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Glycerol as an Ionic Liquid Co-Solvent for Pretreatment of Rice Hulls to Enhance Glucose and Xylose Yield

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Abstract:

Rice hulls, a widely-available secondary agricultural residue, can be pretreated with ionic liquids (IL) prior to enzymatic hydrolysis to enhance glucose and xylose yields. The high cost of ILs is a deterrent to commercial deployment at present. ILs 1-ethyl-3-methylimidazolium acetate, 1-ethyl-3-methylimidazolium formate, 1,3-dimethylimidazolium dimethylphosphate, and 1-ethyl-3-methylimidazolium diethylphosphate were investigated for rice hull pretreatment. Effects of diluting ILs with glycerol were investigated for biomass pretreatment efficacy, and for solvent recovery. When diluted with 50% glycerol, rice hulls treated in 1-ethyl-3-methylimidazolium formate was found to give glucose and xylose yields after enzymatic hydrolysis better than rice hulls treated in pure 1-ethyl-3-methylimidazolium formate. Dilution in glycerol resulted in an increased rate of solvent recovery after pretreatment, as much as six times that when pure 1-ethyl-3-methylimidazolium formate was used. Diluting 1-ethyl-3-methylimidazolium formate with 50% glycerol was found to decrease solvent viscosity at the pretreatment temperature (110 °C) helping explain improved biomass pretreatment.