Enhancing the shelf life of strawberry packaging using agriculture waste fibre-reinforced biocomposite film

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Abstract: Strawberries are a widely consumed fruit known for their various health benefits, including vitamins, antioxidants, and dietary fiber [1]. However, strawberries are highly perishable and susceptible to spoilage, which limits their shelf life, particularly when stored at room temperature. This limited shelf life poses challenges in ensuring the availability of fresh and high-quality strawberries to consumers [2]. One promising solution to extend strawberries' shelf life is using active biocomposite films in their packaging. In this study, an antimicrobial fibre-reinforced biocomposite was fabricated using rice husk fibre varied from 10% to 50 % in the starch matrix to enhance the properties of the packaging film [3]. Benzal konium chloride (BKC) was incorporated (0.05% to 0.20%) into the film to enable active properties. Rice husk fiber was derived from rice husks, recognized as one of the most abundant forms of agricultural waste. Reinforcing of rice husk fibre has significantly enhanced the physio-mechanical properties of the active film. It was found that with an increment of rice husk fibre content, hydrophobicity (contact angle increased from 31° to 58°), thermal stability (322 °C), and water barrier properties (water solubility 41 % to 26 %) have significantly improved. The developed biocomposite films were biodegradable in nature under compositing conditions within 30 days. Incorporation of BKC enables the antimicrobial properties in the biocomposite film. The fabricated biocomposite films exhibit a zone of inhibition against Gram +ve bacteria (S. aureus and B. subtilis) as well as Gram -ve bacteria (E. coli and K. pneumoniae). Strawberries were packed in three different packaging: package A was made of developed active packaging, Package B was made of LDPE plastic, and Package C was kept open. Each package contained pairs of strawberries, with Packages A and B tightly sealed. Parameters such as texture, color, appearance, and microbial growth were considered in the shelf-life analysis. In this analysis, on the fifth day, microbial growth became noticeable on the surface of strawberries stored in open packaging (package C), and by the seventh day, similar growth was observed in packaging made of LDPE (package B). In contrast, the antimicrobial packaging developed in this study exhibited no signs of microbial growth for an extended period exceeding 11 days (package A). These results underscore the significant extension of the strawberry's shelf life facilitated by the antimicrobial packaging. This innovative film created a microenvironment within the strawberry packaging. This fabricated antimicrobial biocomposite is an eco-friendly packaging film that may reduce the food wastage and environmental impact of packaging materials by utilizing agricultural waste.

Keywords: *natural fibre, biocomposite, active food packaging, shelf life.*

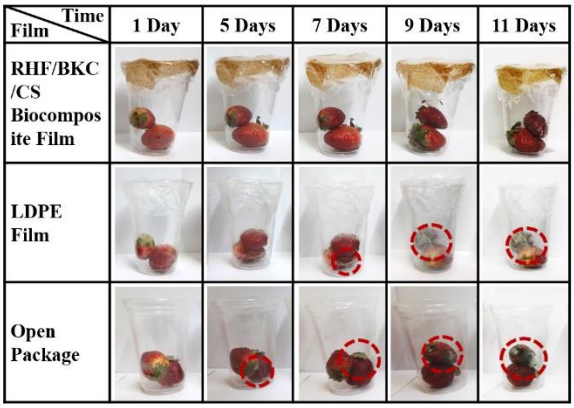

Figure 1 Shelf-life analysis of strawberries packaged in (a) active biocomposite packaging, (b) synthetic packaging (c) open

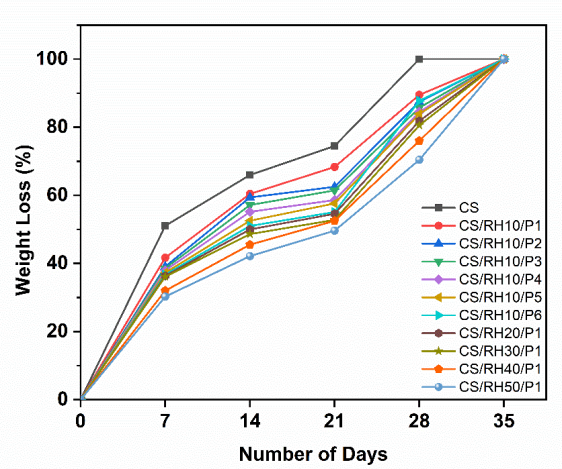

Figure 2 Biodegradation of developed rice husk fibre reinforced biocomposite film.

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