Institute of Chemical Engineering

Study of Biosynthesis and Biodegradation by Microorganisms from Plastic-Contaminated Soil of Polyhydroxybutyrate Based Composites

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Authors:	Agnieszka Gąszczak, Elżbieta Szczyrba, et al.
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The selection of carbon sources and the biosynthesis of polyhydroxybutyrate (PHB) by the Azotobacter vinelandii N-15 strain using renewable raw materials were investigated. Among the tested substrates (starch, sucrose, molasses, bran), molasses as the carbon source yielded the highest PHB production. The maximum polymer yield (26% of dry biomass) was achieved at a molasses concentration of 40 g/L. PHB formation was confirmed via thin-layer chromatography, gas chromatography and Fourier transform infrared spectroscopy. Composite films based on PHB, polylactic acid (PLA), and their blends were fabricated using the solvent casting. The biodegradation of these films was studied with bacteria isolated from plastic-contaminated soil. These bacteria utilized the biopolymers as their sole carbon source, with the biodegradation process lasting three months. Structural and chemical changes in the films were analyzed using FTIR spectroscopy, differential scanning calorimetry, and thermogravimetry. Among the microorganisms used to study the biodegradation of PHB, PLA, and their blends, Streptomyces sp. K2 and Streptomyces sp. K4 exhibited the highest biodegradation efficiency. PHB-containing films demonstrated significant advantages over other biodegradable polymers, as they degrade under aerobic conditions via enzymatic hydrolysis using microbial depolymerases.

Metryczka

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