Nanotechnology In Agriculture Nanotechnology Will Transform The Food Industry and Consume

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Nanotechnology in Agriculture Nanotechnology will transform the food industry into a processed, packaged, transported, and consumed society. Edebf1c2d8140379ed826d4c7f9617


What Can Nanotechnology Learn From Biotechnology?

This new volume, Nanotechnology Applications in Dairy Science, is designed to provide new insight into the utilization of nanotechnology in dairy science and food science. It focuses on applications of nanotechnology in packaging and drying of dairy and meat products, nanofiltration use in the dairy industry, and whey processing and dairy encapsulation. In addition, this book will facilitate the necessary understanding of the different aspects and concerns with regard to the new technological advances that nanotechnologies are contributing to the dairy industry. It also addresses several of the challenges that are overcome by the continuing development of nanotechnology applications in the food and dairy industries. Nanotechnology has the potential to provide healthier, safer, and better tasting foods as well as improved food storage. It will also play a major role in food industry sustainability. Nanotechnology applications in the food industry have contributed to the exponential progress in research and new material formulations due to its unique physicochemical properties useful to a number of other fields.

Emerging Trends in Agri-nanotechnology

The emergence of nanotechnology and the development of new nanodevices and nanomaterials have opened up exciting opportunities for novel applications in agriculture and biotechnology. Nanotechnology has the potential to modernize agricultural research and practice, but although it has gained momentum in the agricultural sector over the last decade, there are still knowledge gaps between scientific communities. This book presents a comprehensive overview of current developments in nanotechnology-based sustainable agriculture. Focusing on various aspects of nanotechnology in different sectors of agriculture, such as crop production, soil fertility management and crop improvement, it offers insights into the current trends and future prospects of nanotechnology, along with the benefits and risks of their impact on agricultural ecosystems. It also highlights the use of nanotechnology to reduce agricultural usage, to increase nutrient uptake efficiency and to improve water and nutrient management, and the use of nanobiosensors to manage plant diseases. The book is a valuable reference resource for scientists, policymakers, students and researchers who are engaged in developing strategies to cope with current agricultural challenges.

Nanoscience in Food and Agriculture 2

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 minimizing 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 provides new formulations that can improve yield without reliance on chemical pesticides and reduce nutrient losses in fertilization. It reveals how nanotechnology is 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 agronomy.

Nanotechnology in Agriculture and Food

This book provides thorough knowledge for dealing with current challenges of agricultural sector using nanotechnology based agricultural interventions. It will serve as reference literature for scientists, policymakers, students and researchers who are engaged in developing strategies to cope up with challenges of current agricultural systems and society.

Nanotechnology and Plant Sciences

Nanotechnology in Agriculture Nanotechnology and the development of new nano-devices and nanomaterials open up opportunities for novel applications in agriculture and biotechnology. Nanotechnology has the potential to modernise the agricultural sector and practices. It has gained momentum in the agriculture sector during last decade, but still there are knowledge gaps between scientific communities. This book provides holistic coverage about current developments in nanotechnology based sustainable agriculture. It contains sections focusing on each aspect of the implications of nanotechnology in different sectors of agriculture from crop production, soil fertility management, crop improvement etc. It also provides insight into the current trends and future prospects of nanotechnology along with the benefits and risks of their impact on agricultural ecosystems. This book emphasizes on use of nanotechnology to reduce agrochemical usage via smart delivery system, increase nutrient use efficiency, improved water and nutrient management, nano-biosensors for management of plant diseases etc. The book provides thorough knowledge to dealing with current challenges of agricultural sector using nanotechnology based agricultural interventions. It will serve as reference literature for scientists, policymakers, students and researchers who are engaged in developing strategies to cope up with challenges of current agricultural systems and society.

Nanotechnology

Handbook of Nanotechnology Applications: Environment, Energy, Agriculture and Medicine presents a comprehensive overview on recent developments and prospects surrounding nanotechnology use in water/wastewater separation and purification, energy storage and conversion, agricultural and food process, and effective diagnoses and treatments in medical fields. The book includes detailed overviews of nanotechnology, including nanofiltration membrane for water/wastewater treatment, nanomembrane and nanosensor development for medical implementation, advanced nanomaterials of different structural dimensions (0D, 1D, 2D and 3D) for energy applications, as well as food and agricultural utilization. Other sections discuss the challenges of lab-based research transitioning towards practical industrial use. Helps scientists and researchers quickly learn and understand the key role of nanotechnology in important industrial applications. Takes an interdisciplinary approach, demonstrating how nanotechnology is being used in a wide range of industry sectors. Outlines the role nanotechnology plays in creating safer, cheaper and more energy-efficient projects and devices.

Biogenic Nano-Particles and their Use in Agro-ecosystems

Fungi Bio-prospects in Sustainable Agriculture: Fungal metabolites and Nano-technology is a three-volume series that has been designed to explore the huge potential
Nanotechnology in Agriculture: New Opportunities and Perspectives

The prediction that in 2050 our planet will be populated by over 9 billion people is quite reliable. This will pose serious problems with food, water and energy supply, particularly in less-developed countries. Considering that the human pressure over natural resources has already reached critical levels, international agencies such as the World Bank and UN Food and Agriculture Organization (FAO) are soliciting scientific research in order to identify innovative solutions to support the primary sector. Nanotechnology is a rapidly evolving field with the potential to take forward the agriculture and food industry with new tools which promise to increase food production and to protect crops from pests. Such expectations are coupled with some uncertainties about the fate of nanomaterials in the agro-environment. Hence, the field application of engineered nanomaterials (ENMs) has been properly investigated yet, and many aspects have only been considered theoretically or with models, which makes it difficult to properly assess the usefulness of ENMs for plant fertilization and protection.

Fungi Bio-prospects in Sustainable Agriculture, Environment and Nano-technology

Agriculture plays a vital role in our lives, providing food and economic benefits. Today, it faces severe challenges, due to decreasing arable land, depleting natural resources, changing climate pattern, and yet increasing demand for food. The recent introduction of nanotechnology in agriculture offers sustainable and precise solutions for developing smart agriculture practices and addressing the challenges faced by the ag-sector. Therefore, it is essential to understand this new science from a multidimensional perspective. Experts have started to explore the applications of fungi in the agro-environment. This book includes applications of fungi in bio-remediation, nutraceuticals, medicinal tasks, and production of food. It also presents the latest information on applications of the CRISPR-Cas9 system in fungi - a powerful platform for gene editing.

Nanoscience in Food and Agriculture 3

Nanotechnology is a fast-evolving field 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, nanotechnology 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. Hence, nanotechnology is a promising way to improve crop production, water quality, soil health, and food security. There are actually few comprehensive reviews and clear textbooks on nanotechnology in agriculture, water, and food. In this book, there are ten chapters describing the synthesis and application of nanomaterials for health, food, and agriculture purposes. The chapters cover unique properties of nanomaterials and the progress in nanomaterials which have been implemented for food production. Additionally, the synthesis of nanoparticles, nanotubes and nanostructured membranes is described by Naghibi et al. in chapter 4. It is not possible to explore the entire field of nanoparticles, nanotubes, and nanostructured membranes in one book. Therefore, the chapter provides an overview of the most promising applications of nanoparticles in food-related fields. The book highlights the importance of understanding the fundamental aspects of nanoparticles and their potential applications in various fields. The book concludes with the future prospects of nanotechnology in agriculture, food, water, and the environment.

Handbook of Nanotechnology Applications in Agriculture

Nanomaterials for Agriculture and Forestry Applications explores how major nanomaterials are being specially used in the agriculture, forestry, and other associated sectors. Plants and their products are used for synthesis of nanomaterials as they provide primary and secondary metabolites, which reduce the metal salts and metal oxides into their nanoparticles. Exposure of these nanoparticles has been observed in crops in growth and yield. Nanomaterials accumulation and translocation have shown interaction with cellular organelles, DNA, RNA, proteins, or other biomolecules; and affect various functions of cell organelles. Application of nanosensors holds a significant promise in monitoring signaling pathways, metabolism, detection of crop/soil diseases, and source of pollutants. Nanomaterials have also been used in soil and water quality management. In this regard, the book's main focus is on the potential applications of nanomaterials in agriculture and forestry. It discusses how property is made effective for specific applications. Exploring the design, fabrication, characterization, and applications of nanomaterials for new agri-products offers an overview of regulatory aspects regarding the use of nanomaterials for agriculture and forestry.

Nanotechnology for Agriculture

Several nano-scale devices have emerged that are capable of analysing plant diseases, nutrient deficiencies and any other ailments that may affect food security in agro-ecosystems. It has been envisioned that nanotechnology systems can be developed and utilised for better management of agricultural ecosystems. These systems could exhibit beneficial, multi-functional characteristics, which could be used to assess and control habitat-imposed stresses to crops. Nanoparticle-mediated smart delivery systems can control the delivery of nutrients or bioactive and/or pesticide molecules in plants. It has been suggested that nanoparticles in plants might help determine their nutrient status and could also be used as cures in agro-ecosystems. Further, to enhance soil and crop productivity, nanotechnology has been used to create and deliver nano fertilizers, which can be defined as nano-particles that directly help supply nutrients for plant growth and soil productivity. Nanoparticles can be added onto clay networks, leading to improved soil health and more efficient nutrient use by crops. Additionally, nanoparticles can be coated with novel nanoparticles that facilitate slow and steady release of nutrients, reducing loss of nutrients and enhancing their efficiency in agro-crops. Although the use of nanoparticles in agro-ecosystems is still in its early stages and needs to be developed further, nano-particle-mediated delivery systems are promising solutions for the successful adoption of ag-ecosystems. In this context, the book offers insights into nanotechnology in agro-ecosystems with reference to biogenic nanoparticles. It highlights the following: occurrence and diversity of Biogenic Nanoparticles mechani...
Nanotechnology Applications in Agriculture Nanotechnology Will Transform The Food Industry The Way Food Is Produced Processed Packaged

Nanotechnology Applications in the Food Industry

Nanotechnology transforms the way food is produced, processed and packaged. It is increasingly used in the food industry in the production, processing, packaging, and preservation of foods. It is also used to enhance flavor and color, nutrition, and safety, and to improve food safety and in quality management. Nanotechnology Applications in the Food Industry is a comprehensive reference book containing exhaustive information on nanotechnology and the scope of its applications in the food industry. The book has five sections delving on all aspects of nanotechnology and its key role in food industry in the present scenario. Part I on Introduction to Nanotechnology in Food Sector covers the technological applications in food and nanotechnology and its applications in agriculture. Part II on Nanotechnology in Food Packaging reviews the use of nanomaterials and nanocomposites in food packaging. Part III on Nanotechnology and Chemistry of Food covers topics such as nanoparticle synthesis, applications of nanomaterials, nanosensors and plasma technologies. The book concludes with a summary of the applications of nanotechnology in the future. The salient features of this book are • Describes nanotechnology as an interdisciplinary and emerging field in life sciences • Useful for researchers in the cutting edge life science related fields of nanoscience, nanobiology and nanotechnology. It deals with various problems in food, agriculture and environmental sustainable solutions through the application of nanotechnology. Supported with illustrations in color, tables and case studies (wherever applicable), and • Contributed and well written by nanotechnology experts across various disciplines

Nanoscience in Food and Agriculture

Nanotechnology is increasingly used in the food industry in the production, processing, packaging, and preservation of foods. It is also used to enhance flavor and color, nutrition, and safety, and to improve food safety and in quality management. Nanotechnology Applications in the Food Industry is a comprehensive reference book containing exhaustive information on nanotechnology and the scope of its applications in the food industry. The book has five sections delving on all aspects of nanotechnology and its key role in food industry in the present scenario. Part I on Introduction to Nanotechnology in Food Sector covers the technological applications in food and nanotechnology and its applications in agriculture. Part II on Nanotechnology in Food Packaging reviews the use of nanomaterials and nanocomposites in food packaging. Part III on Nanotechnology and Chemistry of Food covers topics such as nanoparticle synthesis, applications of nanomaterials, nanosensors and plasma technologies. The book concludes with a summary of the applications of nanotechnology in the future. The salient features of this book are • Describes nanotechnology as an interdisciplinary and emerging field in life sciences • Useful for researchers in the cutting edge life science related fields of nanoscience, nanobiology and nanotechnology. It deals with various problems in food, agriculture and environmental sustainable solutions through the application of nanotechnology. Supported with illustrations in color, tables and case studies (wherever applicable), and • Contributed and well written by nanotechnology experts across various disciplines

Nanotechnology Applications in Dairy Science

What Can Nanotechnology Learn From Biotechnology? presents diverse perspectives on biotechnology and nanotechnologies. Avoiding extreme perspectives, unwarranted hype and absolute rejection, this book explores the diverse territory of proponents and opponents of challenging but potentially risky technologies. Contributions from recognized experts in their fields represent the perspectives of a diverse range of stakeholders. This book details the lessons to be learned from the controversy over genetically modified foods, and how those lessons can be applied to developing nanotechnologies, particularly agricultural and other food-related applications. Exploring the environmental, social and ethical impact of nanotechnology in agriculture, the book highlights the need for new approaches to addressing regulatory and societal issues. The book also explores the potential of nanotechnology to improve the safety of food products, and discusses the role of regulatory agencies in promoting eco-friendly approaches, and as a result to increase plant productivity. It also explores the range of challenges, risks, and concerns that have a direct or indirect impact on nanotechnology and IoNT implementation in agriculture and the food industry. In closing, it discusses the use of green nanotechnology and green IoNT in order to create smart, safe, and sustainable agriculture and healthy food.

Plant Nanotechnology

Advances in Nano-fertilizers and Nano-pesticides in Agriculture: A Smart Delivery System for Crop Improvement explores the use of nanotechnology for the controlled delivery of pesticides, herbicides and fertilizers that improve the safety of products while also increasing the efficiency of food production and decreased environmental pollution. The development of nanodevices such as smart delivery systems to target specific sites, as well as nanocarriers for chemical controlled release are currently important aspects in novel agriculture and require a strong foundation of understanding, not only the technology, but also the resulting impacts. Fills key knowledge-gaps of bio-nanotechnology, how they interact with plant cells and their biological consequences Focuses on agro-nanotechnology which can be utilized for developing healthy seeds Explores the possibilities of macronutrient nano-based fertilizers

Applications of Nanomaterials in Agriculture, Food Science, and Medicine

This book highlights the implications of nanotechnology in plant sciences, particularly its potential to improve food and agricultural systems through innovative, eco-friendly approaches, and as a result to increase plant productivity. Topics include various aspects of nanomaterials: biophysical and biochemical properties; methods of treatment, detection and quantification; methods of quantifying the uptake of nanomaterials and their translocation and accumulation in plants. In addition, the effects of plant growth and development, the role of nanoparticles in changes in gene and protein expression, and delivery of genetic materials for genetic improvement are discussed. It also explores how nanotechnology can improve plant protection and plant nutrition, and addresses concerns about using nanoparticles and their composites. This book provides a comprehensive overview of the application potential of nanomaterials in plant science and serves as a valuable resource for students, teachers, researchers and professionals working on nanotechnology.

Aquananootechnology

This book examines the potential applications of nanotechnology in aquaculture and technological research and innovations. Gathering contributions by researchers actively engaged in various domains of nanotechnology in agriculture, it addresses topics such as nanoscale applications in aquaculture (both top-down and bottom-up approaches); applications of nanomaterials, nanosensors and plasma discharge technologies; environmental monitoring; agriculture; energy recovery; production enhancement; energy conservation and storage; surface modification of materials for energy storage; fuel cells; pollution mitigation; and CO2 capture and sequestration. Given its scope, the book will be of interest to academics and researchers whose work involves nanotechnology or nanomaterials, especially as applied to energy and/or environmental sustainability engineering. Graduate students in the same areas will also find it a valuable resource.

Nanotechnology and Nanomaterial Applications in Food, Health, and Biomedical Sciences

The uses of nanotechnologies continue to rise exponentially. Due to their multifaceted nature, nanomaterials have a vast amount of potential uses in various scientific professions. Professionals in sectors including agriculture, nutrition, and healthcare are discovering the numerous benefits that nanomaterials carry when applied to traditional industries. In order to understand the dynamic properties of nanomaterials and how to utilize them in specific fields, significant research is required. Applications of Nanomaterials in Agriculture, Food Science, and Medicine is an essential reference source that discusses the emerging development of nanotechnology in various sectors of the scientific community as well as the current benefits and future uses. Industries that the book covers include energy storage and renewable energy, environmental science and wastewater treatment, food and agriculture, and medicine and bioinformatics. This book is ideally designed for researchers,
Advances in Phytonanotechnology

A comprehensive overview of the current state of this highly relevant topic. An interdisciplinary team of researchers reports on the opportunities and challenges of nanotechnology in the agriculture and food sector, highlighting the scientific, technical, regulatory, safety, and societal impacts. They also discuss the perspectives for the future, and provide insights into ways of assuring safety so as to obtain confidence for the consumer, as well as an overview of the innovations and applications. Essential reading for materials and agricultural scientists, food chemists and technologists, as well as toxicologists and ecotoxicologists.

Nanogronomy

This book presents recent developments involving the role of nanoparticles on plant physiology and growth. Nanotechnology applications include improvement of agricultural production using bio-conjugated NPs (encapsulation), transfer of DNA in plants for development of insect pest-resistant varieties, nanofertilizations of agrochemicals such as pesticides and fertilizers for crop management, and nanosensors/nanosensors in crop protection for identification of diseases and residues of agrochemicals. Recent findings on the increased use of nanotechnology in agriculture by densely populated countries such as China and India indicate that this technology may impart a substantial impact on reducing hunger, malnutrition, and child mortality.

Advances in Nano-Fertilizers and Nano-Pesticides in Agriculture

Nanotechnology: Importance & Applications highlights the latest developments and advances in the field of nanoscience and nanotechnology and their wide applications in design and development of Material Science and Devices, Energy, Drug Delivery, Cosmetics, Biology, Biotechnology, Tissue Engineering, Bioinformatics, Information Technology, Agriculture and Food, Environmental Protection, Health Risk, Ethics, Regulations and future prospects. This book will be useful to both Undergraduate and Postgraduate students, teachers and researchers, scientists and industrial personnel working in the field of Nanoscience and Nanotechnology.

Nanotechnology in Plant Growth Promotion and Protection


Nanotechnology in Sustainable Agriculture

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 physosynthesis 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 target molecules to specific cellular organelles in plants. The influence of nanoparticles on plant growth and development, however, remains to be investigated. This book reveals the research gaps that must be filled in order to assess the potential implications of nanotechnology in agriculture, and to guide future research.

Nanotechnology for Agriculture

Sustainable Biological Systems for Agriculture: Emerging Issues in Nanotechnology, Biofertilizers, Wastewater, and Farm Machines explores and introduces the use of nanotechnology, biofertilizers, and design of farm machines in agriculture. The contributions are from India, Africa and the USA; the chapters emphasize sustainable solutions to the challenges of agricultural productivity. The volume provides a wealth of information on new and emerging issues in this interdisciplinary field. The book is divided into seven sections: Potential Applications of Nanotechnology in Biological Systems Emerging Issues, Challenges and Specific Examples of Nanotechnology for Sustainable Biological Systems Potential of Nano- and Bio- fertilizers in Sustainable Agriculture Emerging Focus Areas in Biological Systems Performance of Farm Machines for Sustainable Agriculture The information provided here will be valuable to government agricultural professionals, scientists, researchers, farmers, and faculty and students all over the world.

Nanotechnology for Agriculture: Crop Production & Protection

Some of the recent path-breaking achievements in the field of nanotechnology has proved that this technology has potential to take forward the agriculture and allied industries through the development of new tools (nano-based products) which promise to increase plant growth, food production in a sustainable manner and to protect crops from various biotic factors. However, such expectations are coupled with some uncertainties about the fate of nanomaterials in the agro-environment. Considering the importance of the current situation and wide range applications of nanotechnology, this book will broadly focus on the role of nanotechnology in plant growth promotion and plant protection through the management of different microbial pathogens. Moreover, it also contains chapters on most important nanomaterials recently used in plant growth promotion so as to provide a complete and very informative guide to the audience.

Sustainable Biological Systems for Agriculture

This book highlights the implications of nanotechnology and the effects of nanoparticles on agricultural systems, their interactions with plants as well as their potential applications as fertilizers and pesticides. It also discusses how innovative, eco-friendly approaches to improve food and agricultural systems lead to increased plant productivity, improved insights into the effects of off-farm and risks and future perspectives in the field of agricultural ecosystems. Nanomaterials in agriculture reduce the amount of chemical products sprayed by means of smart delivery of active ingredients; minimize nutrient losses in fertilization; and increase yields through optimized water and nutrient management. There is also huge potential for nanotechnology in the provision of state-of-the-art solutions for various challenges faced by agriculture and society, both today and in the future.

Nano-Technological Intervention in Agricultural Productivity

This new volume discusses the multitude of possibilities for new development in nanotechnology that focuses on overcoming the problems and challenges faced by the biomedical and food industries. The volume hopes to facilitate the development of devices and materials that benefit patients and their healthcare. The book is broken down to cover: nanotechnology techniques for biomedical applications nanoparticles and materials for food, health, and pharmaceutical application potential applications of nanotechnology in food safety

Nanoscale Engineering in Agricultural Management

Provides detailed information about the use of nanotechnology in remediating waste and pollution in agriculture Nano-Technological Intervention in Agricultural Productivity explores sustainable, eco-friendly technologies for remediating wastes and contaminated areas in both water and land ecosystems. Focusing on nano-technological innovations that use microbes and microbial agents to improve the quality and pollutant discharge of contaminated sites, this comprehensive volume also discusses molecular approaches for the characterization of nanoparticles, the biosynthetic pathways of microbes, gene and protein expression studies for bio-degradation techniques, and more. Organized into nine chapters, the book opens with a thorough overview of the functions, classification, properties, synthesis, and applications of nanoparticles. Following a discussion of the environmental and agricultural implications of nanotechnology, the authors examine the current role and
Future prospects of nanotechnology in managing plant diseases, improving agrifood production, and increasing agricultural productivity. Subsequent chapters cover lignin nanoparticles, various applications of nanotechnology in agriculture, and nano-based advances in plant and microbial science. Offering an up-to-date account of the role of nanotechnologies in agricultural bioremediation, this book: Explores biotechnological advances in the development of sophisticated green technologies for waste minimization and waste control Emphasizes the use of microbes for degradation and removal of various xenobiotic substances Discusses bioremediation approaches in relation to the impact of increased urbanization and industrialization on the environment Covers a variety of applications of nanotechnology in agriculture, including nano-fertilizers, nano-biosensors, nano-pesticides, and nanoparticle protection in plants Nano-Technological Intervention in Agricultural Productivity is a valuable resource for students in plant biotechnology and agricultural science and engineering, as well as an important reference for researchers in plant biotechnology and agricultural sciences, particularly those with interest in the use of nanomaterials for pollution remediation and sustainable development.

**Nanotechnology for Energy and Environmental Engineering**

The science of nanotechnology, the manipulation, design and engineering of devices at the atomic and molecular scale, is starting to be applied to many disciplines including aspects of agriculture and crop science. This book opens with a brief history of nanotechnology in agriculture. Applications are then examined in detail, including nanopesticides, nanosensors, nano-fertilizers, and nanoherbicides. Topics covered include: the biosynthesis of nanoparticles (through microbes, plants and other biotic agents); the ecological consequences of their delivery into the environment (examining effects and toxicity on soil, soil biota, and plants); safety issues; an overview of the global market for nanotechnology products, and the regulation of nanotechnology in agriculture. The book concludes with speculations on what the future holds for the technology. The book has been written by an international group of researchers and experts from over 12 countries with experience across a wide range of issues relating to the industry. This book will be of use to a wide range of researchers and professional scientists in the agricultural sector, academia and industry, including microbiologists, chemical engineers, geneticists, plant scientists and biochemists.

**Advances in Applied Nanotechnology for Agriculture**

Advances in Phytotechnology: From Synthesis to Application guides readers through various applications of nanomaterials on plants by presenting the latest research related to nanotechnology and nanomaterials on plant systems. The book focuses on the effects of these applications on plant morphology, physiology, biochemistry, ecology and genetics. Sections cover the impact on plant yield, techniques, a review of positive and negative impacts, and an overview of current policies regarding the use of nanotechnology on plants. Additionally, the book offers insights into the appropriate application of nanoscience to plants and crops for improved yield and an exploration of their bioavailability and toxicity in the environment. Discusses the morphological, physiological and biochemical responses of plants to nanomaterials and the ability of the nanomaterials in modifying the genetic constitution of plants Emphasizes new applications of nanomaterials, including nanosensors technology and nanomaterials as nanocarriers based antimicrobial phytochemicals Presents the role of nanotechnology as a novel technique for the remediation of heavy metals by plants.

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**Nanotechnology in Agriculture and Food Science**

Nanobiotechnology in agriculture is a new knowledge area that offers novel possibilities to achieve high productivity levels at manageable costs during the production and merchandising of crops. This book shows us how we can use the cutting-edge knowledge about agriculture, nanotechnology, and biotechnology to increase the agricultural productivity and shape a sustainable future in order to increase the social welfare in rural areas and preserve the environmental health. Specialists from several countries will provide their feedback on a range of relevant topics such as environment-friendly use of nanofertilizers, nanodevices, nanofood packaging, nanocasting and nanocarriers and their relationship with the modern agriculture.

**Nanomaterials for Agriculture and Forestry Applications**

Aquananotechnology: Applications of Nanomaterials for Water Purification focuses on the impacts of, and opportunities for, the application of nanotechnology to enhance water quality and the societal concerns surrounding the widespread use of nanotechnology in the water arena. Sections cover the use of nano-sensors for the detection of water pollutants, the control of waterborne pathogens, and the use of nano-biochar coal fly composites for phytoremediation wastewater pollutants. In addition, the book explores the uses of nanoadsorbents for heavy metals, dyes, Arsenic, pesticides, and water/wastewater remediation and decontamination of water from xenobiotics, bianonanocomposites, metal oxides, silver, zinc nanoparticles, and carbon-based nanomaterials for wastewater treatment. In addition, the book covers the use of zerovalent iron nanomaterials and nanostructured mesoporous silica for water purification, along with nano-hydrogels to increase water efficiency and conservation. Finally, the socioeconomic impacts and risks of aquananotechnology in ecosystems are discussed. This book provides a detailed description of the ecological applications of nanomaterials in aquatic environments, offering a cogent analysis of both major applications and challenges. Shows how a range of nanomaterial types are being used for ecological applications in aquatic environments Explores the effects different types of nanomaterials have on a variety of ecosystems Assesses the major challenges of using nanotechnology to improve water quality on a mass scale.

**Agricultural Nanobiotechnology**

This book is the second volume on this topic within the series. With unique properties, nanomaterials are rapidly finding novel applications in many fields such as food, medicine, agriculture and pollution. Such applications include to treat cancer, nanosensors to detect food contamination, nanomaterials for food packaging, nanocoating and nanoencapsulation to preserve nutraceuticals, and nanofertilisers for advanced agriculture. After an introductory chapter on property rights of nanomaterials, readers will discover the applications of nanotechnology in food, health, environment, ecotoxicology and agriculture.

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