Optimization of Biodegradable Plastic, PHA Production on Bagasse

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Polyhydroxyalkanoates (PHAs) are macromolecules synthesized and accumulated by bacteria as their energy and carbon reserves. PHA molecules extracted from bacterial cells in pure form or altered in various ways can be used to replace petrochemical-based plastics. This has gained much attention because of the biodegradability of PHA under natural environmental conditions. However, PHA-based bioplastics production is found to be more expensive at present than petrochemical-based plastics. Therefore, this work aimed at isolating high-potential PHA-producing marine bacteria and optimizing PHA production on the agro-residue bagasse as the carbon source to reduce the production cost. Using marine bacterial strains reduces the risk of contamination during the PHA production process and thereby brings medium sterilization cost and the total cost of production further down. Water samples collected from Dondra Fisheries Harbor, Southern Sri Lanka were screened for PHA-producing bacteria using PHA-specific Sudan Black B staining. Four isolates were found to produce PHA. Morphological and biochemical characterization of the isolates revealed that they belonged to the genus *Vibrio*. The isolates were cugetltured in a liquid medium containing sugarcane bagasse as the sole carbon source and incubated at different conditions (at the initial pH of 6.5, 7, 7.5, and 8, at the temperatures of 30 °C and 37 °C) for up to 96 hours to figure out the best conditions to obtain higher yields of PHA. All the tests were carried out in triplicates. PHA was extracted from the samples drowned at the end of the incubation and the percentage of PHA accumulated was determined on the dry weight basis (weight of PHA/Dry weight of cells). All the four isolates produced the highest PHA percentage (17.24%, 20.54%, 23.87%, 29.88%) at pH 7, temperature 37 °C in 48 hours of incubation. The study suggests that the above conditions can be used to maximize PHA production of these marine bacterial isolates on sugarcane bagasse and thereby reduce the production cost.

Keywords: Bioplastic, PHA, Polyhydroxyalkanoates