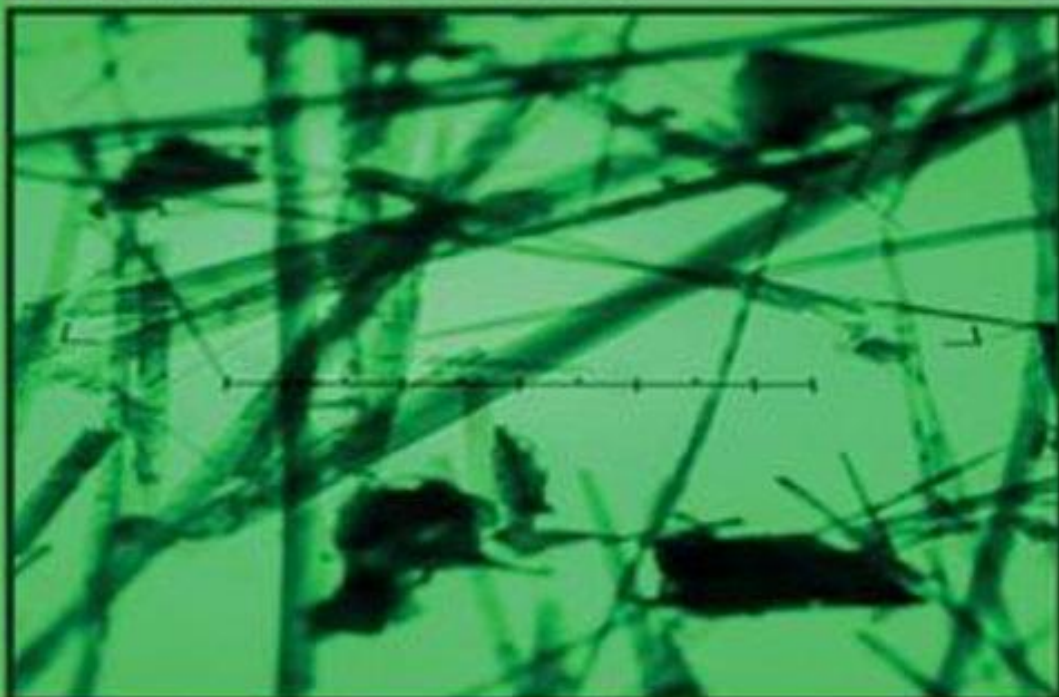


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# **POLYMER COMPOSITES DERIVED FROM ANIMAL SOURCES**



Edited by  
**S. M. SAPUAN**  
**C. H. AZHARI**  
**N. M. NURAZZI**

# **Polymer Composites Derived from Animal Sources**

Woodhead Publishing in Materials

# **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

chitosan and collagen. Most of the chapters provide an overview with several chapters focussing on the properties of the specific composites.

Section II provides a comprehensive outlook in novel applications such as natural silk in car bodies and energy attenuation, keratin in biomedical applications, hybrid sea shell for structural applications, sea life collagen for bone regeneration, coral for structural applications, tunicate cellulose for electronics, and chitosan composites for electrical applications. There are two chapters devoted to the challenges of environmental and economic concerns of these exciting animal-based composites.

The editors take great pleasure in thanking the Elsevier editorial team who has made our work an easy and a pleasurable one. We take the opportunity to thank the Ministry of Higher Education Malaysia who has generously funded some of the research mentioned in this book. Their funding has indeed contributed significantly to the burgeoning of high-quality research coming out of our universities and research institutes.

We record our gratitude to the unstinting support given by our respective universities, Universiti Putra Malaysia (Prof. Ir. Dr. S.M. Sapuan), Universiti Kebangsaan Malaysia (Emeritus Prof. Dr. C.H. Azhari), and Universiti Sains Malaysia (Dr. N. M. Nurazzi) and their research management infrastructure. Their support has been invaluable in soliciting funding and managing the smooth operations of the research.

We thank our families who are our staunchest supporters in all adversity and celebration.

Finally, our greatest gratitude is reserved for our cowriters and contributors in this book. It has been an honor and privilege to work with a group of dedicated researchers, hailing from Malaysia as well as from so many other countries. We wish them success in their future endeavor and we hope to continue to keep the field of composites exciting, vibrant, and invigorated.

**S.M. Sapuan**  
**C.H. Azhari**  
**N.M. Nurazzi**

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