Mechanical and thermal properties of starch films reinforced with microcellulose fibres

ABSTRCT

The use of starch as food packaging material has drawn increased attention due to its biodegradability, availability, and cost-effective. In order to improve the limitations of starch films in terms of mechanical and thermal resistance, the bio-composite concept was employed. In this work, microcellulose fibres (MCF) were incorporated into thermoplastic starch (TPS) films at various loading contents (1, 5, and 10 wt%). The MCF was prepared via NaOH/urea dissolution, followed by ultrasonication. The obtained MCF was characterized by FTIR and FESEM, and the size was in the range of 2 to 15 μm in diameter and 150 μm to hundreds of micrometres in length. The effect of the MCF addition on mechanical and thermal properties of starch films was investigated using universal testing machine and thermogravimetric analysis (TGA), respectively. Due to similar polysaccharide structures and good interfacial interactions, the tensile strength (TS) and the elongation at break (EAB) of the films increased with the addition of MCF, but only at 1 wt% loading content. Meanwhile, there was no significant improvement in the degradation temperature of the composite films, due to the presence of hemicellulose compounds that interrupted the crystallinity of the MCF. The results indicated that the MCF has the potential to be utilized as reinforcement in bio-based polymers for food packaging applications.

Keyword: Food packaging; NaOH/urea; Mechanical; Microcellulose fibres; TGA.