Junior Science Communications
Faculty of Applied Sciences, UiTM Shah Alam
https://journal.uitm.edu.my/ojs/index.php/JSC

E-ISSN 2637-0689
Vol 41 2024

Colloquium on Applied Sciences 2024
19-21 January 2024, Faculty of Applied Sciences, UiTM Shah Alam, Malaysia

Effect of Natural Beta Carotene on Physicochemical Characteristics of Chitosan Film

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Structured Abstract

Background: Packaging plays a crucial role in protecting products and ensuring food safety. However, the widespread use of non-biodegradable plastic packaging has contributed to pollution and societal issues. Edible films offer an eco-friendly alternative, enhancing both food aesthetics and safety. Chitosan, especially when combined with beta-carotene, shows promise as an environmentally friendly packaging material. This study uses chitosan film with beta-carotene, a natural colorant, as a substitute for synthetic dye-based packaging, aiming to assess its impact on the film's physicochemical properties

Methods: The film was created using a casting procedure with chitosan, glycerol, beeswax, and beta carotene. The chitosan film had varying amounts of beta carotene incorporation, specifically 20% (CSBC20), 60% (CSBC60), and 80% (CSBC80).

Results: The results of the study indicated that films formulated with beta-carotene exhibited no significant differences ($p>0.05$) in terms of thickness and water solubility. Notably, the formulation containing 80% beta-carotene demonstrated a significant enhancement ($p<0.05$) in opacity (2.738), color attributes (L*: 38.90, a*: 2.70, b*: 9.07), and exhibited the lowest crystallinity (7.55%) compared to films without beta-carotene and those with 20% and 60% beta-carotene formulations. Scanning electron microscopy (SEM) revealed that the surface morphology of films with 80% beta-carotene formulation (CSBC80) was smoother and more even in comparison to films without beta-carotene (CSBC0). Under extreme pH conditions (pH < 4 and pH > 10), a decrease in the color intensity of the films was observed. The results from attenuated total reflectance (ATR) spectra suggested strong interactions between chitosan and beta-carotene, particularly evident at the wavenumber 1032.31±0.37 cm^{-1} corresponding to C-O stretching vibration. The studies of SEM and XRD revealed that chitosan and beta carotene were compatible to a certain degree in this blend system.

Conclusion: In conclusion, the findings of this study suggest that the incorporation of beta-carotene leads to an enhancement in the physicochemical properties of chitosan film. Consequently, the formulation with 80% beta-carotene incorporation is recommended as the optimal choice for producing chitosan film.

Keywords: Edible film, Beta Carotene, Chitosan

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