing the support values for application with very low support and vast amount of items.
5. The candidate generation could be extremely slow (pairs, triplets, etc.).
6. The candidate generation could generate duplicates depending on the implementation.
7. The counting method iterates through all of the transactions each time.
8. Constant items make the algorithm a lot heavier.
9. Huge memory consumption

Step 1

The first step is we count all the items in all the transactions
 $T_{\text{Mario}} = [\text{beer: 5, bread: 2, butter: 3, milk: 3, cheese: 3, diapers: 1}]$

Step 2

Next we apply the threshold we had set previously. For this example let's say we have a threshold of 30% so each item has to appear atleast twice.

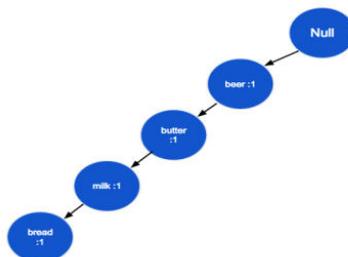
$T_{\text{Mario}} = [\text{beer: 5, bread: 2, butter: 3, milk: 3, cheese: 3, ~~diapers: 1~~}]$

Step 3

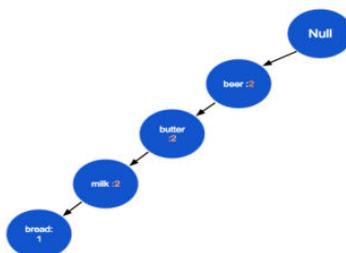
Now we sort the list according to the count of each item.
 $T_{\text{MarioSorted}} = [\text{beer: 5, butter: 3, milk: 3, cheese: 3, bread: 2}]$

Step 4

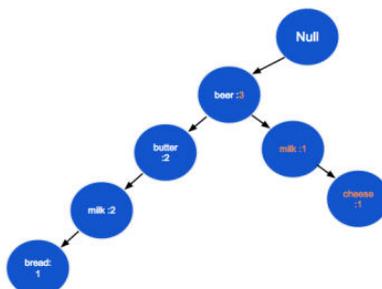
Now we build the tree. We go through each of the transactions and add all the items in the order they appear in our sorted list. **Transaction to add= [beer, bread, butter, milk]**



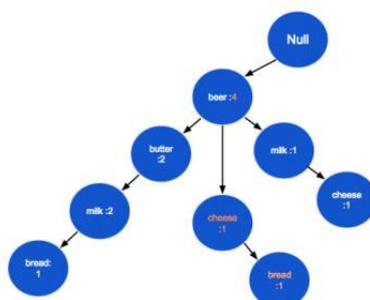
Transaction 2: [beer, milk, butter]



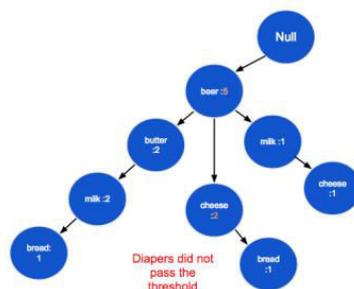
Transaction 3= [beer, milk, cheese]



Transaction 4=[beer, cheese, bread]

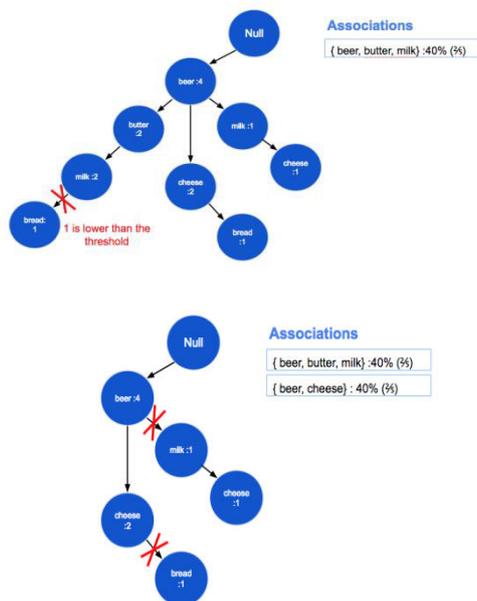


Transaction 5=[beer, cheese, diapers]



Step 5

In order to get the associations now we go through every branch of the tree and only include in the association all the nodes whose count passed the threshold.



RESEARCH METHODOLOGY

For actual testing & getting the result by implementing new methodologies in data mining, the researcher gone through all the details about the consumer behavior & he experiment it by choosing a organization a mall or super market as a sample for his study. Researcher collect all the live data day wise, month wise i.e. transaction of each customer.

After collecting the data researcher searches various methodologies which go through the methodology for finding the answer. He choose the suitable technique, formula, algorithms, methods for the customer data base

Comparison between Apriori, Improved Apriori Algorithm and FP Growth Tree

Association Rule Mining has attracted a lot of intention in research area of Data Mining and generation of association rules is completely dependent on finding Frequent Item sets. Various algorithms are.

S.NO.	ALGORITHMS	TECHNIQUES	BENEFITS
1.	Apriori	-Temporary tables for scanning -logarithmic decoding	-Low system overhead and goodoperating performance -efficiency higher than apriori algorithm
2.	Improved apriori	-Variable Size Of Transaction on the basis of which transactions are reduced	-reduced the I/O cost -reduced the size of Candidate Itemsets(CK)
3.	FP growth tree	-Combine the apriori and fp tree structure of FP growth algo	-It doesnt generate conditional and sub-conditional patterns of the tree recursively -it works faster than apriori for large database available for this purpose

Conclutionand Future

Data Mining System is useful to study buying behavior of the customers in retail departmental stores. With this study researcher has concluded that there are certain buying habits of the customers. And according to this buying habits of customer, management may update their system of providing various types of services to their customers to delight the customers and to retain the customer with same business house.

The data mining system is useful to Business house to find out the association of the customers with different products. And how customers are shifting from one brand to another brand of product to satisfy their need because their earlier buying habits are properly studied by the Data mining System.

Association rule mining is used to discover the frequently occurring patterns in the database. Apriori algorithm

can be considered as one of the oldest algorithm in the field of association rule mining. This paper includes a brief overview of apriori algorithm and recent improvements done in the area of apriori algorithm. With the survey on various improved algorithms, it is concluded that the main focus is to generate less candidate sets which contains frequent items within a reasonable amount of time. Also, in future some more algorithms can be developed that requires only single scan for the database and are efficient for large databases.

REFERENCES

1. Dr (Mrs).Sujni Paul Associate Professor Department of Computer Applications, Karunya University, Coimbatore 641114 , Tamil Nadu, India sujni_paul@yahoo.com
2. María N. Moreno, Saddys Segrera and Vivian F. López Universidad de Salamanca, Plaza Merced S/N, 37008, Salamanca.
3. K. Pazhani Kumar Assistant Professor Dept of Computer Science S.T. Hindu College S. Arumugaperumal Head Dept of Computer Science S.T. Hindu College
4. Dr. M. Dhanabhakya* & Dr. M. Punithavalli** *Assistant Professor, Department of Commerce, Bharathiar University, Coimbatore, Tamilnadu, INDIA. E-Mail: dhana_giri@rediffmail.com **Director and Head of the Department, Department of Computer Science, Ramakrishna College of Engineering, Vattamalaipalayam, Coimbatore, Tamilnadu, INDIA.
5. <http://www.singularities.com/blog/2015/08/apriori-vs-fpgrowth-for-frequent-item-set-mining>
6. https://en.wikibooks.org/wiki/Data_Mining_Algorithms_In_R/Frequent_Pattern_Mining/The_FP-Growth_Algorithm
7. C. Wang, R. Li, and M. Fan, "Mining Positively Correlated FrequentItemsets," Computer Applications, vol. 27, pp. 108-109, 2007
8. J. Pei, J. Han, and H. Lu. Hmine: Hyper-structure mining of frequent patterns in large databases. In ICDM, 2001, pp441-448.
9. Ms. Rina Raval, Prof. Indr Jeet Rajput , Prof. Vinitkumar Gupta, "Survey on several improved Apriori algorithms", IOSR Journal of Computer Engineering (IOSR-JCE), Volume 9, Issue 4 (Mar. - Apr. 2013), PP 57-61
10. Reeti Trikha, Jasmeet Singh, "improving the efficiency of apriori algorithm by adding new parameters", International Journal for Multi Disciplinary Engineering and Business Management, Volume-2, Issue-2, June-2014
11. Mohammed Al-Maolegi, Bassam Arkok, "An improved apriori algorithm for association rules", International Journal on Natural Language Computing (IJNLC) Vol. 3, No.1, February 2014
12. <https://www.seas.gwu.edu/~bell/csci243/lectures/ar.doc>

Stratospheric Ozone Depletion, Ultraviolet Radiation and their Effect on Environment: A Review

Dipak Kumar Saha

Chemistry, Dinabandhu Mahavidyalaya, Bongaon, (N) 24 PGS- 743235 West Bengal, India

ABSTRACT

Although ozone is a minor constituent of the atmosphere it plays an important significant role to protect the entire living organism by forming ozone layer in the stratosphere which absorbs the harmful ultraviolet radiation (UVR). But this ozone is being depleted in many ways that has a tremendous effect on environment. A lot of works and researches on the effect of ozone depletion on the environment have been performed by different researchers and scientists throughout the world. In this review various effect of stratospheric ozone depletion on environment has been presented.

Keywords: UV-radiation, ozone depletion, skin cancer, cataract, DNA

INTRODUCTION

Many manmade chemicals such as CFCs, halocarbon refrigerant, solvents, and propellants etc. which are known as ozone depleting substance (ODS), are responsible for the depletion of ozone layer. Highly reactive free radicals are produced by sunlight from many of these ODS and free radicals react with O₃ and destroy it [1]. Severe polar spring time depletion of ozone occurs due to the formation of polar stratospheric clouds and subsequent chemical reactions. Ozone depletion and ozone layer formation have many harmful effects on human as well as environment. Wave length having the ranges from 100-400 nm is known as Ultraviolet (UV) region. It is further classified into UV-A (315-400 nm), UV-B (280-315 nm) and UV-C (100- 280 nm). Among them UV-C is completely absorbed by ozone layer, UV-B is not absorbed completely but partially whereas UV-A is very weakly absorbed by stratospheric ozone layer and transmitted to the earth's surface very easily. Ozone depletion enhances the solar UV-radiation reaching tendency on the surface of the earth [2]. Antarctic ozone hole is directly associated with the high levels of UV-B radiation [3-4]. Although UV-A penetrates human skin more deeply than UV-B, biological reactions indicate that UV-B radiation is absorbed by DNA, and that subsequent DNA damage appears to be a major component in the commencement of the carcinogenic process in skin [5]. An individual's exposure to ambient UVB while outdoors with skin exposed directly to the sky is determined by factors such as stratospheric ozone levels, solar elevation, regional pollution, cloud cover and presence of reflective environmental surfaces such as water, sand or snow.

DISCUSSION

Effect on Skin

Excessive exposure to sunlight has been known to cause skin damage since the 1850s. Skin cancer develops in the most often exposed places according to observations of boatmen, fisherman, lightermen, agricultural labourers, and farmers [6]. Over the last few decades, the incidence of skin cancer, particularly cutaneous malignant melanoma, has progressively increased in white populations [7]. This is especially true in areas with a lot of UVR exposure, such South Africa, Australia, and New Zealand. Cutaneous malignant melanoma more quickly and more frequently develops to a person lacking of pigment or having a defective DNA dark repair mechanism. Deficiency of vitamin B3 can cause photosensitive dermosis. Solar radiation is a cause of skin cancer, according to the International Agency for Research on Cancer [8]. Slaper et al, [9] looked at three different forms of skin cancer. The most common yet least aggressive cancers are squamous cell carcinoma (SCC) and basal cell carcinoma (BCC). The cutaneous malignant melanoma (CMM) is the rarest yet most dangerous type of melanoma. According to Scotto and Fears [10], the current skin cancer incidence in the United States is around 2000 per million per year, while in North-West Europe, the Netherlands as a representative [11], the incidence is around 11000 per million per year. Squamous cell cancer (SCC) in cattle, horses, cats, sheep, goats, and dogs has been linked to ambient sun radiation. According to scientists, the combined effect of recent stratospheric ozone depletion and its continuation over the next one to two decades will result in an increase in skin cancer incidence in fair-skinned populations living at mid to high latitudes (due to the accumulation of additional UVB exposure) [12].

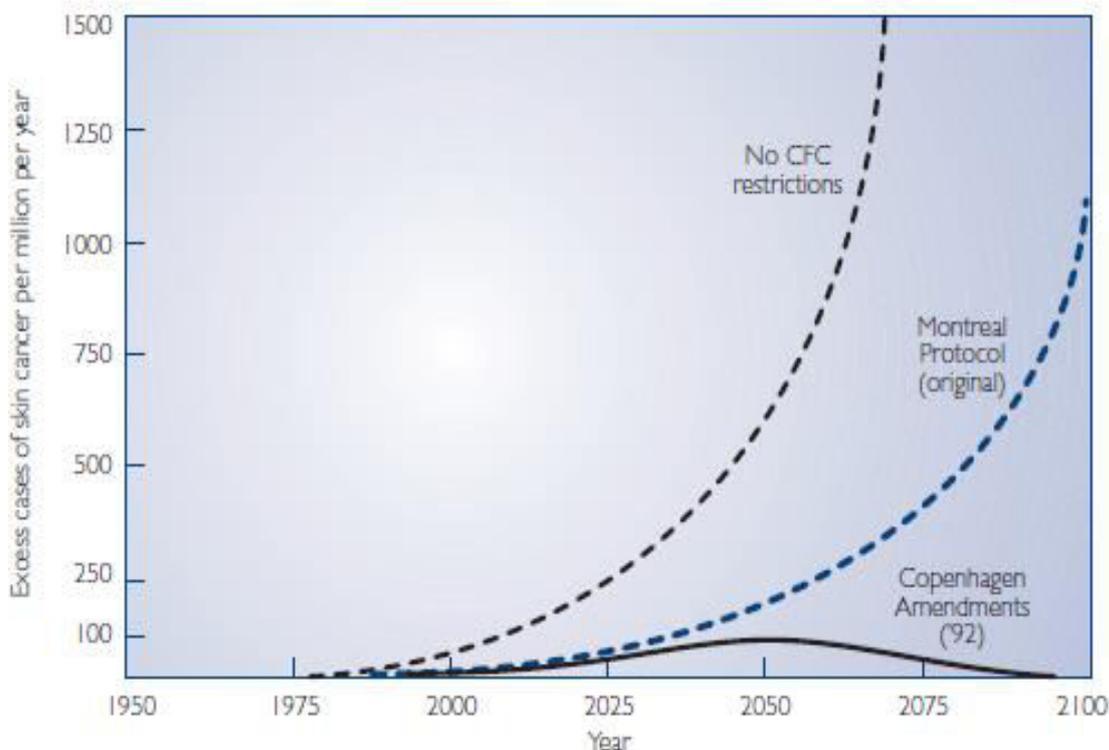


Figure 1: Estimates of ozone depletion and skin cancer incidence to assess the success of the Montreal Protocol. Adapted from reference 9

White Caucasians, particularly those of Celtic ancestry who live in places with high UVR are the most prone to skin cancer. Furthermore, lifestyle changes, particularly among fair-skinned groups, have resulted in significantly increased UV exposure from sunbathing and skin tanning. The significant increase in skin malignancies in these communities over the last few decades is mostly due to a mix of post-migration geographic vulnerability and current behavioural habits

Effect on Eyes

UV rays can harm the eyes since the front of the eyes absorbs more than 99 percent of UV radiation. Photo keratitis [13], often known as snow blindness, is an eye disorder caused by UVR exposure in the environment. The reddening of the eyeball, a gritty sense of acute discomfort, photophobia, and blepharospasm (twitching) are all symptoms of photo keratitis. Pterygium is a common disorder that affects the nasal conjunctiva and can sometimes extend to the cornea. It's especially common in those who live in locations with a lot of UVR or a lot of particulate matter. Studies of Chesapeake Bay watermen revealed a dose-response connection between UVR exposure and pterygium risk [14]. Climate droplet keratopathy (CDK), pingueclue, and squamous cell carcinoma (SCC) of the cornea and conjunctiva are other visual consequences. Cataract is a progressive reduction in the transparency of the lens caused by the accumulation of oxidised lens proteins [13]. It is one of the ocular illnesses related with sun exposure that damages the lens. Blindness is the final outcome. Melanoma is a kind of skin cancer that can grow in the eye. Even modest levels of sunshine, according to the American Medical Association's journal, can raise the risk of eye damage such as cataracts. The effects of UV radiation on the eyes are cumulative. As a result, eye protection is critical in the early phases.

Effect on Tropospheric Ozone and Lung Function

Photochemical processes produce tropospheric ozone from pollutants such as nitrogen oxides and hydrocarbons in urban and industrialised areas. UV-B rays are absorbed by this O_3 . However, an increase in tropospheric ozone contributes to climate change by causing global warming and pollution, as well as affecting human health. A large amount of tropospheric ozone is toxic and harms the environment as well as human health. Some researchers reported that cumulative exposure to ozone concentrations greater than 120 ppb increased respiratory symptoms. Because of the longer exposure and potentiation by other factors, Spector et al [14] found that ozone exposures in ambient air caused higher lung function impairments in active young persons in natural settings than pure O_3 exposures in controlled chamber exposure experiments. Anyone who spends time outside in areas with high levels of ozone pollution may be at danger. The effects of inhaling ozone are particularly harmful to four types of people: teenagers and children, anyone over the age of 65, persons who have asthma or

chronic obstructive pulmonary disease and people who work or exercise outside [15]. Researchers in California discovered that some children with specific genotypes were more likely to develop asthma as teens as a result of differences in ozone levels in their neighbourhoods after reviewing data from their long-term Southern California Children's Health Study [16]. It was also found that qualitative and quantitative judgments about the risk of chronic lung injury in children aged 8 to 16 years old and adult outdoor workers due to long-term ozone exposure in areas with exposure patterns similar to those in Southern California and the northwestern United States. Studies link lower birth weight and decreased lung function in newborns to ozone levels in their community [17]. This research provides increasing evidence that ozone may harm newborns. Ozkaynak et al [18] showed that ozone exposure after a 24 hour lag period increased pneumonia and influenza in adults. Asthma, bronchitis even heart attack can occur in presence of high concentration of tropospheric ozone.

Damages to Aquatic Life

UV rays can also harm aquatic life. Phytoplankton, which lives in the top layers of the oceans and fresh water, is the most important biomass generator in aquatic ecosystems. Photosynthesis activities are aided by sun radiation. UV radiation has an impact on development, reproduction, and other cellular proteins, as well as the quantity of photo synthetic pigments [19]. In several organisms, radiation has been reported to cause DNA damage and a delay in DNA synthesis. Phytoplankton availability, grazing pressure, and solar UV and temperature all influence zooplankton numbers. DNA damage caused by UV-B is also seen in zooplankton. In certain intertidal copepods [20], UV-B has a significant impact on survival fertility and sex ratio. UV-B radiation is harmful to the eggs and larvae of many fish. Increased UV-B exposure has various negative consequences on the systematic development of boreal toad tadpoles in the laboratory, according to Worrest and Kimeldorf [21]. Furthermore, loss of biodiversity in seas, rivers, and lakes can diminish commercial and recreational fish outputs.

Effect on atmospheric concentrations of HO_x, CH₄, CO and H₂O₂:

In tropospheric chemistry, HO_x radicals play an important function. Increased UV-B actinic fluxes result in greater HO_x radical concentrations in the troposphere. According to Fuglestad et al [22], increases in UV-B radiation from 1979 to 1993 resulted in an 8 percent increase in OH content on a global basis. The effects of UV-B increases on tropospheric O₃, OH, methane, CO, and perhaps other tropospheric constituents are not negligible, they will be difficult to detect because the concentrations of these species are impacted by a variety of other variables (e.g., emissions). Trifluoroacetic acid (TFA, CF₃COOH) is formed in the atmosphere when HCFC-123 (CF₃CHCl₂), HCFC-124 (CF₃CH₂Cl), and HFC-134a (CF₃CH₂F) are used as the alternatives of ozone-depleting material [23]. Carbon monoxide concentration measurements show a 1% annual rise in CO abundance in the Northern Hemisphere and no substantial change in the Southern Hemisphere [24] during the last 40 years. According to model predictions, increased tropospheric UV-B actinic fluxes should result in higher tropospheric H₂O₂ concentrations. Photochemical model calculation for Summit [25], ozone depletion from 1980 to 1990 results in a 7% increase in H₂O₂ in the summer. Around 100 years ago, the amount of methane in the atmosphere began to rise. In the late 1970s, the rate of rise was about 16 ppb per year.

Immune System Function and Immune Related Disorders

Although the majority of the existing evidence comes from animal research, UV radiation appears to decrease components of both local and systemic immune activity. As a result, increased UV exposure may increase the occurrence and severity of infectious diseases while decreasing the development and severity of various autoimmune conditions. Multiple sclerosis, rheumatoid arthritis, and insulin-dependent (Type 1) diabetes may be helped if the immune system's T lymphocyte (helper cell type 1) component, or "TH¹," is suppressed. Undifferentiated TH⁰ cells are immunologically prepared to develop into either TH¹ or TH² cells, which are mutually hostile in animals [26]. As a result, UVR exposure has the potential to exacerbate TH²-mediated illness by reducing TH¹ cell function [27]. Data from animal experiments was recently utilised to create a model to anticipate possible changes in infection patterns in people as a result of increased UVR caused by stratospheric ozone depletion [28]. In humans, the cellular immune response to the bacteria *Listeria monocytogenes* was shown to be influenced by outdoor UVB exposure levels in a theoretical model. Ninety minutes of noontime sunlight exposure in mid-summer at 40° N was expected to result in a 50% inhibition of human host lymphocyte responses against *Listeria monocytogenes* using the worst-case scenario (sun-sensitive individuals with no UVR adaptation). This exposure period might be reduced by roughly 2.5 percent if the ozone layer thickness was reduced by 5%. [28] (Table 1). Personal exposure to ultraviolet radiation has been shown to enhance the number and severity of orolabial herpes simplex lesions in humans (i.e. around the mouth). Concerns have recently been raised concerning the potential negative effects of UVR-induced immunosuppression on HIV-infected people.

Table 1: Effects of lower stratospheric ozone on biologically effective UV irradiance, and thus suppression of certain cellular immune responses against *Listeria* bacteria, as predicted (local noon, clear skies, southern Europe).

Latitude(month)	Decrease in ozone (%)	Ozone (dobson units)	Biologically Effective irradiance (W/m ²)	Increase in BE _{imm} %	RAF _{imm}	Calculated time (min) for 50% immunosuppression ^a
40 °N	0	335.6	0.073	0.0	—	350
January	5	318.8	0.075	3.0	0.60	340
	10	302.0	0.078	6.3	0.63	327
	20	268.5	0.083	13.5	0.68	307
40 °N	0	307.9	0.278	0.0	—	92
July	5	292.5	0.285	2.5	0.50	90
	10	277.1	0.292	5.3	0.53	87
	20	246.3	0.310	11.5	0.58	82

Abbreviations: BE_{imm}, biological effective irradiance for immunosuppression; RAF_{imm}, radiation amplification factor for immunosuppression.

Source: adapted from reference [28].

Effect on the Antarctic and Arctic Aquatic Ecosystem

According to Sullivan et al [29] productivity in the southern ocean is characterised by large-scale spatial and temporal variability. This makes filtering out UV-B specific effects from other variable environmental effects (Neale et al) and estimating the impact on single species or whole phytoplankton difficult. In a worst-case scenario, Neale et al [30] found that a 50 percent reduction in ozone cloud reduced daily integrated water column photosynthesis by as much as 8.5 percent. They discovered that inhibition caused by realistic environmental variability has a greater impact on integrated water column photosynthesis than UV-B effects. They also point out that UV is a substantial environmental stressor, regardless of natural interactions, and that its effects are exacerbated by O₃ depletion. There are some distinctions between the aquatic ecosystems of the Arctic and Antarctica. The Arctic Ocean's productivity has been reported to be higher and more diverse than that of the Antarctic Ocean [31]. Both endemic and migratory species breed and reproduce in this ocean throughout the spring and early summer, when UV-B radiation levels are at their highest. The primary productivity of marine habitats is governed by the nitrogen cycle. UV-B sensitive nitrogen and phosphorous uptake capacity [32] may boost Arctic phytoplankton's UV-B sensitivity.

Non- Hodgkin's Lymphoma

Non-Lymphoma Hodgkin's (NHL) has become much more common in recent decades all over the world. The causes of this increase are unknown, however high personal UVR exposure has been proposed as a contributing factor for the following reasons:

- NHL incidence in England and Wales is positively associated with higher solar UV radiation by region [33].
- Patients with NHL have a higher risk of non-melanoma skin cancer.
- Chronic immunosuppression is an established risk factor for NHL, and UVR has immunosuppressive effects on humans.

CONCLUSION

The incidence of stratospheric ozone depletion during the last quarter-century, and the expectation that it will continue for at least the next several decades, has heightened interest in the effects of UVR on human biology and disease risks. This has corresponded with a growing understanding of some of the fundamental biological processes through which UVR influences human biology. A change in UVR exposure, in particular, is clear that it will alter the risk of skin cancer, as well as the incidence of certain ocular ailments, such as cataracts, and immune-related diseases and disorders. There is some uncertainties about the extent to which the depletion of stratospheric ozone has resulted in increases in ground-level UVR. Environmental monitoring devices are frequently unstandardized, non-spectral, and positioned in inconvenient locations. The link between ozone depletion and ground-level UVR appears to have been worsened by climate-related variations in cloud cover. Aside from the aforementioned effects, a variety of environmental hazards can arise, hence quick precautions to safeguard the ozone layer should be implemented. To prohibit ozone depleting substances (ODS), the Montreal

Protocol agreement should be strictly followed. A massive study effort is underway to learn more about the harmful impacts of UV radiation and ozone depletion.

REFERENCES

1. M. J. Molina and F. S. Rowland, Stratospheric sink for chlorofluoro methanes: Chlorine catalyzed destruction of ozone. *Nature (UK)*, 249: 810, (1974).
2. R. McKenzie et al. Increased summertime UV radiation in New Zealand in response to ozone loss. *Science*, 285 (5434): 1709–1711 (1999).
3. G. Seckmeyer, B. Mayer, G. Bernhard, R. L. McKenzie, P. V. Johnson, T. Lucas and C. R. Boodh, Geographical differences in the UV Measured by intercompared spectroradiometers. *Geophys.Res.Lett.* 22: 1889, (1995).
4. J. E. Frederick and A. D. Alberts, Prolonged enhancement in surface ultraviolet radiation during the Antarctic spring of 1990, *Geophys.Res.Lett.* 18: 1869, (1991).
5. G. Horneck, Quantification of the biological effectiveness of environmental UV radiation. *Journal of Photochemistry and Photobiology B: Biology*, 31(1–2): 43–49 (1995).
6. G.M. Findlay, Ultraviolet light and skin cancer. *Lancet*, 2: 1070–1073 (1928).
7. B.K. Armstrong, & A. Kricger, Cutaneous melanoma. *Cancer Surveys*, 19–20: 219–240.
8. International Agency for Research on Cancer (IARC). Solar and ultraviolet radiation. IARC monographs on the evaluation of carcinogenic risks to humans. Vol. 55. Lyon, France, International Agency for Research on Cancer, (1992).
9. H. Slaper, et al. Estimates of ozone depletion and skin cancer incidence to examine the Vienna Convention achievements. *Nature*, 384(6606): 256–258 (1996).
10. J. Scotto, et al. Nonmelanoma skin cancer. In: *Cancer epidemiology and prevention*. Schottenfeld, D. & Fraumeni, J.F. eds. New York, USA, Oxford University Press, 1313–1330, (1996a)
11. Health council of the Netherlands UV-radiation from sunlight the Hague 1994/05E.
12. S. Madronich, & F.R. de Gruijl, Skin cancer and UV radiation. *Nature*, 366(6450): 23 (1993).
13. C.A. McCarty, H.R.Taylor, Recent developments in vision research: light damage in cataract. *Invest Ophthalmol Vis Sci*, 37: 1720–1723, (1996).
14. H.R.Taylor et al. Corneal changes associated with chronic UV irradiation. *Archives of Ophthalmology*, 107(10): 1481–1484, (1989).
15. U.S. EPA, 2013, Section 8.3.1.2. Medina-Ramón M, Schwartz J. Who is more vulnerable to die from ozone air pollution? *Epidemiology*, 19: 672-679, (2008).
16. T. Islam, R. McConnell, W.J. Gauderman, E. Avol, J.M. Peters and F.Gilliland, Ozone, oxidant defense genes, and risk of asthma during adolescence. *Am J Respir Crit Care Med.* 177(4):388-395, (2009).
17. R. Morello-Frosch, B.M. Jesdale, J.L. Sadd and M.Pastor, Ambient air pollution exposure and full-term birth weight in California. *Environ Health.* 9: 44, (2010).
18. H. Ozkaynak, P. L. Kinney and B. Burbank, Recent epidemiological finding on morbidity and mortality effects of ozone. *Proc. Annu. Meet—AirWaste Manage. Assoc.*, June 24-29, (1990).
19. S. Gerber and D. P. Hader, Effect of enhanced solar radiation on chlorophyll fluorescence and photosynthetic oxygen production of five species of phytoplankton. *FEMS Microbiol. Ecol.* 16: 33, (1995).
20. L. Chalker Scott, Survival and sex ratios of the intertidal copepod, *tigriopus californicus*, following ultraviolet – B (290-320) radiation exposure. *Marine Biol.* 123:799-804, (1995).
21. R. C. Worrest and D. J. Kimeldorf, Distortions in amphibian development induced by ultraviolet B enhancement of a simulated solar spectrum . *Photochem. Photobiol.* 24: 377-382 (1976).
22. J. S. Fuglestedt, J. E. Jonson, W. C. Wang and I. S.A. Isaksen, Responses in tropospheric chemistry to change in UV fluxes, temperatures and water vapour densities. *NATO ASI Series*, 132: 145 (1995).

23. X Tang, S Madronich, T wallington and D Calamari, Changes in tropospheric composition and air quality. *J. Photochem Photobiol B: Biol* 45: 83, (1998).
24. E. Brunke, H. Scheel and W. Seiler, Trends of tropospheric CO, N₂O, and CH₄ as observed at Cape Point, South Africa. *Atmospheric Environment*, 24A: 585 (1990).
25. A Neftel, R C Bales and D J Jacob, H₂O₂ and HCHO in polar snow and their relation to atmospheric chemistry. *NATO ASI Ser.*, I30: 249,(1995).
26. P.G. Holt, A potential vaccine strategy for asthma and allied atopic diseases during early childhood. *Lancet*, 344(8920): 456–458 (1994).
27. M.L. Kripke, Ultraviolet radiation and immunology: something new under the sun—presidential address. *Cancer Research*, 54(23): 6102–6105 (1994).
28. W. Goettsch, et al. Risk assessment for the harmful effects of UVB radiation on the immunological resistance to infectious diseases. *Environmental Health Perspectives*, 106(2): 71–77 (1998).
29. C. W. Sullivan, K. R. Arrigo and C. R. Comiso, Distributions of Phytoplankton Blooms in the Southern Ocean. *Science*, 262: 1832 (1993).
30. P. J. Neale, J. J. Cullen and R. F. Davis, Inhibition of marine photosynthesis by ultraviolet radiation: Variable sensitivity of phytoplankton Limonol, *Oceanogr*, 43: 433 (1998).
31. A. M. Springer and C. P. Mcroy, **The paradox of pelagic food webs in the northern Bering Sea—III. Patterns of primary production** *Continental Shelf Res.* 13: 575 (1993).
32. G. Dohler, **Impact of UV-B radiation on uptake of 15N-ammonia and 15N nitrate by phytoplankton of the Wadden Sea.** *Marine Biol.* 112: 485 (1992).
33. G.Bentham, Association between incidence of non-Hodgkin's lymphoma and solar ultraviolet radiation in England and Wales. *British Medical Journal*, 312(7039): 1128–1131 (1996).

Preparation, Optimization and Evaluation of Voriconazole Loaded Tri-Methyl Chitosan Nanoparticles

Deepika Yadav*, Pankaj Aggarwal, Anand Singh and Mamta Yadav

School of Pharmacy and Medical Science Singhania University, Pacheri Bari, Dist. Jhunjhunu -333515, Rajasthan (India)

ABSTRACT

Ocular diseases affect a growing number of people across the globe. So the present research work focused to prepare and evaluate Voriconazole nanoparticles containing trimethyl chitosan for ophthalmic drug delivery with primary goal is to develop topical ocular delivery systems with improved ocular bioavailability and reduced systemic side effects while maintaining the dosage form's simplicity and convenience. In the present study, the nanoparticles are prepared using ionotropic gelation method. The physicochemical interactions between drugs and selected excipients were studied using various techniques like FTIR, DSC, XRD and H-NMR. The physicochemical properties of the nanoparticles like size, PDI, pH, drug content/entrapment efficiency were determined. The in-vitro drug release properties were characteristics and examined for the formulations. The synthesized form of chitosan i.e. tri-methyl chitosan is used due to solubility issue. The comparative study was done using TMC and cyclodextrin as a polymer out of which TMC polymer gives better results. The optimization is done using 3^2 factorial design using design expert software. The optimized batch follows the zero order release kinetics.

Keywords: Voriconazole, Tri-methyl chitosan, Nanoparticles, Ophthalmic drug delivery system, thermogelling.

INTRODUCTION

Nanotechnology has been developed to overcome eye barriers and protect active substances. Mucoadhesive Chitosan nanocarriers increase eye contact time and act as permeability enhancers. Chitosan, on the other hand, does not get dissolved in both neutral and basic aqueous environments so its use is limited in drug delivery applications.^{1,2} The use of Chitosan in ophthalmic drug delivery is restricted due to its insolubility at neutral and basic pH. Considering this major drawback of the Chitosan, there is need to improve its solubility and other properties so that it can be widely utilized in ophthalmic drug delivery applications. Similarly, a major hurdle in the ophthalmic drug delivery system is poor adhesion of the dosage form and frequent administration of conventional drug products leads to noncompliance to the therapy. Also, the lesser corneal permeation of the drugs leads to poor bioavailability and nearly 1% or even less of the instilled dose is absorbed and frequent administration of conventional products is mandatory. The conventional ophthalmic dosage forms like eye drops, suspensions have poor corneal permeation as well as bioavailability of less than 5 % due to various factors like nasolacrimal drainage, lacrimation induction, blink reflexion, or corneal barrier. In presence of diseased conditions like glaucoma, fungal infection, age-related macular degeneration, diabetic retinopathy, dry eye syndrome that requires a novel drug delivery system for a prolonged period.^{4,6} So it has become necessary to create pharmaceutical formulations that provide sustained release, increased bioavailability with decreased frequency of administration. A significant challenge in achieving this goal is to overcome ocular barriers without causing permanent tissue damage. So considering all these discussed potential drawbacks of the pure Chitosan molecule and conventional ophthalmic formulations, an innovative drug delivery system using modified Chitosan derivatives is need of the hours. The use of Chitosan in ophthalmic drug delivery is restricted due to its insolubility at neutral and basic pH. But Chitosan is chemically modified to produce derivatives like Trimethyl Chitosan (TMC) that are soluble at both neutral and basic pH. Chemical changes can also be utilized to regulate hydrophobic, cationic, and anionic characteristics as well as attach various functional groups. Progress is being made quickly in this area, and the produced TMC have almost limitless application potential in a variety of fields. Also, poor patient compliance, lesser corneal permeation, frequent dosage administration, and very less bioavailability are some of the major challenges associated with the ophthalmic drug delivery system. In the ophthalmic drug delivery system, most of the drug is drained away from the precorneal area in few minutes. As a result, frequent instillation of concentrated solutions is needed to achieve the desired therapeutic effects. But, by the tear drainage, the main part of the administered drug is transported via the nasolacrimal duct to the gastric intestinal tract where it may be absorbed, sometimes causing side effects. To increase the effectiveness of the drug, a dosage form should be chosen which increases the contact time of the drug in the eye. This may then increase the bioavailability, reduce systemic absorption, and reduce the need for frequent administration leading to improved patient compliance.⁷⁻¹⁰

Voriconazole (VCZ) is the first second-generation triazole antifungal to hit the market. With low minimal inhibitory concentrations, it exhibits strong and broad-spectrum effectiveness against a variety of fungal species, including *Aspergillus*, *Candida*, and other fungi. VCZ is used in adults and children 2 years of age and older to treat serious fungal infections such as invasive aspergillosis (a fungal infection that begins in the lungs and spreads through the bloodstream to other organs), esophageal candidiasis (a yeast [a type of fungus] infection that may cause white patching in the mouth and throat), and candidemia (a fungal infection in the blood). It is also used to treat certain other fungal infections when other medications will not work for certain patients. VCZ is in a class of antifungal medications called triazoles. It works by slowing the growth of the fungi that cause infection. VCZ is available in both oral and intravenous dosage forms. The systemic injection of VCZ, on the other hand, is associated with severe side effects and drug interactions. However, because of VCZ's low aqueous solubility, no commercial ocular product is currently available. So considering the drawback of the current drug delivery system, a novel drug delivery system in the form of VCZ- TMC nanoparticles would be the better approach to overcome the serious issues associated with the current drug delivery system.^{11,12}

MATERIAL AND METHOD

Material

Voriconazole is obtained as a gift sample from Apollo Pharmaceutical, Mumbai, India. All the other ingredient's used are of analytical grade.

Method

Preparation of tri-methyl chitosan (TMC)

TMC was synthesized by reductive methylation according to a previous report with some modifications. Briefly, 2 g chitosan, 1.3 g sodium azide, 4 mL sodium hydroxide (10 %w/v), and 3.5 mL methyl iodide were added and stirred at 50 °C for 2 h. Next, 150 mL of distilled water (DW) was added and stirring was continued for 1 h before being dialyzed against DW overnight. A precipitate was formed by adding a large volume of acetone; it was washed with sodium hydroxide. The precipitate was suspended in water and dialyzed for 24 h, followed by freeze drying.^{13,14}

Preparation of Nanoparticles by Iontropic gelation method

The drug-loaded (VCZ) nanoparticles will be prepared by using the ionotropic gelation method as per the reported method. Briefly, 10 mg of TMC or cyclodextrin will be dissolved in 5 ml 10 mM HEPES buffer (pH 7.4), and drug solutions will also be prepared in the same buffer at a definite concentration. The drug solution will be added to the TMC or cyclodextrin solution achieving a final concentration ranging from 0.1 to 0.5 mg/ml under constant stirring. While continuous stirring 1 ml to 2 ml of the crosslinking agent, TPP solution (1.7-2.0 mg/ml) will be added to the TMC or cyclodextrin-drug solution drop by drop to induce ionotropic complexation. An opalescent dispersion formed after TPP addition will indicate the formation of nanoparticles. The nanoparticles will be collected by centrifugation at 12,000 rpm for 15 min on a 10 µl glycerol bed. The particles will be stored at -20°C until further use.^{15,16}

CHARACTERIZATION OF NANOPARTICLES

For further characterization, nanoparticles was performed to access interaction if any between the drug and polymer and also to find out what properties of polymer make them an effective material for solubility and bioavailability enhancement.

1. Particle Size Measurement

The sizes of particles are maintained during polymerization for the formation of free-following powders having fine aesthetic attributes. Particle size analysis of loaded and unloaded nanoparticles performed by nanoparticle size analyzer. Cumulative graph is maintained or plotted as particle size against time to study effect of particle size on drug release.¹⁷

2. Drug Content

To calculate the drug content, accurately weighed quantity of nanoparticles (10mg) with 5 ml of methanol in a volumetric flask was shaken for 1min using vortex mixer. The volume was made upto 10 ml. Then the solution was filtered and diluted and the concentration of Voriconazole was determined spectrometrically.¹⁸

$$\% \text{ Drug Content} = \frac{\text{Actual drug content}}{\text{Theoretical drug content}} \times 100$$

3. In Vitro Release Studies

In vitro release studies were performed in triplicate using USP Paddle method at 100 rpm and 37±0.2°C in 900 ml of simulated tear fluid. Samples were taken at appropriate time intervals. The samples were measured spectrophotometrically at 257 nm. Fresh dissolution medium was replenished each time when sample is withdrawn to compensate the volume.¹⁹

Table 1: Dissolution test parameters for powder dissolution test of nanoparticles

Batches	Dissolution media (900ml)	Paddle speed (RPM)	Bath temperature (°C)	UV Analysis (λ_{max}) (nm)	Time (hrs)
F1 to F9	Simulated tear fluid	100	37±0.5	257	12

4. Surface Morphology:

Scanning electron microscopy (JSM-5200, Tokyo Japan) was used to analyze particle size and surface topography was operated at 30kV acceleration voltage. A concentrated aqueous suspension was spread over a slab and dried under vacuum. The sample was shadowed in a cathodic evaporator with a gold layer 20nm thick. Photographs were elaborated by an image processing program and individual NP diameters were measured to obtain mean particle size.²⁰

5. Encapsulation Efficiency and Drug Loading Capacity:

For the determination of encapsulation efficiency accurately weighed NPs (10 mg) were added to 10 mL of distilled water and after the equilibrium solubility was attained, clear supernatant after centrifugation was filtered and 1 mL of the filtrate was mixed with 4 mL of methanolic HCl. Resulting sample was analyzed on UV visible spectrophotometer at 257 nm.

For the determination of drug loading capacity, NPs (5 mg) were dissolved in 5 mL of methanolic HCl and the solution was filtered through 0.2 μ m filter (Axiva syringe filter). VCZ concentration in the sample was determined using UV visible spectrophotometer at 257 nm.²¹ The percentage drug loading capacity was determined using the following formula:

$$\% \text{ Drug loading} = (\text{Mass of drug in NP} / \text{Mass of NP recovered}) \times 100$$

Formulation of Voriconazole loaded – TMC OR CD Nanoparticles

Table 2: Formulation of Voriconazole loaded TMC and CD nanoparticles

Batch	Drug solution	TMC	TMC Solution	TPP solution	CD	CD Solution
TMCF1	10	0.50	5	1.70	-	-
CDF1	10	-	-	1.70	0.50	5
TMCF2	10	0.50	5	1.85	-	-
CDF2	10	-	-	1.85	0.50	5
TMCF3	10	0.50	5	2.00	-	-
CDF3	10	-	-	2.00	0.50	5
TMCF4	10	1.25	5	1.70	-	-
CDF4	10	-	-	1.70	1.25	5
TMCF5	10	1.25	5	1.85	-	-
CDF5	10	-	-	1.85	1.25	5
TMCF6	10	1.25	5	2.00	-	-
CDF6	10	-	-	2.00	1.25	5
TMCF7	10	2.00	5	1.70	-	-
CDF7	10	-	-	1.70	2.00	5
TMCF8	10	2.00	5	1.85	-	-
CDF8	10	-	-	1.85	2.00	5
TMCF9	10	2.00	5	2.00	-	-
CDF9	10	-	-	2.00	2.00	5

RESULT AND DISCUSSION

UV-Spectroscopic Analysis

Determination of λ_{max} of Voriconazole in dissolution media

The standard solution (100 μ g/ ml) of pure drug (Voriconazole) was prepared in freshly prepared simulated tear fluid. The prepared solution was scanned between 200-400 nm by UV- visible spectrophotometer.

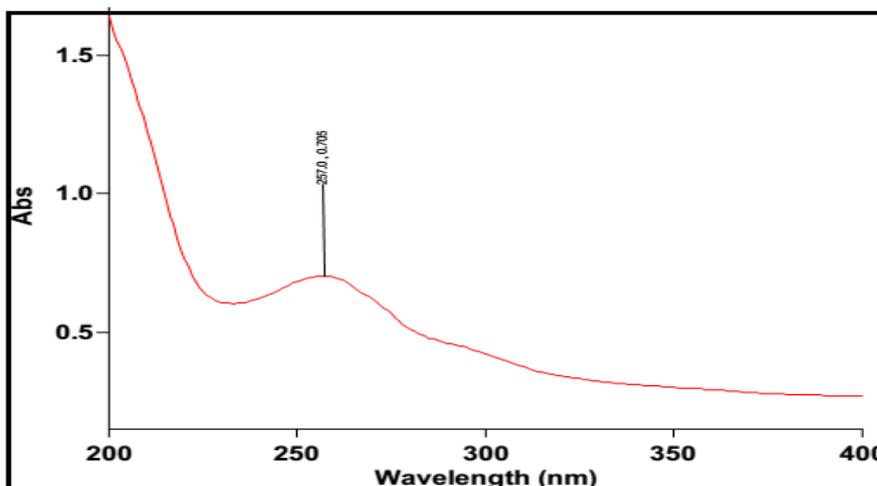


Fig.1: UV- Spectra of pure Voriconazole in simulated tear fluid

Fourier Transform Infra- Red (FTIR) Spectroscopy

The FTIR spectra was taken on IR Spectrophotometer using KBr pellet technique. The scanning range was 4000-400 cm^{-1} . The peaks were interpreted for the confirmation of various functional groups.

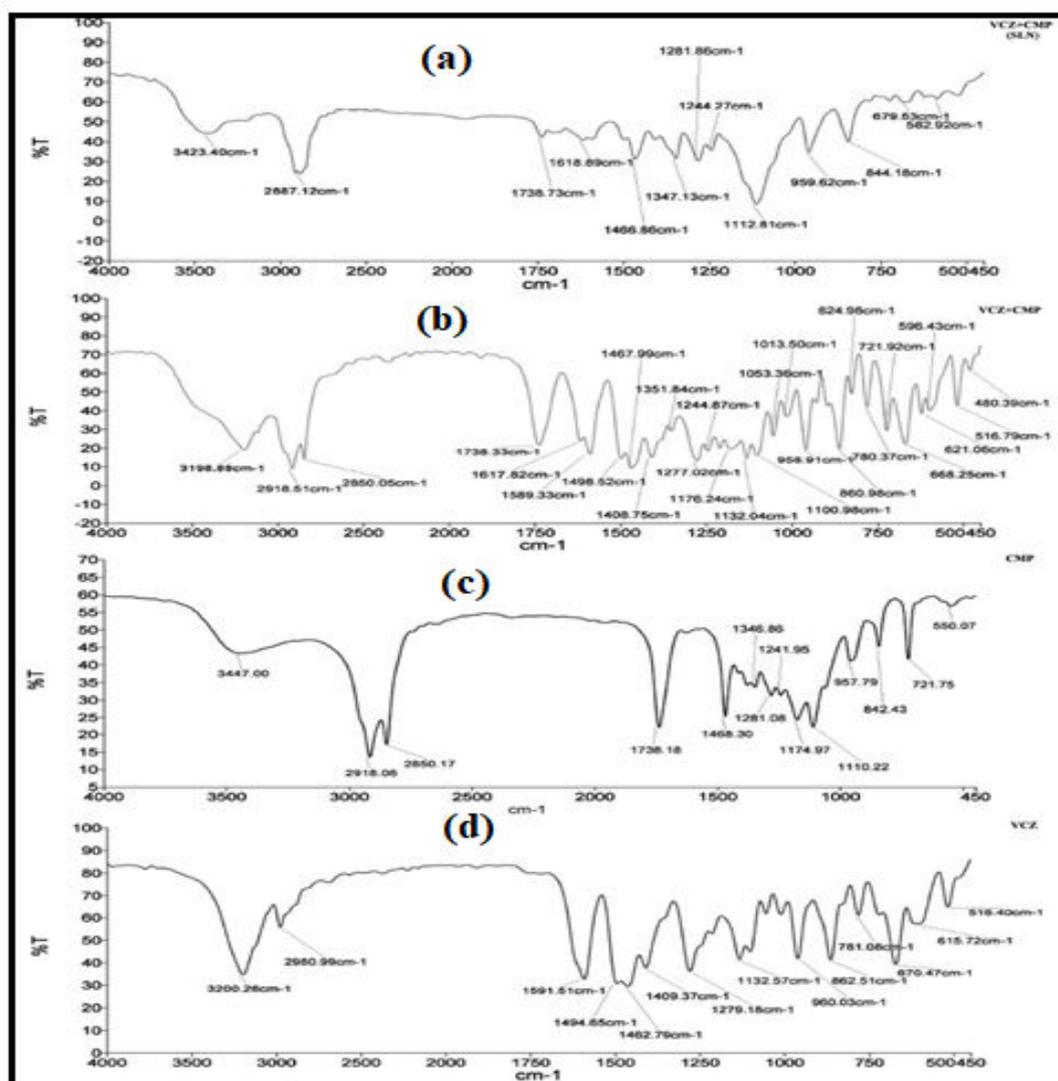


Fig.2: FTIR spectra of (a)Drug, (b) TMC, (C) Physical mixture of drug and TMC and (d) Nanoparticles

Nuclear Magnetic Resonance (NMR)

H-NMR is the technique used to identify hydrogen content and their positioning. A small amount of the sample was dissolved in CDCl_3 in a narrow glass vial and positioned in the sample holder of the instrument. NMR was recorded and interpreted for the validation of the compound.

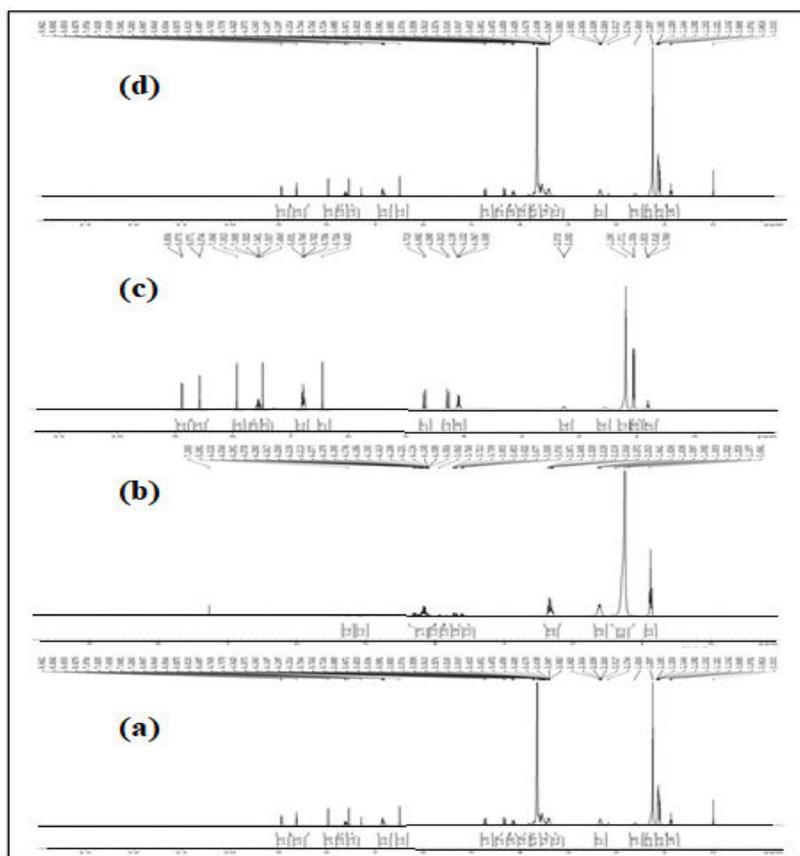


Fig.3: H-NMR spectra of (a)Drug, (b) TMC, (C) Physical mixture of drug and TMC and (d) Nanoparticles

X-ray diffraction (XRD):

The XRD measurements were carried out using Bruker D8 Advance X-ray diffractometer. The x-rays (Cu K-alpha) were produced using a sealed tube and the samples were scanned over a 2θ range of 2° – 50° with a scanning rate of $5^\circ/\text{minute}$. The x-rays were detected using a fast counting detector based on silicon strip technology (Bruker Lynx Eye detector). The XRD spectrum of VCZ exhibited sharp peaks at 6.9° , 12.6° , 13.8° , 15.9° , 16.5° , 17.4° and 19.8° at 2θ -scattered angles, which indicates the crystalline nature of the drug.

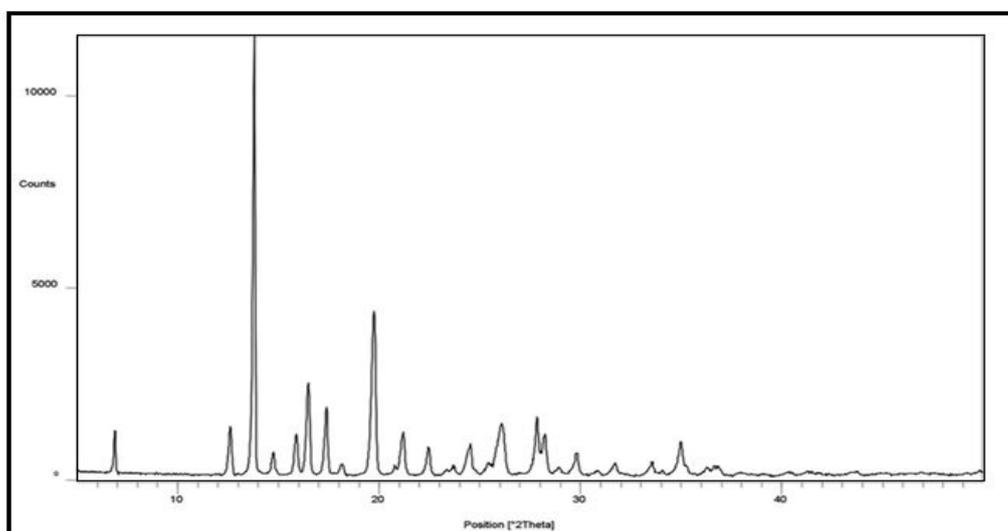


Fig. 4: XRD spectra of VCZ

Differential Scanning Calorimeter (DSC)

Small amount of sample (2 mg) was placed in the DSC aluminium pan and sealed. It was then heated under nitrogen flow at scanning rate of 10°C/min in the temperature range of 20 to 250°C. An empty aluminium pan was placed as a reference. Endothermic peaks were recorded. A sharp peak was observed at 132°C, indicative of its melting point this was near the reported melting point of the drug i.e. 128-130°C. The DSC thermogram confirmed the crystalline nature of the drug.

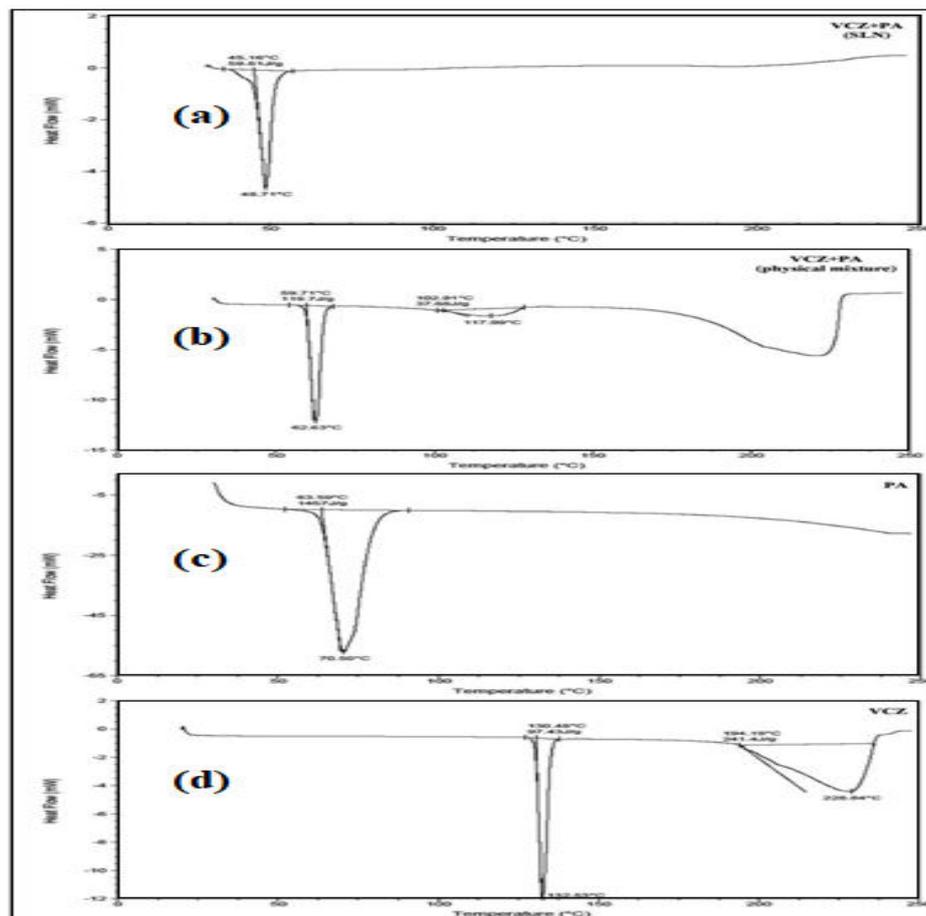


Fig.5: DSC thermogram of (a) Drug, (b) TMC, (C) Physical mixture of drug and TMC and (d) Nanoparticles

Synthesis of Trimethyl Chitosan

Quaternization (methylation) of amino groups in chitosan can be achieved with methyl iodide at elevated temperature in strong alkaline environment to bind the acid being generated during the reaction taking place and to avoid protonation of the unreacted primary amino groups. The degree of quaternization (DQ) can be altered by increasing the number of reaction steps or by increasing the reaction time or by controlling the reaction steps or by using different deacetylation grades of chitosan. At higher degrees of quaternization however evidence of O-methylation on the 3 and 6 hydroxyl groups of chitosan is found. In general, O-methylation led to less soluble products. It is desirable hence to prepare trimethyl chitosan (TMC) polymers with a high DQ but with a low degree of O-methylation.

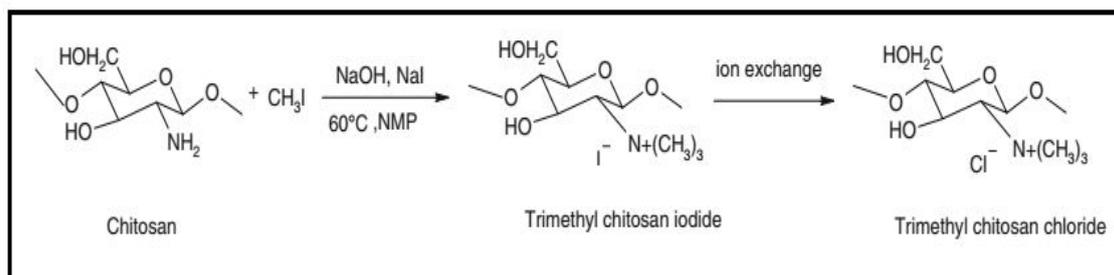


Fig.6: Synthesis of TMC

Evaluation of Nanoparticles

Percentage Yield

The percentage yield of different batches was determined by weighing the Nanoparticle after drying and were found to be in range as shown in below table.

Zeta potential

The zeta potentials of voriconazole formulation is sufficient enough (-10 to -20 mV) to stabilize the formulation.

Particle Size Analysis:

The Change in the concentration of polymer results in variation of particle size of Nanoparticles. The results of particle size of various batches were discussed in the table.

Table 3: Evaluation of different batches of Nanoparticle

Batch	Yield (%)		Particle size		Zeta potential	
	TMC	CD	TMC	CD	TMC	CD
F1	84.56	75.65	123.32	132.52	-19	-20
F2	93.68	84.62	75.62	142.32	-11	-18
F3	89.65	89.65	54.52	110.23	-14	-17
F4	88.65	79.85	89.92	98.65	-15-	-16
F5	75.98	86.65	94.62	101.32	-17	-15
F6	94.56	94.65	79.65	84.25	-13	-14
F7	84.54	74.65	82.54	99.65	-18	-20
F8	68.75	88.62	68.65	123.65	-16	-19
F9	80.21	72.32	58.65	104.65	-20	-17

Drug Content Determination

The various batches of the Nanoparticle were subjected for drug content analysis. The powdered Nanoparticle (10mg) were dissolved in adequate quantity (10ml) of Methanol. The UV absorbance was measured using a UV spectrometer at 255 nm.

Table 4: Drug content values of different batches of Nanoparticle.

Batch	Drug content (%)		Drug loading (%)	
	TMC	CD	TMC	CD
F1	75.23	54.65	81.25	79.65
F2	88.32	74.65	87.65	68.95
F3	94.87	84.62	95.54	84.65
F4	85.65	68.65	86.65	79.86
F5	91.23	78.65	89.39	89.65
F6	86.45	91.32	95.99	90.33
F7	89.54	88.56	91.23	88.98
F8	94.65	81.32	86.22	93.65
F9	90.21	89.32	90.68	90.32

Comparative study of TMC and cyclodextrin polymer:

Nanoparticles are prepared by using ionic gelation method. The comparative study was done between polymer TMC and polymer cyclodextrin.

Then the prepared nanoparticles are evaluated. The nanoparticles prepared by using TMC shows better results than the nanoparticles prepared using cyclodextrin. The results are as shown below:

Table 5: Results of comparative study

Batch	Particle size	Zeta potential	Drug content
F3 (using TMC)	54.52	-14	94.87
F6 (using cyclodextrin)	84.25	-14	91.32

From the above mentioned results, the VCZ-loaded TMC nanoparticles shows good drug content with minimum particle size than VCZ-loaded CD nanoparticles. So, TMC polymer is better than the cyclodextrin polymer.

In-Vitro Drug Release Study

In vitro drug release for drug loaded nanoparticles for a period of 12hrs was carried out by using simulated tear fluid at $37 \pm 5^{\circ}\text{C}$. From the dissolution profile of formulations F1 to F9, it is concluded that formulation batch F3 shows better drug release profile than other formulations. Cumulative % release has been shown for average of three preparations. Cumulative % drug release for all the formulations are depicted in the table below.

Table 6: In- vitro drug release studies of different batches of Nanoparticle

Time (hrs)	% Drug release of Nanoparticle								
	F1	F2	F3	F4	F5	F6	F7	F8	F9
0	0	0	0	0	0	0	0	0	0
1	5.45	5.98	4.32	6.01	3.25	5.46	6.45	4.51	4.56
2	14.32	19.65	12.35	18.65	14.65	24.32	25.36	14.65	20.6
3	24.65	24.65	28.65	26.65	31.23	29.68	24.65	20.65	27.65
4	33.25	36.65	38.95	34.56	39.65	40.35	30.32	37.65	31.65
5	41.42	47.65	44.35	50.32	49.56	51.56	39.56	40.23	39.45
6	49.56	58.65	50.65	55.62	51.65	64.56	48.65	49.62	45.35
7	54.62	64.62	58.65	64.32	59.56	69.56	54.35	60.56	51.62
8	64.65	66.52	64.62	69.25	69.01	75.65	64.23	68.56	64.65
9	69.51	76.56	70.32	72.36	75.65	79.56	69.56	76.65	72.65
10	72.65	81.26	79.65	79.65	81.56	84.65	75.62	84.65	84.65
11	84.65	88.62	89.65	91.32	89.65	90.24	84.65	89.62	89.45
12	92.32	93.32	98.65	96.35	97.65	98.45	95.62	97.86	95.62

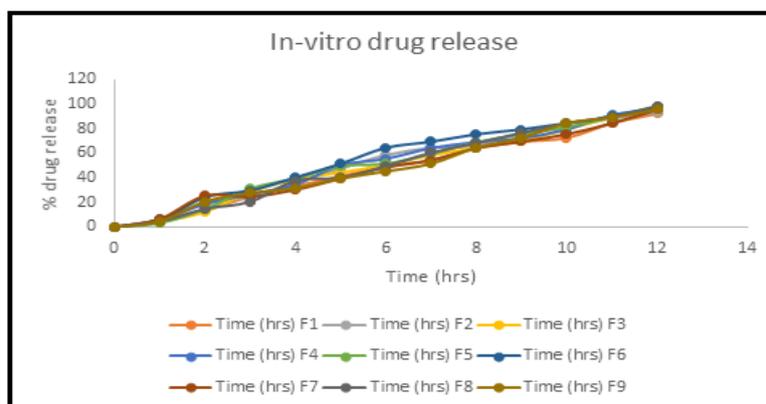


Fig.7: Graphical presentation of comparative drug release profile for F1 to F9 formulations.

OPTIMIZED BATCH:

From the above results, F3 batch was found to be optimized.

Table 7: Results of optimized batch

Batch	Particle size	Zeta potential	Drug content	Drug release
F3	54.52	-14	94.87	98.65

Surface Morphology:

The surface Morphology is done by using scanning electron microscopy.

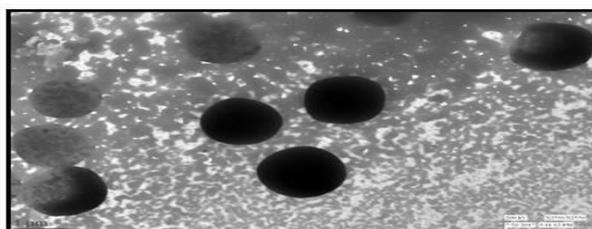


Fig.8: SEM image of optimized batch

OPTIMIZATION

A) Particle Size:

Counter Plot

Figure show the counter plot of TPP Solution and TMC is actual factor. It shows as TPP Solution concentration increases the particle size decreases. TMC concentration increases, particle size was found to be decreased.

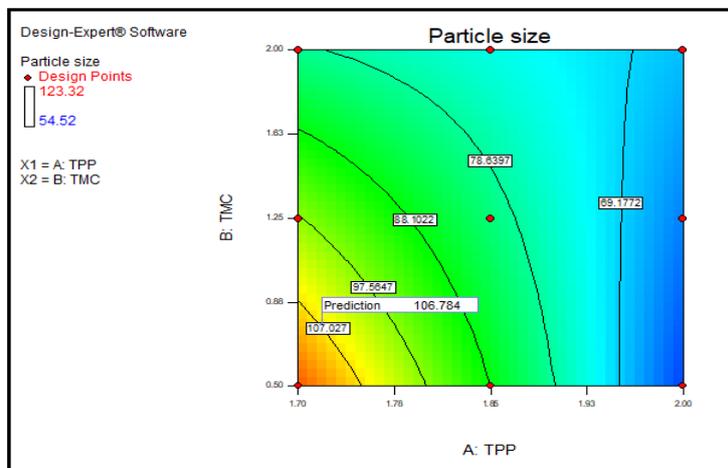


Fig. 9: Countour plot the effect of TPP Solution and TMC on particle size

Three Dimensional Graphical Presentations 3D surface

The 3D in figure shows that as increase in concentration of TPP Solution and TMC Concentration it shows decrease in particle size. It was concluded from the graph that the factor A have significance effect on the particle size.

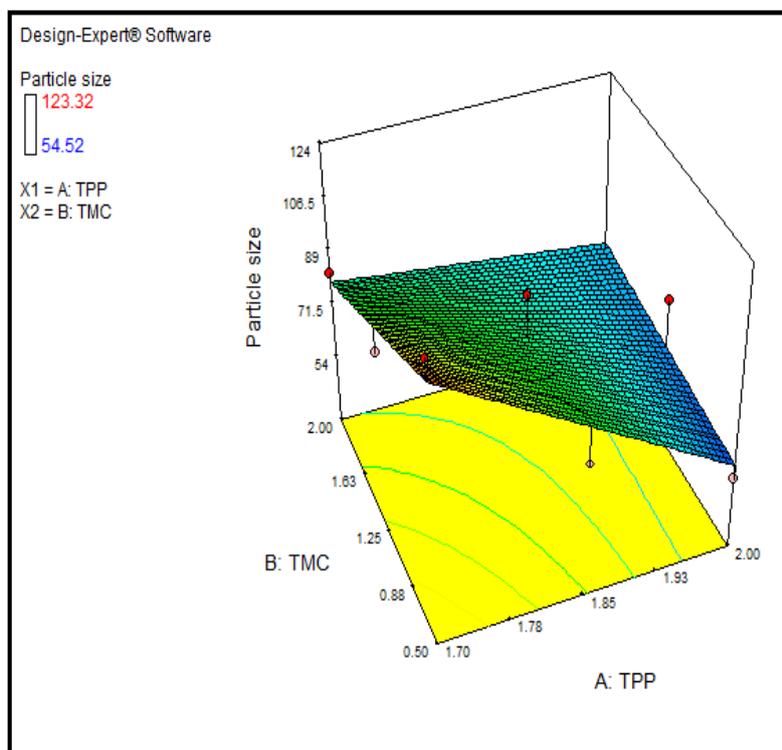


Fig.10: 3D Surface Plot of particle size of voriconazole with Respect to TPP Solution and TMC

B) Drug Content:

Counter Plot

Figure show the counter plot of TPP Solution and TMC is actual factor. It shows as TPP Solution concentration increases the drug content increases. Also, as TMC concentration increases, drug content was found to be increased.

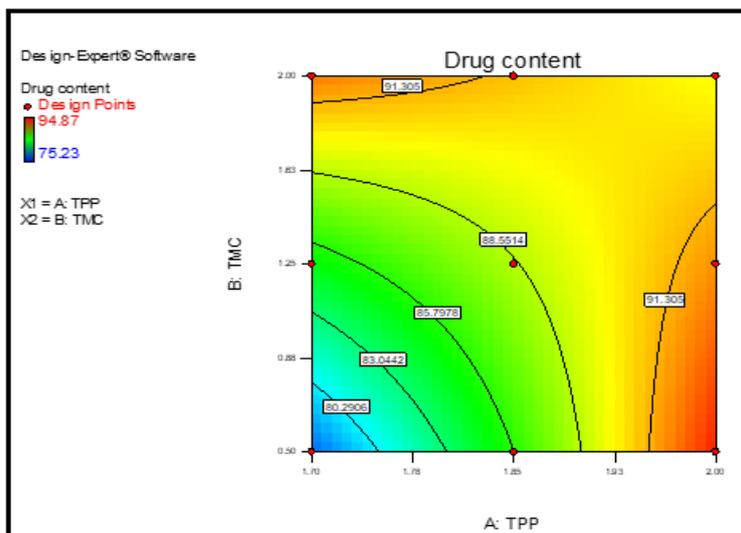


Fig.11: Countour plot the effect of TPP Solution and TMC on drug content

Three Dimensional Graphical Presentations 3D surface

The 3D in figure shows that as increase in concentration of TPP Solution and TMC Concentration it shows increase in drug content. It was concluded from the graph that the factor A have significance effect on the particle size.

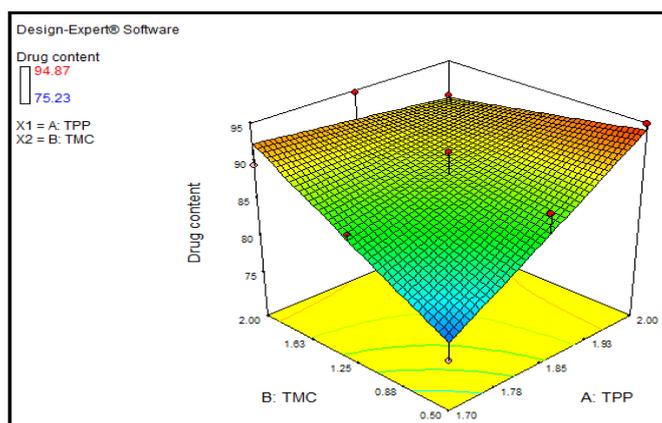


Fig.12: 3D Surface Plot of drug content of voriconazole with Respect to TPP Solution and TMC

C) Drug Release:

Counter Plot

Figure show the counter plot of TPP Solution and TMC is actual factor. It shows as TPP Solution concentration increases the drug release increases. Also, as TMC concentration increases, drug release was found to be increased.

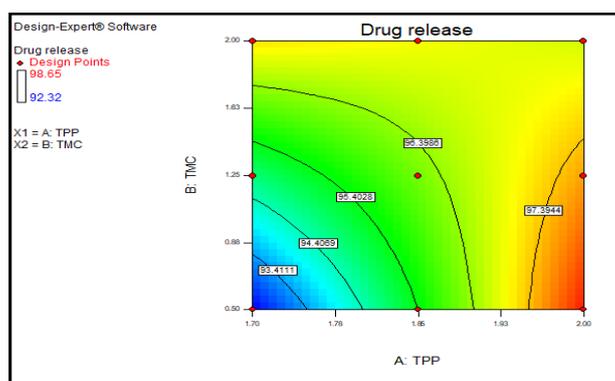


Fig.13: Countour plot the effect of TPP Solution and TMC on drug release

Three Dimensional Graphical Presentations 3D surface

The 3D in figure shows that as increase in concentration of TPP Solution and TMC Concentration it shows increase in drug release. It was concluded from the graph that the factor A have significance effect on the particle size.

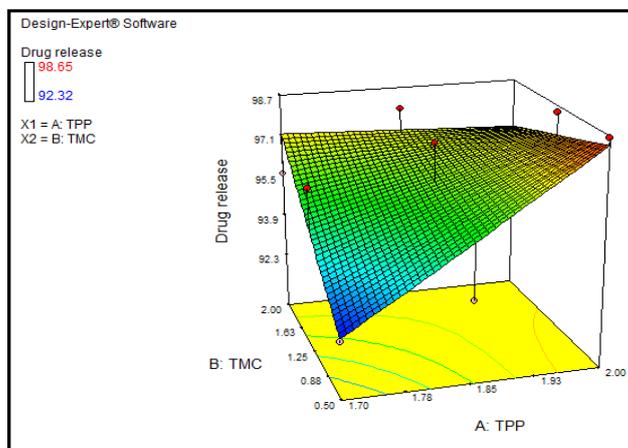


Fig.14: 3D Surface Plot of drug release of voriconazole with Respect to TPP Solution and TMC

KINETIC TREATMENT TO DISSOLUTION DATA

Table 8: The release data obtained

Zero order Equation line Y=	R2	First order Equation line Y=	R2	Higuchi equation line Y=	R2	Korsmeyers peppas Equation line Y=	R2
8.4328x+0.5229	0.993	0.0927x+1.0379	0.8214	38.826x-39.297	0.9875	1.1163x+0.8333	0.9866

From result shown in table, we can conclude that overall order of release data of drug after fitting in different mathematical model shows following results

F3 BATCH

Zero order > Higuchi > Korsmeyerspeppas > first order

Table 9: Model fitting of optimize batch of voriconazole formulation

Run (R ²)	Zero order	1st order	Higuchi	Korsmeryspeppas
	0.993	0.8214	0.9875	0.9866

Discussion: From the R² value it was concluded that the drug releases profile of optimize batch followed zero order kinetics & release pattern respectively.

STABILITY STUDIES

Optimized formulation was subjected to stability studies as per ICH guidelines. Various parameters such as drug content, and in vitro drug release were measured before and after 30, 60, 90 days of stability. Results of stability studies are shown in following table. Results of stability studies showed there is no significant change in above mentioned parameter after elevated temperature and humidity condition during stability studies. Thus it can be proved from the stability studies that the prepared formulation is stable and not much affected by elevated humidity and temperature conditions.

Table 9: Stability study of Optimized formulation

Time(day)	Drug content (%)	In vitro drug release (%)
0	99.13	99.884
30	97.52	96.522
60	95.61	93.548
90	88.32	91.365

CONCLUSION

Eye drops (solutions) are one of the widely preferred topical formulations; however, their frequent administration and poor bioavailability have been the major issue of concern. The exploitation of nanotechnology in ophthalmic drug delivery could be an effective strategy in resolving these drawbacks. The

point of major concern for nanoparticles is stability issues (particle aggregation and poor drug entrapment) on long-term storage, which needed further attention.

The objective of the present study was to develop optimum topical delivery systems of voriconazole containing tri-methyl chitosan, which ensures the effective delivery of the drug with lesser side effects. The present study is aimed to synthesize N-trimethyl chitosan (TMC), a water-soluble chitosan derivative, which is used in the ophthalmic drug delivery. Chitosan is a natural polymer which is insoluble in water while TMC is soluble at neutral and basic pH. Voriconazole is a BCS class II drug having low solubility and high permeability. So, Voriconazole nanoparticles are prepared to increase the solubility of Voriconazole and also to maintain the pH.

REFERENCES

1. Asasutjarit R, Theerachayanan T, Kewsuwan P, Veeranodha S, Fuongfuchat A, Ritthidej GC. Development and evaluation of diclofenac sodium loaded-N-trimethyl chitosan nanoparticles for ophthalmic use. *Aaps Pharmscitech*. 2015 Oct;16(5):1013-24.
2. Bunjes H, Unruh T. Characterization of lipid nanoparticles by differential scanning calorimetry, X-ray and neutron scattering. *Advanced drug delivery reviews*. 2007 Jul 10;59(6):379-402.
3. Donohue EK, Wilensky JT. Dorzolamide: A review. In *Seminars in Ophthalmology* 1997 Jan 1 (Vol. 12, No. 3, pp. 119-126). Taylor & Francis.
4. Felt O, Furrer P, Mayer JM, Plazonnet B, Buri P, Gurny RJ. Topical use of chitosan in ophthalmology: tolerance assessment and evaluation of precorneal retention. *International journal of pharmaceutics*. 1999 Apr 15;180(2):185-93.
5. Fouda NH, Abdelrehim RT, Hegazy DA, Habib BA. Sustained ocular delivery of Dorzolamide-HCl via proniosomal gel formulation: in-vitro characterization, statistical optimization, and in-vivo pharmacodynamic evaluation in rabbits. *Drug delivery*. 2018 Jan 1;25(1):1340-9.
6. Gupta KC, Ravi kumar MN. An overview on chitin and chitosan applications with an emphasis on controlled drug release formulations. *Journal of Macromolecular Science, Part C: Polymer Reviews*. 2000 Nov 20;40(4):273-308.
7. Harikumar SL, Sonia A. Nanotechnological approaches in ophthalmic delivery systems. *Int J Drug Dev & Res*. 2011 Oct;3(4):9-19.
8. Kashin AS, Ananikov VP. A SEM study of nanosized metal films and metal nanoparticles obtained by magnetron sputtering. *Russian Chemical Bulletin*. 2011 Dec;60(12):2602-7.
9. Kesarla R, Tank T, Vora PA, Shah T, Parmar S, Omri A. Preparation and evaluation of nanoparticles loaded ophthalmic in situ gel. *Drug delivery*. 2016 Sep 1;23(7):2363-70.
10. Li J, Jin X, Yang Y, Zhang L, Liu R, Li Z. Trimethyl chitosan nanoparticles for ocular baicalein delivery: Preparation, optimization, in vitro evaluation, in vivo pharmacokinetic study and molecular dynamics simulation. *International journal of biological macromolecules*. 2020 Aug 1;156:749-61.
11. Malik A, Gupta M, Mani R, Gogoi H, Bhatnagar R. Trimethyl chitosan nanoparticles encapsulated protective antigen protects the mice against anthrax. *Frontiers in immunology*. 2018 Mar 20;9:562.
12. Marangon FB, Miller D, Giaconi JA, Alfonso EC. In vitro investigation of voriconazole susceptibility for keratitis and endophthalmitis fungal pathogens. *American journal of ophthalmology*. 2004 May 1;137(5):820-5.
13. Min JB, Kim ES, Lee JS, Lee HG. Preparation, characterization, and cellular uptake of resveratrol-loaded trimethyl chitosan nanoparticles. *Food science and biotechnology*. 2018 Apr;27(2):441-50.
14. Mourya VK, Inamdar NN. Chitosan-modifications and applications: opportunities galore. *Reactive and Functional polymers*. 2008 Jun 1;68(6):1013-51.
15. Munier A, Gunning T, Kenny D, O'Keefe M. Causes of blindness in the adult population of the Republic of Ireland. *British journal of ophthalmology*. 1998 Jun 1;82(6):630-3.
16. Naik JB, Pardeshi SR, Patil RP, Patil PB, Mujumdar A. Mucoadhesive Micro-/Nano Carriers in Ophthalmic Drug Delivery: an Overview. *BioNanoScience*. 2020 Sep;10:564-82.

17. Okur NÜ, Yozgatlı V, Okur ME, Yoltaş A, Siafaka PI. Improving therapeutic efficacy of voriconazole against fungal keratitis: Thermo-sensitive in situ gels as ophthalmic drug carriers. *Journal of drug delivery science and technology*. 2019 Feb 1; 49:323-33.
18. Pandit J, Sultana Y, Aqil M. Chitosan-coated PLGA nanoparticles of bevacizumab as novel drug delivery to target retina: optimization, characterization, and in vitro toxicity evaluation. *Artificial cells, nanomedicine, and biotechnology*. 2017 Oct 3;45(7):1397-407.
19. Patel P, Shastri D, Shelat P, Shukla A. Ophthalmic drug delivery system: challenges and approaches. *Systematic Reviews in Pharmacy*. 2010 Jul 1;1(2):113.
20. Popa L, Ghica MV, Dinu-Pîrvu CE, Irimia T. Chitosan: A good candidate for sustained release ocular drug delivery systems. *Chitin-Chitosan—Myriad Functionalities in Science and Technology*; InTech: London, UK. 2018 Jul 18:283-310.
21. Shinde UA, Joshi PN, Jain DD, Singh K. Preparation and evaluation of N-trimethyl chitosan nanoparticles of flurbiprofen for ocular delivery. *Current eye research*. 2019 May 4;44(5):575-82.

