ABSTRACT

PRETREATMENT AND ENZYMATIC HIDROLISIS OPTIMATIONS OF CACAO POD FOR BIOETHANOL PRODUCTION

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Cacao pod - solid waste of cacao plantation - contains high lignocellulose which can be utilized as raw material of bioethanol production. The lignocellulose consisted of 31.25% cellulose, 48.64% hemicellulose, and 20.11% lignin. The cacao pod should be pretreated for degrading its lignin and hydrolyzed its holocellulose into reduced sugar before converting it into bioethanol with *Saccharomyces cerevisiae*.

Objectives of this research were to find out the optimum conditions of pretreatment with NaOH and hydrolysis with cellulase enzyme. Conversion of reduced sugar in to bioethanol was also carried out. Cacao pod was dried, grounded, and then submerged into NaOH solution at concentrations of 0, 0.5, 1.0, and 2.0 M at $121^{o}C$ for 15 and 30 minutes for degrading its lignin. After filtering and drying, 5, 10, 15, and 20% (w/v) cacao pod holocelluloses were hydrolyzed with 0, 10, 20, and 30 FPU celluase enzyme at $50^{o}C$, pH 4.8 for 18 hours. After hydrolyzing, filtrat was taken for measuring its reduced sugar content.

Obtained data were collected, tabulated, and analyzed statistically to determine the optimum condition of pretreatment and the optimum condition of hydrolysis. The optimum condition of pretreatment was submersion cacao pod into 1.59 M NaOH solution at $121^{o}C$ for 30 minutes. This condition yielded lignin decreasing from 14.32% to 0.60%, hemicellulose decreasing from 21.59% to 0.54%, and cellulose increasing from 15.94% to 35.05%. Mean while, the optimum condition of hydrolysis was submersion 10% (w/v) cacao pod holocellulose into 30 FPU cellulase enzyme solution at $50^{o}C$ and pH 4.8 for 18 hours. This condition yielded reduced sugar at a concentration of 2.54 g/L. After fermentation with 10% (v/v) *Saccharomyces cerevisiae* at $30^{o}C$ for 72 hours, the reduced sugar yielded 0.33% (v/v) bioethanol.

Key word: Cacao pod, NaOH pretreatment, cellulase, enzymatic hydrolysis, bioethanol