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Synergistic Effects of Double Oxidation on the Extraction and Characterization of Crystalline Nanocellulose from Rattan Waste and Kenaf Fiber

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Abstract
This study investigates the potential of rattan fiber, a by-product of the furniture industry, as a feedstock for nanocellulose production. Cellulose nanocrystals (CNC) were extracted using a double oxidation process that combined bleaching with ammonium persulfate (APS) treatment. The effects of APS reaction time, pre-treatment with and without bleaching, on the crystallinity and morphology of CNC were evaluated. Additionally, the feasibility of applying this extraction method to agro-industrial kenaf fiber was assessed. Fourier transform infrared (FTIR) spectroscopic confirmed the removal of lignin and hemicellulose, while the X-ray diffraction (XRD) analysis showed a gradual increase in the crystallinity index (CrI) of CNCs extracted from rattan and kenaf, achieving 73.40% and 72.40, respectively. Scanning Electron Microscope (SEM) revealed fiber disintegration and Transmission Electron Microscopy (TEM) confirmed the spherical CNCs of rattan and kenaf having a diameter of 61.51 ± 6.46 nm and 31.76 ± 6.34 nm, respectively. Atomic force microscopy (AFM) further indicated smaller CNC sizes in kenaf compared to rattan. These findings suggest that rattan fiber is a promising renewable feedstock for producing nanocellulose, with potential application in various industries.

Author Keywords
AFM; FTIR; Kenaf; Nanocellulose; Oxidation; Rattan

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