

2nd World Congress on Petrochemistry and Chemical Engineering

October 27-29, 2014 Embassy Suites Las Vegas, USA

Structural insights of Indian origin biomass from various sources during pretreatment

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Lignocellulosic biomass has shown potential as a source of renewable energy via biochemical conversion of cellulose and hemi-cellulose to ethanol. Characterization of biomass in terms of cellulose, hemicellulose and lignin is of prime importance for structural insight of biomass feed for the purpose of pretreatment optimization and subsequent sachharification. Solid State Nuclear Magnetic Resonance (SSNMR) spectroscopy is useful technique for deeper understanding of structural details of complex organic materials like polymers and other solid material. Many lignocellulosic raw materials as Populus, Switchgrass, Wheat straw, Rice straw etc. have been evaluated for their bioconversion to ethanol. India has very large amount of biomass from various sources, where not much work has been reported on biomass conversion process.

In the present study, chemical composition of Indian origin biomass from various sources subjected to pretreatment under different conditions, from moderate to severe, has been investigated. Cross Polarization Magic Angle Spinning NMR has been used for studying changes occurring in the supramolecular structure of biomass, especially cellulose. Different cellulose allomorphs (I_{α} , I_{β} , $I_{\alpha+\beta}$ and paracrystalline) have been directionally estimated and increase in the crystallinity of pretreated biomass pretreatment. Hemicellulose degradation process leading to increase in the cellulose and lignin ratio, is clearly observed. It has also been demonstrated that the changes contributing to this remarkable improvement occur as consequence of hemicellulose removal and lignin disruption. Non-etherified lignin is in higher amount in pretreated biomass due to cleavage of β -O-4 linkages. The results presented herewith show the efficiency of the pretreatment procedure for improving the enzymatic digestibility of biomass and provide understanding of the pretreatment action mechanism. This study will contribute to a fundamental understanding of basic constituents of biomass and how pretreatment can impact the important constituents of biomass. Results on characterization of biomass from various Indigenous sources after pre-treatment have been discussed.

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