

Alkaline pretreatment of Mexican pine residues for bioethanol production

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Abstract

The locally sourced residue samples of *Pinus arizonica*, *Pinus cooperi*, and *Pinus durangensis* from the state of Durango in Mexico were analyzed for optimal yield of ethanol production. The samples were mixed at an equal proportion using a particle size of 0.59 mm. Each individual mixture was pretreated with either NaOH or Ca (OH)₂ (at 0.5, 1.0 and 1.5% w/v) for periods of 30, 60, and 90 min at 60, 90, and 120°C. The pretreated blending was subjected to enzymatic hydrolysis for 130 h at 80 rpm and 50°C with an enzymatic load of 25 filter paper units (FPU) and 50 IU β -glucosidase per gramme of cellulose to obtain a maximum yield of reducing sugars (RS) with NaOH subject at 120°C for 90 min. The results show that the hydrolysis yield depends on temperature and alkali concentration particularly (NaOH), which increased from 2.0 to 3.5% w/v. The best yield of glucose (41.33% w/w) was obtained using a pretreatment of 2.5% NaOH for 90 min, 120°C, and a hydrolysis residence time of 130 h. The removal of lignin and hemicellulose acetylation was observed to have influence on the enzymatic digestibility of cellulose. This process could theoretically produce a maximum yield of 90.19% of ethanol / substrate (glucose) and about 80 L of bioethanol per dry ton of woody biomass from pine residues.