

# Produksi Biodiesel dengan Reaksi Transesterifikasi dari Lemak Daging Sapi Menggunakan Katalis Kalsium Oksida (CaO) yang Diperoleh dari Cangkang Telur Bebek melalui Proses Kalsinasi = Biodiesel Production by Transesterification Reaction from Beef Tallow Using Calcium Oxide (CaO) Catalyst Obtained through Duck Eggshells by Calcination Process

Muhammad Farizan, author

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## Abstrak

Transesterifikasi adalah reaksi kimia yang digunakan untuk mengubah minyak hewani menjadi biodiesel yang dapat digunakan. Pada penelitian ini, bahan bakar biodiesel disintesis dari lemak sapi dalam reaktor menggunakan katalis CaO yang disintesis dari cangkang telur bebek. Katalis CaO berbasis limbah disintesis dari cangkang telur bebek melalui proses kalsinasi pada suhu 900 <sup>O</sup>C selama 2 jam. Transesterifikasi dilakukan pada suhu 55 <sup>O</sup>C pada 6 sampel dengan variasi penggunaan jumlah katalis (1.5 wt%, 6.5 wt%, dan 10 wt%) serta variasi katalis CaO komersial dan limbah. Katalis yang disintesis dari cangkang telur itik menghasilkan kadar Kalsium Oksida (CaO) sebesar 93.2%. Hasil pengujian sampel terbaik diperoleh untuk biodiesel dengan katalis 6.5% berbahan dasar limbah dan 10% katalis komersial. Untuk biodiesel dengan katalis berbasis limbah 6.5%, rendemen 90.75%, densitas 855.1 kg/m<sup>3</sup>, viskositas 5.73 mm<sup>2</sup>/cst, keasaman 1.69 mg-KOH/g, dan bilangan yodium 30.87 g-I<sub>2</sub>/100g. Untuk biodiesel dengan katalis berbasis limbah 10%, rendemen 90.81%, densitas 860.5 kg/m<sup>3</sup>, viskositas 6.52 mm<sup>2</sup>/cst, keasaman 2.03 mg-KOH/g, dan bilangan yodium 27.51 g-I<sub>2</sub>/100g. Angka keasaman standar tidak tercapai dimana maksimumnya adalah 0.5 mg-KOH/g.

Transesterification is a chemical reaction used to convert animal oils into usable biodiesel. In this study, biodiesel fuel was synthesized from beef tallow in a reactor using a CaO catalyst which also synthesized from duck eggshells. Waste-based CaO catalyst synthesized from duck eggshells through a calcination process at 900 <sup>O</sup>C for 2 hours. Transesterification carried out at a temperature of 55 <sup>O</sup>C on 6 samples with variations in the use of the amount of catalyst (1.5 wt%, 6.5 wt%, and 10 wt%) as well as variations of commercial and waste based CaO catalysts. The catalyst synthesized from duck eggshells obtained a yield of 93.2% amount of Calcium Oxide (CaO). The synthesized biodiesel also tested for its chemical and physical properties to fulfill the Indonesian National Standard (SNI). The best sample test results were obtained for biodiesel with 6.5% catalyst from waste-based and 10% catalyst from commercial. For biodiesel with 6.5% waste-based catalyst, 90.75% yield, 855.1 kg/m<sup>3</sup> density, 5.73 mm<sup>2</sup>/cst viscosity, 1.69 mg-KOH/g acidity, and 30.87 g-I<sub>2</sub>/100g iodine number. For biodiesel with 10% waste-based catalyst, 90.81% yield, 860.5 kg/m<sup>3</sup> density, 6.52 mm<sup>2</sup>/cst viscosity, 2.03 mg-KOH/g acidity, and 27.51 g-I<sub>2</sub>/100g iodine number. The standard acidity number is not reached where the maximum is 0.5 mg-KOH/g.