



Development of Biodegradable Plastics and their Environmental Impact

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INTRODUCTION

Plastic pollution has become one of the most pressing environmental issues of our time. With millions of tons of plastic waste entering the oceans and landfills each year, the call for sustainable alternatives has never been more urgent. Biodegradable plastics have emerged as a promising solution, but their development, usage, and environmental impact warrant careful examination.

DESCRIPTION

Biodegradable plastics are materials designed to break down more quickly than conventional plastics when exposed to natural environmental conditions. Unlike traditional plastics, which can take hundreds of years to decompose, biodegradable options can degrade into natural substances like water, carbon dioxide, and biomass within a shorter timeframe. This property is achieved through the incorporation of natural polymers, such as starch, polylactic acid and polyhydroxyalkanoates into the manufacturing process. The development of biodegradable plastics began in the late 20th century, driven by increasing awareness of plastic pollution. Early innovations included starch-based plastics, which were among the first to be introduced commercially. These materials have gained popularity, particularly in agricultural applications, where they can be used for mulching films and other temporary uses. In recent years, technological advancements have led to the creation of synthetic biodegradable plastics, like PLA and PHA, derived from renewable resources. PLA, produced from fermented plant sugars, has found wide application in packaging, disposable utensils, and even textiles. PHA, produced by bacteria through the fermentation of organic materials, is gaining attention for its versatility and compatibility with existing plastic manufacturing processes. The primary advantage of biodegradable plastics lies in their potential to mitigate environmental harm. When disposed of properly, these materials can significantly reduce the volume of plastic waste. Biodegradable plastics also pose

less risk to wildlife. Traditional plastics can cause severe harm to animals that ingest or become entangled in plastic debris. In contrast, when biodegradable options break down, they are less likely to remain in the environment for extended periods, reducing the risk to ecosystems. Despite their potential benefits, biodegradable plastics are not a panacea for plastic pollution. One of the significant challenges is the misconception that all biodegradable plastics will degrade in any environment. Another challenge is the competition for agricultural resources. The production of biodegradable plastics from crops can lead to land-use changes, potentially impacting food supply and contributing to deforestation. This raises ethical questions about prioritizing plastic production over food security and biodiversity. Moreover, the infrastructure for composting biodegradable plastics is limited in many regions. Without proper disposal methods, these materials may end up in landfills or incinerators, negating their environmental advantages. The future of biodegradable plastics lies in research and innovation. Scientists are exploring new bio-based materials and production methods to create more efficient and effective biodegradable options. One area of focus is the development of hybrid plastics that combine traditional and biodegradable materials, potentially enhancing their performance while retaining environmental benefits.

CONCLUSION

The development of biodegradable plastics represents a significant step toward addressing the global plastic pollution crisis. While they offer promising environmental benefits, challenges remain in their production, disposal, and public perception. To harness the full potential of biodegradable plastics, ongoing research, improved waste management infrastructure, and consumer education are essential. By navigating these complexities, we can move closer to a more sustainable future, reducing our reliance on traditional plastics and protecting our planet for generations to come.

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