ABSTRACT

In this study, *Sterculia foetida, Eucalyptus grandis* and garden waste were studied as a possible source for bioethanol production. Two pre-treatment processes i.e. alkaline treatment and alkaline peroxide treatment, assisted by autoclave heating and conventional heating were investigated for *Sterculia foetida, Eucalyptus grandis* and garden waste. In addition to that deep eutectic solvent was also used for *E.grandis*. The structural and chemical changes occurred during pretreatment was observed through FTIR, XRD analysis and DNS assay. The effects of NaOH & H_2O_2 concentration along with temperature on lignin removal efficiency and production of reducing sugar were studied. The result showed that alkaline treatment alone was not significant enough for reduction in lignin content (14-15%) and must be accompanied by peroxide. When treated under autoclave assisted heating, for *S.foetida* a sharp decrease in reaction time (from 3 hours to 45 minutes), peroxide requirement (2-5%) and lignin concentration (80%) were observed. Moreover, in case of autoclave assisted heating less percentage of peroxide was able to remove same amount of lignin compared to that of conventional heating. Upon enzymatic hydrolysis for *S. foetida* the combination of 5%NaOH and 3%H_2O_2 gives best results with glucose concentration of 18.59g/L at substrate conc of 50g/L and enzyme conc of 1.5g/L. The enzymatic hydrolysis kinetics of delignified biomass shows decreased product inhibition with increased substrate concentration under a particular enzyme loading. Dried bark of Eucalyptus grandis (EG) was treated in alkaline (NaOH) and alkaline peroxide (NaOH along with H_2O_2) solution at 60°C (AHP-60), 80°C (AHP-80) and in an autoclave (AAHP). Kinetic parameters of enzymatic hydrolysis and fermentation indicated removal of lignin and easy accessibility of cellulose as crystallinity of the pretreated Eucalyptus grandis increased. The lignin removal was highest (73.20%) for AAHP. Maximum reducing sugar yield of 215.5 mg/g was also obtained from the same pretreatment conditions confirming recalcitrance nature of lignin is the key inhibitory factor for production of reducing sugars. During enzymatic hydrolysis, glucose concentration is observed to be increased over time with the increase in substrate concentration for a particular enzyme loading. EG in upon enzymatic hydrolysis generates highest amount of reducing sugar and yields better ethanol conversion (9.941g/g). The kinetic parameters from hydrolysis and fermentation indicates no inhibition of enzymes by reducing sugar and glucose inhibition.