ABSTRAK

PEMANFAATAN LIMBAH SABUT KELAPA MENJADI BIOETANOL DENGAN METODE *SIMULTANEOUS SACCHARAFICATION AND FERMENTATION* (SSF) MENGGUNAKAN ENZIM SELULASE

(Azzahra Shania Subhan Putri, 2026: 42 Halaman, 9 Tabel, 15 Gambar)

Meningkatnya kebutuhan energi mendorong pengembangan energi alternatif terbarukan, salah satunya bioetanol dari limbah sabut kelapa yang kaya akan selulosa. Struktur lignoselulosa pada sabut kelapa memerlukan proses konversi khusus, sehingga metode *Simultaneous Saccharification and Fermentation* (SSF) dipilih karena menggabungkan hidrolisis dan fermentasi dalam satu tahap. Penelitian ini bertujuan untuk menganalisis pengaruh volume enzim selulase dan waktu fermentasi terhadap produksi bioetanol dari limbah sabut kelapa menggunakan metode *Simultaneous Saccharification and Fermentation* (SSF). Variasi volume enzim selulase yang digunakan adalah 8 mL, 9 mL, 10 mL, 11 mL, dan 12 mL dengan waktu fermentasi 4 hari dan 6 hari. Bioetanol yang dihasilkan dianalisis berdasarkan kadar etanol, densitas, indeks bias, viskositas sesuai dengan SNI dan kandungan senyawa menggunakan GC-MS. Hasil penelitian menunjukkan bahwa kadar bioetanol tertinggi sebesar 30% diperoleh pada fermentasi 4 hari dengan enzim selulase 9 mL dan fermentasi 6 hari dengan enzim selulase 10 mL. Karakteristik bioetanol yang diperoleh memiliki densitas 0,9250–0,9985 g/mL, indeks bias 1,3387–1,3553, dan viskositas 0,71–0,88 cP atau 0,899 – 1,115 cSt. Analisis GC-MS menunjukkan kandungan etanol sebesar 42,6% area. Hasil penelitian membuktikan bahwa limbah sabut kelapa berpotensi dimanfaatkan sebagai bahan baku bioetanol, namun kualitas bioetanol yang dihasilkan masih perlu ditingkatkan agar memenuhi standar yang berlaku.

Kata Kunci: Bioetanol, sabut kelapa, *Simultaneous Saccharification and Fermentation* (SSF), enzim selulase, fermentasi.

ABSTRACT

UTILIZATION OF COCONUT FIBER WASTE INTO BIOETHANOL WITH THE SIMULTANEOUS SACCHARAFICATION AND FERMENTATION (SSF) METHOD USING CELLULASE ENZYME

(Azzahra Shania Subhan Putri, 2026: 42 *Pages*, 9 *Tables*, 15 *Images*)

The increasing demand for energy is driving the development of alternative renewable energy sources, one of which is bioethanol from cellulose-rich coconut fiber waste. The lignocellulosic structure of coconut fiber requires a special conversion process, so the Simultaneous Saccharification and Fermentation (SSF) method was chosen because it combines hydrolysis and fermentation in a single step. This study aimed to investigate the effect of cellulase enzyme volume and fermentation time on bioethanol production from coconut coir using the Simultaneous Saccharification and Fermentation (SSF) method. The cellulase enzyme volumes applied were 8 mL, 9 mL, 10 mL, 11 mL, and 12 mL, with fermentation periods of 4 and 6 days. The resulting bioethanol was analyzed based on ethanol content, density, refractive index, viscosity in accordance with SNI and chemical composition using GC-MS. The results showed that the highest bioethanol content of 30% was obtained at 4 days of fermentation with 9 mL cellulase enzyme and at 6 days of fermentation with 10 mL cellulase enzyme. The bioethanol produced had density values ranging from 0.9250 to 0.9985 g/mL, refractive index values from 1.3387 to 1.3553, and viscosity values from 0.71 to 0.88 cP or 0,899 – 1,115 cSt. GC-MS analysis revealed that ethanol was the major compound with an area percentage of 42.6%. These findings indicate that coconut coir has potential as a raw material for bioethanol production; however, the quality of the bioethanol obtained still requires further improvement to meet applicable standards.

Keywords: *Bioethanol, Coconut coir, Simultaneous Saccharification and Fermentation (SSF), cellulase enzyme, fermentation.*