Polyhydroxyalkanoate Production by Marine Bacteria Using Agro Waste as Carbon Feedstocks and Its Characterisation

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Abstract:

Plastic pollution is a major environmental concern, with global plastic production surpassing 400 million tonnes annually. Conventional plastics resist degradation, harming ecosystems and wildlife. Polyhydroxyalkanoates (PHAs), biodegradable polymers derived from bacteria produced using excess carbon and limited nutrients, offer a sustainable alternative. Agricultural residues like banana peels, sugarcane bagasse, rice husk, and pineapple peels typically discarded, can serve as carbon sources for PHA production. Marine bacteria, recognized for their unique metabolic capabilities, were screened for PHA synthesis. In this study, seven isolates with isolated from Pulau Bidong. Staphylococcus hominis was identified as the most promising. The optimal pre-culture of S.hominis for PHA synthesis was identified at eighteen hours during the mid-log phase. The study aims to produce PHAs, particularly polyhydroxybutyrate (PHB), by using chemically pretreated and acid-hydrolysed agro waste as optimised carbon sources. Further optimization of the carbon-to-nitrogen (C/N) ratio and incubation time was conducted to enhanced PHA yield. Characterization of the biopolymer was performed using gas chromatography (GC), Fourier-transform infrared spectroscopy (FTIR), nuclear magnetic resonance (NMR), and differential scanning calorimetry (DSC). This study also provides new insights into harnessing marine resources and transforming agro-waste into biodegradable plastics, offering an innovative approach to mitigating plastic pollution and promoting environmental sustainability.