

Plastic Technology Innovative Project Proposal report



SUBJECT
PT 306 PLASTIC TECHNOLOGY

Submitted to
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1.Aim

To study the Biological Degradation of Polymers

2.Motivation

Polymers present to modern society show remarkable performance characteristics desired by a wide range of consumers but the fate of polymers in the environment has become a massive management problem. Response to these conditions has elicited an effort to devise innovative strategies for plastic waste management, invention of biodegradable polymers, and education to promote proper disposal using laboratory techniques.

3.Introduction

There is a world-wide research effort to develop biodegradable polymers as a waste management option for polymers in the environment. Biodegradation (i.e., biotic degradation) is a chemical degradation of materials (i.e. polymers) provoked by the action of microorganisms such as bacteria, fungi and algae. The most common definition of a biodegradable polymer is “a degradable polymer wherein the primary degradation mechanism is through the action of metabolism by microorganisms.” Many synthetic polymers, are resistant to chemical and physical degradation are produced and utilized. Increasing amounts of syn-thetic polymers produced result in increasing interest in polymers biodegradation. In recent times many technologies have been developed to effectively control the degradation of polymers, still there exists a lot of scope for improvement.

4.Literature review

In a review paper by [1], discussed the idea of polymers based on natural materials, such as starch. In this review biodegradation processes of aromatic compounds, plastics and polymer blends were described. Moreover, this review consists of information about biodegradable polymers, such as a mixture of synthetic polymers and substances which are easily digestible by microorganisms.

In a study by [2], discussed exposing the polymer samples to a simulated biomass environment. Various parameters including concentration, moisture content (for soil), temperature, pH were explored. Other than that, Analytical methods like respirometry, melt index, gel-permeation chromatography, tensile strength, and thermogravimetric analysis were used to study the relationship between polymer structure and biodegradation properties.

This article [3] discusses about the aspects related to biological degradation of polymers in the environment. The core idea revolves around the polymer substrate properties that are highly important for colonization by microbes. Various polymers and their nature were studied and various conditions under which they degraded.

5.Methodology

In this part we would discuss the entire work plan and processes required for the experimental studies.

1. We plan to take up various conventional polymers like polyethene, polypropylene, polystyrene, PVC, Polyurethane, Polyethylene terephthalate (PET), and lookup for their persistence in the environment when subjected to devised conditions.
2. We aim to measure the performance using visual observations which include weight loss measurements, molar mass and mechanical properties, Carbon-dioxide evolution or consumption and enzymatic degradation followed by standard analytical approaches such as differential scanning calorimetry, thermal gravimetric analysis, FTIR (Fourier Transform Infrared Spectroscopy) and Scanning electron microscopy.
3. We aim to employ analytical techniques to trace out trends of change in weight loss measurements, molar mass and mechanical properties.

6.Possible Outcomes

Through this project we aim to determine the conditions and environmental conditions necessary to cause the biological degradation of polymers. We further aim to find out their persistence time and the by-products in such a scenario. Through the project, we aim to throw light on techniques that could make this process feasible for large scale applications in the waste management industry.

7.Possible Applications

Utilization of this technique in the real realm can help reap the following benefits:

1. Degradation can be useful for recycling/reusing the polymer waste to prevent or reduce environmental pollution.
2. Degradation can also be induced deliberately to assist structure determination.

8.References

- [1][https://www.researchgate.net/publication/230793131_Polymer_Biodegradation_and_Biodegradable_Polymers - a Review](https://www.researchgate.net/publication/230793131_Polymer_Biodegradation_and_Biodegradable_Polymers_-_a_Review)
- [2][https://www.researchgate.net/publication/242119774_Biodegradable_Polymer_Characterization_Laboratory Unit](https://www.researchgate.net/publication/242119774_Biodegradable_Polymer_Characterization_Laboratory_Unit)
- [3]<https://www.intechopen.com/books/plastics-in-the-environment/biological-degradation-of-polymers-in-the-environment>