Analysis of Transesterification Time in Microwave-Assisted Transesterification (MAT) Using a KOH-Impregnated Duck Eggshell Nanocatalyst

Saiful Anwar, S.TP., M.P. (*Supervisor*)

Intan Adellavia Putri

Renewable Energy Engineering Study Program

Department Of Engineering

ABSTRACT

Used cooking oil is a waste material that has the potential to be utilized as a raw material for biodiesel production. This study aims to analyze the effect of transesterification time variation based on Microwave-Assisted Transesterification (MAT) using KOH-impregnated duck eggshell CaO nanocatalyst on biodiesel production and characteristics, as well as to compare it with the conventional transesterification method. The transesterification process was carried out using a nanocatalyst concentration of 1% (w/v) with reaction time variations of 5, 10, and 15 minutes. The produced biodiesel was tested for yield, Free Fatty Acid (FFA) content, density, kinematic viscosity, and acid value. The results showed that transesterification time affected the characteristics of the biodiesel produced. The highest yield was obtained at 15 minutes, reaching 66.54%, while the other characterization parameters reached optimum conditions at 5 minutes, with FFA content, density, kinematic viscosity, and acid value ranging from 0,94%, 892,04 kg/m³, 4,11 cSt, dan 0,20 mgKOH/g, *respectively. Compared with the conventional transesterification method, MAT was able to significantly shorten the reaction time from 60 minutes to 5 minutes. The use of this method also demonstrates the potential for improving energy efficiency, utilizing waste materials, and accelerating a more environmentally friendly biodiesel production process at a simple laboratory research scale.*

Keywords*: Biodiesel, duck eggshell, microwave-assisted transesterification, used cooking oil, CaO nanocatalyst.*