

# Structural, morphological and thermal properties of cellulose nanofibers from napier fiber (*Pennisetum purpureum*)

## Abstract

The purpose of the study is to investigate the utilisation of Napier fiber (*Pennisetum purpureum*) as a source for the fabrication of cellulose nanofibers (CNF). In this study, cellulose nanofibers (CNF) from Napier fiber were isolated via ball-milling assisted by acid hydrolysis. Acid hydrolysis with different molarities (1.0, 3.8 and 5.6 M) was performed efficiently facilitate cellulose fiber size reduction. The resulting CNFs were characterised through Fourier-transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), thermogravimetric analysis (TGA), particle size analyser (PSA), field-emission scanning electron microscopy (FESEM), atomic force microscopy (AFM), and transmission electron microscopy (TEM). The FTIR results demonstrated that there were no obvious changes observed between the spectra of the CNFs with different molarities of acid hydrolysis. With 5.6 M acid hydrolysis, the XRD analysis displayed the highest degree of CNF crystallinity at 70.67%. In a thermal analysis by TGA and DTG, cellulose nanofiber with 5.6 M acid hydrolysis tended to produce cellulose nanofibers with higher thermal stability. As evidenced by the structural morphologies, a fibrous network nanostructure was obtained under TEM and AFM analysis, while a compact structure was observed under FESEM analysis. In conclusion, the isolated CNFs from Napier-derived cellulose are expected to yield potential to be used as a suitable source for nanocomposite production in various applications, including pharmaceutical, food packaging and biomedical fields.

## Keywords

Cellulose nanofiber; Crystallinity; Morphology properties; Napier fiber; Thermal properties