

Analysis and physicochemical properties of cellulose nanowhiskers from Pennisetum purpureum via different acid hydrolysis reaction time

ABSTRACT

Cellulose nanowhisiker (NWC) was extracted by hydrolysing Pennisetum purpureum (PP) fibres with acid and alkali. They were subjected to different periods of acid hydrolysis; 30, 45, and 60 min. NWC morphology and physicochemical properties were characterised by transmission electron microscopy (TEM), field emission scanning electron microscopy (FESEM), atomic force microscopy (AFM), particle size analyser, Fourier transform infrared (FTIR) spectroscopy, X-ray diffraction (XRD), and thermogravimetric analysis. NWC3, which underwent the longest hydrolysis time, showed the smallest width and length, under TEM. All samples presented a needle-like shape under TEM and AFM; uneven lengths and irregular shapes under FESEM; and a broad range of distribution, with the particle size analyser. All samples exhibited a good crystallinity index (CrI)—72.0 to 74.6%. The highest CrI% corresponded to 60 min of acid hydrolysis. Thermogravimetric analysis showed thermal stability between 310.72 °C and 336.28 °C. Thus, cellulose nanowhisiker from PP fibres, have high potential as bio-nanocomposites.

Keyword: Pennisetum purpureum; Cellulose nanowhiskers; Acid hydrolysis; Thermal stability