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Utilization of Organic Wastes for the Production of Bacterial Polyhydroxyalkanoates

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Abstract

Due to their incapability to degrade, synthetic plastics can no longer be used forever and have become a global problem. Disposable plastics that are biodegradable and biocompatible and have comparable properties to traditional plastics are replacing conventional plastics. The current study was focused on using cost-effective carbon sources, such as industrial and organic wastes. Four bacterial species were used with the different carbon sources such as potato and banana peel extract (0.5%, 1.0%, 1.5%, 2.0%, 2.5%), corn and dairy industry effluent (2.0%, 4.0%, 6.0%, 8.0%, 10.0%) for PHA production. With potato peels, *Alcaligenes* sp., *B. subtilis*, *B. cereus*, and *P. aeruginosa* yielded 91%, 91%, 93%, and 63% PHA. *Alcaligenes* sp., *B. subtilis*, *B. cereus*, and *P. aeruginosa* produced 95%, 93%, 91%, and 92% of their respective growth rates with banana peels extract. When *Alcaligenes* sp., *B. subtilis*, and *B. cereus* were tested on cheese whey, the results were best at 10% concentration, producing 94%, 98%, and 98% PHA, respectively. Using 2%, 4%, and 8% cheese whey, *P. aeruginosa* yielded 97% PHA. As a result, the maximum PHA yield in effluent from the dairy industry was achieved after 24 to 48 hours of incubation. The isolated biopolymers were analysed by FTIR, revealing that the extracted powder is PHA and PHB. FTIR spectra of obtained PHA powder showed absorption bands at 3375.09 cm^{-1}, 3251.92 cm^{-1}, 2923.63 cm^{-1}, 2922.39 cm^{-1}, 2853.38 cm^{-1}, 2852.42 cm^{-1}, 1801 cm^{-1}, 1743.08 cm^{-1}, 1742.51 cm^{-1}, 1644.59 cm^{-1}, 1633 cm^{-1}, 1462.79cm^{-1}, 1462.54 cm^{-1}, 1460.53 cm^{-1}, 1461.80 cm^{-1}, and the rest of the peaks were lying in the region between 1100 cm^{-1} and 600 cm^{-1}.

Key Words: *Biopolymers, Biodegradable polymers, Polyhydroxyalkanoates, Polyhydroxybutyrate, Organic wastes*