

# Green Biosynthesis Of Nanoparticles Mechanisms And Applications

This book, Green Nanotechnology - Overview and Further Prospects, is intended to provide an overview and practical examples of the use of nanomaterials in the new scientific challenges of the green nanotechnology world. We aimed to compile information from a diversity of sources into a single volume to give some real examples, extending the concept that green nanotechnology is far from being a scientific conundrum, and instead a real answer to some of the actual problems the whole planet is dealing with.

Nanomaterials in Plants, Algae and Microorganisms:

Concepts and Controversies: Volume 2 not only covers all the new technologies used in the synthesis of nanoparticles, it also tests their response on plants, algae and micro-organisms in aquatic ecosystems.

Unlike most works in the field, the book doesn't focus exclusively on the higher organisms. Instead, it explores the smaller life forms on which they feed. Topics include the impacts of plant development, how different nanoparticles are absorbed by biota, the impact different metals—including silver and rare earth metals—have on living organisms, and the effects nanoparticles have on aquatic ecosystems as a whole. As nanotechnology based products have become a trillion-dollar industry, there is a need to understand the implications to the health of our biota and ecosystems as the earth is

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increasingly inundated with these materials. Covers the issues of nanoparticles on more simple organisms and their ecosystems Draws upon global experts to help increase understanding of the interface mechanisms at the physiological, biochemical, molecular, and even genomic and proteomic level between ENPs and biological systems Provides a critical assessment of the progress taking place on this topic Sheds light on future research needs and scientific challenges that still exist in nanoparticle and living organism interactions

Nanotechnology is expected to bring revolutionary changes in a variety of fields. This volume describes nanoparticles and their biomedical applications, and covers metal nanoparticles, metal oxide nanoparticles, rare earth based nanoparticles and graphene oxide nanoparticles. It elaborates on a number of biomedical applications, including therapeutic applications. It addresses the topic of green synthesis, in view of increasing health and environmental concerns.

The use of biological sources such as microbes and plants can help in synthesizing nanoparticles in a reliable and eco-friendly way. The synthesis of nanoparticles by these natural sources is characterized by processes that take place near to ambient temperature and pressures and also near neutral pH. This edited volume authored by subject specialists, provides all the latest research and builds a database of bioreduction agents to various metal nanoparticles using different precursor systems. The book also highlights the different strategies such as simplicity, cost-effectiveness, environment-friendly and easily scalable, and includes parameters for controlling

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the size and shape of the materials developed from the various greener methods. In order to exploit the utmost potential metal nanoparticles synthesis from the different sources such as agricultural waste, flora and fauna, food waste, microbes and biopolymer systems, it is also crucial to recognize the biochemical and molecular mechanisms of production of nanoparticles and their characterization.

This book provides an account of the biogenic synthesis of nanomaterials by using different microorganisms. The chapters are focused on the biosynthesis of various metal and metal oxide nanosized materials by using bacteria, actinomycetes, fungi, and algae, including mechanisms of microbial synthesis. Other chapters summarize recent developments of microbial-based nanostructures for the management of food-borne pathogens, plant pathogenic fungi, as nutrients, and biomedical applications. Microorganisms are discussed not only as biofactories for the synthesis of nanomaterials but also as removal agents of toxic metals from the environment. Exposure sources and ecotoxicity of microbially synthesized nanoparticles are also discussed.

This book describes the biogenic and green synthesis of gold, palladium and platinum nanoparticles through a variety of methods. 80% of the world's population use traditional medicinal plants as the primary form of healthcare. Biogenic nanoparticles are those particles which are synthesized by biogenic systems like plants, microbes, and fishes. Different plants possess different properties according to their use in fighting against

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disease. The biological synthesis of metal nanoparticles is mainly a strategy which is employed to protect against toxic and harsh effects that can often arise in the normal synthesis of such particles. The book explains the properties of gold, palladium and platinum metal nanoparticles and discusses the mechanisms behind biological synthesis. It emphasises the basic idea of various syntheses and will, therefore, be of particular support to potential researchers interested in plant synthesis.

A much-needed summary of the importance, synthesis and applications of metal nanoparticles in pharmaceutical sciences, with a focus on gold, silver, copper and platinum nanoparticles. After a brief introduction to the history of metal complexes in medicine and fundamentals of nanotechnology, the chapters continue to describe different methods for preparation of metal nanoparticles. This section is followed by representative presentations of current biomedical applications, such as drug delivery, chemotherapy, and diagnostic imaging. Aimed at stimulating further research in this field, the book serves as an reference guide for academics and professionals working in the field of chemistry and nanotechnology. Focusing on the application of nanotechnology in pharmaceutical technology the editors seek to integrate the two in order to obtain innovative products and solutions in pharmacology. Interdisciplinary in content it is of interest to those who are involved in the development of nanoproducts including nanotechnologists, microbiologists, biotechnologists

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pharmacologists and clinicians. Recent studies are presented that include the biosynthesis of nanoparticles focusing on antimicrobials; nanomaterial-based formulations that treat cancer, infections, skin disorders and wounds; nanomaterials in eye diseases and toxicity and safety issues. It demonstrates the crucial role this plays in tackling multi-drug resistant threats.

The book provides an introduction to the basics of fungi, discussing various types ranging from edible mushrooms to *Neurospora* – a model system for genetics and epigenetics. After addressing the classification and biodiversity of fungi, and fungi in different ecological niches, it describes the latest applications of fungi, their role in sustainable environments and in alleviating stress in plants, as well as their role in causing plant and animal diseases. Further chapters explore the advances in fungal interactions research and their implications for various systems, and discuss plant-pathogen interactions. The book also features a section on bioprospecting, and is an extremely interesting and informative read for anybody involved in the field of mycology, microbiology and biotechnology teaching and research.

Nanotechnology is a fast-evolving discipline that already produces outstanding basic knowledge and industrial applications for the benefit of society. Whereas the first applications of nanotechnology have been developed mainly in material sciences,

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applications in the agriculture and food sectors are still emerging. Due to a rapid population growth there is a need to produce food and beverages in a more efficient, safe and sustainable way. Here, nanotechnology is a promising way to improve crop production, water quality, nutrition, packaging, and food security. There are actually few comprehensive reviews and clear textbooks on nanotechnology in agriculture, water, and food. In this book there are 10 chapters describing the synthesis and application of nanomaterials for health, food, and agriculture are presented. Nanomaterials with unique properties will dramatically improve agriculture and food production. Applications will include nanofertilisers to enhance plant growth and nanosensors to detect food contamination. An overall view of nanotechnology applications in agriculture, food, water, and environment are described in the first two chapters by Dasgupta et al. and Singh. Health and environmental applications of nanotechnology are presented in chapters 3-5. Shukla and Iravani review green methods to synthesize metal nanoparticles, and give applications to water purification, in chapter 3. The removal of up to 95% of contaminants by nanoparticles, nanotubes and nanostructured membranes is described by Naghdi et al. in chapter 4. Yoti et al. then review nanosensors for the detection of pathogenic bacteria in chapter 5. Those nanosensors can be used as biodiagnostics to

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control food and water quality. Food applications of nanoscience are presented in chapters 6 and 7 by Kuswandi and Sarkhar et al. Kuswandi explain in chapter 6 that nanomaterials can improve packaging quality and that nanosensors can detect freshness and contaminants. The use of nanoparticles to protect ingredients such as vitamins, flavours, and antimicrobials is reviewed by Sarkhar et al. in chapter 7.

This book discusses the ability of nanomaterials to protect crop-plant and animal health, increase production, and enhance the quality of food and other agricultural products. It explores the use of targeted delivery and slow-release agrochemicals to reduce the damage to non-target organisms and the quantity released into the soil and water, as well as nanotechnology-derived tools in the field of plant and animal genetic improvement. It also addresses future applications of nanotechnology in sustainable agriculture and the legislative regulation and safety evaluation of nanomaterials. The book highlights the recent advances made in nanotechnology and its contribution towards an eco-friendly approach in agriculture.

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An authoritative summary of the quest for an environmentally sustainable synthesis process of nanomaterials and their application for

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environmental sustainability Green Synthesis of Nanomaterials for Bioenergy Applications is an important guide that provides information on the fabrication of nanomaterial and the application of low cost, green methods. The book also explores the impact on various existing bioenergy approaches. Throughout the book, the contributors—noted experts on the topic—offer a reliable summary of the quest for an environmentally sustainable synthesis process of nanomaterials and their application to the field of environmental sustainability. The green synthesis of nanoparticles process has been widely accepted as a promising technique that can be applied to a variety of fields. The green nanotechnology-based production processes to fabricate nanomaterials operates under green conditions without the intervention of toxic chemicals. The book's exploration of more reliable and sustainable processes for the synthesis of nanomaterials, can lead to the commercial application of the economically viability of low-cost biofuels production. This important book: Summarizes the quest for an environmentally sustainable synthesis process of nanomaterials for their application to the field of environmental sustainability Offers an alternate, sustainable green energy approach that can be commercially implemented worldwide Covers recent approaches such as fabrication of nanomaterial that apply low cost, green methods and examines its

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impact on various existing bioenergy applications  
Written for researchers, academics and students of nanotechnology, nanosciences, bioenergy, material science, environmental sciences, and pollution control, *Green Synthesis of Nanomaterials for Bioenergy Applications* is a must-have guide that covers green synthesis and characterization of nanomaterials for cost effective bioenergy applications.

*Biological Synthesis of Nanoparticles and Their Applications* gives insight into the synthesis of nanoparticles utilizing the natural routes. It demonstrates various strategies for the synthesis of nanoparticles utilizing plants, microscopic organisms like bacteria, fungi, algae and so forth. It orchestrates interdisciplinary hypothesis, ideas, definitions, models and discoveries associated with complex cell of the prokaryotes and eukaryotes.

**Highlights:** Discusses biological approach towards the nanoparticle synthesis  
Describes the role of nanotechnology in the field of medicine and its medical devices  
Covers application and usage of the chemicals at the molecular level to act as catalysts and binding products for both organic and inorganic  
**Chemical Reactions** Reviews application in physics such as solar cells, photovoltaics and other usage  
Microorganisms can aggregate and detoxify substantial metals because of different reductase enzymes, which can diminish metal salts to metal

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nanoparticles. The readers after going through this book will have detailed account of mechanism of biosynthesis of nanoparticles.

Nanobiotechnology: Microbes and Plant Assisted Synthesis of Nanoparticles, Mechanisms and Applications covers in detail the green synthesis of nanostructures of tailor-made size, shape and physico-chemical and opto-electronic properties. The rationale behind the selection of bacteria, cyanobacteria, algae, fungi, virus and medicinal plants for the synthesis of biologically active exotic nanoparticles for biomedical applications is also part of this book. It also explores metal recovery, bioconversion, detoxification and removal of heavy metals using nanobiotechnology and discusses the potential of nanobiotechnology to address environmental pollution and toxicity. The book further covers the economic and commercial aspects of such green nanobiotechnology initiatives, its current status in intellectual property rights like patents filed so far globally, technology transfers, and market potential. This information enables one to decipher the scope of biogenic nanoparticles and its prospects. Provides an overview on the general and applied aspects on nanotechnology. Gives the scope of exploring bacteria, fungi, algae, virus and medicinal plants for the synthesis of exotic nanoparticles. Furnishes a comprehensive report on the underlying molecular mechanisms behind the

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biosynthesis of nanoparticles. Outlines sustainable alternative strategies of bioremediation of heavy metals, metal recovery, detoxification and bioconversion using nanobiotechnology. Explores the promises of patenting, technology transfer and commercialization potential of biogenic nanoparticles.

Green synthesis is an emerging method for deriving nanoparticles present in natural plants for use in nanomedicine. Written by experts in the field, *Green Synthesis in Nanomedicine and Human Health* showcases the exciting developments of this specialty and its potential for promoting human health and well-being. This book gives practical information on novel preparation methods for identifying nanoparticles present in natural plants. It discusses applications of nanoparticles in combating communicable, non-communicable and vector-borne diseases. It also explores the potential for nanoparticles to combat antimicrobial resistance through improvements in treatment methods, diagnostics and drug delivery systems. Features scientific evidence of opportunities for integrating indigenous flora into nanomedicine to develop cost-effective therapeutic and diagnostic solutions for diseases, including cancer, tuberculosis, malaria and diabetes. Places green synthesis and nanomedicine in the African orthodox and traditional healthcare context. Provides policymakers with scientific

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evidence to inform policies for controlling or mitigating dangerous diseases. This book is essential reading for students, scientists, policymakers and practitioners of nanotechnology, and will appeal to anyone with an interest in integrating traditional African healthcare and Western medicine.

Green Synthesis of Silver Nanomaterials illustrates how to biologically scale up silver nanoparticle synthesis. This book covers green synthesis of silver nanomaterials, via plants, agricultural waste, fungi, and microorganisms. Sections cover the synthesis and characterization of chemical and green synthesis, various types of silver nanomaterialism, the ability of different fungal species, such as filamentous fungi, to produce silver nanoparticles, the microbial synthesis of silver NMs, biosynthesis mechanisms, toxicity, fate and commercialization. As examples, greener pathways and mechanisms, toxicity of silver nanoparticles in aquatic life and in natural eco-systems, and strategies for the scaling up of green-synthesized nanomaterials are discussed. With the extended work in enhancing nanomaterials synthesis performance, and discovering their biomedical, environmental, and agricultural applications, it is hoped that the execution of these methods on a large scale and their industrial applications in different fields will take place in the near future. Assesses the impact of a large variety of silver-based nanostructures in the biomedical, environmental and agri-food sectors Discusses the major synthesis methods used for effectively processing plant-

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based silver nanoparticles Outlines the potential and major challenges for adopting green synthesis methods on a mass scale

Nanotechnology is the application of science to control matter at the molecular level. It has become one of the most promising applied technologies in all areas of science. Nanoparticles have multi-functional properties and have created very interesting applications in various fields such as medicine, nutrition, bioenergy, agriculture and the environment. But the biogenic syntheses of monodispersed nanoparticles with specific sizes and shapes have been a challenge in biomaterial science. Nanoparticles are of great interest due to their extremely small size and large surface-to-volume ratio, which lead to both chemical and physical differences in their properties (e.g., mechanical properties, biological and sterical properties, catalytic activity, thermal and electrical conductivity, optical absorption and melting point) compared to bulk of the same chemical composition. Recently, however, synthesizing metal nanoparticles using green technology via microorganisms, plants, viruses, and so on, has been extensively studied and has become recognized as a green and efficient way for further exploiting biological systems as convenient nanofactories. Thus the biological synthesis of nanoparticles is increasingly regarded as a rapid, ecofriendly, and easily scaled-up technology. Today researchers are developing new techniques and materials using nanotechnology that may be suitable for plants to boost their native functions. Recently, biological nanoparticles were found to be more pharmacologically

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active than physico-chemically synthesized nanoparticles. Various applications of biosynthesized nanoparticles have been discovered, especially in the field of biomedical research, such as applications to specific delivery of drugs, use for tumor detection, angiogenesis, genetic disease and genetic disorder diagnosis, photoimaging, and photothermal therapy. Further, iron oxide nanoparticles have been applied to cancer therapy, hyperthermia, drug delivery, tissue repair, cell labeling, targeting and immunoassays, detoxification of biological fluids, magnetic resonance imaging, and magnetically responsive drug delivery therapy. Nanoparticle synthesis for plant byproducts for biomedical applications has vast potential. This book offers researchers in plant science and biomedicine the latest research and opportunity to develop new tools for the synthesis of environmentally friendly and cost-effective nanoparticles for applications in biomedicine as well as other various fields.

This book consisting of three sections; Mathematical Sciences, Physical Sciences and Multidisciplinary Sciences. It contains the articles contributed by well known researchers.

Recently, magnetic nanostructures have gained a remarkable interest for basic research and applied studies. Because of their low cost and ease of manufacture and modification, they have great potential for agricultural and environmental applications. The use of magnetic nanostructures has been proven in a wide range of fields including catalysis, biotechnology, biomedicine, magnetic resonance imaging, agriculture,

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biosensors, and removal of environmental pollutants, among others. This book includes 16 chapters of collected knowledge, discoveries, and applications in agriculture, soil remediation, and water treatment. It describes the role of nano-agriculture with regard to food security and discusses environmental and agricultural protection concerns. It further offers potential applications of magnetic nanomaterials in the agriculture and food sectors, such as the development of sensors, environment monitoring for wastewater treatment and the remediation of contaminated soils. Increasing crop yield through the use of nanopesticides or nanofertilizers and biosecurity using sensors for detecting pathogens along the entire food chain are discussed as well. This book also brings together various sources of expertise on different aspects magnetic nanostructure application in the agri-food sector and environment remediation. Magnetic nanostructures also have great potential in biotechnological processes, as they can be utilized as a carrier for enzymes during different biocatalytic transformations. Novel magnetic nanomaterials can be used for detection and separation of pesticides from environmental and biological samples. The excellent adsorption capacity of the modified magnetic nanoadsorbents together with other advantages such as reusability, easy separation, environmentally friendly composition, and freedom of interferences of alkaline earth metal ions make them suitable adsorbents for removal of heavy metal ions from environmental and industrial wastes. One of the most important environmental applications of magnetic nanostructures

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has been in the treatment of water, whether in the remediation of groundwater or through the magnetic separation and/or sensing of contaminants present in various aqueous systems. The integrated combination of these 16 chapters, written by experts with considerable experience in their area of research, provides a comprehensive overview on the synthesis, characterization, application, environmental processing, and agriculture of engineered magnetic nanostructures. Its comprehensive coverage discusses how nanostructure materials interact in plants as well as their potential and useful applications.

Green Synthesis, Characterization and Applications of Nanoparticles shows how eco-friendly nanoparticles are engineered and used. In particular, metal nanoparticles, metal oxide nanoparticles and other categories of nanoparticles are discussed. The book outlines a range of methodologies and explores the appropriate use of each. Characterization methods include spectroscopic, microscopic and diffraction methods, but magnetic resonance methods are also included as they can be used to understand the mechanism of nanoparticle synthesis using organisms. Applications covered include targeted drug delivery, water purification and hydrogen generation. This is an important research resource for those wishing to learn more about how eco-efficient nanoparticles can best be used. Theoretical details and mathematical derivations are kept to a necessary minimum to suit the need of interdisciplinary audiences and those who may be relatively new to the field. Explores recent trends in growth, characterization,

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properties and applications of nanoparticles Gives readers an understanding on how they are applied through the use of case studies and examples Assesses the advantages and disadvantages of a variety of synthesis and characterization techniques for green nanoparticles in different situations

Agri-Waste and Microbes for Production of Sustainable Nanomaterials assesses the most recent trends used to produce bionanomaterials from agricultural waste and microorganisms. The book covers the green synthesis of various nanomaterials using microorganisms and agricultural waste, including the synthesis and characterization of green nanomaterials, the production of nanomaterials from agri-waste, including metallic, copper, silica, cellulose, nanopolymers and nano/micro plastics, and biological methods such as agricultural and microbial synthesis of metallic/metal oxide, magnetic, silver, copper, nanomaterials and nanonutrients. This is an important reference source for plant scientists, materials scientists and environmental scientists who want to understand this new generation of sustainable nanomaterials. The synthesis of nanocellulose materials from agri-wastes is an emerging alternative for waste treatment methods, developing new biosensors and antimicrobial agents. Silicon nanoparticles are an additional ingredient for the improvement of crop yields. With recent advances in nanomaterials synthesis performance and the discovery of their biomedical, environmental and agricultural applications, it is hoped that the implementation of these methods will be used at large-scale for industrial applications in different sectors.

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Highlights recent methods to produce bionanomaterials from agricultural waste and microorganisms Explores the use of agri-waste in environmental and agricultural applications Assesses the major challenges for using agri-waste to create eco-friendly nanomaterials at large scale

Nanotechnology in Sustainable Agriculture presents applications of nanobiotechnology for eco-friendly agriculture practices. Implementing sustainable agriculture techniques is a crucial component in meeting projected global food demands while minimising toxic waste in the environment. Nano-technological tools – including nanoparticles, nanocapsules, nanotubes and nanomolecules – offer sustainable options to modernise agriculture systems. Written by nanotechnology experts, this book outlines how nano-formulations can improve yield without reliance on chemical pesticides and reduce nutrient losses in fertilization. It reveals how nanotools are used for rapid disease diagnostics, in treating plant diseases and enhancing the capacity for plants to absorb nutrients. Features: Combines nanotechnology and agronomy presenting applications for improving plant performance and yields. Reveals nanotechnology-based products used for the soil and plant health management which mitigate climate change. Discusses roles of microbial endophytes, heavy metal nanoparticles and environment health, nano-nutrients, phytochemicals, green bioengineering and plant health. This book appeals to professionals working in the agriculture and food industry, as well as agricultural scientists and researchers in nanotechnology and

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agronomy.

There are physical and chemical methods of synthesis of nanomaterials. But due to the damage caused by these methods to the environment there is a pressing need of green nanotechnology, which is a clean and eco-friendly technology for the development of nanomaterials. The present book includes green synthesis of nanoparticles by algae, diatoms and plants. The mechanism behind the synthesis of nanoparticles will also be discussed.

The book would be a valuable resource for students, researchers and teachers of biology, chemistry, chemical technology, nanotechnology, microbial technology and those who are interested in green nanotechnology.

This book provides the state-of-the-art survey of green techniques in preparation of different classes of nanomaterials, with an emphasis on the use of renewable sources. Key topics covered include fabrication of nanomaterials using green techniques as well as their properties and applications, the use of renewable sources to obtain nanomaterials of different classes, from simple metal and metal oxide nanoparticles to complex bioinspired nanomaterials, economic contributions of nanotechnology to green and sustainable growth, and more. This is an ideal book for students, lecturers, researchers and engineers dealing with versatile (mainly chemical, biological, and medical) aspects of nanotechnology, including fabrication of nanomaterials using green techniques and their properties and applications.

This book covers biological synthesis approaches for

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nanomaterials and nanoparticles, including introductory material on their structure, phase compositions and morphology, nanomaterials chemical, physical, and biological properties. The chapters of this book describe in sequence the synthesis of various nanoparticles by microorganisms, bacteria, yeast, algae, and actinomycetes; plant and plant extract-based synthesis; and green synthesis methods. Each chapter provides basic knowledge on the synthesis of nanomaterials, defines fundamental terms, and aims to build a solid foundation of knowledge, followed by explanations, examples, visual photographs, schemes, tables and illustrations. Each chapter also contains control questions, problem drills, as well as case studies that clarify theory and the explanations given in the text. This book is ideal for researchers and advanced graduate students in materials engineering, biotechnology, and nanotechnology fields. As a reference book this work is also appropriate for engineers in R&D and product manufacturing.

Polymer-coated noble metal nanoparticles are currently of particular interest to investigators in the fields of nanobiomedicine and fundamental biomaterials. These materials not only exhibit imaging properties in response to stimuli but also efficiently deliver various drugs and therapeutic genes. Even though a large number of polymer-

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coated noble metal nanoparticles have been fabricated over the past decade, most of these materials still present some challenges emanating from their synthesis. The metal nanoparticles when encapsulated in a polymer and taken up by human cells might show a lower degree of toxicity; however, the degree of toxicity for some of the starting materials and precursors has raised serious concerns. Hence, there is a need to implement the principle of green chemistry in the synthesis of nanomaterials. The use of environmentally benign materials for the synthesis of metal nanoparticles provides numerous benefits ranging from biocompatibility, availability, cost-effectiveness, amenable scale-up to eco-friendliness. The biopolymer-based nanovehicles have been found to be more suitable in the field of nanotechnology owing to their high reproducibility, ease of manufacture, functional modification and safety (they are not carcinogenic). Unlike synthetic polymers where the raw material can be derived from petrochemicals or chemical industrial processes, biopolymers are produced from renewable resources such as plant and/or living organism. They are degradable by natural processes down to elemental entities that can be resorbed in the environment. Furthermore, they can also be modified to serve a particular purpose which explains the myriad of their potential applications. The macromolecular chain of

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these biopolymers possess a large number of hydroxyl groups which can easily complex with metal ions. Additionally, these biopolymers also contain supramolecular structures that can lead to new functionalities of their composites with metal and semiconductor nanoparticles. In this chapter, a comprehensive discussion on different biopolymers, green synthesis of noble metal nanostructures, mechanisms, characterization and application in various fields is presented.

Zinc oxide nanoparticles have potential applications in various areas including optical piezoelectric, semiconductors, magnetic and gas sensing. Most of the approaches for synthesis zinc oxide (ZnO) nanoparticles use hazardous chemicals, high energy requirements and wasteful purification. Therefore, there is a growing need to develop environmentally friendly methods for synthesis of nanoparticles without using hazardous chemicals. Plant leaves provide a better platform for nanoparticles synthesis and have many advantages free from toxic materials, cost-effective and natural capping and stabilizing agents. In this work we designed a simple and green method for synthesis highly dispersed uniform zinc oxide nanoparticles (ZnO-NPs) at ambient temperature using pistachio leaf extract. The mechanism responsible for the zinc nanoparticles formation was discussed. X-Ray diffraction (XRD) pattern reveals the formation of

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ZnO nanoparticles, which shows crystallinity. Transmission electron microscopy (TEM) suggested particles size and shape in the range of 5-40 nm. Scanning electron microscopy (SEM) image reveals that the particles are of spherical and granular nature. UV-Vis absorption shows

This book describes various strategies for the synthesis of green nanoparticles using plant extracts and microbes, including the advantages and disadvantages of different methods and their applications. After discussing strategies for and the potential of green synthesis of noble metal nanoparticles, it highlights the role of the solvent system. The book then explores the stability/toxicity of nanoparticles and the associated-surface engineering techniques for achieving biocompatibility, and examines the antimicrobial efficacy of green nanoparticles with regard to various bacterial pathogens, as well as the underlying cytotoxicity mechanisms. Lastly, the book addresses the potential applications of various green nanoparticles in cancer theranostics, and reviews a number of plant-mediated nanoparticles as potential pharmaceutical agents. Given its scope, the book will be of interest to all scientists and students wanting to learn more about the synthesis and applications of green nanoparticles.

Document from the year 2017 in the subject Chemistry - Bio-chemistry, Mansoura University,

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language: English, abstract: Forty-two medicinal plants were collected depending on their availability on Egypt. These plant were extracted and screened for their activity towards green synthesis of AgNPs. A new modified method was used in order to screen large number of extracts in short time (high throughput screening). In this method, the synthesized nanoparticles were evaluated in using 96-well plate which is transparent to facilitate the color monitoring and easy to be read spectrophotometrically using microplate reader. The green synthesis activity by the different plant extracts was monitored and evaluated by color change and UV-Vis absorption at time intervals. Out of these 42 plants, only 3 plants viz., *Pyllanthusemblica* fruits, *Psidium guajava* leaves and *Lawsoniainermis* leaves, showed high AgNPs synthetic activity. The most active plant extracts were further partitioned with ethyl acetate. The results showed that the EtOAc fraction of the three active plants showed superior AgNPs green synthesis over their remaining aqueous. Thus, chromatographic columns were used to isolate the active compounds from the EtOAc fraction of each plant. Metal nanoparticles synthesis is a leading topic of research in modern material science owing to their distinctive potential applications in the field of electronic, optoelectronic, information storage and Health care. Among the all noble metal nanoparticles, silver nanoparticles are

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one the main products in the field of nanotechnology which has acquired limitless attention due to their unique properties such as chemical stability, good conductivity, catalytic and most important antibacterial, antiviral and antifungal activities. Nevertheless, there is still need for economic commercially viable as well as environmentally clean synthesis route to synthesize the silver nanoparticles.

This book presents the green synthesis of nanoparticles by algae, diatoms, bacteria and plants, and discusses the mechanisms behind the synthesis of nanoparticles. The book should be immensely useful for students, researchers and teachers of biology, chemistry, chemical technology, nanotechnology, microbial technology and those who are interested in green nanotechnology.

Nanomaterials possess astonishing physical and chemical properties. They play a key role in the development of novel and effective drugs, catalysts, sensors, and pesticides, to cite just a few examples. Notably, the synthesis of nanomaterials is usually achieved with chemical and physical methods needing the use of extremely toxic chemicals or high-energy inputs. To move towards more eco-friendly processes, researchers have recently focused on so-called “green synthesis”, where microbial, animal-, and plant-borne compounds can be used as cheap reducing and stabilizing agents to fabricate

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nanomaterials. Green synthesis routes are cheap, environmentally sustainable, and can lead to the fabrication of nano-objects with controlled sizes and shapes—two key features determining their bioactivity. However, real-world applications of green-fabricated nanomaterials are largely unexplored. Besides, what do we really know about their non-target toxicity? Which are their main modes of action? What is their possible fate in the environment? In this framework, the present Special Issue will include articles by expert authorities on nanomaterials synthesis and applications. Special emphasis will be placed on their impact on the environment and long-term toxicity.

Handbook of Greener Synthesis of Nanomaterials and Compounds, Volume One: Fundamental Principles and Methods provides a comprehensive review of developments in this field, combining foundational green and nano-chemistry with key information researchers need to assess, select and apply the most appropriate green synthesis approaches to their own work. Beginning with a clear introduction to the fundamentals of green synthesis that places synthesis in the context of green chemistry, the book goes on to discuss key greener physical, chemical and biological methods for synthesis, before going on to discuss greener synthesis at the macro and nanoscales. Further chapters explore the potential for synthesis at the

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industrial scale, synthesis from renewable sources, and environmental aspects of greener synthesis. Drawing on the experiences of a global team of expert contributors, this book provides an indispensable guide for all those interested in understanding, identifying, developing or applying greener synthetic approaches in their work. This book presents a holistic view of the complex and dynamic responses of plants to nanoparticles, the signal transduction mechanisms involved, and the regulation of gene expression. Further, it addresses the phytosynthesis of nanoparticles, the role of nanoparticles in the antioxidant systems of plants and agriculture, the beneficial and harmful effects of nanoparticles on plants, and the application of nanoparticles and nanotubes to mass spectrometry, aiming ultimately at an analysis of the metabolomics of plants. The growing numbers of inventions in the field of nanotechnology are producing novel applications in the fields of biotechnology and agriculture. Nanoparticles have received much attention because of the unique physico-chemical properties of these compounds. In the life sciences, nanoparticles are used as “smart” delivery systems, prompting the Nobel Prize winner P. Ehrlich to refer to these compounds as “magic bullets.” Nanoparticles also play an important role in agriculture as compound fertilizers and nano-pesticides, acting as chemical delivery agents that

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target molecules to specific cellular organelles in plants. The influence of nanoparticles on plant growth and development, however, remains to be investigated. Lastly, this book reveals the research gaps that must be bridged in the years to come in order to achieve larger goals concerning the applications of nanotechnology in the plants sciences. In the 21st century, nanotechnology has become a rapidly emerging branch of science. In the world of physical sciences, nanotechnological tools have been exploited for a broad range of applications. In recent years, nanoparticles have also proven useful in several branches of the life sciences. In particular, nanotechnology has been employed in drug delivery and related applications in medicine.

Noble metal nanoparticles have been extensively studied for use in applications in a diverse range of fields such as optoelectronics, catalysis, sensing, medicine, etc. due to their unique properties that arise as a result of their dimensions. Metal nanoparticles of size less than 3 nm exhibit molecular properties, unlike larger nanoparticles. These molecular nanoparticles are excellent model systems to study the chemistry of nanomaterials at the molecular level as their molecular formulae, crystal structure, chemical composition, electronic structures etc. can be experimentally measured and theoretically calculated. In addition, knowledge of

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their thermodynamic stability and mechanisms of formation can be leveraged in developing green synthetic routes in order to produce safer products that widen the range of applications, and to develop safer processes that increase manufacturability and decrease waste. Even though nanoparticle research is more focused on the end product and their properties, rather than the process, we have taken a different route of dismantling the M4Ag44(p-MBA)30 nanoparticle synthesis and developing a green route with significantly improved efficiency and an 89% yield. The need of solvent, which contributed to 98% of the waste, was kept to a minimum by using a stoichiometric silver-thiolate polymer as a precursor to intimately mix the metal atoms and ligands, and by forming a paste using a small amount of liquid to promote mass transport. The process mass intensity (PMI), a green metric defined by material input over product output, was decreased by almost 18-fold compared to the solution-phase synthesis. Some toxic chemicals were also removed or replaced throughout the process. This method is very effective for thermodynamically favorable products, and should be useful for other systems too. Alloying of metal nanoparticles is advantageous to achieve new properties. For example, gold-silver bimetallic NPs can be more stable than silver NPs and have better optical properties than gold NPs. Here we have studied the alloying process in M4AuxAg44-x(p-

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MBA)<sub>30</sub> alloy nanoparticles, where  $0 \leq x \leq 12$ , and M is a counteranion. Two methods were used to synthesize M<sub>4</sub>AuxAg<sub>44-x</sub>(p-MBA)<sub>30</sub> alloy nanoparticles: (i) co-reduction of gold-thiolate and silver-thiolate with alkali borohydride, and (ii) galvanic-exchange reaction between gold-thiolate and M<sub>4</sub>Ag<sub>44</sub>(p-MBA)<sub>30</sub> nanoparticles in order to substitute silver with gold. The major findings were: (i) the number of gold atoms incorporated in the alloy was always less than the gold input, (ii) only up to twelve gold atoms were incorporated, (iii) gold prefers to stay at the innermost core energetically in alloy nanoparticles, as shown by the x-ray crystal structure of M<sub>4</sub>Au<sub>12</sub>Ag<sub>32</sub>(p-MBA)<sub>30</sub> alloy nanoparticles, (iv) gold atom distributions were generally Gaussian, and (v) addition of gold in silver nanoparticles to create alloys increases the stability against oxidation.

Plant Nanobionics, Volume 2 continues the important discussion of nanotechnology in plants, but focuses with a focus on biosynthesis and toxicity. This book discusses novel approaches to biosynthesis of nanoparticles for the increase of plant production systems, controlled release of agrochemicals and management of plant biotic stress. Green biosynthesis of metallic nanoparticles from bee propolis, artificial photosynthesis and hybrid structures are presented. Although engineered nanoparticles have great potential for

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solving many agricultural and societal problems, their consequences on the ecosystems and environment must be responsibly considered. This volume aims to contribute to the limited literature on this topic through its comprehensive examination of nanoparticle toxicity on plants, microbes and human health. Environmental risks with recent data are discussed as well as risks associated with the transfer of nanoparticles through the food chain. This volume highlights the study of a mechanistic approach and the study of nanoparticles towards nanobionics. The application of polymeric materials for smart packing in the food industry and agriculture sector as well as the future of nanomaterials in detecting soil microbes for environmental remediation are also included.

This volume gathers the proceedings of the International Conference on Medical and Biological Engineering, which was held from 16 to 18 May 2019 in Banja Luka, Bosnia and Herzegovina. Focusing on the goal to 'Share the Vision', it highlights the latest findings, innovative solutions and emerging challenges in the field of Biomedical Engineering. The book covers a wide range of topics, including: biomedical signal processing, medical physics, biomedical imaging and radiation protection, biosensors and bioinstrumentation, bio-micro/nano technologies, biomaterials, biomechanics, robotics and minimally invasive

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surgery, and cardiovascular, respiratory and endocrine systems engineering. Further topics include bioinformatics and computational biology, clinical engineering and health technology assessment, health informatics, e-health and telemedicine, artificial intelligence and machine learning in healthcare, as well as pharmaceutical and genetic engineering. Given its scope, the book provides academic researchers, clinical researchers and professionals alike with a timely reference guide to measures for improving the quality of life and healthcare.

Microbial Nanobionics: Volume 1, State of the Art, discusses a wide range of microbial systems and their utilization in biogenic synthesis of metallic nanoparticles. The rich biodiversity of microbes makes them excellent candidates for potential nanoparticle synthesis biofactories. Through a better understanding of the biochemical and molecular mechanisms of the microbial biosynthesis of metal nanoparticles, the rate of synthesis can be better developed and the monodispersity of the product can be enhanced. The characteristics of nanoparticles can be controlled via optimization of important parameters, such as temperature, pH, concentration and pressure, which regulate microbe growth conditions and cellular and enzymatic activities. Large scale microbial synthesis of nanoparticles is a sustainable method due to the non-

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hazardous, non-toxic and economical nature of these processes. The applications of microbial synthesis of nanoparticles are wide and varied, spanning the industrial, biomedical and environmental fields. Biomedical applications include improved and more targeted antimicrobials, biosensing, imaging and drug delivery. In the environmental fields, nanoparticles are used for bioremediation of diverse contaminants, water treatment, catalysis and production of clean energy. With the expected growth of microbial nanotechnology, this volume will serve as a comprehensive and timely reference.

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