

## **ABSTRACT**

### **EFFECT OF PREHYDROLYSIS AND INCUBATION PERIOD OF *SIMULTANEOUS SACCHARIFICATION AND FERMENTATION* ON ETHANOL CONCENTRATION FROM EMPTY OIL PALM BUNCHES**

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When producing bioethanol from oil palm empty fruit bunches (EFB) using *simultaneous saccharification and fermentation* (SSF) method, enzymatic hydrolysis runs slowly because SSF incubation occurs at 38°C. To solve the problem, EFB needs to be pre-hydrolyzed at the optimum temperature of cellulase (50°C) prior to SSF. The objectives of this study were to find out the effect of pre-hydrolysis and incubation period of SSF EFB for producing bioethanol on bioethanol concentration as well as the remaining cellulose and reducing sugar concentrations. After drying and milling, EFB was pre-treated with 1.0 M NaOH solution at 121°C for 15 minutes. After filtering the solution, the residue (EFB holo-cellulose) was analysed to determine its cellulose content (as the initial cellulose content). The holocellulose was then prehydrolysed with cellulase at 50°C, pH 4.8, and at 150 rpm for 0 hours (with out pre-hydrolysis) and 24 hours. After prehydrolysis, 1 mL filtrate was taken to determine its reducing sugar

concentration; and the solution was added with cellulose and incubated at 38°C, pH 4.8, and 150 rpm for 24, 48, 72, and 96 hours. After SSF incubation, the solution was centrifuged; the residue was analysed to determine its cellulose content (as final cellulose); and the filtrate was analysed to determine its ethanol and reducing sugar contents as final reducing sugar. The results showed that prehydrolysis for 24 hours resulted in higher ethanol content, lower cellulose content, and higher reducing sugar content than that without prehydrolysis (prehydrolysis for 0 hours). The longer SSF incubation yielded the higher bioethanol content as well as the lower cellulose content the lower reducing sugar. The highest ethanol concentration (0,916% v/v) was obtained from a combination treatment of prehydrolysisfor 24 hours and SSF incubation of 96 hours.

Keywords: bioethanol, oil palm empty bunches, prehydrolysis, SSF.

## **ABSTRAK**

### **PENGARUH PREHIDROLISIS DAN LAMA INKUBASI *SIMULTANEOUS SACCHARIFICATION AND FERMENTATION* TERHADAP KADAR ETANOL DARI TANDAN KOSONG KELAPA SAWIT**

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Proses hidrolisis secara enzimatik pada pembuatan bioetanol secara *simultaneous saccharification and fermentation* (SSF) dari TKKS berjalan lambat karena suhu inkubasi SSF dilakukan pada suhu 38°C. Untuk mempercepat proses hidrolisis tersebut, TKKS perlu diberi perlakuan prehidrolisis pada suhu optimum enzim selulase, yaitu 50°C. Tujuan penelitian ini yaitu untuk mengetahui pengaruh prehidrolisis dan lama inkubasi SSF terhadap kadar bioetanol, kadar selulosa, dan gula reduksi pada pembuatan bioetanol dari tandan kosong kelapa sawit (TKKS). TKKS diberi perlakuan awal dengan cara direndam dalam larutan NaOH 1 M pada suhu 121°C selama 15 menit. Setelah disaring, ampas (holoselulosa) TKKS dianalisis untuk menentukan kadar selulosanya (sebagai kadar selulosa awal). Holoselulosa TKKS kemudian diberi perlakuan prehidrolisis dengan menambahkan enzim selulase pada suhu 50°C, pH 4,8, dan goyangan 150 rpm selama 0 jam dan 24 jam. Setelah proses prehidrolisis tersebut,

filtrat diambil sebanyak 1 ml untuk ditentukan kadar gula reduksi. Setelah prehidrolisis selama 0 jam (tanpa prehidrolisis) dan 24 jam, larutan ditambah *Saccharomyces cerevisiae* sebagai starter dan inkubasi SSF dilakukan pada suhu 38°C, pH 4,8, dan goyangan 150 rpm selama 24, 48, 72, dan 96 jam. Setelah inkubasi, larutan dipusingkan, ampas dianalisis kadar selulosanya (sebagai selulosa akhir), dan filtratnya dianalisis kadar etanol dan gula reduksinya sebagai kadar gula reduksi akhir. Hasil penelitian menunjukkan bahwa prehidrolisis selama 24 jam menghasilkan kadar etanol yang lebih tinggi dan menyisakan kadar selulosa yang lebih rendah, serta kadar gula reduksi lebih tinggi, dibandingkan dengan tanpa prehidrolisis (prehidrolisis selama 0 jam). Semakin lama inkubasi SSF semakin tinggi kadar etanol, dan menyisakan kadar selulosa dan kadar gula reduksi yang semakin rendah. Kadar etanol tertinggi (0,916 %v/v) diperoleh pada kombinasi perlakuan prehidrolisis selama 24 jam dan inkubasi SSF selama 96 jam.

Kata kunci : Tandan kosong kelapa sawit, bioetanol, SSF, prehidrolisis.