

ABSTRACT

The increasing volume of conventional plastic waste, which is difficult to degrade, poses an urgent environmental challenge that must be addressed. One promising approach to mitigate this issue is the development of alternative, more environmentally friendly materials, such as bioplastic films derived from natural and *biodegradable* components. This study aims to formulate and characterize a multicomponent bioplastic film composed of chitosan, poly(vinyl alcohol) (PVA), and sodium alginate. The film was modified by adding sodium tripolyphosphate (STPP) as a crosslinking agent for chitosan, and calcium acetate produced from the reaction between calcium oxide (CaO) derived from eggshells and acetic acid as a crosslinker for alginate. Glycerol was added as a *plasticizer*. The synthesis was carried out using a layer-by-layer method to obtain a more stable and integrated film structure. Film characterization included tests for thickness, weight, tensile strength, elongation at break, water absorption, contact angle, moisture content, and porosity. Structural analyses were performed using Fourier Transform Infrared (FTIR) spectroscopy and X-Ray Diffraction (XRD). The study investigated the effect of varying calcium acetate concentrations (0, 2.5, 5.0, 7.5, and 10 mg) on the physical and mechanical properties of the films. The results showed that the addition of calcium acetate improved mechanical strength, reduced water absorption and moisture content, increased contact angle, and decreased film porosity. FTIR spectra indicated the formation of electrostatic and ionic interactions between the amine groups of chitosan, the carboxylate groups of alginate, and the polyanionic ions from STPP and Ca²⁺. Meanwhile, XRD analysis revealed enhanced crystallinity and the formation of semi-crystalline regions due to ionic crosslinking. An application test was conducted using fresh tomatoes stored at room temperature for 49 days. Observations indicated that the bioplastic film effectively preserved the tomatoes' visual appearance compared to the control, demonstrating its packaging performance. Therefore, this multicomponent bioplastic film shows strong potential for further development as an effective and eco-friendly *biodegradable* food packaging material.

Keywords : alginate, bioplastic, crosslinker, chitosan, PVA