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Biopolymer Composites an In-Depth Review of Chemical Properties and Emerging Applications

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Abstract

This review provides a comprehensive analysis of the chemical properties and emerging applications of biopolymer composites. Biopolymers, derived from renewable resources, have gained significant attention due to their environmental benefits, but their mechanical and thermal properties often require enhancement for broader applications. The integration of various fillers and reinforcing agents into biopolymers has led to the development of biopolymer composites with improved properties. This review examines the chemical interactions between biopolymers and composite materials, highlighting advancements in biopolymer-based composites in fields such as packaging, biomedical devices, and environmental sustainability. The potential challenges and future directions for research in biopolymer composites are also discussed.

Keywords: Biopolymers; Biopolymer composites; Chemical properties; Mechanical reinforcement; Sustainable materials; Packaging applications; Biomedical applications

Introduction

Biopolymers, derived from natural sources such as plants, animals, and microorganisms, have emerged as sustainable alternatives to conventional plastics. While biopolymers offer environmental benefits, their relatively poor mechanical and thermal properties limit their use in high-performance applications [1]. To address these limitations, the development of biopolymer composites—materials combining biopolymers with various fillers and reinforcing agents—has gained prominence [2,3]. These composites exhibit enhanced chemical, mechanical, and thermal properties, making them suitable for a wide range of applications, from packaging to biomedical devices. This review aims to explore the chemical properties of biopolymer composites, their interactions with reinforcing agents, and the latest advancements in their applications across various industries.

Materials and Methods

The review focuses on the following types of biopolymers and reinforcing agents

Polylactic Acid (PLA): A biodegradable polyester derived from renewable resources like corn starch or sugarcane, widely used in packaging and medical applications.

Polyhydroxyalkanoates (PHA): A class of biopolyesters produced by bacterial fermentation, known for their biodegradability and versatility [4]. Derived from natural starch, these polymers are used in various applications, including packaging and biodegradable plastics. A biopolymer derived from chitin, found in the exoskeletons of crustaceans, with applications in biomedical fields [5].

Cellulose Nanofibers: Derived from plant cellulose, these nanofibers enhance the mechanical strength and barrier properties of biopolymer composites. Known for their exceptional strength and electrical conductivity, CNTs are used to reinforce biopolymers in high-performance applications [6,7]. These are used to improve the thermal stability and barrier properties of biopolymer composites. Renewable fibers that enhance the mechanical properties of biopolymer composites while maintaining biodegradability.

Methodology

This review was conducted through a systematic analysis of recent literature on biopolymer composites, focusing on studies published within the last decade. The methodology involved the following steps

Literature search

Databases: Key academic databases, including Scopus, Web of Science, and Google Scholar, were searched for relevant articles [8]. Search terms included biopolymer composites, chemical properties of biopolymers, reinforcing agents, mechanical properties, and biomedical applications of biopolymers. Articles selected for review included experimental studies, reviews, and patents that provided insights into the chemical properties, interactions, and applications of biopolymer composites [9].

Data extraction

Chemical Properties: Information was extracted on the chemical composition, bonding mechanisms, and interactions between biopolymers and reinforcing agents.

Mechanical and Thermal Properties: Data on the impact of various reinforcements on the mechanical and thermal properties of biopolymer composites were gathered [10]. The review focused on the application areas of biopolymer composites, with particular attention to packaging, biomedical devices, and environmental sustainability. The chemical properties and performance of different biopolymer composites were compared to identify trends, strengths, and limitations. The review highlighted emerging trends and innovative applications, as well as potential areas for future research.

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Conclusion

Biopolymer composites represent a promising avenue for enhancing the performance of biopolymers, making them viable for a broader range of applications. The chemical properties of these composites, including the nature of the interactions between biopolymers and reinforcing agents, play a crucial role in determining their mechanical and thermal performance. The review highlights significant advancements in the development of biopolymer composites, particularly in packaging and biomedical applications. However, challenges such as the scalability of production, cost, and environmental impact remain. Future research should focus on optimizing the synthesis of biopolymer composites, improving their properties, and exploring new applications to fully realize their potential as sustainable materials.

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Conflict of Interest

None

References

1. Nowlin WH, Vanni MJ, Yang H (2008) Comparing resource pulses in aquatic and terrestrial ecosystems. Ecology by the Ecological Society of America 89: 647-659.
2. Kautza A, Sullivan SMP (2016) The energetic contributions of aquatic primary producers to terrestrial food webs in a mid- size river system. Ecology by the Ecological Society of America 97: 694-705.
3. Beasley JC, Olson ZH, De Vault TL (2012) Carrion cycling in food webs: comparisons among terrestrial and marine ecosystems. Nordic Society Oikos 121: 1021-1026.
4. Cheng-Di D, Chih-Feng C, Chiu-Wen C (2012) Determination of Polycyclic Aromatic Hydrocarbons in Industrial Harbor Sediments by GC-MS. Int J Environ Res Public Health 9: 2175-2188.
5. Nasher E, Heng LY, Zakaria Z, Salmijah S (2013) Assessing the Ecological Risk of Polycyclic Aromatic Hydrocarbons in Sediments at Langkawi Island, Malaysia. The Scientific World Journal 13.
6. López GI (2017) Grain size analysis. Encyclopedia of Earth Science Series Encyclopedia of Geoarchaeology, Allan S Gilbert Springer 341-348.
7. Bhatta LD, Sunita CH, Anju P, Himlal B, Partha JD, et al. (2016) Ecosystem Service Changes and Livelihood Impacts in the Maguri-Motapung Wetlands of Assam, India. Land 5: 15.
8. Dechasa F, Feyera S, Dawit D (2019) Determinants of Household Wetland Resources Use and Management Behavior in the Central Rift Valley of Ethiopia. Environ Sustain 2: 355-368.
9. Deka S, Om PT, Ashish P (2019) Perception-Based Assessment of Ecosystem Services of Ghagra Pahar Forest of Assam, Northeast India. Geol Ecol Landsc 3: 197-209.
10. Benjamin Achzet CH (2013) How to evaluate raw material supply risks-an overview. Resour Pol 38: 435-447.