

Evaluating The Role of Eco-Packaging in Achieving Carbon Neutrality: Malaysian Perspective

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Structured Abstract

Background: As global temperatures continue to rise due to excessive carbon dioxide (CO₂) emissions and other greenhouse gases (GHGs), the urgency for industries to achieve carbon neutrality becomes more pronounced. One sector experiencing growing transformation is the packaging industry, where sustainable materials are being developed to replace conventional plastics—especially single-use variants. Malaysia, currently the highest carbon emitter in Southeast Asia, has pledged to achieve carbon neutrality by 2050, thereby intensifying the need for innovative and eco-conscious strategies. It is highlighted that Malaysia also need to play important role in converting the usage of conventional plastic to eco-packaging.

Methods: This study critically evaluates the role of eco-packaging in supporting Malaysia's carbon neutrality goals through Life Cycle Assessment (LCA) and Material Flow Analysis (MFA). The materials analyzed include polylactic acid (PLA), polyhydroxyalkanoates (PHA), and sugarcane bagasse. These were compared against traditional fossil-based plastics to assess cradle-to-grave environmental performance, including emissions, resource usage, and end-of-life (EOL) scenarios such as composting, incineration, and landfill. In addition, Malaysia's government initiative on achieving carbon neutrality especially in packaging industry also being evaluate by existing policy and public participation.

Results: The findings highlight significant variability in environmental impacts among the selected eco-packaging materials. PLA and PHA generally perform better in GHG emissions under composting conditions, while sugarcane bagasse shows promise in biodegradability and renewability. However, performance is highly dependent on production methods and available waste infrastructure. Nationally, Malaysia has introduced several initiatives such as the Malaysia Plastics Sustainability Roadmap 2021–2030 and public awareness campaigns, yet challenges like infrastructure limitations, low recycling rates, and inconsistent consumer behavior hinder wide adoption.

Conclusion: Eco-packaging presents a promising pathway toward reducing Malaysia's carbon footprint, but its effectiveness relies on integrated policies, improved waste management systems, and stronger stakeholder engagement. Addressing these gaps is essential to ensure that eco-packaging solutions contribute meaningfully to national carbon neutrality targets.

Keywords: Eco-packaging, Carbon Neutrality, Life Cycle Assessment (LCA), Malaysia, Biodegradable Plastics

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