Process parameter optimization of pretreated pineapple leaves fiber for enhancement of sugar recovery

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ABSTRACT

Pineapple leaves fibers (PALF) is one of the abundant biofibers that have high cellulose content. The complex structure arrangement of PALF that contains a bundle of packed fiber filled with fiber matrix makes it hard to remove lignin and disrupt hemicellulose–lignin complex structure, thus difficult to produce reducing sugar. Dilute sulfuric acid (H_2SO_4), sodium hydroxide (NaOH), and hot water pretreatment were employed in this study to determine the digestibility of PALF prior to enzyme hydrolysis as a pretreatment method. PALF pretreated with 0.5 % (w/v) NaOH gave the highest yield of reducing sugar (11.65 mg/mL) compared to dilute H_2SO_4 (8.11 mg/mL) and hot water pretreatment (6.50 mg/mL). The structural changes of PALF after pretreatments were observed through scanning electron microscopy (SEM) and confirmed the structural modification caused by NaOH pretreatment. The optimization of NaOH pretreatment was further carried out by using Box–Behnken design (BBD) to enhance the yield of reducing sugar from PALF and the parameters considered for the optimization include NaOH concentration (0.5 %–2.5 % (w/v)), temperature (80–100 °C), and pretreatment time (30–90 min). The model developed for the response (reducing sugar yield) indicates that the optimum operating condition is 2.43 % (w/v) of NaOH, 87 °C, and 57.15 min of pretreatment time with 17.26 mg/mL of reducing sugar via enzymatic hydrolysis. This result indicates that the pretreatment condition significantly improved the rate of enzymatic hydrolysis and sugar recovery.

KEYWORDS

Lignocellulosic biomass; Pretreatment; Pineapple leaves fiber; Optimization

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