PREPARATION AND SEPARATION OF CELLULOSE ACETATE FROM SAWDUST BY USING IONIC LIQUID

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Abstract: Higher price and dependency on fossil fuel has forced us to find alternative resources including renewable energy like biomass. Ethanol has received great attention since it produces less air pollution compared to fossil fuels and can be prepared from natural resources, including crops such as corn and sugar. However, cultivating ethanol from edible crops by fermentation has caused a price hike in the market of corn. Therefore, biomass like switch grass has been studied intensively as a resource for ethanol. Sawdust with cellulose and hemicellulose (about 40 %) has high potential to be an alternative resource for ethanol production. We have studied Acid-Catalyzed hydrolysis of cellulose and hemicellulose and been able to produce ethanol from the hydrolyzate. However its economical aspect is not great since the cost of production is high due to the usage of a great amount of sulfuric acid. This leads us to the project of developing an effective way to separate cellulosic material from sawdust. Recent studies show that ionic liquid is able to dissolve crystalline cellulose and allows us to manipulate its phase. This study is about the direct reaction of cellulose and hemicellulose found in sawdust in a heterogeneous ionic liquid solution. Ionic liquid, 1-n-butyl-3-methylimidazolium chloride ([C₄mim]⁺Cl⁻), was prepared and purified for the solvent. Acetic anhydride and acetic acid were used for formation of cellulose acetate. Sawdust was mixed with reactants in ionic liquid and was heated at 80°C for several hours. Undissolved brown solid is separated by centrifuge. The homogeneous solution then is quenched with cold water, and it produced a dark brown solid. It was analyzed by an Infra Red Spectrophotometer. The spectrum shows new absorption at 1740 cm⁻¹ representing a carbonyl of acetyl group and the O-H absorption at 3400 cm⁻¹ was reduced significantly. It proves the O-H group has been converted into an acetyl group. The dark brown solid, cellulose acetate, was reacted with sodium hydroxide in ionic liquid again. The powder separated shows the strong O-H absorption at 3400 cm⁻¹ and reduced a carbonyl peak. The yield after separation of cellulose acetate was less than 15% based on 40% content of cellulose in sawdust.

Keywords: Sawdust, cellulose, cellulose acetate, ionic liquid, and IR spectrum.

Acknowledgements: This research was supported by DOE Grant DEFG3605G085002/07-08-001 via DOE-MRT/SBIR, NSF STARGE (NSF-HRD-0411559) program and the program of Army High Performance Computing for the Design of Novel Materials.