

Biogenic Nanoparticles: Nanofertilizers and Nanoscale Biocontrol Agents

Biogenic nanoparticles, also known as nanofertilizers and nanoscale biocontrol agents, have emerged as promising tools in the field of agriculture. With their unique properties and functionalities, these nanoparticles offer significant potential for enhancing crop productivity and managing plant diseases in a sustainable and environmentally friendly manner.

The Role of Biogenic Nanoparticles in Agriculture

Biogenic nanoparticles are nanoparticles that are synthesized by living organisms, such as bacteria, fungi, and plants. These naturally occurring nanoparticles have gained attention due to their eco-friendly synthesis process and their ability to perform various agricultural functions.

One of the key applications of biogenic nanoparticles is their use as nanofertilizers. These nanoparticles can be loaded with essential nutrients, such as nitrogen, phosphorus, and potassium, and delivered to plants to enhance their nutrient uptake efficiency. By improving nutrient availability and absorption, nanofertilizers can promote plant growth, increase crop yield, and improve the overall quality of agricultural produce.



Agricultural Nanobiotechnology: Biogenic Nanoparticles, Nanofertilizers and Nanoscale Biocontrol Agents (Woodhead Publishing Series in Food Science, Technology and Nutrition)

by Sougata Ghosh (Kindle Edition)

★★★★☆ 4.7 out of 5

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Enhanced typesetting : Enabled
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In addition to their role as nanofertilizers, biogenic nanoparticles also possess biocontrol properties. These nanoparticles can be engineered to carry antimicrobial compounds or enzymes that target and eliminate plant pathogens, such as fungi, bacteria, and viruses. By effectively managing plant diseases, nanoscale biocontrol agents can minimize yield losses and reduce the reliance on chemical pesticides, leading to a more sustainable agricultural system.

Advantages of Biogenic Nanoparticles

Biogenic nanoparticles offer several advantages over their chemically synthesized counterparts. Firstly, their eco-friendly synthesis process eliminates the need for toxic chemicals, making them safer for both humans and the environment. Secondly, biogenic nanoparticles are often biocompatible and possess higher stability, allowing for controlled release of nutrients or biocontrol agents. Moreover, these nanoparticles can be easily synthesized on a large scale and at a lower cost, making them accessible to farmers and agricultural industries.

Another notable advantage of biogenic nanoparticles is their potential to mitigate the negative environmental impacts associated with conventional fertilizers and pesticides. The controlled release mechanism of nanofertilizers ensures that nutrients are provided to plants in a targeted and efficient manner, reducing nutrient runoff and groundwater contamination. Similarly, the use of nanoscale

biocontrol agents minimizes the overuse of chemical pesticides, which can lead to the development of pesticide-resistant strains and ecological imbalances.

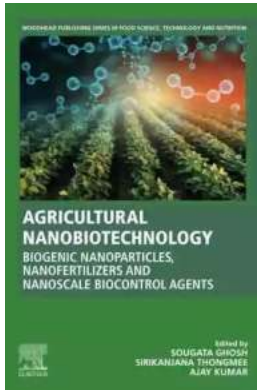
Current Research and Future Directions

The field of biogenic nanoparticles in agriculture is rapidly evolving, with ongoing research focusing on enhancing their efficiency and understanding their interactions with plants and the environment. Scientists are investigating the optimal synthesis conditions and exploring different loading strategies to maximize the nutrient delivery or biocontrol efficacy of these nanoparticles.

Furthermore, research is being conducted to assess the long-term effects and potential risks associated with the use of biogenic nanoparticles in agriculture. It is essential to understand the fate and behavior of these nanoparticles in the soil, their uptake by plants, and their interactions with soil microorganisms to ensure their safe and sustainable use.

Biogenic nanoparticles have emerged as promising tools in agriculture, offering significant potential for enhancing crop productivity and managing plant diseases. With their eco-friendly synthesis process, biocontrol properties, and unique functionalities, these nanoparticles can revolutionize the agricultural sector towards a more sustainable and efficient future. Ongoing research and development efforts in this field will further unlock the immense benefits of biogenic nanoparticles, paving the way for a greener and healthier agricultural system.

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Agricultural Nanobiotechnology: Biogenic Nanoparticles, Nanofertilizers and Nanoscale Biocontrol Agents presents the most up-to-date advances in nanotechnology to improve the agriculture and food industry with novel nanotools for the controlling of rapid disease diagnostic and enhancement of the capacity of plants to absorb nutrients and resist environmental challenges.

Highlighting the emerging nanofertilizers, nanopesticides and nanoherbicides that are being widely explored in order to overcome the limitations of conventional agricultural supplements, the book provides important insights to enable smart, knowledge-driven selection of nanoscale agricultural biomaterials, coupled with suitable delivery approaches and formulations will lead to promising agricultural innovation using nanotechnology.

Agricultural Nanobiotechnology: Biogenic Nanoparticles, Nanofertilizers and Nanoscale Biocontrol Agents explores emerging innovations in nanobiotechnology for agriculture, food, and natural resources to address the challenges of food security, sustainability, susceptibility, human health, and healthy life. The book is ideal for the multidisciplinary scientists whose goal is to see the use of nanomaterials in agriculture to reduce the amount of spread

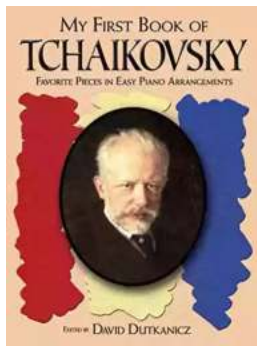
chemicals, minimize nutrient losses in fertilization and to generate increased yield through pest and nutrient management.

- Includes mechanisms of plant-metal interaction and green synthesis
- Explores the fabrication of nanostructures including carbon nanotubes, quantum dots, encapsulation and emulsions
- Presents agriculturally focused application insights including nanofertilizers, nanopesticides, and nanoherbicides



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