

PRETREATMENT PELEPAH SALAK DENGAN ALKALI DAN
HIDROLISISNYA MENGGUNAKAN KOMBINASI ENZIM SELULASE
DAN XILANASE DARI *Aspergillus niger* DAN *Trichoderma reesei*
UNTUK MENGHASILKAN GULA

ABSTRAK

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Pemanfaatan pelepah salak sebagai sumber glukosa dilakukan melalui tahapan perlakuan pendahuluan (*pretreatment*) kemudian dilanjutkan dengan proses hidrolisis enzimatis. *Pretreatment* diperlukan agar selulosa dapat diakses oleh enzim secara mudah pada saat hidrolisis. Pengaruh *pretreatment* menggunakan larutan NaOH 8% terhadap pelepah salak dengan variasi ukuran 20 mesh, 30 mesh, dan 50 mesh dikaji pada penelitian ini.

Sampel dengan persentase selulosa tertinggi dipilih untuk digunakan sebagai substrat pada tahapan hidrolisis. Proses hidrolisis enzimatis dilakukan dengan mengkombinasikan enzim kasar dari *Aspergillus niger* FNCC 6114 dan *Trichoderma reesei* FNCC 6012 dengan perbandingan (1:1, 1:2, dan 1:3). Hasil penelitian menunjukkan bahwa semakin kecil ukuran partikel sampel semakin banyak lignin yang terdegradasi selama proses *pretreatment* menggunakan NaOH 8%. Pelepah salak dengan ukuran partikel 50 mesh merupakan sampel dengan persentase lignin terendah sebesar 21,7% diiringi dengan persentase selulosa tertinggi sebesar 59,1%.

Berdasarkan hasil analisis *Scanning Electron Microscopy* (SEM), proses *pretreatment* menggunakan NaOH 8% efektif dalam memutuskan ikatan ester dan ikatan silang antara hemiselulosa, selulosa, dan lignin. Sehingga menghasilkan pemaparan struktur internal dengan porositas serat selulosa pada permukaan menjadi lebih longgar. Kombinasi enzim kasar *Aspergillus niger* FNCC 6114 dan *Trichoderma reesei* FNCC 6012 menghasilkan kadar gula reduksi (glukosa) tertinggi pada rasio An:Tr = 1:3. Pada rasio ini diperoleh konsentrasi glukosa sebesar 69,241 mg/g substrat kering.

Kata Kunci : pelepah salak, *pretreatment* alkali, glukosa, enzim kasar, hidrolisis enzimatis, *Aspergillus niger*, *Trichoderma reesei*

ALKALI PRETREATMENT AND ENZYMATIC HYDROLYSIS OF SALAK
MIDRIB USING COMBINATION OF CELLULASE AND XILANASE
ENZYME FROM *Aspergillus niger* AND *Trichoderma reesei*
TO PRODUCE SUGAR

ABSTRACT

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The use of salak midrib as a source of glucose is carried out through the pretreatment stage and then followed by enzymatic hydrolysis process. Pretreatment is needed so that cellulose can be accessed by enzymes easily during hydrolysis. The effect of pretreatment using 8% NaOH solution on salak midrib with variations in size of particle (20, 30, and 50 mesh) was studied.

The sample with the highest percentage of cellulose was chosen to be used as a substrate at the hydrolysis stage. The enzymatic hydrolysis process was carried out by combining the crude enzyme from *Aspergillus niger* FNCC 6114 and *Trichoderma reesei* FNCC 6012 with a mixture (1:1, 1:2 and 1:3). The results showed that the smaller the particle size, the more lignin was degraded during the pretreatment process using 8% NaOH. Salak midrib with a particle size of 50 mesh is the sample with the lowest percentage of lignin at 21.7% accompanied with the highest percentage of cellulose at 59.1%.

Based on the results of the Scanning Electron Microscopy (SEM) analysis, the pretreatment process using 8% NaOH was effective in breaking the ester bond and cross-link between hemicellulose, cellulose, and lignin. So that it produces exposure to internal structures with porosity of cellulose fibers on the surface to be more loose. The combination of the crude enzyme *Aspergillus niger* FNCC 6114 and *Trichoderma reesei* FNCC 6012 produced the highest reducing sugar (glucose) levels in the ratio 1:3 (An:Tr). At this ratio, the glucose concentration of 69,241 mg / g of dry substrate was obtained.

Keywords: salak midrib, alkali pretreatment, glucose, crude enzyme, enzymatic hydrolysis, *Aspergillus niger*, *Trichoderma reesei*