Bench scale steam explosion pretreatment of acid impregnated elephant grass biomass and its impacts on biomass composition, structure and hydrolysis

In the present study, an acid mediated steam explosion process was evaluated for pretreatment of elephant grass biomass in a bench scale reactor. Different combinations of $H_2SO_4$ concentration, reaction time and temperature (leading to different values of combined severity factor - CSF) were used for biomass pretreatment, and the impact of the resultant pretreatment conditions on biomass composition, structure and enzymatic hydrolysis was assessed. The optimal pretreatment conditions consisted in performing the steam explosion at 161°C during 11.5min, and using the biomass impregnated with 0.5% $H_2SO_4$ (CSF=1.42). Under these conditions, a pretreated solid containing 52.13% (w/w) cellulose and 31.00% (w/w) lignin was obtained. The modifications in the biomass structure resulting from the different pretreatment conditions were evaluated by scanning electron microscopy, thermogravimetric analysis and nuclear magnetic resonance spectroscopy analysis. Enzymatic hydrolysis of the pretreated material resulted in a cellulose saccharification yield of 55%. These results allow a better understanding about the pretreatment and enzymatic saccharification of elephant grass biomass and also reveal a great potential of this raw material for use in a biorefinery.

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