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Extraction and Characterization of Cellulose Nanocrystals from Tea Leaves Waste Fiber

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Abstract. The aim was to extract cellulose nanocrystals (CNC) from tea leaves waste fibers (TLWF) by treated the fibers with alkali and then followed by bleached treatment before hydrolyzed with concentrated sulfuric acid (H_2SO_4). The materials obtained after each stage of chemical treatments was carefully characterized and its chemical composition was studied. The structure analysis was examined by Fourier transform infrared (FTIR) spectroscopy, water holding capacity (WHC) and X-ray diffraction (XRD) analysis. From FTIR analysis, two peaks at 1716 cm^{-1} (C=O stretching) and 1207 cm^{-1} (C-O stretching) slowly disappeared in the spectra after the alkali and bleaching treatments indicated that hemicellulose and lignin were almost entirely removed from the fiber. The morphology and dimensions of the fibers and acid-released CNC were investigated by scanning electron microscope (SEM) and transmission electron microscope (TEM). The extraction of CNC increased the surface roughness and the crystallinity index of fiber from 41.46% to 83.14%. Morphological characterization from TEM clearly showed the appearance of rod-shaped CNCs. The promising results prove that TLWF is a principal source of natural materials which can produce CNC.

Keywords: tea leaves waste fibers, acid hydrolysis, cellulose nanocrystals