

# Preface

In recent years, there has been a growing global concern about the environmental impact of materials and on the urgent need for sustainable solutions. In response to this challenge, the field of green materials has emerged as a promising avenue for developing eco-friendly alternatives that minimize the ecological footprint while maintaining or even enhancing performance. One such area of research is the development of green micro- and nanocomposites, which combines the principles of green chemistry and advanced materials science to create sustainable and functional materials.

This book provides a comprehensive overview of the state-of-the-art advancements in the field of environmentally friendly micro- and nanocomposite materials. It brings together the collective knowledge and expertise of researchers and practitioners from various disciplines, including materials science, chemistry, engineering, and sustainability.

The objective of this book is to provide a comprehensive overview of green micro- and nanocomposites, offering a holistic understanding of their synthesis, properties, and applications. It encompasses a wide range of aspects, including green synthesis methods, characterization techniques, mechanical and thermal properties, electrical conductivity, and barrier performance of micro- and nanocomposites.

Chapter 1, Green Micro- and Nanocomposites, serves as an introduction to the subject, discussing the importance of green composites and their potential to revolutionize various industries. It sets the stage for the subsequent chapters, which delve deeper into specific aspects of green composites.

Chapter 2, Biodegradability of Green Composites: Mechanisms and Evaluation Methods, explores the fascinating world of biodegradability, examining the mechanisms involved and the methods used to evaluate the biodegradation potential of these materials. Understanding the biodegradability of green composites is crucial for their sustainable use in various applications.

Chapter 3, *Green Composites Reinforced with Cellulose*, focuses on the utilization of cellulose, a renewable and abundant resource, as a reinforcement in green composites. The chapter discusses the preparation, properties, and applications of cellulose-based composites, highlighting their unique advantages and challenges.

Chapter 4, *Green Composites Reinforced with Chitin and Chitosan*, explores the potential of chitin and chitosan, natural polymers derived from shellfish, as reinforcements in green composites. The chapter investigates the properties, processing techniques, and applications of these composites, shedding light on their immense potential in various industries.

Chapter 5, *Green Composites based on Polyhydroxyalkanoates*, focuses on the applications of polyhydroxyalkanoates (PHAs), biodegradable and biocompatible polyesters produced by microorganisms, in green composites. The chapter delves into the synthesis, properties, and applications of PHA-based composites, providing insights into their wide-ranging uses.

Chapter 6, *Green Composites Based on Poly(Lactic Acid)*, explores the utilization of poly(lactic acid) (PLA), a renewable and biodegradable polymer derived from plant sources, in green composites. The chapter discusses the processing techniques, properties, and applications of PLA-based composites, highlighting their potential to replace conventional petroleum-based materials.

Chapter 7, *Green Composites Based on Protein Materials*, examines the use of protein materials, such as soy protein, zein, and gluten, as reinforcements in green composites. The chapter explores the preparation methods, properties, and applications of protein-based composites, emphasizing their biocompatibility and potential applications in the biomedical field.

Chapter 8, *Surface Modification of Biobased Polysaccharide Nanoparticles via Grafting*, focuses on the surface modification techniques employed to enhance the properties and performance of biobased polysaccharide nanoparticles. The chapter discusses various grafting methods and their impact on the composite materials, paving the way for tailored properties and applications.

This book will be a valuable resource for researchers, scientists, engineers, and professionals interested in the development and applications of green micro- and nanocomposites. By providing a comprehensive understanding of the synthesis, properties,

and applications of these materials, it aims to inspire further advancements in the field and contribute to a sustainable future.

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