Preparation of Surface-Modified Nanocellulose from Sugarcane Bagasse by Concurrent Oxalic Acid-Catalyzed Reactions

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ABSTRACT

Concurrent oxalic acid-catalyzed reactions, including cellulose hydrolysis and esterification of the hydrolyzed cellulose, were performed to prepare the nanocellulose from sugarcane bagasse. Hydrothermal hydrolysis at 100ºC in a microwave digester was performed using oxalic acid at the concentrations of 0, 5, 10, and 30%w/v as catalysts. The hydrolyzed cellulose so obtained was characterized by several techniques, including FTIR, TGA, XRD, and viscosity measurements. The concentration of oxalic acid slightly affects the thermal stability, crystallinity, and molecular weight of the hydrolyzed cellulose. Apart from acting as a catalyst, oxalic acid at 10 or 30%w/v could react with OH groups of the cellulose by esterification. After mechanical homogenization, microfibrils of hydrolyzed cellulose were separated. The SEM results show a web-like network structure of the mixture of cellulose fibrils (CNFs) and fibril aggregates—indicating the nanofiber form of nanocellulose. The dispersion stability of the suspensions in deionized water and organic solvents (dimethyl formamide (DMF) and acetone) increases with increasing concentration of oxalic acid for hydrolysis—as seen in the presence of oxalate groups on the surfaces of CNFs. Thus, the microwave-assisted oxalic acid hydrolysis, followed by the homogenization of cellulose provides a potential method for the production of surface-modified CNFs.

Keywords: Oxalic acid-catalyzed reactions, Nanocellulose, Nanofibers