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Biopolymers: An Acceptable Substitute for Plastic Materials in Packaging

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Abstract

Plastics are the most commonly used product packaging materials in almost all manufacturing industries, from electronics to food and fashion accessories. However, many issues surround plastics due to their non-biodegradability, which poses a serious threat to the environment. This research has revealed the potential for replacing and discouraging the use of plastics in product packaging. A few academic papers have successfully demonstrated that biopolymers, which are valuable polymers derived from plant-based and organic materials, are superior for packaging products. Biopolymers, unlike plastics, are biocompatible and biodegradable in a short period of time, which helps to preserve the ecosystem and is healthier for humans. Biopolymers, in particular, have found useful applications in consumer, medical, electrical, and structural products. Numerous studies on plastic are still ongoing as a result of the growing demand and quest to remove plastics from human communities, making this area of study very prolific and grey.

Keywords: Polymers; Bioplastic product; Biopolymers

Introduction

Plastic packaging was a major breakthrough in one era of human history. Plastics were discovered to have several properties that made them revolutionary in the preservation, protection, and transportation of various goods. Plastic packaging is low-cost, lightweight, sanitary, versatile, shatter-resistant, and sealable. Plastics also reduce waste because products can be divided into small quantities at a low cost. Furthermore, plastics provide long-lasting surfaces on which to print product information. Non-plastic alternatives in packaging and consumer goods will be four times as expensive as plastics. Biodegradable plastics are twice as expensive to produce as conventional plastics. What's the problem with plastics if they're so useful? Plastics degrade over 400 years. Plastics are becoming increasingly important in the current geological epoch, known as the Anthropocene. It has created the plastisphere, a new microbial habitat. Plastic packaging and advanced forms of plastic have several alternatives. Bioplastics, which are plastics that are partially or entirely made from bio-based materials, are being promoted as a solution to plastic waste. Not all bio-based plastics, however, are biodegradable. Because biodegradable and compostable plastics are treated as impurities in conventional plastic feedstock, they pose a problem in recycling. Scientists have investigated various constituents of plastics and polymers, with biopolymers and advanced polymer composites receiving particular attention in recent years. [1]

Methods

Packaging made of plastic

Plastic packaging is used in a variety of industries. Rigid plastic packaging was worth $267.38 billion in 2021 and is expected to grow by 5.55% to $429.13 billion by 2030. In 2020, the value of flexible plastic packaging was estimated to be $160 billion. In 2021, approximately 33.6 million tonnes of flexible plastic packaging were sold. According to the UNEP, 1 million plastic bottles are purchased every minute, and 5 trillion plastic bags are used globally each year. In 2019, the world produced 460 million tonnes of plastic, accounting for 3.4% of total greenhouse gas emissions. Plastic packaging accounts for approximately 36% of these plastics (165.6 million tonnes). Annually, $80-120 billion is lost in the sorting and processing of plastic packaging. Claims on food and beverage packaging. [2, 3]

According to recent research, fresh food spoils faster in plastic packages. According to the study, £2.1 billion of fresh food is thrown away in the UK each year due to moulds, squishiness, or expiry date labels on plastic packages. The UK would save 100,000 tonnes of food and 10,300 tonnes of plastic if these fresh products were sold without plastic wrappers. However, industry experts argue that removing plastic packaging completely from the equation will result in a worse environmental threat than plastic packaging. Plastics also save energy in transportation because they are lightweight. A glass yoghurt container, for example, weighs 85 grammes, while its plastic counterpart weighs 5.5 grammes. Because glass drinks account for 36% of the load and plastic drinks account for 3.56%, only two Lorries will be used to transport plastic yoghurts while three lorries will be used to transport the same amount of glass drinks. Packaging accounts for the majority of global plastic consumption. [4, 5].

Plastics with a single use

Design for Reuse and Design for Recycling are critical concepts in the circular economy that can be used independently or in tandem. Plastic packaging for reuse must be extremely durable in order to last in a variety of applications. Packaging for recycling, on the other hand, must encourage dematerialization. Dematerialization cannot be said to be explicitly sustainable. There has been discussion about the sustainability of designing for reuse versus recycling. According to one study, the processes involved in reusability designs are 171% less harmful to the environment than dematerialization processes. Many governments and organisations are actively enacting regulations to reduce plastic use Bangladesh was one of the first countries to prohibit the use of plastic bags. [6, 7]

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Conclusion

This research looked into the actual benefits and drawbacks of ostensibly eco-friendly alternatives to plastics. Plastics are popular in product packaging. The main issue with plastic waste is that it takes over 400 years to degrade. As a result, more research is needed to develop better technologies to accelerate plastic degradation while minimising environmental impact. In bio-related plastics, biopolymers are used as a matrix or as substrates. Biopolymers differ significantly from one another. Biopolymers such as starch, cellulose, and polylactic acid are widely used. Biopolymers are still in their early stages and have experienced several setbacks. They are made of various materials and are vulnerable to various threats. More innovations are needed in the industry to improve the mechanical strength and moisture affinity of biopolymers. [8,9,10].

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Potential Conflict of Interest

No conflict or competing interests in the publication of this paper.

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