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POLYMER COMPOSITES DERIVED FROM ANIMAL SOURCES

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Preface

Polymer composites that are derived from animal sources have debuted as a major class of structural materials used as substituents for synthetic reinforcement and nanofillers in several critical components in the automotive, biomedical and marine, and sports goods sectors owing to their properties of low density, strength−weight ratio, and superior fatigue strength. These versatile composites offer the added advantages of low density and resistance to corrosion, compared to the conventional metallic, synthetic fibers and ceramic composites when used in diverse engineering applications. Thus their presence lends cost-effectiveness and environmental sustainability in the field of composites.

However, the full scale of their potential in engineering design is hampered by the lack of practical data available, for design applications and in process fabrication. Polymer Composites Derived from Animal Sources, a pioneering book, fills this vacuum, highlighting the green engineering, processing, performance, and applications of polymer composites derived from animals. It shares fundamental and practical knowledge in designing for circularity to readers, especially for product development applications throughout the conceptual design, material selection, and fabrication and material characterization processes. The vast amount of data needed highlights the imperative for integrated research and multidisciplinary working teams for high-end applications. Much focus centers on the progress and recent developments as well as the applications of polymer composites derived from silk, chicken, bovine, marine life, animal waste, and other related sources.

This book presents a widespread all-inclusive review of animal-reinforced composites ranging from the different types of processing techniques to chemical modification of the extracted keratin and cellulose surface to enhance the interfacial adhesion between the matrix and reinforcement, and the structure−property relationship. It illustrates how high-value composites can be produced by efficient and sustainable processing methods by selecting different constituents (animal based and polymer matrix). In addition, several topics covering recent advances in design for animal-based composites for automotive component design and furniture design are also included in this book to provide practical examples of this green and sustainable materials in current applications.

The book itself is divided into two sections; Section I focussing on the overview of animal-based composites with 9 chapters and Section II on the applications and future perspective with 10 chapters. Section I sets the tone with an introduction to animal-based composites and then discussing the animal resources such as wool, natural silk, bovine, chicken feather, egg shell−based hydroxyapatite, and crab-based chitin and

Development and characterization of crab-based chitosan filler–reinforced polymer composites

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9.1 Introduction

Over the last few decades, the global environmental problem has attracted significant awareness from the research community and policymakers for the development of polymeric materials that are degradable in a natural environment. Recyclability and environmental safety are becoming increasingly crucial in the pursuit of a more sustainable future. The production of biodegradable polymers that are decomposed by microorganisms and photodegradable polymers that are decomposed by sunlight is a priority among researchers. As a result of the increased need for more adaptable polymer-based materials, there is growing interest in polymer composites filled with natural, organic fillers, such as biodegradable and renewable fillers. An ideal biodegradable polymeric material is one that after being disposed of can be recycled many times before promptly being decomposed by microorganisms or sunlight providing carbon dioxide and water (Ahmed & Ikram, 2015; Samir et al., 2022). In recent years, there has been a growing interest in developing sustainable and eco-friendly materials for various applications, including polymer composites. Polymer composites offer improved mechanical properties and can be tailored for specific applications by incorporating fillers or reinforcements (Ahmad et al., 2020; Rani et al., 2021; Sadasivuni et al., 2020).

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