

# Sintesis Core-shell CaO@SiO<sub>2</sub> untuk Reaksi Transesterifikasi Waste Cooking Oil Membentuk Fatty Acid Methyl Ester = Synthesis of Core-Shell CaO@SiO<sub>2</sub> for Transesterification Catalyst from Waste Cooking Oil to Form Fatty Acid Methyl Ester

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## Abstrak

Biodiesel yang terdiri dari senyawa fatty acid methyl ester (FAME) menjadi salah satu solusi bahan bakar alternatif karena dapat terurai secara hayati sehingga lebih ramah lingkungan dan dapat digunakan secara berkelanjutan di masa mendatang. Senyawa FAME terbentuk dari reaksi transesterifikasi asam lemak yang terkandung dalam minyak nabati atau limbah yang kaya asam lemak seperti minyak goreng bekas menggunakan alkohol rantai pendek dengan bantuan katalis. Pada penelitian ini dilakukan sintesis katalis core-shell CaO@SiO<sub>2</sub> menggunakan metode Stöber dan surfaktan CTAB dengan variasi parameter waktu, jenis katalis, dan jumlah katalis terhadap uji aktivitas katalisis dalam proses reaksi transesterifikasi minyak goreng bekas menjadi FAME. Kombinasi dari material CaO dan SiO<sub>2</sub> dengan struktur core-shell memberikan kinerja aktivitas katalisis yang baik dalam proses reaksi transesterifikasi minyak goreng bekas menjadi FAME. Katalis yang berhasil disintesis dikarakterisasi menggunakan FTIR, XRD, dan SEM. Sedangkan, yield dan kemurnian FAME dianalisis menggunakan GC-MS. Reaksi transesterifikasi dari core-shell CaO@SiO<sub>2</sub> menghasilkan yield FAME sebesar 60.29% dengan jumlah katalis 2 wt.% dan waktu reaksi selama 4 jam pada suhu 65 °C.

.....Biodiesel consists of fatty acid methyl ester (FAME) compounds, which is one of the alternative fuel solutions due to its biodegradable nature. Thus, making it more environmentally friendly and can be used sustainably in the future. FAME compounds are formed from the transesterification reaction of fatty acids contained in vegetable oil or waste which are rich in fatty acids, such as waste cooking oil using short chain alcohol with the help of a catalyst. In this research, the synthesis of core-shell CaO@SiO<sub>2</sub> catalyst carried out using the Stöber method and CTAB surfactant with various parameters of time, type, and the amount of catalyst to test the catalytic activity in the transesterification reaction process of waste cooking oil into FAME. The combination of CaO and SiO<sub>2</sub> materials with a core-shell structure provide good catalytic activity performance and stability in the transesterification reaction process of used cooking oil into FAME. The synthesized catalyst is characterized using FTIR, XRD, and SEM. Meanwhile, the yield and purity of FAME are analyzed using GC-MS. The transesterification reaction from core-shell CaO@SiO<sub>2</sub> obtained the highest yield of FAME up to 60.29% with a catalyst amount of 2 wt.% and a reaction time of 4 hours at 65 °C.