

The Role of Indigenous Microorganisms in Enhancing The Breakdown of Eco-Friendly Packaging in Malaysia

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Structured Abstract

Background: The plastic waste that keeps increasing over time remains a major environmental problem in Malaysia. Synthetic plastic accumulates in landfills and natural ecosystem due to its non-degradable nature, posing long-term threats towards biodiversity and human health. Traditional waste management methods such as landfills and incineration are no longer sufficient to address the non-degradable nature of plastic waste. Thus, a sustainable alternative, eco-friendly packaging, was introduced. This type of packaging is often made from biodegradable materials like cellulose. However, the role of indigenous microorganisms in enhancing the breakdown of such packaging remains poorly understood. This study reviews the biodegradation process with a focus on native microbial strains that can break down cellulose-based eco-friendly packaging, specifically within Malaysia's environment.

Methods: This study involved a comprehensive literature review and analysis focusing on microbial strains and environmental factors that influence cellulose biodegradation. It explored the enzymatic systems of native microorganisms, including bacteria and fungi found in Malaysia's soil and landfill environments. The study also identified the knowledge gaps related to microbial metabolic pathways and the effect of environmental conditions such as temperature, pH, moisture, and nutrient levels.

Results: Findings indicate that indigenous microbial groups such as *Actinobacteria*, *Proteobacteria*, *Firmicutes*, *Bacteroidetes*, and fungi from *Ascomycota* and *Basidiomycota* exhibit enzymatic capabilities to degrade cellulose. These organisms utilize enzymes like endoglucanases, exoglucanases, and β -glucosidases to break down complex polymers into non-toxic by-products such as glucose, CO₂, water. Environmental conditions significantly impact degradation efficiency. The study also identifies key knowledge gaps in microbial strain specificity and real-world environmental simulation.

Conclusion: In conclusion, this study highlights the potential of indigenous microorganisms in accelerating the degradation of cellulose-based eco-friendly packaging. It emphasizes the need for further research to isolate effective microbial strains and test their efficiency under real environmental conditions. The findings support sustainable waste management practices in Malaysia, aligning with global sustainability goals and contributing to a cleaner, healthier ecosystem.

Keywords: Indigenous microorganisms, biodegradation, eco-friendly packaging, cellulose, Malaysia

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