Effect of sugar palm nanofibrillated cellulose concentrations on morphological, mechanical and physical properties of biodegradable films based on agro-waste sugar palm (*Arenga pinnata (Wurmb.) Merr*) starch

ABSTRACT

Sugar palm (*Arenga pinnata*) fibres and starches are considered as agro-industrial residue in the agricultural industry. This paper aims to investigate the effect of different concentrations (0–1.0 wt%) of sugar palm nanofibrillated cellulose (SPNFCs) reinforced sugar palm starch (SPS) on morphological, mechanical and physical properties of the bionanocomposites film. The SPNFCs, having a diameter of 5.5 ± 0.99 nm and length of several micrometres, were prepared from sugar palm fibres via a high-pressure homogenisation process. FESEM investigation of casting solution displayed good miscibility between SPS and SPNFCs. The FTIR analysis revealed good compatibility between the SPS and SPNFCs, and there were existence of intermolecular hydrogen bonds between them. The SPS/sPNFCs with 1.0 wt% had undergone an increment in both the tensile strength and Young's modulus when compared with the SPS film, from 4.80 MPa to 10.68 MPa and 53.97 MPa to 121.26 MPa, respectively. The enhancement in water barrier resistance was led by reinforcing SPNFCs into the matrix, which resulted in bionanocomposites. The properties of bionanocomposites will be enhanced for short-life applications, such as recyclable container and plastic packaging through the incorporation of SPNFCs within the SPS bionanocomposites.

Keyword: Sugar palm starch; Nanofibrillated cellulose; Nanocomposites; Mechanical properties; High-pressure Homogenisation; Agro-waste