Effect of glycerol plasticizer loading on the physical, mechanical, thermal, and barrier properties of arrowroot (Maranta arundinacea) starch biopolymers

ABSTRACT

This research was set out to explore the development of arrowroot starch (AS) films using glycerol (G) as plasticizer at the ratio of 15, 30, and 45% (w/w, starch basis) using solution casting technique. The developed films were analyzed in terms of physical, structural, mechanical, thermal, environmental, and barrier properties. The incorporation of glycerol to AS film-making solution reduced the brittleness and fragility of films. An increment in glycerol concentration caused an increment in film thickness, moisture content, and solubility in water, whereas density and water absorption were reduced. The tensile strength and modulus of G-plasticized AS films were reduced significantly from 9.34 to 1.95 MPa and 620.79 to 36.08 MPa, respectively, while elongation at break was enhanced from 2.41 to 57.33%. FTIR analysis revealed that intermolecular hydrogen bonding occurred between glycerol and AS in plasticized films compared to control films. The G-plasticized films showed higher thermal stability than control films. The cross-sectional micrographs revealed that the films containing 45% glycerol concentration had higher homogeneity than 15% and 30%. Water vapour permeability of plasticized films increased by an increase in glycerol concentrations. The findings of this research provide insights into the development of bio-degradable food packaging.