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Physico-Mechanical of Chitosan Biodegradable Film Incorporated with Virgin Coconut Oil

Muhammad Haziq Muhamad Hisham[a], So'bah Ahmad[a*]

Structured Abstract

Background: Consumers and food makers desire innovative, eco-friendly packaging that provides added benefits, such as antibacterial safeguards. This initiative facilitates the shift towards the use of biodegradable materials, effectively addressing the problem of plastic waste. Virgin coconut oil, which is rich in antibacterial and antioxidant properties, appears to be an optimal choice. However, using it into chitosan films poses challenges. The oil's hydrophobicity may result in the formation of a separate layer, which might potentially impair its integrity and impede its ability to undergo biodegradation. Chitosan films, despite their natural composition, may demonstrate a comparatively lower rate of biodegradation in comparison to other biopolymers. These barriers may hinder the widespread adoption of this technology as a sustainable solution. This study aims to bridge the gap by evaluating the physical, mechanical, and antimicrobial properties of chitosan films that have been enriched with virgin coconut oil.

Methods: The research used four chitosan films: one without any virgin coconut oil (VCO) and three with progressively higher concentrations of VCO (0.1%, 0.3%, and 0.5%). Their physical and mechanical qualities were assessed using measures of thickness, tensile strength, colour, water absorption, and solubility. The films were evaluated for their antibacterial properties as packaging materials by disc diffusion experiments. The results were validated by statistical analysis using one-way ANOVA.

Results: Adding VCO thickened chitosan films from 0.35mm to 0.39mm but reduce the tensile strength from 0.008MPa to 0.003MPa. Films darkened, with a significant decrease in L* value (46.51 to 34.46) indicating reduced overall brightness. Additionally, a* values increased with decreasing VCO, revealing a shift towards green hues, while b* values climbed with increasing VCO, suggesting a stronger yellow colour. Despite these colour changes and the strength compromise, water resistance improved remarkably. Water absorption dropped from 72% to 40.7%, and swelling reduced from 24.1% to 3.1%. Notably, antibacterial activity remained unaffected across all VCO concentrations.

Conclusion: In conclusion, the chitosan film including 0.5% virgin coconut oil is considered the optimal choice owing to its substantial thickness and exceptional water repellency, rendering it acceptable for food packing.

Keywords: Chitosan, Virgin Coconut Oil, Biodegradable Film, Physical properties, Antimicrobial properties

*Correspondence: sobah@uitm.edu.my

[a] School of Industrial Technology, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia