Sustainable Bioplastic Manufacturing: Unleashing Microbial Metabolites using Agricultural Wastes

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ABSTRACT

Background: Plastic waste has become a global crisis due to its non-biodegradable nature and improper waste management. Bioplastics, on the other hand, are biodegradable and have attracted significant interest in recent years as a potential alternative to petroleum-based plastics. Bioplastics produced from bacteria are a type of biodegradable plastic made from microbial fermentation. Agricultural waste is a promising source of carbon for microbial bioplastic production because it is abundant, cheap, and renewable. The use of bioplastics can help to reduce the environmental impact of plastic waste and promote sustainable practices (Guliani et al., 2023 and Ali et al., 2022).

Aim and objective: Due to their rapid degradability under natural environmental conditions, bioplastics are selected as alternatives of petrochemical plastics. The objective of this work was to isolate bacteria potentially producing bioplastics and to evaluate the production of polyhydroxybutyrate (PHB) using agricultural waste as carbon sources (Hidalgo et al., 2024).

Methodology: In the present study Soil samples were collected from a plastic waste dump site, and bacterial strains were isolated. A total of 10 bacterial strains were isolated, out of which four were confirmed to produce bioplastic. The most promising strain was identified as *Bacillus* AB03. Screening for bioplastic production was carried out using Sudan-black staining.

Results and Discussion: The optimal pH, temperature and time course for the maximum production of PHB from *Bacillus* AB03 were 7.0, 35◦C and 72 hours respectively. *Bacillus* AB03 was found to produce 3.11gm, 3.08 gm and 25.26 gm polyhydroxybutyrate when fed on sugar cane bagasse, waste paper and rose petals respectively. The extracted polymer was characterized by Fourier transform infrared (FTIR) which confirmed the structure of the polymer as polyhydroxybutyrate (PHB) (Loh et al., 2023 & Kapoor et al., 2023).

Conclusion: In conclusion, this study demonstrates the potential of converting agricultural waste into biodegradable plastics like polyhydroxybutyrate (PHB) through microbial fermentation, offering a sustainable solution to plastic pollution.

Keywords: Bioplastic; Microbial; Polyhydroxybutyrate; Agricultural waste.

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