Analisis Penambahan Nanokatalis Cangkang Telur Bebek Terimpregnasi KOH pada Produksi Biodisel Menggunakan Metode *Microwave Assisted Transesterification* (*Analysis of the addition of KOH-Impregnated Duck Eggshell Nanocatalysts in Biodiesel Production Using the Microwave-Assisted Transesterification Method*)

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ABSTRACT

Used cooking oil is a waste product with significant potential as a feedstock for biodiesel production. However, its high Free Fatty Acid (FFA) content can inhibit the transesterification process. This study aimed to analyze the effect of adding KOH-impregnated CaO nanocatalyst derived from duck eggshells on biodiesel production and quality using the Microwave Assisted Transesterification (MAT) method, as well as to compare the results with the process conducted without nanocatalyst addition. Prior to transesterification, the used cooking oil was pretreated through an adsorption process using HCl 4 M-activated corncob charcoal, reducing the FFA content from 3.76% to 1.88%. The transesterification process was carried out at a methanol-to-oil molar ratio of 9:1 with nanocatalyst concentrations of 1%, 3%, and 6% (w/v) for a reaction time of 5 minutes. The evaluated parameters included biodiesel yield, FFA content, density, viscosity, and acid value. The results demonstrated that the addition of the nanocatalyst influenced the characteristics of the produced biodiesel. The best performance was achieved using 1% (w/v) nanocatalyst with a reaction time of 5 minutes, producing a biodiesel yield of 51.96%, an FFA content of 0.94%, a density of 926.14 kg/m³, a viscosity of 4.11 cSt, and an acid value of 0.20 mg KOH/g. Compared with the process without nanocatalyst addition, the use of the KOH-impregnated CaO nanocatalyst improved biodiesel quality, as indicated by lower FFA content, density, and acid value. These findings indicate that KOH-impregnated CaO nanocatalyst derived from duck eggshells has promising potential as a heterogeneous catalyst for biodiesel production from used cooking oil using the Microwave Assisted Transesterification method.

Keywords: Biodiesel, KOH impregnation, CaO nanocatalyst, waste cooking oil, Microwave Assisted Transesterification (MAT).