

ABSTRAK

***MICROWAVE ASSISTED ALKALINE (NaOH) PRETREATMENT* TANDAN KOSONG KELAPA SAWIT (TKKS) DALAM PENINGKATAN PRODUKSI BIOETANOL GENERASI KEDUA.**

(Rayna Catulisti, 2025 : 48 Halaman, 8 Tabel, 24 Gambar)

Kelangkaan bahan bakar fosil mendorong pengembangan energi terbarukan, salah satunya bioetanol generasi kedua yang berbahan baku lignoselulosa. Tandan Kosong Kelapa Sawit (TKKS) merupakan limbah agroindustri yang melimpah dan kaya akan selulosa, sehingga berpotensi sebagai bahan baku bioetanol. Penelitian ini bertujuan untuk menganalisis efektivitas metode *Microwave Assisted-Alkaline Pretreatment* dalam mengoptimalkan konversi TKKS menjadi bioetanol. Proses praperlakuan menggunakan NaOH dan gelombang mikro bertujuan untuk mengurangi kandungan lignin, meningkatkan kadar selulosa, serta menurunkan tingkat kristalinitas. Penelitian ini juga mengevaluasi pengaruh Daya Microwave (380 W, 500 W, 700W) dan konsentrasi alkali (0,5 M, 0,6 M, 0,7 M) terhadap kadar lignin, selulosa, hemiselulosa, serta produksi etanol. Penelitian ini diharapkan dapat meningkatkan efisiensi konversi limbah TKKS menjadi energi terbarukan, mendukung keberlanjutan lingkungan dan ketahanan energi. Hasilnya didapatkan kondisi optimal metode *pretreatment* menggunakan *microwave* yaitu dengan Konsentrasi NaOH 0,6 M dan daya microwave 500 W terjadi penurunan lignin 40,73 % menjadi 29,48 %. Dengan hasil akhir Bioetanol sebesar 14%.

Kata Kunci : Bioetanol Generasi Kedua, Tandan Kosong Kelapa Sawit (TKKS), *Microwave Assisted-Alkaline Pretreatment*, Lignoselulosa, Energi Terbarukan.

ABSTRAK

MICROWAVE ASSISTED ALKALINE (NAOH) PRETREATMENT OF OIL PALM EMPTY FRUIT BUNCHES (EFB) FOR ENHANCING SECOND-GENERATION BIOETHANOL PRODUCTION.

(Rayna Catulisti, 2025 : 48 Halaman, 8 Tabel, 24 Gambar)

The scarcity of fossil fuels encourages the development of renewable energy, one of which is second-generation bioethanol made from lignocellulosic biomass. Oil Palm Empty Fruit Bunches (EFB) are abundant agro-industrial waste rich in cellulose, making them a potential raw material for bioethanol production. This study aims to analyze the effectiveness of the Microwave Assisted-Alkaline Pretreatment method in optimizing the conversion of EFB into bioethanol. The pretreatment process using NaOH and microwave irradiation aims to reduce lignin content, increase cellulose levels, and decrease crystallinity. This study also evaluates the effect of microwave power (380 W, 500 W, 700 W) and alkali concentration (0.5 M, 0.6 M, 0.7 M) on the content of lignin, cellulose, hemicellulose, as well as ethanol production. This research is expected to improve the efficiency of converting EFB waste into renewable energy, supporting environmental sustainability and energy security. The results showed that the optimal pretreatment condition using microwaves was with 0.6 M NaOH concentration and 500 W microwave power, resulting in a lignin reduction from 40.73% to 29.48%. The highest final yield of bioethanol achieved in this study was 14%

Keywords: *Second-Generation Bioethanol, Oil Palm Empty Fruit Bunches (EFB), Microwave Assisted-Alkaline Pretreatment, Lignocellulose, Renewable Energy.*