

KARAKTERISTIK FISIKOKIMIA, FTIR, DAN ^1H NMR BIODIESEL DARI LEMAK SAPI LOKAL MENGGUNAKAN NaOH SEBAGAI KATALIS

INTISARI

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Penelitian ini mengevaluasi karakteristik fisikokimia serta struktur molekul biodiesel berbasis lemak sapi lokal (tallow) yang diproduksi melalui proses transesterifikasi menggunakan katalis natrium hidroksida (NaOH). Tahapan penelitian meliputi rendering lemak, sintesis biodiesel, dan pemurnian melalui liquid–liquid extraction. Parameter mutu biodiesel yang dianalisis meliputi densitas, viskositas kinematik, titik nyala, *cloud point*, *pour point*, kadar air, nilai asam, nilai iodin, nilai penyabunan, angka setana, serta verifikasi struktur kimia melalui FTIR dan ^1H NMR. Hasil pengujian menunjukkan bahwa biodiesel tallow memiliki densitas 880 kg/m^3 , viskositas $4,968\text{ mm}^2/\text{s}$, *flash point* 165°C , kadar air $0,017\%$, dan angka setana 67, yang seluruhnya berada dalam kisaran standar mutu biodiesel internasional serta menghasilkan konversi $97,3\%$ dan yield 72% . Analisis FTIR mengonfirmasi pembentukan gugus ester melalui pita serapan karakteristik C=O pada 1740 cm^{-1} , sedangkan analisis ^1H NMR menunjukkan sinyal proton –OCH₃ pada δ 3,67 ppm yang menandai terbentuknya metil ester secara optimal. Temuan ini membuktikan bahwa lemak sapi lokal merupakan bahan baku potensial untuk produksi biodiesel berkualitas tinggi yang aplikatif pada kondisi iklim tropis.

Kata kunci: Biodiesel, lemak sapi lokal, transesterifikasi, energi terbarukan

PHYSICOCHEMICAL CHARACTERISTICS, FTIR, AND ^1H NMR ANALYSIS OF
BIODIESEL DERIVED FROM LOCAL BEEF TALLOW USING NaOH AS A
CATALYST

ABSTRACT

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This study evaluates the physicochemical properties and molecular structure of biodiesel synthesized from local beef tallow through a transesterification reaction using sodium hydroxide (NaOH) as a catalyst. The experimental procedure consisted of fat extraction, biodiesel synthesis, and purification by liquid–liquid extraction. The quality parameters assessed included density, kinematic viscosity, flash point, cloud point, pour point, moisture content, acid value, iodine value, saponification value, and cetane number, along with structural characterization using FTIR and ^1H NMR spectroscopy. The results indicated that the produced biodiesel exhibited a density of 880 kg/m^3 , kinematic viscosity of $4.968\text{ mm}^2/\text{s}$, flash point of 165°C , moisture content of 0.017% , and a cetane number of 67, meeting the requirements of international biodiesel standards, with a conversion rate of 97.3% and a yield of 72% . FTIR analysis confirmed the formation of ester functional groups with a distinctive C=O absorption band at 1740 cm^{-1} , while the ^1H NMR spectrum showed a prominent $-\text{OCH}_3$ peak at $\delta\ 3.67\text{ ppm}$, confirming successful conversion of triglycerides into methyl esters. These findings demonstrate that local beef tallow is a promising and feasible feedstock for high-quality biodiesel production, particularly suited for application in tropical regions.

Kata Kunci: Biodiesel, local beef tallow, transesterification, renewable energy