

Development of a Starch-Based Biopolymer Composite Film Reinforced with Chitosan and Seaweed Extract for Sustainable Instant Noodle Packaging

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Abstract

Single-use plastic packaging from instant noodles is one of the major contributors to plastic pollution since it is only used once and takes centuries to degrade. To solve this issue, an edible and biodegradable packaging material was developed using cassava starch as the main component. Starch-based films are eco-friendly and safe to consume, but on their own they are often too weak and allow moisture to pass through easily. To improve these properties, chitosan and seaweed extract were added as natural reinforcements. The objectives of this study were to investigate whether cassava starch, chitosan, and seaweed powder can be developed into an edible and biodegradable bioplastic film that could replace instant noodle packaging, and to formulate a film using cassava starch, chitosan, seaweed powder, glycerin, vinegar, and water, and evaluate its strength, flexibility, dissolving time, and water resistance. The results showed that the composite film with chitosan and seaweed had a dissolving time of 2 min 43 s compared to 1 min 05 s for starch-only films, water resistance of 5 min 34 s compared to 1 min 39 s, and tensile strength up to 4000g compared to only 800 g without reinforcements. These findings highlight that the edible bioplastic film is not only safe for direct food contact but also stronger, more flexible, and more resistant to water, making it highly suitable for instant noodle packaging. This study shows the potential of combining cassava starch, chitosan, and seaweed extract to create a sustainable, eco-friendly alternative that reduces plastic waste while supporting food safety and human health.

Keywords: Biopolymer, Starch, Chitosan, Seaweed