ABSTRAK

PEMANFAATAN TANDAN KOSONG KELAPA SAWIT SEBAGAI BAHAN BAKU PEMBUATAN BIOETANOL DITINJAU DARI JUMLAH RAGI DAN LAMA WAKTU FERMENTASI

(Muhammad Hadi Pratama, 2025, 41 Halaman, 5 Tabel, 6 Gambar)

Kelangkaan bahan bakar minyak (BBM) dan kebutuhan energi yang terus meningkat mendorong penelitian bioetanol sebagai alternatif terbarukan yang ramah lingkungan, khususnya dari biomassa lignoselulosa seperti tandan kosong kelapa sawit (TKKS). Penelitian ini bertujuan mengevaluasi pengaruh variasi jumlah ragi (Saccharomyces cerevisiae) dan lama fermentasi terhadap volume serta kadar bioetanol yang dihasilkan. Proses penelitian melibatkan pretreatment TKKS dengan NaOH 0,6 M dan microwave 500 watt, hidrolisis asam dengan H2SO4 2,5 M pada 115-121°C, serta fermentasi dengan ragi 3%, 5%, dan 7% selama 3, 5, dan 7 hari, diikuti distilasi. Hasil analisis menunjukkan TKKS setelah pretreatment mengandung selulosa 27,2%, hemiselulosa 28,20%, dan lignin 30,48%, dengan kadar glukosa hasil hidrolisis 6,2%. Kondisi optimum fermentasi ditemukan pada penggunaan ragi 5% selama 5 hari, menghasilkan volume bioetanol 180 mL dan kadar bioetanol tertinggi 11%. Hal ini menunjukkan bahwa TKKS memiliki potensi besar sebagai sumber bioetanol yang menjanjikan, dengan optimasi kondisi fermentasi dapat meningkatkan perolehan produk secara signifikan sekaligus mengurangi dampak lingkungan dari limbah industri kelapa sawit.

Kata kunci: Bioetanol, Tandan Kosong Kelapa Sawit, Fermentasi, *Saccharomyces cerevisiae*, Energi Terbarukan.

ABSTRACT

UTILIZATION OF OIL PALM EMPTY FRUIT BUNCHES AS RAW MATERIAL FOR BIOETHANOL PRODUCTION BASED ON THE AMOUNT OF YEAST AND FERMENTATION TIME

(Muhammad Hadi Pratama, 2025, *41 Page, 5 Table,6 Images*)

The scarcity of fuel oil (BBM) and the increasing need for energy encourage bioethanol research as an environmentally friendly renewable alternative, especially from lignocellulosic biomass such as oil palm empty fruit bunches (TKKS). This study aims to evaluate the effect of variations in the amount of yeast (Saccharomyces cerevisiae) and the duration of fermentation on the volume and content of bioethanol produced. The research process involved pretreatment of TKKS with 0.6 M NaOH and 500 watt microwave, acid hydrolysis with 2.5 M H2SO4 at 115-121°C, and fermentation with 3%, 5%, and 7% yeast for 3, 5, and 7 days, followed by distillation. Analytical results showed that TKKS after pretreatment contained 27.2% cellulose, 28.20% hemicellulose, and 30.48% lignin, with glucose content from hydrolysis of 6.2%. The optimum fermentation condition was found in the use of 5% yeast for 7 days, producing a bioethanol volume of 180 mL and the highest bioethanol content of 11%. This shows that TKKS has great potential as a promising source of bioethanol, with optimization of fermentation conditions can significantly increase product yields while reducing the environmental impact of palm oil industry waste.

Keyword : *Bioethanol, Oil Palm Empty Bunch, Fermentation, Saccharomyces cerevisiae, Renewable Energy*