

PEMANFAATAN LIGNOSELULOSA INTI KENAF (*Hibiscus cannabinus* L.) UNTUK PRODUKSI BIOETANOL DENGAN METODE SIMULTANEOUS SACCHARIFICATION AND FERMENTATION (SSF)

Gian Muhammad Ra'afi
15 / 383283 / PA / 16943

INTISARI

Kenaf merupakan salah satu biomassa lignoselulosa yang dapat dimanfaatkan sebagai bahan baku pembuatan bioetanol. Proses pembuatan bioetanol terdiri atas, tahap perlakuan awal, sakarifikasi, dan fermentasi. Penelitian ini bertujuan untuk mengetahui komposisi lignoselulosa inti kenaf sebelum dan sesudah dilakukannya perlakuan awal alkali *steam explosion* serta mengetahui pengaruh konsentrasi substrat dan enzim pada hasil fermentasi. Pada penelitian ini, rasio kenaf dan larutan NaOH 10% yang dimasukkan ke dalam reaktor *steam explosion* yaitu 1:7 dan 1:9 (b/v), tekanan 4 bar, variasi suhu 140 °C, 150 °C, 160 °C dengan waktu tinggal 30 menit. Pada tahapan sakarifikasi enzimatik dan fermentasi, substrat yang digunakan sebanyak 5%, 7,5%, 10%, dan 20%. Campuran enzim Cellic ®CTec2 dan enzim ®HTec2 dengan rasio 5:1 ditambahkan pada substrat dengan variasi konsentrasi enzim 10, 20, dan 30 FPU/g substrat. Proses fermentasi dilakukan dengan bantuan ragi roti *Saccharomyces cerevisiae* yang dilakukan pada suhu 32 °C 150 rpm selama 72 jam. Konsentrasi glukosa, xilosa, dan etanol diukur dengan HPLC sedangkan kadar lignin diukur dengan Spektrofotometer UV.

Hasil penelitian menunjukkan komposisi lignoselulosa inti kenaf sebelum perlakuan awal yaitu selulosa sebesar 37,77%, hemiselulosa 13,66%, dan lignin 30,65%. Setelah dilakukan perlakuan awal komposisi lignin dan hemiselulosa menurun dan komposisi selulosa meningkat. Sampel biomassa dengan suhu perlakuan awal 160 °C dan rasio biomassa dengan pelarut 1:9 menghasilkan kadar selulosa 87,58%, hemiselulosa 4,94% dan lignin sebesar 7,30%. Saat dilakukan proses sakarifikasi dan fermentasi secara serentak juga dapat dilihat adanya pengaruh jumlah substrat dan konsentrasi enzim yang digunakan. Substart dengan kadar 20% dengan enzim 30 FPU menghasilkan kadar etanol tertinggi sebesar 7,92% (b/b) pada jam ke-48 waktu fermentasi.

Kata kunci: bioetanol, kenaf, perlakuan awal, *simultaneous saccharification and fermentation* (SSF), *steam explosion*

**UTILIZATION OF KENAF (*Hibiscus cannabinus* L.) CORE
LIGNOCELLULOSE FOR BIOETHANOL PRODUCTION BY
SIMULTANEOUS SACCHARIFICATION AND FERMENTATION (SSF)**

Gian Muhammad Ra'afi
15 / 383283 / PA / 16943

ABSTRACT

Kenaf is one of the lignocellulose biomass that can be used as a raw material for bioethanol. The process of making bioethanol consists of the pretreatment, saccharification, and fermentation stages. This study aims to know the composition lignocellulose of kenaf core before and after pretreatment alkaly steam explosion and to determine the effect of the concentration of enzymes on fermented products. In this study, the ratio of kenaf and 10% NaOH solution were put into a steam explosion reactor, namely 1: 7 and 1: 9 (w/v), pressure 4 bar, temperature variation 140 °C, 150 °C, 160 °C with a residence time of 30 minute. At the enzymatic saccharification stage and fermentation, the substrate used is 5%, 7.5%, 10%, and 20%. The mixture Cellic ®CTec2 enzyme and Cellic ®HTec2 enzyme with ratio of 5:1 was added to the substrate with variations in the concentration of enzymes 10, 20, and 30 FPU/g substrate. The fermentation process is carried out with the help of *Saccharomyces cerevisiae* bread yeast carried out at a temperature of 32 °C 150 rpm for 72 hours. The concentration of sugar and ethanol components were measured by HPLC while lignin levels were measured by UV spectrophotometers.

The results showed the composition lignocellulose of kenaf core before the pretreatment of cellulose by 37.77%, hemicellulose 13.66% and lignin 30.65%. After pretreatment the composition ogf lignin and hemicelullose decreased and celullose composition increased. Biomass samples with a pretreatment temperature of 160 °C and biomass ratio with 1: 9 solvents produced 87.58% cellulose, 4.94% hemicellulose and 7.30% lignin. When the saccharification process and fermentation are carried out simultaneously can also be seen the influence of the amount of substrate and the concentration of the enzyme used. Substrates with a concentration of 20% with 30 FPU enzymes produced the highest ethanol content of 7.92% (w/w) in 48 hours fermentation.

Keywords: bioethanol, kenaf, pretreatment, simultaneous saccharification and fermentation (SSF), steam explosion