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REVIEW

A Comprehensive Review on Green Synthetic Approaches and Applications of 3*d*-Series Metal Oxide Nanoparticles

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Transition metal oxides have been studied by many workers of fields who want to find new ways to use them in medical devices and other fields. Researchers have done a lot of research on solid-state synthesis methods, which require high temperatures and make molecules that are thermodynamically stable. Transition metal oxides have been used for a wide range of things, from nanoparticles that deliver drugs to systems that store information in more than one state. In materials science and technology research and development, a new era of "green synthesis" methods is getting a great attention. Basically, green synthesis of materials and nanomaterials, which is done through a process of regulation, control, cleaning and remediation, will directly help make them more friendly to the environment. In this review, various green approaches for 3*d*-series metal oxide nanoparticles and their applications are discussed.

Keywords: Metal oxide, Green synthesis, Nanoparticles.

INTRODUCTION

Nanoscience is one of the most relevant and effective fields of study in modern science. In last few years, nanotechnology has become an advanced technology, with interdiscipline research taking place between various fields of study. Nanoparticles (NPs) are more interesting than bulk materials because of the enhanced surface Rayleigh scattering, plasmon resonance and enhanced surface Raman scattering of fine metals and their related metal oxides nanoparticles. Because of this, nanoparticle technology has a significant impact on the development of various chemical and biological sensors [1-7]. Nanoparticle materials made from metal and metal oxides with substantial surface modification are being studied for a wide range of applications, including medical, biological and electronic ones. Nanoparticle production can only be accomplished using a small number of harmful chemicals and solvents. The development of new green, non-toxic and safe technologies for synthesizing nanoparticle materials is accelerating [8]. The intrinsic qualities of inorganic materials are mostly governed by their composition, structure, crystallinity, size and shape. Developing new ways to make nanomaterials, which are safe for people to use is very important because of the problems that have been talked about [9]. Literature shows that there has been a rise in the use of biosynthesis or green synthesis of metal oxide nanoparticles [10,11].

Metal oxide nanoparticles: Microelectronic circuits, sensors, piezoelectric devices, fuel cells and corrosion catalysts are only few of the applications of metal oxides in materials science. Environmental pollutants can be absorbed by metal oxides, too. Due to their small size, oxide nanoparticles in nanotechnology may exhibit unusual chemical characteristics. A wide range of fields have been studied transition metal oxides in the hopes of finding new uses for them in medical devices and other fields. Solid-state synthesis methods, which demand high temperatures and produce thermodynamically stable molecules, have been studied extensively. From drug delivery nanoparticles to multiple-state memory storage systems, transition metal oxides have also been used in a wide variety of applications [12,13].

Sc_2O_3 nanoparticles: Scandium(III) oxide adopts a cubic crystal structure (tetrahedral containing six-coordinated metal centres. Powder diffraction analysis shows Sc–O bond distances of 2.159-2.071 Å. Scandium oxide is an insulator with a band gap of 6.0 eV. Scandium sol-gel chemistry has had a significant impact on the development of scandium oxide as a dopant in garnet lasers [14] or as a stabilizer for zirconia [15,16]. Mixed nickel-copper oxides can also form materials that are sensitive to NO_2 [17]. The breakdown of propan-2-ol and the oxidation of CO on the surfaces of porous Sc_2O_3 bulk materials synthesized by precipitation in an aqueous solution have been explored as catalytic applications [18,19]. Materials with high refractive index, high transparency to emitted radiation and strong thermal stability are now being studied and developed in response to the possibility for UV lasers to be used in inertial confinement fusion (ICF). Among the high index materials coated using physical methods, scandia coatings generated by chemical vapour deposition demonstrate the best reflecting characteristics and laser damage resistance for multilayer UV-mirrors [20].

TiO_2 nanoparticles: Rutile is a mineral that is mostly made up of titanium dioxide (TiO_2) and it is the most common natural form of TiO_2. Anatase, akaogiite and brookite are some of the other rare polymorphs of TiO_2. Today, biosynthesis of nanoparticles has been used in a lot of different ways by making them with plants. The green method to make titanium oxide nanoparticles is better because it doesn't use a lot of chemicals [21,22]. TiO_2 is one of the metal oxide antimicrobial agents, which is both inert and durable. It can be used in a wide range of areas *viz*. optical, sensors, electronics, solar cells, gas sensing, magnetic, antibacterial and antifungal agents. TiO_2 contains high surface area, good surface morphology and is not harmful in nature. It has good activity on a wide range of bacteria [23-27].

V_2O_5 nanoparticles: Among the various vanadium oxide compositions that can be obtained, vanadium pentoxide (V_2O_5) possesses a unique set of properties as one of the most widely studied of the more stable phases of vanadium oxides. The vanadium pentoxide powders have been prepared mostly by dry processes such as vacuum evaporation [28,29] and sputtering [30], although wet processes such as electrodeposition and sol-gel method [31,32] seem to be more advantageous in producing large scale films. Recently, microbial cells have been proposed as inexpensive and environmentally friendly biotemplates to direct the deposition, assembly and patterning of inorganic nanoparticles and microstructures [33]. Both living and dead microorganism's cells are capable of directing the synthesis and assembly of crystalline inorganic materials due to their cell wall's active biomolecules. The synthesis of nanoparticles of metal oxides using yeasts as biological templates are reported [34-36].

The transition metal vanadium is highly sought after in a wide range of industrial applications. Potential applications include solar cells, sensors, batteries and catalysis [37-42] due to its oxides form. The valence electron state of vanadium can affect the structure of vanadium oxides form. In various VO, V_2O_3, VO_2 and V_2O_5 phases [43], the valence state of the metal fluctuates between the V^{2+} and V^{5+} range. The V_2O_5 is the most stable orthorhombic vanadium oxide and has the best electrical and optical characteristics of all vanadium oxides [44].

Cr_2O_3 nanoparticles: Because of their relevance in both science and technology, chromium oxides have recently gained a great deal of media interest. Chromium may create a variety of oxides due to its various stable oxidation states. When it comes to specific applications like high temperature resistance materials [45], corrosion resistance materials [46], liquid crystal displays [47,48], green pigments [49], catalysts [50,51], *etc*., researchers have paid close attention to the formation and properties of chromium oxide (Cr_2O_3). Many studies have been done on the synthesis of diverse Cr_2O_3 materials [52-54]. It is well-known that inorganic materials' intrinsic qualities are mostly governed by their composition, structure, crystallinity, size and morphology. The medical applications of nanoparticles for therapy and antibacterial action have been the focus of nanobiotechnology investigations. There are numerous uses for chromia (Cr_2O_3), such as high-temperature and corrosion-resistant materials; liquid crystal displays; green pigment; heterogeneous catalysts; coating materials, *etc*. [55-65].

MnO_2 nanoparticles: MnO_2 is one of the most promising transition metal oxides for catalytic applications due to its distinctive physical and chemical properties [66,67]. MnO_2 has the stable isomorph called pyrolusite, β-MnO_2. MnO_2 nanoparticles have been investigated through numerous applications in several fields like immobilization of proteins [68], sensitive biosensors [69], electrochemical capacitors [70], removal of dyes [71,72], lithium ion batteries [73], synthesis bioactive compound [74], analysis of neuro-behaviour of rats [75], biomimetic catalyst [76] and metal adsorption [77].

Fe_3O_4 nanoparticles: The separation and purification of dye, pharmaceutical and heavy metal contamination, as well as labelling and medication delivery systems, have all been made possible with iron oxide-based magnetic nanoparticles in recent years. Among iron oxide nanostructures, magnetite (Fe_3O_4) has drawn the most interest due to its exceptional magnetic and electrical properties [78]. Super-paramagnetism is one of the Fe_3O_4 nanoparticles' most noteworthy characteristics and supports that Fe_3O_4 nanoparticles behave like atomic paramagnets above the blocking temperature and act as a single magnetic domain. High saturation magnetization and high field irreversibility are the result of this sort of magnetism in Fe_3O_4 nanoparticles, making this iron oxide nanostructure more easily separable in external magnetic fields than other metal oxide nanoparticles.

The majority of iron oxide nanoparticle synthesis has utilized dangerous, costly and environmentally harmful laboratory compounds as reducing agents. Wet chemical, dry procedures and microbiological techniques can all be used to make iron oxide magnetic nanoparticles [79-84]. Many scientists have proposed an alternate and environmentally acceptable method for synthesizing nanoparticles: biogreen synthesis. Different magnetic nanocomposites can be made by putting high adsorption coatings on their surfaces [85-92]. Plant extracts, particularly ferrous magnetic oxides, have been used in green nanoparticle manufacturing.

When compared to chemically produced Fe_3O_4 nanoparticles, green biosynthesized Fe_3O_4 nanoparticles can have better properties with improved biocompatibility and biodegradability. They can therefore be used in biomedical applications because of the distinctive surface coating of green materials, which is not only non-toxic and biocompatible but also allows targeted medication administration with Fe_3O_4 nanoparticles localization in a specific area. Because the green materials used to synthesize Fe_3O_4 nanoparticles are safe to consume, the toxicity to humans can be decreased, which is advantageous in biomedical applications [93]. Fe_3O_4 nanoparticles could be used in a variety of medical applications, including antimicrobial, tissue engineering and hyperthermia [94,95]. Fe_3O_4 nanoparticles can be employed in the fields of catalysts, water remediation and lithium-ion batteries [96-99]. Numerous studies have been done in order to maximise the potential use of Fe_3O_4 nanoparticles in various domains of application because of their intriguing properties, such as superparamagnetic. In addition, they serve as MRI contrast agents, photothermal therapy of malignancies, magnetofection agents, magnetic storage media, magnetic bioseparation and DNA molecule identification *via* targeted drug delivery systems. Due to their remarkable magnetic characteristics, Fe_3O_4 nanoparticles are becoming increasingly popular as a drug delivery system component [100-105].

Co_3O_4 nanoparticles: As a result of their wide range of applications in lithium ion batteries, cobalt oxide (Co_3O_4) nanoparticles with normal spinel structure have been extensively studied as promising types of multifunctional materials among the many transition metal oxides that have been extensively investigated because of their intriguing electronic and electrical properties as well as their catalytic and magnetic properties.

These nanoparticles have been synthesized using a variety of processes, including co-precipitation, sol-gel, sonochemical approach, chemical vapour deposition and thermal breakdown of cobalt precursors [106-112]. Co_3O_4 nanoparticles of various morphologies can be synthesized *via* hydrothermal techniques, chemical spray pyrolysis, combustion, mechanochemical processing, microwave irradiation and microemulsion methods [113-118]. However, the utilization of expensive equipments, complex synthesis stages, high temperatures, protracted reaction times and a high cost of synthesis have been associated with many of these synthesis approaches. These approaches are also not environmentally friendly. Toxic and hazardous chemicals used in the nanoparticle-synthesis technique have been reduced using green chemistry during the past two decades in both research and industry. Friendly environment materials can be used in a variety of contexts. It is therefore possible to reduce the use and environmental impact of some chemicals (capping agents, reducing agents and solvents) used in the production of various nanoparticles [119-129]. Biosynthesis utilizing plants is regarded the safest, most economically viable and environmentally benign strategy for synthesising nanoparticles. It also produces more stable nanoparticles more quickly. Co_3O_4 nanoparticles can be made using various plant extracts, such as *Calotropis gigantea* and *Aspalathus linearis* leaves [130,131], *Punica granatum* peal extract [132,133] and so on.

NiO nanoparticles: Recently, a lot of attention has been paid to nickel oxide nanomaterials, which have a large band gap (3.6-4.0 eV), p-type conductivity and can be used in a lot of different ways. There are a lot of different technologies that can be used to make smart windows, which include photocatalysis, antimicrobial, anti-ferromagnetic, electrochemical, photoelectronic, gas sensors, *etc*. Nanostructured NiO, on the other hand, has better properties than micro and macro-sized NiO particles in terms of volume, surface and quantum size [134]. A nanomaterial of NiO has been called a cheap semiconductor because of its long-term stability, availability and nontoxicity [134]. In addition, nickel nanoparticles have been found to have a superior antimicrobial impact to that of other metal nanoparticles. Jeyaraj *et al*. [135] reported that NiO nanostructures are better act as a antibaterial agent than silver nanostructures however, number of factors also depends upon the process and quantity.

A variety of methods may be used to produce NiO nanoparticles, including solvothermal process [136], chemical precipitation, thermal breakdown, sol-gel combustion [137], *etc.* These procedures, on the other hand, require special equipment, high temperatures and a long process. Plant extracts are used to make nanomaterials as a reducing agent and a capping agent instead of chemical and photochemical methods [138]. Moreover porous parts of plants also work as biotemplates to reduce metal ions to get the right shape [139].

CuO nanoparticles: Copper oxide nanoparticles have better biological and photocatalytic abilities than metal nanoparticles. It has been shown that copper oxide nanoparticles could be used in gas sensors, catalysis and batteries, as well as in agriculture [140-143]. They could also be used to remove dyes, remove field emission emitters and convert solar energy. CuO nanoparticles also have unique anticancer, antimicrobial and antioxidant properties, which makes them a good tool for biomedical applications [144,145].

Microwave irradiation, thermal decomposition, sol gel, colloidal thermal synthesis, sonochemical, hydrothermal and quick precipitation have all been used to make CuO nanoparticles that have the right morphologies and properties [146-152]. Phytosynthesis of CuO nanoparticles has been getting more attention recently because of its long-term sustain-ability, low cost and ease of use [153]. It has also been reported that different techniques can change their shape and its toxicity [154-157]. Using green methods, CuO nanoparticles act as both a reducing agent and a stabilizing agent, moreover, presence of biomolecules like flavonoids, saponins, tannins, starches and polypeptides help CuO nanoparticles less acidic and more stable [158].

Despite the fact that synthesizing nanoparticles from the microorganisms is beneficial for the environment, however, they too have some drawbacks, for example, the toxicity of some bacteria, the difficulties in separating them and the time it takes to grow them [159]. Nevertheless, plants are still the best source of metal and metal oxide nanoparticles, since they consists a fast reaction rate, contains a number of biomolecules, low-cost, stable and are easy to use [160].

ZnO nanoparticles: ZnO can be used in biosensors, cosmetics, drug carriers and antibacterial agents, because it has a wide band gap of 3.1-3.3 eV [161]. Synthesizing ZnO can be done in a number of different ways, which include sol-gel processing, homogeneous precipitation, mechanical milling and organometallic synthesis [162,163]. These kinds of methods usually use organic solvents and toxic reducing agents, most of which are highly reactive and corrosive. For the extraction of plant metabolites, mild solvents like water, alcohol and methanol were used [164-167] during the synthesis of zinc oxide nanoparticles using zinc salt solution.

Table-1 shows the summary of the several metal oxide nanoparticles prepared using various plant extracts.

Conclusion

In conclusion, the recent findings show that 3*d*-metal oxide nanoparticles are of substantial interest because of the prospective technological and therapeutic uses. The synthesis of 3*d*-metal oxides nanoparticles using traditional as well as greener, milder synthetic procedures that make use of plants, organisms and other natural products was also discussed. There are still many unanswered concerns regarding the operation of plant extracts, particularly plant leaf extracts, and how they produce even greener nanoparticles. Additionally, the molecular mechanism of plant nanoparticle interaction is still necessary for the bioreduction mechanism, the synthesis, growth,

TABLE-1
VARIOUS GREEN APPROACHES FOR SYNTHESIS OF 3d SERIES METAL OXIDE NANOPARTICLES AND THEIR APPLICATIONS

Plant	Size	Shape	Application	Ref
		TiO_2 nanoparticles		
Leaf extract *Aloe barbadensis* (aloevera)	~ 20 nm	Poly-dispersed, spherical	Antibiofilm potential against *Pseudomonas aeruginosa*	[168]
Flower aqueous extract of *Calotropis gigantea* (*C. gigantea*)	10.52 nm (XRD) 160-220 nm (SEM)	Aggregated and spherical	Acaricidal activity *Rhipicephalus microplus* and *Haemaphysalis bispinosa*	[169]
Leaf (KL), pod (KP), seed (KS) and seed shell (KSS) extracts of kola nut tree	25.00-191.41 nm	Spherical	Antimicrobial, dye degradation, antioxidant and anticoagulant activities	[170]
Echinacea purpurea herba extract	120 nm	Spherical agglomerated	Bio reductant	[171]
Aqueous leaf extract of *Psidium guajava*	32.58 nm	Spherical	Antibacterial and antioxidant activities *Staphylococcus aureus*	[172]
Leaf aqueous extract of *Mangifera indica* L	30 ± 5 nm	Spherical	Larvicidal activity, blood-feeding parasites	[173]
The root extract of with *Ania somnifera*	50-90 nm	Spherical and square	Broad-spectrum attenuation of biofilm and cytotoxic properties against HepG2 cell lines	[174]
Leaf aqueous extract of *Solanum trilobatum*	70 nm		To assess the antiparasitic efficacies	[175]
Aqueous leaf extracts of *Parthenium hysterophorus*	20-50 nm	Spherical	Larvicidal, antibacterial and photocatalytic efficacy	[176]
Leaf extract of *Morinda citrifolia*	15-19 nm	Quasi-spherical	Antimicrobial properties	[177]
		V_2O_5 nanoparticles		
Cotton fibres	19.21 nm	Orthorhombic	Catalytic activity for the degradation of 4-nitrophrnol	[178]
Tinospora cordifolia	10-40 nm	Orthorhombic nano rods	DNA cleaving and anti angiogenic agent	[179]
Phytomolecule isolated from *Phyllanthus amarus*	10-60 nm	Nano rods	High degree of cell viability with relatively less cytotoxicity for against breast cancer cell line MDA MB	[180]
Tannic acid is a type of green material which is extracted from natural tree bark and leaves	20-40 nm	Nanobelts	High electrochromic contrast	[181]
Daphne alpine (*D. alpine*) leaves extract	34-50 nm	Spherical	The degradation of methyl orange and picloram	[182]
Yeast *Saccharomyces cerevisiae* active dry yeast cells	40-50 nm	Nano disks	Comparison with different methods obtained different morphology	[183]
		Cr_2O_3 nanoparticles		
Tridax procumbens leaf extract	80-100 nm	Strips with rough surfaces	Antibacterial activity on *Escherichia coli*	[184]
Callistemon viminalis' red flower extract	~ 92.2 nm	A cubic-like platelet shape with sharp edge		[185]
Klebsiella pneumoniae	24 nm		Antibacterial activity pathogenic bacteria	[186]
Fungal extract of *Aspargillus niger*	36 nm	Hexagonal crystals		[187]
Leaf extract of *Rhamnus virgata* (RV)	~ 28 nm	Cubic	Anticancer, antileishmanial, antibacterial, antifungal, antioxidants, bio- compatibility,	[188]
Mukia maderaspatana or mulberry leaves	54 nm	Orthorhombic	Catalyst, pigment and antibacterial effect.	[189]

		MnO_2 nanoparticles		
Euphorbia heterophylla L. leaf extract	56.68 nm	Irregular		[190]
Orange peel and the extract of orange juice	12 nm	Fine interconnected nanowires	Storage electrode materials for supercapacitor	[191]
Yucca gloriosa leaf extract	32 nm	Spherical	Optimization	[192]
Gardenia resinifera leaves	17-35 nm	Spherical	Antimicrobial activity	[193]
Yucca gloriosa leaf extract	80 mm	Spherical	Photocatalytic activities for the dye degradation in the visible light region	[194]
		Fe_3O_4 nanoparticles		
Aqueous leaf extract of *Ficus hispida* L.	10.96 nm	Spherical	Adsorption of organic dye	[195]
Azadirachta indica leaf extract	3-8 nm			[196]
Seaweed *Kappaphycus alvarezii* (K. alvarezii)	14.7 nm	Spherical		[197]
Using natural rubber latex (NRL) extracted from *Hevea brasiliensis*				[198]
Rhus coriaria	53 nm	Spherical	Reusable catalyst for efficient synthesis of some new 2-naphthol *bis*-Betti bases	[199]
Clover leaf aqueous extract	14 nm	Spherical	Green synthesis of 1,3-benzoxazole derivatives	[200]
Couroupita guianensis Aubl. fruit extract for	17 ± 10 nm	Spherical	Antibacterial and cytotoxicity activities	[201]
Grape seed Proanthocyanidin	30 nm	Irregular		[202]
Perilla frutescens leaf extract	50 nm	Spherical	Synthesis of biologically interesting benzoxazinone and benzthioxazinone	[203]
Leaf extract of *Artemisia annua* (*A. annua*)	6 nm	Spherical	Biologically interesting benzoxazinone and benzthioxazinone derivatives	[204]
		Co_3O_4 nanoparticles		
Latex of *Calotropis procera*	10 nm	Spherical	Antibacterial activity for assessing eco-toxic effects	[205]
Ethanolic extract of *Trigonella foenumgraceum* (Fenugreek) leaves	13.2 nm	Spherical		[206]
Microbial induced precipitation (MIP) process using *Bacillus pasteurii*	10-31 nm	Non specific	Supercapacitor as applicable to energy sector.	[207]
Litchi chinensis		Elongated rod like morphology		[208]
Maltose	25 nm	emi-hexagonal nanoparticles	Potential hydrogen storage material	[209]
Punica granatum peel extract	40-80 nm	Spherical	Photo-catalytic activity	[210]
Four fungi were isolated from plant *Nothapodytes foetida*, *Aspergillus nidulans* (endophytic fungus *Aspergillus nidulans*)	20.29 nm	Spherical		[211]
Taraxacum officinale plant extract	50-100 nm	Spherical	Catalytic reduction of direct yellow-142 and methyl orange dyes	[212]
		NiO nanoparticles		
Solanum trilobatum extract	25-30 nm	Cylindrical and rod	Cytotoxicity, antibacterial and photocatalytic studies	[213]
Vicennia marina leaf extract in an aqueous medium	30-100 nm	Flacks like structure nano rods like structure		[214]
Leaves extract of a wild plant "*Calotropis gigantea*"	< 60 nm		Catalytic and antimicrobial potentials	[215]
Maize (*Zea mays* L.) dry silk extract	10-20 nm	Spherical and quasi spherical	Positive electrode material for electrochemical energy storage devices.	[216]
Terminalia chebula dried fruit extract	20-25 nm	FCC cubical structure	*In vitro* cytotoxicity, MMP and ROS activity against MCF-7 Cells	[217]
Phoenix dactylifera (Dates) extract	32 nm	Nanorod like morphology	Cytotoxic activity against A549 cell lines, antibacterial activity and photocatalytic degradation of 4-chlorophenol (4-CP)	[218]
E. heterophylla (L.) leaves extract	12-15 nm	Rhombohedra	Cytotoxicity against human lung cancer cell line (A549) and human hepatocarcinoma (HepG2) cell lines and anti bacterial activity	[219]
Fresh egg white (EW)		Cubic morphology	Cytotoxicity and photocatalytic activity	[220]

CuO nanoparticles				
Leaf extract of *Enicostemma axillare* (Lam.)	30 nm			[221]
Leaves extract of *Citrofortunella microcarpa* (Calamondin)	54-68 nm	Spherical	Rhodamin B (RhB) dye was degraded by photocatalytic activity	[222]
Peel extracts of *Banana musa* acuminate	50-60 nm	Rectangular	Toxicological profiling and sensing applications	[223]
Punica granatum peels extract	10-100 nm	Spherical	Mortality of Aphid 1st, 2nd, 3rd and 4th nymphal instars by 86% compared with control.	[224]
Rosa canina fruit extract	15-25 nm	Spherical	A recyclable and heterogeneous nanocatalyst for C-N Ullmann coupling reactions	[225]
ZnO nanoparticles				
Averrhoe carrambola (star) fruit extract	20 nm	The flake-like structure with sharp edges	Photocatalytic activity on Congo red dye	[226]
Hydnocarpus alpina aqueous alcoholic extract	38.84 nm	Spherical morphology	Screening of its antimicrobial, free radical scavenging and photocatalytic activity	[227]
Prunus dulcis (Almond gum)	25 nm	Spherical	Antimicrobial and supercapacitor applications	[228]
Tecoma castanifolia leaf extract	70-75 nm	Spherical	Antioxidant, bactericidal and anticancer activities	[229]
Cassia fistula plant extract	5-15 nm	Hexagonal wurtzite structure	Photodegradative, antioxidant and antibacterial activities	[230]
Aspalathus linearis's natural extract	1 to 8.5 nm	Non-agglomerated quasi-spherical		[231]
Agathosma betulina natural extract	15.8 nm	Quasi-spherical		[232]
Euphorbia Jatropa latex	15 nm	Hexagonal		[233]
Solanum nigrum leaf extract	29.79 nm	Quasi-spherical	Antibacterial activity	[234]
Banana peel crude extract, peels of medium ripe banana (*Musa sapientum*)	39-69 nm	Rod-like or sheet-like	Antibacterial activity and anticancer activity	[235]

and stabilization of metal oxide nanoparticles utilizing plant extracts.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this article.

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