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ORIGINAL ARTICLE

Production and characterization of seaweed-based bioplastics incorporated with chitin from ramshorn snails

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Abstract

Petroleum-based plastics have been associated with several environmental issues, including land and water pollution, greenhouse gas emissions, and waste accumulation due to their non-biodegradable properties. Bioplastics derived from renewable natural resources have emerged as an eco-friendly substitute for conventional plastics, leading to a reduced carbon footprint and conservation of non-renewable fossil fuels. Seaweed is an attractive material for bioplastic production due to its abundant polysaccharide content, high biomass, rapid growth rate and suitability for consumption. This work aimed to explore the feasibility of producing seaweed bioplastics, specifically starch and carrageenan from *Kappaphycus alvarezii*, along with chitin extracted from ramshorn snails (*Planorbarius corneus*). The surface morphology of the bioplastics was assessed through scanning electron microscopy (SEM), and their biodegradability was also examined through a soil burial biodegradation test. Starch-based bioplastics incorporated with carrageenan and chitin exhibited a more substantial network structure, rougher surface texture and smaller void sizes with improved mechanical strength and water barrier properties. The bioplastics underwent decomposition, resulting in fragmentation into small pieces (with more than 76% weight loss) or complete degradation through the enzymatic activity of *Acinetobacter* spp. and *Burkholderia cepacia*. Therefore, seaweed-chitin-based bioplastics demonstrate their potential as a sustainable and environmentally friendly alternative to conventional plastics.

Keywords Bioplastics · Seaweed · Chitin · Carrageenan · Biodegradable plastics

Introduction

Conventional synthetic plastics, commonly derived from petroleum, are extensively applied in industry and daily life owing to their excellent formality, durability, cost-effectiveness, and lightweight attributes [1]. However, plastic pollution has become a significant environmental concern due to the poor degradability and low recycling rate of plastics, resulting in adverse impacts on both terrestrial and aquatic ecosystems [2, 3]. Globally, approximately 8.3

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