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1 of 1

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Volume 14, Issue 3, 4 May 2017, Pages 437-449

Sonosynthesis of Microcellulose from Kenaf Fiber: Optimization of Process Parameters (Article)

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Abstract

Green composites using cellulose fibers as a reinforcement material provide a sustainable and renewable alternative to petroleum-based polymers. However, controlling the usage of chemicals and processing parameters to extract the cellulose could be sometimes difficult. Therefore, this study aims to optimize the conditions for extracting the microcellulose from kenaf fibers using central composite design (CCD), a statistical tool in design of experiments. Three factors and three levels were chosen for carrying out the analysis. The design was based on sodium hydroxide (NaOH) dosage, Sodium Chlorite (NaClO₂) dosage and sonication time as independent variables, while dependent variables were the fiber size and degradation point. Later, size responses were fitted using quadratic polynomial model and degradation responses using 2-factor interaction model (2FI). The R² values of 0.89 and 0.83 were obtained for the quadratic and the 2FI model, respectively. Further, surface morphology, thermal analysis, Fourier transform infrared (FTIR) spectroscopy and X-Ray diffraction (XRD) were also used for design validation. Optimal parameters for microcellulose extraction were found to be 0.15 g of NaOH at first stage, 4.6 mL of NaClO₂ at second stage, and 10 min of sonication during third stage. © 2017 Taylor & Francis.

Reaxys Database Information

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Author keywords

Chemical treatment extraction microcellulose optimization sonication thermal stability

Indexed keywords

Engineering controlled terms:

Cellulose Chemical stability Design of experiments Extraction Fibers
Fourier transform infrared spectroscopy Hemp Optimization Sodium Sonication Statistical mechanics
Thermoanalysis Thermodynamic stability X ray diffraction

Compendex keywords

Central composite designs Chemical treatments Independent variables microcellulose
Optimization of process parameters Processing parameters Quadratic polynomial Reinforcement materials

Engineering main heading:

Kenaf fibers

ISSN: 15440478


Source Type: Journal

Original language: English

DOI: 10.1080/15440478.2016.1212767

Document Type: Article

Publisher: Taylor and Francis Inc.

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