An Economic Approach to Ionic Liquid Pretreatment and Kudzu (Pueraria montana) Feedstock for Lignocellulosic Biofuel Production

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Current biofuel practices largely rely on primary food crops (presenting a sustainability dilemma). Alternatively, lignocellulosic ethanol has the potential to be sustainable and cost-competitive solution, while proposing an application to unwanted biomass (such as the invasive kudzu). The greatest obstacle to commercialization is the recalcitrant structure of lignocellulose, requiring an additional processing step using harsh acids/or bases (known as Pretreatment) which increases overall production expenditure . Recent ionic liquids have shown to be effective solvents for pretreatment; however, economic obstacles prevent implementation. This study aims to analyze the effects of aqueous solutions of 1-ethyl-3-methylimidazolium diethyl phosphate ([EMIM]DEP) and kudzu's potential as a lignocellulosic feedstock, in hopes of minimizing production costs without sacrificing saccharification abilities. To test this hypothesis, kudzu was used as an experimental feedstock to compare with a feedstock already under investigation (switchgrass). Both feedstocks were subject to varied concentrations of aqueous 1-ethyl-3-methylimidazolium diethyl phosphate, then chemically hydrolyzed. Following depolymerization, reduced sugar yield was evaluated using a colorimetric glucose assay. Results demonstrated that kudzu saccharification was comparable to switchgrass, while the application of 1-ethyl-3-methylimidazolium diethyl phosphate significantly increased overall glucose yields. Most importantly, low concentrations of 1-ethyl-3-methylimidazolium diethyl phosphate produced similar carbohydrate yields as NEAT ILs, thus demonstrating the industrial potential of aqueous ionic solution pretreatment.

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