MICROBIAL DEGRDATION OF PLASTICS- A REVIEW

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ABSTRACT

Plastic waste is causing an increasing environmental catastrophe that calls for creative and long-lasting solutions. The intricate and widespread nature of plastic contamination is beyond the scope of conventional recycling techniques. In order to improve resource efficiency and waste reduction, this review investigates the possibility of microbial degradation as an environmentally acceptable process. Although bioplastics are frequently more expensive than conventional plastics, they have various advantages, including environmental benefits and sustainability. It does this by tying in with the ideas of a circular economy. First review examines the types of plastics, chemical formula, and their applications. This study further examines several biodegradable plastics such as polylactic acid (PLA), polyhydroxyalkanoates (PHAs), and starch-based polymers. To guarantee environmental integrity and customer trust, certification requirements are explored. The review looks into enzymatic degradation mechanisms, focusing on the functions of hydrolytic enzymes (e.g., esterases, lipases) and oxidative enzymes (e.g., peroxidases), as well as the importance of microbial consortia and synergistic enzyme activities. Emerging biotechnological methods, such as enzyme engineering and metagenomic screening, are investigated for their potential to identify novel plastic-degrading enzymes. To optimize degradation efficiency, factors influencing enzymatic degradation, such as substrate qualities, environmental factors are examined. Advanced analytical techniques, including as mass spectrometry, thermal analysis, and non-destructive imaging, are evaluated for their efficacy in characterizing degradation products and visualizing degradation processes. The review presents on the use of enzymatic degradation in various industries. It also discusses the potential of these technologies to facilitate closed-loop recycling systems, enzymatic upcycling and drive the transition towards a circular economy. Finally, the paper discusses obstacles associated with scaling up enzymatic degradation technologies.

Key words: Enzymatic degradation, Biodegradable plastics, Plastic waste management, Incineration. Landfilling, Recycling

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