

PRODUCTION OF SOLUBLE AND HYDROLYZABLE CARBOHYDRATES FROM BIOMASS USING THF/WATER CO-SOLVENT IN THE PRESENCE OF ACID CATALYST

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Non-enzymatic sugar production from lignocellulosic biomass using polar aprotic solvents is drawing increasing attention. In this study, two-step solvent liquefaction of red oak was studied. In the first step, biomass was pretreated at 120°C in 80/20 vol% of THF/water mixture with 20-50 mM sulfuric acid to remove lignin as a THF-soluble by-product and recover the pretreated red oak, rich in polysaccharides. The solubilized lignin was easily precipitated out by adding water to the pretreatment liquid. In the second step, the pretreated red oak was further decomposed in a mixture of THF/water (90/10 vol%) with 0.25-1.25 mM sulfuric acid at a higher temperature (e.g., 300°C). The yield of solubilized product was 97 wt% from the pretreated red oak within 2 min of reaction. HPLC analysis indicates that the solubilized product primarily consists of hydrolyzable C₆ and C₅ monosaccharides and oligosaccharides. The yields of C₆ and C₅ monosaccharides were as high as 50 wt% and 56 wt%, respectively, based on cellulose and hemicellulose content in red oak. Future work includes quantification of the hydrolyzable solubilized oligosaccharides. In addition to being an effective solvent for deconstructing biomass, THF can be easily separated from water and the sugars by simple distillation due to its low boiling point (66 °C). Additionally, it would be important to evaluate the performance of other low-boiling polar aprotic solvents for developing the most effective and economically feasible solvent liquefaction process for producing solubilized carbohydrates from biomass.