

## Active Packaging Films Based on Chitosan Incorporated with Thyme Essential Oil and Cross Linkers and Its Effect on the Quality Shelf Life of Food

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**Abstract :** Packaging has a vital role as it contains and protects the food that moves from the supply chain to the consumer. Chitosan (CH) has been extensively used in food packaging applications among the plentiful natural macromolecules, including all the polysaccharide class, owing to its easy film-forming capacity, biodegradability, better oxygen and water vapour barrier ability and good mechanical strength. Compared to synthetic films, the films produced from chitosan present poor barrier and mechanical properties. To overcome its deficient qualities, a number of modification procedures are required to enhance the mechanical and physical properties. Various additives such as plasticizers (e.g., glycerol and sorbitol), crosslinkers (e.g., CaCl<sub>2</sub>, ZnO), fillers (nanoclay), and antimicrobial agents (e.g. thyme essential oil) have been used to improve the mechanical, thermal, morphological, antimicrobial properties and emulsifying agents for the stability and elasticity of chitosan-based biodegradable films. Different novel biocomposite films based on chitosan incorporated with thyme essential oil and different additives (ZnO, CaCl<sub>2</sub>, NC, and PEG) were successfully prepared and used as packaging material for carrot candy. The chitosan film incorporated with crosslinkers was capable of forming a protective barrier on the surface of the candy to maintain moisture content, water activity, TSS, total sugars, and titratable acidity. ZnO +PEG +NC +CaCl<sub>2</sub> remarkably promotes a synergistic effect on the barrier properties of the film. The combined use of ZnO +PEG +NC +CaCl<sub>2</sub> in CH-TO films was more effective in preventing the moisture gain in candies. The lowest a<sub>w</sub> (0.624) was also observed for the candies stored in treatment. The color values L\*, a\*, b\* of the candies were also retained in the film containing all the additives during the 6th month of storage. The value for L\*, a\*, and b\* observed for T was 42.72, 9.89, and 10.84, respectively. The candies packaged in film retained TSS and acidity. The packaging film significantly p≤0.05 conserved sensory qualities and inhibited microbial activity during storage. Carrot candy was found microbiologically safe for human consumption even after six months of storage in all the packaging materials.

**Keywords :** chitosan, biodegradable films, antimicrobial activity, thyme essential oil, crosslinkers

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