BIOL-04

Seaweed-Based Bioplastics: A Sustainable Solution to Plastic Pollution

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Plastics have revolutionised modern life, but their environmental impact, from the extraction of fossil fuels to the production, distribution, and disposal of plastics, have raised major global concerns. Seaweed-based bioplastics derived from Phaeophyceae, or brown seaweed, offer a solution as a sustainable alternative to petroleum-based plastics. Brown seaweed is an abundant type of seaweed found along the coasts of Australia. It holds immense promise as it necessitates no fresh water, arable land, or fertilisers for cultivation, all while effectively absorbing substantial amounts of carbon, nitrogen, and phosphorus. This seaweed also exhibits many favourable qualities that render it an excellent alternative to petroleum-based plastic. Its malleability, biodegradability, and hydrophilic nature can be attributed to the presence of alginate in their cell walls. This project assesses the biodegradability of seaweed-based bioplastic to petroleum-based plastic with different enzymes including:

1. Cellulase – breaks down polysaccharides into simple sugars.
2. Lipase – breaks down triglycerides into fatty acids and glycerol.
3. Amylase – breaks down starch into smaller sugars.

Enzymes are biological catalysts that aid in degrading organic compounds such as bioplastics. These enzymes bind to specific regions of the bioplastic's molecular structure, breaking chemical bonds, and ultimately degrading them into simpler organic compounds. The extent of degradation can be assessed by observing changes in weight as well as qualitative observations in appearance and texture. Furthermore, the samples were also subjected to a saline solution of different concentrations (10%, 7.5%, 5%, 2.5%, 0% saline solution) to further assess the degradation. Overall, this project aims to ascertain the extent to which seaweed bioplastics can result in a more environmentally friendly alternative to petroleum-based plastics, addressing the concerns of plastic pollution, resource depletion, and environmental sustainability.

Keywords: Bioplastics, Sustainability, Biodegradability, Cellulase, Lipase, Amylase