

Nanocellulose Aerogel from Biomass Waste for Water Purification

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Abstract

Purpose of the experiment: Energy cane is a perennial, non-food, low input crop popular for bioethanol production. The biomass waste (bagasse) consists up to 42% cellulose and is often underutilized. Limited research has been conducted on value added product potential of cellulose nanofibrils (CNF) utilizing energy cane. Hydrophobic CNF aerogels can selectively remove oil and other impurities from water with limited environmental impact. The purpose of this project was to synthesize aerogels from bagasse as a value-added greener product for growers involved in the biofuel industry with a potential application in water purification.

Procedure: Finely ground and dried bagasse and cane fibers were treated with sodium hydroxide, DMSO and TEMPO. After washing with deionized water, filtered and dried samples were homogenized and subjected to ultrasonication. The resulting cellulose nanofibrils aqueous suspension was freeze dried to obtain cellulose nanofibrillar aerogels. High magnification images were used to study the structure of the aerogels while crude oil absorption capacity was calculated using a modified ASTM F726-06 test method.

Data: High magnification images of aerogels were taken showing porous network of cellulose nanofibrillar aerogels. Crude oil absorption capacity of aerogels ranged from 2-14-fold of their weight for the tested oils.

Conclusions:

The high magnification microscopic images verified the successful formation of cellulose nanofibrillar aerogels from bagasse and cane fibers. Higher crude oil absorption capacity of the aerogels offers significant application in purifying water contaminated with oil. Further experimentation is required for consistency with method and surface modification for making the aerogel hydrophobic and oleophilic. This technique has potential to be applied to different biomass wastes and lead to greener oil clean-up methods.

Keywords: Biomass waste, nanocellulose, aerogel, green material, water purification