Development of sweet potato starch-based thin films to produce biodegradable packaging materials

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Abstract

Starch-based bio plastics have been widely used because of their renewability, sustainability, and cost-effectiveness. However, due to the excessive water absorption and poor mechanical characteristics, native starch films fail to fulfil process or product requirements. In the present study, it was developed as an acid hydrolysed, sweet potato starch based thin film as a biodegradable packaging material, and the effect of the acid hydrolysis process on the structural, thermal, and chemical properties of the thin film have been investigated. The sweet potato starch was extracted, and acid hydrolysed using HCl for 30, 60 and 90 minutes. Fourier Transform Infrared spectroscopy (FTIR) results show that acid hydrolysis causes a decrease in water absorption and the optimal acid hydrolysis time was taken as 60 minutes. Films were prepared through the gelatinization, using Glycerine as the plasticizer. The thin films were characterized through FTIR, X-ray diffraction (XRD), and Thermogravimetric analysis (TGA) tests. According to the FTIR test, it can be concluded that moisture absorbance decreases upon the acid hydrolysis. According to the water absorption test, the acid hydrolysed sweet potato starch films have low water absorption than the native sweet potato starch thin film, respectively 26.39% and 46.88% after 24 hours. The acid hydrolysed film increases the tensile strength to 5.72 MPa and reduces the elongation. It can be concluded that, due to lower water absorption of acid hydrolysed starch based thin films; they have increased tensile strength and durability. Further, these films can be introduced as non-toxic, low cost and biodegradable material for packaging applications.

Keywords: *Acid hydrolysis, Bioplastic, Biodegradable packaging, Sweet potato starch, Water absorption*