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Chitosan Based Nanomaterials in Plant Growth and Protection

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Abstract

The aim of this brief is to explain the synthesis, properties and potential uses of chitosan-based nanomaterials in plant protection and growth. Precise assessment of chitosan-based nanomaterials' synthesis and properties are mentioned. A description of various factors which affect their synthesis and characters has been elucidated. Biological activities like antimicrobial activity (e.g. antifungal-antibacterial activity) including the mode of action have been discussed. In addition, the effect of chitosan-based nanomaterials in plant growth is also pointed out. Authors summarize the plant protection and growth regulatory applications of chitosan nanomaterials. Current and possible utilization of chitosan nanomaterials in plant nutrition, abiotic stress management and post-harvest application is also highlighted. The authors have highlighted their own research views and concluded the recent and future prospects of chitosan nanomaterials' applications in plant protection and growth.

Keywords

Chitosan, Plant growth, Antimicrobial activity, Nanomaterials, Nanotechnology

Preface

The term ‘Nanotechnology’ comprises the understanding of the fundamental physics, chemistry, biology, and technology of nanometer scale objects. In recent years, it has become one of the most important and exciting forefront fields in science. It shows great promise for providing us in the near future with many breakthroughs that will change the direction of technological advances in a wide range of applications. Of late, it has become a popular and well-accepted term and a central pillar in many nationally and internationally funded research programs. Considerable funding has been allocated and invested in the development of this discipline in many countries such as USA, Korea, Japan, Australia, and the European Union.

Life is organized at the level of cells, but it is well known that natural cellular events, interactions, and processes take place at the subcellular scale and at the molecular level. This is the reason why nanotechnology is meant to play a key leading role in developing tools able to identify, measure, and study such events at the nanometric level, as well as in contributing to the disclosure of unknown biological interactions and mechanisms.

Taking into consideration the above facts and views and given the importance and potential impact of nanotechnology in agriculture, this brief document aims to provide an overview of synthesis, properties, and potential uses of chitosan-based nanomaterials in plant growth and protection. Precise assessment of chitosan-based nanomaterials’ synthesis and properties are mentioned. The topics presented here were chosen based on the maturity of understanding of the subjects, their potential for applications, and/or the number of already existing applications. Many of the chapters discuss present and future possibilities. General references are included for those who wish to further pursue some of the areas in which this technology is moving ahead. The book is divided into five chapters. The book starts with the introduction, importance, and the potential capacity of bulk and nanochitosan in the agriculture sector. Second chapter provides full description of methodologies followed for the synthesis and characterization of chitosan-based nanomaterials with state-of-the-art figures. The other chapters are dedicated to the biological activities of chitosan-based nanomaterials.

This mini book provides established scientists, junior researchers, and students involved in nanotechnology research with a sound foundation of a wide variety of approaches in agriculture sector. We would like to thank PhD Scholars of Nano research facility lab, Ram Chandra Choudhary, Kumaraswamy R.V., Manju Kumari Choudhary, Sarita Kumari and Swati for their contributions to this book. We sincerely acknowledge Dr Ramesh Raliya, Research Scientist, Department of Energy, Environmental and Chemical Engineering, Washington University in St. USA for valuable suggestions.

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