

Effect of various plasticizers and concentration on the physical, thermal, mechanical, and structural properties of cassava-starch-based films

ABSTRACT

The present study investigated the effects of plasticizers (fructose, urea, tri-ethylene glycol, and triethanolamine) with different concentrations on the physical, thermal, and mechanical properties of cassava-starch-based films. The film samples were prepared using casting methods. The moisture content, water solubility, and water absorption of the films increased with increasing plasticizer content. Fructose-plasticized films show excellent water resistance compared to other plasticizers. Film plasticized with 30% fructose showed the highest density (1.74 g/cm^3), but the lowest water content (10.96%) and water absorption (110%). Films containing fructose presented smooth surfaces without pores. The glass transition temperatures of the plasticized film also decreased with increased plasticizer content, irrespective of the plasticizer type. The relative crystallinity decreased with increasing plasticizer content. The film plasticized by 30% fructose presented higher relative crystallinity (0.31). The increase of plasticizer concentration resulted in a decrease of tensile strength, but increased elongation at break of the film samples. Film plasticized with 30% fructose showed the highest tensile strength (4.7 MPa) and tensile modulus (69 MPa). Thus, fructose was the most efficient plasticizer agent among the various plasticizers used in this study. High contents of plasticizer resulted in changes in the properties of the films. Overall, it can be concluded that the plasticizer type and concentration significantly influence the properties of cassava-starch-based film.

Keyword: Cassava film; Mechanical properties; Physical properties; Plasticizers; Thermal properties