Accelerated Biochemical Depolymerization of Polyethylene Terephthalate (PET) Using Bacterial Consortium and UV Pretreatment Over Six Weeks

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Global production of plastics has grown significantly since the 1950s, with its waste accumulating in the ocean, shorelines, soil, wildlife and human digestive tracts. After plastics are used, they are generally disposed of in three ways: they can be recycled and reprocessed into secondary material; discarded into the landfill; or incinerated through destructive thermal treatment, which can release carcinogenic chemicals into the atmosphere, harming humans and the environment. This project studied the degradation of UV-treated and untreated polyethylene terephthalate (PET) fibers using a consortium of bacteria found to degrade PET film over 6 weeks. The independent variable was whether the fibers were UV-treated or not. The dependent variable was plastic degradation, quantified by FTIR spectrometer analysis, biofilm formation, and colony-forming units (CFU) per ml. FTIR analysis showed changes in percent transparency in some functional groups, and biofilm formation was observed, both signaling degradation. The original experiment included yeast extract in media. Therefore, a concurrent experiment was conducted to determine if the bacteria could survive with the fibers as their sole carbon source. Additionally, CFU averages were taken from both studies and compared to determine how long the bacteria depended on the yeast. Growth of bacteria with yeast plateaued after 1 week, whereas samples with plastic continued to grow up to 6 weeks, supporting bacterial degradation of the fiber. While the data shows promising results, additional chemical analysis and longer periods in solution can be used to find if this pathway is feasible for commercialization and larger scale impact.

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