Nanocellulose Synthesis and Characterization from Bread Fruit (*Artocarpus altilis*) Leaves

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ABSTRACT

The following study focuses on the synthesis of nanocrystals from bread fruit leaves for the first time. Nanocellulose is a renewable, biodegradable material valued for its mechanical strength and biodegradability. This study focuses on extracting nanocellulose from the leaves of *Artocarpus altilis* (breadfruit), an abundant but underutilized lignocellulosic biomass. Breadfruit leaves are rich in cellulose, has a low economic value, has a slow environmental degradation and has a tendency to retain water conditions favorable for mosquito breeding. Their use in nanocellulose production adds value while addressing environmental and public health concerns. The extraction process involved dewaxing with a 1:1 ethanol–water mixture, alkaline treatment using 4% sodium hydroxide, bleaching with 5% sodium hypochlorite, and acid hydrolysis with 64% sulfuric acid at 45 °C for 45 min and 90 min. The percentage yield of nanocellulose is 20.43%. The resulting nanocellulose was characterized using Fourier Transform Infrared Spectroscopy (FTIR) and Scanning Electron Microscopy (SEM). FTIR confirms removal of lignin and hemicellulose. Scanning Electron Microscopy (SEM) analysis revealed spherical nanocrystals with an average diameter of 315 ± 37 nm after treatment at 45 °C for 45 min, and 368 ± 72 nm after 90 min at 45 °C. These findings demonstrate that breadfruit leaves can serve as a sustainable and cost-effective raw material for nanocellulose production, contributing to waste valorization and the development of eco-friendly materials.