OPTIMASI SUHU DAN WAKTU PADA TRANSESTERIFIKASI MINYAK KEPUH (*Sterculia foetida L.*) TERHADAP KUALITAS *YIELD* BIODIESEL DENGAN *RESPONSES SURFACE METHODOLOGY* (RSM)

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INTISARI

Krisis energi global akibat menipisnya bahan bakar fosil dan tingginya permintaan energi mendorong pencarian sumber energi alternatif berkelanjutan. Indonesia menghadapi ketergantungan impor solar yang tinggi. Biodiesel dari minyak biji kepuh (*Sterculia foetida L.)*, bahan baku nonpangan, potensial menjadi solusi. Penelitian ini bertujuan mengoptimalkan suhu dan waktu transesterifikasi minyak biji kepuh menggunakan *Response Surface Methodology* (RSM) untuk menghasilkan biodiesel berkualitas sesuai standar SNI 7182:2015.

Proses transesterifikasi minyak biji kepuh dirancang menggunakan *Central Composite Design* (CCD) dalam metode *Response Surface Methodology* (RSM) dengan dua variabel, yaitu suhu (55-65°C) dan waktu reaksi (30-60 menit) menggunakan *software Design Expert* 13. Respons yang diukur meliputi *yield* dan berbagai parameter kualitas biodiesel sesuai standar. Data dianalisis dengan uji ANOVA untuk menguji signifikansi pengaruh variabel dan menentukan model kuadratik terbaik. Model divalidasi dengan membandingkan hasil prediksi dan data aktual.

Hasil uji biodiesel dari proses transesterifikasi minyak biji kepuh menunjukkan pengaruh signifikan suhu dan waktu reaksi terhadap kualitas biodiesel. Yield tertinggi mencapai 86,36% pada suhu 60°C dan waktu 66,21 menit, sedangkan *yield* terendah 56,36% pada suhu 52,93°C dan waktu 45 menit. Parameter seperti angka asam, angka penyabunan, angka iodium, viskositas, dan angka setana berada dalam rentang standar SNI 7182:2015. Optimasi menggunakan CCD dan RSM menghasilkan kondisi optimal pada suhu 61,05°C dan waktu 52,01 menit dengan *yield* 82,37%, menunjukkan biodiesel berkualitas tinggi dan proses transesterifikasi yang efisien.

Kata Kunci: transesterifikasi, minyak biji kepuh, *Design Expert*, *Response Surface Methodology*, optimasi biodiesel

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OPTIMIZATION OF TEMPERATURE AND TIME IN THE TRANSESTERIFICATION OF KEPUH OIL (sterculia foetida L.) ON BIODIESEL YIELD QUALITY USING RESPONSE SURFACE METHODOLOGY (RSM)

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ABSTRACT

The global energy crisis caused by the depletion of fossil fuels and the increasing demand for energy drives the search for sustainable alternative energy sources. Indonesia faces a high dependence on imported diesel fuel. Biodiesel derived from kepuh seed oil (Sterculia foetida L.), a nonfood raw material, has the potential to be a viable solution. This study aims to optimize the temperature and reaction time of the transesterification process of kepuh seed oil using Response Surface Methodology (RSM) to produce biodiesel that meets SNI 7182:2015 quality standards.

The transesterification of kepuh seed oil were designed using Central Composite Design (CCD) within the RSM framework, with two variables: temperature (55-65°C) and reaction time (30-60 minutes), employing Design Expert 13 software. The Responses measured included biodiesel yield and various quality parameters as per the standard. Data were analyzed using ANOVA to assess the significance of the variables and to identify the best quadratic model. The model was validated by comparing Predicted results with actual experimental data to ensure accuracy.

The biodiesel test results showed that temperature and reaction time significantly influenced biodiesel quality. The highest yield reached 86.36% at 60°C and 66.21 minutes, while the lowest yield was 56.36% at 52.93°C and 45 minutes. Quality parameters such as acid number, saponification number, iodine value, viscosity, and cetane number were within the ranges stipulated by SNI 7182:2015. Optimization using CCD and RSM resulted in optimal conditions at 61.05°C and 52.01 minutes with an 82.37% yield, demonstrating high-quality biodiesel production and an efficient transesterification process.

Keywords: *transesterification, Sterculia foetida seed oil, Design Expert, Response Surface Methodology, biodiesel optimization*

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