A Systematic Review on the Biodegradability, Environmental Compatibility, and End-of-Life Management Options for Polylactic Acid (PLA) Polymers

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Abstract: The Philippines is a major contributor to global plastic waste, generating 2.7 million tons of plastic waste annually, 20% of which ends up in the country's waterways. Bioplastics, which are made from renewable biomass, have been developed as a potential solution to this problem. However, the perception that bioplastics are inherently better and more environmentally-appropriate may lead to irresponsible disposal practices and their accumulation in the environment without proper decomposition. Thus, this study aimed to: (a) verify the biodegradability of polylactic acid (PLA) bioplastics, (b) evaluate their environmental compatibility with soil, and (c) identify the most appropriate end-of-life management strategy specific to PLA bioplastics. This study conducted a systematic review of 27 studies published between 2013 and 2023. The study found that PLA bioplastics exhibited inconsistent biodegradability under anaerobic conditions but higher and more consistent biodegradability in aerobic conditions, particularly in high-temperature aerobic settings. Furthermore, the study also discovered that certain earthworm species can biodegrade PLA, but its microplastics have a negative impact on soil pH level and plant growth. Therefore, beyond composting, mechanical recycling was found to be the most sustainable end-of-life management strategy for PLA bioplastics.

Keywords: bioplastics; biodegradation; waste management; end-of-life strategies; environmental compability