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Extraction of Cellulose from Lignocellulosic Biomass: Dependence of Rheological Properties on the Concentration, Ionic Strength and pH of Cellulose

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ABSTRACT

Lignocellulosic biomass refers to the agricultural wastes, forest remains, industrial food wastes and domestic wastes. These biomasses are a rich source of cellulose, hemicellulose and lignin. Therefore, a cascade utilization of lignocellulosic biomass is very important to attain a sustainable development. The objective of this study is to extract cellulose from lignocellulosic biomass using alkali hydrolysis and bleaching process. The obtained cellulose was characterized by using SEM, FTIR and XRD. The rheological characteristics of the cellulose suspension such as flow and dynamic properties were conducted at different pH, ionic strength and concentrations of cellulose. The FTIR spectroscopy confirmed the presence of cellulose in the obtained extract. The SEM images and EDX spectra demonstrated the microstructure of cellulose fibrils and their major elemental components as carbon and oxygen, respectively. The crystallinity of cellulose was found to be 69.42% from XRD analysis. From the rheological analysis, it was observed that cellulose suspension exhibited shear thinning property for the entire range of pH, ionic strength and concentrations. The creep and thixotropic recovery test revealed that upon removal of stress, there is the recovery of strain and viscosity up to a certain extent, which is a characteristic property of viscoelastic material. The study of rheological characteristics of cellulose will be helpful for its extensive application as a thickening agent in ice-creams, soups and sauces, emulsion stabilizers, developing hydrogel and oleogel, food packaging material, 3D printing inks, etc. Thus, the aim of this study was to utilize the biomass to extract cellulose and understand its properties that can be further helpful for developing products.

Keywords: Lignocellulosic biomass, Cellulose, Alkali hydrolysis, Rheology, Crystallinity

