

Effect of hydrolysis treatment on cellulose nanowhiskers from oil palm (*Elaeis guineensis*) fronds: morphology, chemical, crystallinity, and thermal characteristics

ABSTRACT

Oil palm fronds biomass was used as a source for isolation of cellulose nanowhiskers (CNW), and its subsequent characterization was done. Non-cellulosic components such as lignin, hemicellulose, and pectin were removed from the biomass by chemimechanical alkaline hydrogen peroxide method followed by sulphuric acid hydrolysis having different time duration of hydrolysis. Apart from the progressive reduction in peaks characteristic of hemicellulose and lignin dissolution, FTIR spectroscopy analysis showed that there were no significant variations in peak positions, signifying that the hydrolysis did not affect the chemical structure of CNW. FESEM showed that there was gradual reduction in the aggregated structure of fiber due to bleaching. Nanoscale structure of CNW was revealed by TEM. XRD analysis revealed that the natural structure of cellulose I polymorph was maintained irrespective of the hydrolysis time. High thermal stability and aspect ratio of the extracted CNW demonstrated its suitability as a reinforcement material in nanocomposites.

Keyword: Oil palm frond; Cellulose nanowhiskers; Thermal analysis; FESEM; XRD; FTIR; TEM