

Evaluation of the interactive effect pretreatment parameters via three types of microwave-assisted pretreatment and enzymatic hydrolysis on sugar yield

ABSTRACT

This study aims to evaluate the sugar yield from enzymatic hydrolysis and the interactive effect pretreatment parameters of microwave-assisted pretreatment on glucose and xylose. Three types of microwave-assisted pretreatments of sago palm bark (SPB) were conducted for enzymatic hydrolysis, namely: microwave-sulphuric acid pretreatment (MSA), microwave-sodium hydroxide pretreatment (MSH), and microwave-sodium bicarbonate (MSB). The experimental design was done using a response surface methodology (RSM) and Box–Behenken Design (BBD). The pretreatment parameters ranged from 5–15% solid loading (SL), 5–15 min of exposure time (ET), and 80–800 W of microwave power (MP). The results indicated that the maximum total reducing sugar was 386 mg/g, obtained by MSA pretreatment. The results also illustrated that the higher glucose yield, 44.3 mg/g, was found using MSH pretreatment, while the higher xylose yield, 43.1 mg/g, resulted from MSA pretreatment. The pretreatment parameters MP, ET, and SL showed different patterns of influence on glucose and xylose yield via enzymatic hydrolysis for MSA, MSH, and MSB pretreatments. The analyses of the interactive effect of the pretreatment parameters MP, ET, and SL on the glucose yield from SPB showed that it increased with the high MP and longer ET, but this was limited by low SL values. However, the analysis of the interactive effect of the pretreatment parameters on xylose yields revealed that MP had the most influence on the xylose yield for MSA, MSH, and MSB pretreatments.

Keyword: Microwave-assisted pretreatment; Pretreatment parameters; Enzymatic hydrolysis; Glucose; Xylose