Microwave-assisted dilute acid pretreatment and enzymatic hydrolysis of sago palm bark

ABSTRACT

Maximizing the amount of monomeric sugar yield from lignocellulosic materials requires an effective pretreatment process and identification of an optimal enzyme loading for cost-effectiveness. In this work, a microwave-diluted sulfuric acid pretreatment was applied prior to enzymatic hydrolysis of sago palm bark (SPB). Characterization of the solid fraction was completed before and after the pretreatment process. Analysis of SPB ash showed a presence of 6.8% silica. There was a 32% reduction in lignin content, an increased crystallinity from 29% to 47%, and clear damage and fragmentation to the surface structure of SPB after the pretreatment. Inhibitors were not detectable in the liquor after the microwave-acid pretreatment. The enzymatic hydrolysis of SPB was employed by adding 6 to 42 FPU/g of cellulase and 50 U/g of β-glucosidase to identify the optimal cellulase loading at fixed β-glucosidase loading. The maximum total monomeric sugar yield and total reducing sugar (using DNS method) at 77 mg/g and 378 mg/g were achieved using 24 FPU/g of cellulose, respectively. Thus, this enzyme loading can be recommended for further microwave-acid pretreatment and enzymatic hydrolysis of SPB.

Keyword: Microwave pretreatment; Sago palm bark; Microwave pretreatment; Enzymatic hydrolysis; Yield; Enzyme loading; Cellulase