Asian Journal of Chemistry Vol. 13, No. 3 (2001), 1123–1126

Bacteriological Pollution of Ground Water in Textile City, Bhilwara, Rajasthan (India)

J. HUSSAIN, I. HUSSAIN†, K.G. OJHA* and K.C. SHARMA‡
Department of Applied Chemistry, M.D.S. University, Ajmer-305 009, India

The growing population and inadequacy of municipal water supply has led to exploitation of ground water resources for drinking water. However, the quality of ground water has deteriorated substantially due to malpractice in sewage and garbage disposal. Ths study was carried out to evaluate the quality of ground water in urban area of Bhilwara. The bacteriological analysis of 107 samples from various areas in the town revealed that in Gulmandi area and near Sanganer gate area, the water contains an exceeding high number of coliforms and, therefore, is not suitable for human consumption.

INTRODUCTION

Water is a liquid of life as it is the most essential component to sustain life on the earth. From the very beginning of human civilization people have settled close to water sources along rivers, lakes and natural springs. The use of water for domestic purposes may be subdivided into various categories, namely for drinking and culinary uses, for food preparation, for washing, bathing, laundering, swimming, wading pools and for industrial applications as well as agricultural purposes.[1] Therefore, water quality is directly linked with the health of living beings. The water used may be unsafe chemically as well as microbiologically. Chemically unsafe water shows long term and slow effect while microbiologically unsafe water creates short term problems such as dysentery, diarrhea, jaundice, gastrointestinal disorders, fever and ameboisis which may assume epidemic proportions.[2] UNICEF (1990–92)[3] estimated 45,000 diarrhea associated deaths (44% of the children under the age of 5) each year. Pandey *et al.*[4] also revealed that deaths of 8.7% of old age group and 19.1% of 5–15 age group are due to water-borne diseases.

Industrialization as well as urbanization affects physico-chemical quality of water; on the other hand, microbiological quality change is due to improper sewage and sanitary system as well as illiteracy. The importance of water quality assessment has been a compelling fact for avoiding environmental risk and for maintenance of health atmosphere. Environmental research focuses an effort to reduce water pollution, although the pollution condition may become unhealthy

†Public Health Engineering Department Laboratory, Bhilwara-311 001, Rajasthan, India.
‡Department of Environmental Studies, M.D.S. University, Ajmer-305 009, Rajasthan, India.
All correspondence: K-21, Gandhi Nagar, Naka Madar, Ajmer, India.

for human or any species that we value.[5] The work on microbiological pollution is still lacking. Kaushik and Prasad[6], Thapliya *et al.*[7], Shrivastava *et al.*[8], Richariya and Mishra[9] and Garode *et al.*[10, 11] are among the few workers who have worked on microbiological quality of water. However, in case of Rajasthan state, information on this topic is still lacking. Bhilwara (25° 1′ to 25° 58′ North latitude and 74° 1′ to 75° 28′ East longitude), the south-eastern district of Rajasthan with semi-humid climate, known as 'Textile city' is facing a critical problem of ground water pollution. The residential colonies of the city are exposed to various water borne diseases due to improper sewage and sanitary system. Two wastewater nallahs, *viz.*, Shastri Nagar Nallah and Subhash Nagar Nallah are doing the maximum damage to health. The present study was carried out to assess MPN/100 mL of total coliform and *E. coli.*

EXPERIMENTAL

In Bhilwara town 14 colonies were selected for bacteriological examination. At least 6 samples were collected from each colony. 107 samples from hand pumps and bore wells are collected in 125 mL sterilized borosil glass bottles with necessary precautions.[12] Bacteriological examination of all samples, for total coliforms, was carried out by multiple tube fermentation method.[13] After 24 and 48 h the positive tubes were examined for *E. coli.*

RESULTS AND DISCUSSION

The result (Table-1) shows that MPN values are found to vary from nil to 2400 MPN/100 mL. The highest MPN values were observed in Sanganer gate and Gulmandi area, which are situated at low ground water level. Therefore, it facilitates all the domestic waste to flow through these areas. The other reasons for greater contamination may be high population density, poor drainage and orthodox design of sewage disposal system. The sewers are blocked at many places and hence provide a good climate for pathogenic growth. Water logging problems are also observed in these regions. Water contamination is an integral factor, which has recognizably increased with urbanization and industrialization by direct and indirect means. This poses a threat to water sources, which have evolved into a formidable factor in the spread of human and animal diseases. The causative agents for typhoid fever, bacillary dysentery, amoebic dysentery, paratyphoid fever and cholera are spread by polluted water.[14] *Escherichia coli* is the most abundant coliform in human and animal intestines and is derived almost exclusively from these sources.[15] The presumptive coliform count laid out in the area of study indicates that the water was contaminated with *E. coli*, and thus not potable. The highest *E. coli* value (9) was observed in Gulmandi area. All the samples are categorized (Table-3) as per various standards (Table 2). From the study of Table 3 it is clear that out of 104 samples, which were examined for total coliform, 47% samples are of excellent grade while 24% samples are of satisfactory grade. Remaining 17% samples were of suspicious and 11% samples are of unsatisfactory grade. The 49 remaining were of excellent grade and the remaining 55 samples were examined for *E. coli.* Out of these 55 samples, 41 samples are within excellent grade while 11 samples are with suspicious grade. Remaining 3 samples were found to be

of unsatisfactory grade. From the study of Table-3 it is also noticed that the hand pumps are more contaminated than of tube wells. The reason for this fact is good sanitary condition and better maintenance for tube wells than hand pumps. The coliform and *E. coli* values in the present study area found to exceed the standard permissible limts at several sampling stations are potentially hazardous to the health of the public. Therefore, it is necessary to take steps for preventing pollution of these places.

TABLE-1
TOTAL COLIFORM AND *E. Coli* IN GROUND WATER OF VARIOUS COLONIES

S.No.	Sampling site	No. of samples examined	MPN/100 mL			
			Total coliforms		*E. coli*	
			Min	Max	Min	Max
1.	Shastri Nagar	7	Nil	72	Nil	1
2.	Sindu Nagar	6	Nil	8	Nil	Nil
3.	Gul Mandi	7	Nil	1100	Nil	9
4.	Sanganeri Gate	6	Nil	2400	Nil	10
5.	V.S.P. Nagar	6	Nil	240	Nil	2
6.	Manikya Nagar	7	Nil	48	Nil	Nil
7.	Subhash Nagar	10	Nil	92	Nil	1
8.	R.K. Colony	7	Nil	29	Nil	Nil
9.	Police Line	6	Nil	58	Nil	1
10.	Gandhi Nagar	7	Nil	60	Nil	Nil
11.	Pratap Nagar	6	Nil	24	Nil	1
12.	Bapu Nagar	7	Nil	8	Nil	Nil
13.	C.S. Azad Nagar	7	Nil	7	Nil	Nil
14.	Bhopal Ganj	15	Nil	9	Nil	Nil

TABLE-2
VARIOUS STANDARDS OF COLIFORM AND *E. coli*

Bacteria	ICMR	ISI	WHO	BMHC	MWBLC	Water Class
Total Coliform	0	0	0	0	0	Excellent
				1–3	1–3	Satisfactory
				4–10	4–10	Suspicious
				>10	>10	Unsatisfactory
E. coli	0	0	0	0	0	Excellent
					1–3	Suspicious
				1	>4	Unsatisfactory

TABLE-3
CATEGORIZATION OF GROUND WATER SAMPLES AS PER TABLE-2

Type of source	Total coliform					*E. coli*			
	No. of samples examined	Excellent	Satisfactory	Suspicious	Unsatisfactory	No. of samples examined	Excellent	Suspicious	Unsatisfactory
Hand pump	68	30	16	12	10	38	27	8	3
Tube wells	36	19	9	6	2	17	14	3	0
Total	104	49	25	18	12	55	41	11	3

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(*Received:* 1 March 2001; *Accepted:* 25 April 2001) AJC-2328