Development of Biodegradable Shock-Absorbing Egg Trays from Grass Jelly Waste and Durian Fiber Coated with Chitosan for Salmonella Inhibition

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ABSTRACT

Conventional plastic egg trays contribute to the accumulation of non-biodegradable plastic waste, resulting in long-term environmental concerns. At the same time, agricultural by-products such as grass jelly waste and durian fibers are generated in large quantities but remain underutilized. Transforming these waste materials into value-added products offers an environmentally friendly alternative to conventional egg packaging.

This project aims to reduce the use of plastic packaging and increase the value of agricultural waste materials by utilizing grass jelly waste and durian fibers as the primary materials for developing shock-absorbing egg trays. The trays are coated with chitosan solution, which possesses antibacterial properties and enhances the mechanical strength of the material. The mechanical properties and antibacterial activity of the developed egg trays were evaluated and compared with those of a commercial recycled pulp egg tray.

The mechanical evaluation showed that the chitosan-coated bio-based egg tray had a maximum load capacity of 25.80 ± 1.10 kg (253.10 ± 10.79 N), compared with 28.50 ± 1.20 kg (279.58 ± 11.77 N) for the commercial recycled pulp tray and 22.40 ± 0.95 kg (219.74 ± 9.32 N) for the uncoated bio-based egg tray. The water absorption rate of the chitosan-coated bio-based egg tray was 48.6 ± 1.8%, compared with 85.4 ± 2.1% for the commercial recycled pulp egg tray. The antimicrobial test showed that the uncoated egg tray had a bacterial count of 1.5×10^5 CFU/cm², while the chitosan-coated tray had a bacterial count of $1.4 \times 10^5 \pm 0.3 \times 10^5$ CFU/cm² after incubation. Therefore, egg trays developed from grass jelly waste and durian fibers coated with chitosan have the potential to serve as an alternative environmentally friendly packaging material that can reduce plastic waste while enhancing food safety.

Keywords: Grass jelly waste/ Durian fiber/ Chitosan/ Egg tray/ Shock-absorbing packaging/ *Salmonella* spp. inhibition