

ABSTRAK

PENGARUH KATALIS Ni/NaOH DALAM KONVERSI LIMBAH MINYAK JELANTAH MENJADI *BIOFUEL* SEBAGAI ALTERNATIF ENERGI TERBARUKAN

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Peningkatan konsumsi energi fosil di Indonesia memicu perlunya pengembangan energi alternatif yang ramah lingkungan dan berkelanjutan. Penelitian ini bertujuan mengkaji pengaruh penggunaan katalis Ni/NaOH dalam proses Thermal Catalytic Cracking (TCC) terhadap hasil dan kualitas *biofuel* yang dihasilkan dari limbah minyak jelantah. Variabel bebas dalam penelitian meliputi konsentrasi katalis (2%, 4%, 6%, 8%, dan 10% w/w) serta temperatur operasi (200°C, 250°C, dan 300°C), sedangkan variabel tetap berupa massa minyak (2000 mL) dan waktu reaksi (3 jam). Analisis karakteristik *biofuel* mencakup viskositas, densitas, nilai kalor, titik nyala, kadar asam lemak bebas (FFA), %yield, dan kekeruhan, serta identifikasi senyawa menggunakan GC-MS. Hasil penelitian menunjukkan bahwa peningkatan konsentrasi katalis dan suhu reaksi secara signifikan meningkatkan mutu *biofuel*, ditandai dengan penurunan viskositas menjadi 14 mm²/s, densitas 0,879 g/mL, kekeruhan menjadi 95.1 NTU dan FFA 1,47%, serta peningkatan %yield menjadi 37,5%, *sectane number* sebesar 55,5 dan nilai kalor sebesar 39,69 cal/Kg. Kombinasi optimum diperoleh pada 10% katalis dan temperatur 300°C. Penelitian ini membuktikan bahwa katalis Ni/NaOH efektif dalam mempercepat deoksigenasi dan perengkahan senyawa berat, menghasilkan *biofuel* berkualitas tinggi yang berpotensi sebagai bahan bakar alternatif berbasis limbah domestik.

Kata kunci : *Biofuel*, *Thermal Catalytic Cracking*, minyak jelantah, Ni/NaOH, energi terbarukan.

ABSTRACT

THE EFFECT OF THE Ni/NaOH CATALYST IN THE CONVERSION OF WASTE WASTE OIL INTO BIOFUEL AS AN ALTERNATIVE RENEWABLE ENERGY

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The increasing consumption of fossil fuels in Indonesia has triggered the need to develop environmentally friendly and sustainable alternative energy sources. This study aims to examine the effect of Ni/NaOH catalyst use in the Thermal Catalytic Cracking (TCC) process on the yield and quality of biofuel produced from used cooking oil waste. The independent variables in this study include catalyst concentration (2%, 4%, 6%, 8%, and 10% w/w) and operating temperature (200°C, 250°C, and 300°C), while the fixed variables are oil mass (2000 mL) and reaction time (3 hours). Analysis of biofuel characteristics includes viscosity, density, calorific value, flash point, free fatty acid (FFA) content, % yield, and turbidity, as well as compound identification using GC-MS. The results showed that increasing catalyst concentration and reaction temperature significantly improved the quality of biofuel, characterized by a decrease in viscosity to 14 mm²/s, density to 0.879 g/mL, turbidity to 95.1 NTU and FFA 1.47%, as well as an increase in % yield to 37.5%, sectane number of 55,5 and calorific value of 39,69 cal/Kg . The optimum combination was obtained at 10% catalyst and a temperature of 300°C. This study proves that the Ni/NaOH catalyst is effective in accelerating the deoxygenation and cracking of heavy compounds, producing high-quality biofuel that has the potential as an alternative fuel based on domestic waste.

Keywords: *Biofuel, Thermal Catalytic Cracking, used cooking oil, Ni/NaOH, renewable energy.*