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Effect of Emulsifiers on Chitosan-Alginate-Beeswax Edible Coatings and Films for Cherry Tomato (*Solanum Lycopersicum* var. *Cerasiforme*) Quality

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Structured Abstract

Background: The effect of emulsifiers incorporated into chitosan-alginate-beeswax edible films and coatings was studied based on the mechanical, optical and barrier properties. The development of functional edible films for food packaging applications depends on the successful dispersion of hydrophobic compounds inside hydrophilic matrices, which is facilitated by emulsifiers.

Methods: The chitosan-alginate-beeswax films were prepared with three emulsifiers, Tween 80 (T80), Tween 20 (T20), and Span 80 (S80) at concentrations of 1%, 2%, and 3%. Mechanical properties such as tensile strength, elongation at break, water content, swelling degree, water solubility, and water vapor permeability (WVP) were evaluated. Fourier Transform Infrared (FTIR) spectroscopy confirmed interactions at 3% emulsifier concentration, and Scanning Electron Microscopy (SEM) analyzed S80 films at 1-3%. Storage analysis, including weight loss, firmness, pH, and total soluble solids (TSS) of edible coatings with 3% emulsifiers, was conducted over 15 days.

Results: The physicochemical properties of chitosan-alginate-beeswax films were significantly influenced by the type and concentration of emulsifiers. All three emulsifiers exhibited the highest TS (3.43-5.24 MPa) and EAB (14.02-18.18%) at 1% concentration. Span 80 (S80) had the lowest opacity (2.00-1.12) and water vapor permeability (2.98-2.24) with increasing concentration. Water content and swelling degree decreased with higher concentrations, while water solubility of S80 declined (64.32-51.77%) and increased for Tween 80 (T80) and Tween 20 (T20) (66.49-84.24%). FTIR confirmed emulsifier integration, and SEM showed S80 films smoothing with higher concentrations (1-3%). S80 had the lowest weight loss (7.58%), highest firmness (34.44 N), and highest pH (4.77). T80 had the smallest increase (5.40%) in total soluble solids (TSS), while the control (CAB) had the highest (6.80%) increase in TSS.

Conclusion: In conclusion, the best performance in terms of mechanical stability and moisture barrier qualities, Span 80 can be added to chitosan-alginate-beeswax films at a concentration of 3%. This indicates that film and coating incorporated with S80 serves as exceptional excelling in mainly barrier properties which allow for cherry tomatoes to maintain an overall quality in terms of weight loss and firmness.

Keywords: Emulsifiers, Edible Film, Chitosan-Alginate-Beeswax, Barrier Modification, Coating

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