Journal of King Saud University - Engineering Sciences • *Open Access* • Volume 35, Issue 1, Pages 24 - 31 • January 2023

Document type
Article • *Green Open Access*

Source type
Journal

ISSN
10183639

DOI
10.1016/j.jksues.2021.03.003

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Entangled cellulose nanofibers produced from sugarcane bagasse via alkaline treatment, mild acid hydrolysis assisted with ultrasonication

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Abstract

Author keywords

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Abstract

Agriculture waste such as sugarcane bagasse (SCB) is composed mostly of cellulose, a very versatile natural biopolymer with well-established applications in many industries. The purpose of this study was to use combination treatment methods which include alkaline treatment and mild acid hydrolysis assisted with ultrasonication to extract cellulose nanofibers (CNFs) from sugarcane bagasse. Initially, the SCB fibers were treated with sodium hydroxide and aqueous hydrogen peroxide, a bleaching agent, before being subjected to mild acid hydrolysis, followed by ultrasonication at 70 % amplitude to defibrillate and disperse the fibers. The study focused on acid hydrolysis using mild sulfuric acid to the

alkaline-treated cellulose fibers extracted from SCB. The FESEM images of isolated CNFs exhibited a diameter in the range of 20–30 nm and a length of up to several micrometers. This observation suggests that the combined treatment methods are highly effective in isolating CNFs from plant biomass. Moreover, XRD analysis reveals the presence of peaks at 2θ of 15.2° and 22°, indicating cellulose type I with a crystallinity of 42 %. Meanwhile, the FTIR spectra prove that individual CNF was successfully isolated due to the removal of non-cellulosic constituents. This result verifies that amorphous portions such as lignin and hemicellulose were completely removed. CNFs with long entangled network fibrils were successfully extracted from SCB through the combination of alkaline treatment and mild acid hydrolysis assisted with ultrasonication. The CNFs are expected to have high strength and aspect ratio that can be used as reinforced material in manufacturing nanocomposites. © 2021 The Authors

Author keywords

Acid hydrolysis; Alkaline treatment; Cellulose nanofibers; Sugarcane bagasse; Ultrasonication

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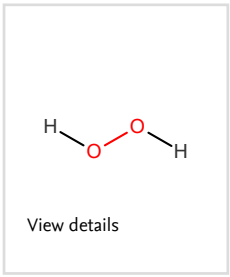

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