Analysis of the Blood Clam Shell Catalyst Concentration Effect on the Production of Biodiesel from Kusum Oil Using Response Surface Methodology

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ABSTRACT

The increasing global energy demand in the industrial and transportation sectors has led to a depletion of fossil fuel reserves. Biodiesel, derived from vegetable or animal oils through esterification and transesterification processes, emerges as a future renewable energy alternative. The high cost of raw materials and production impedes biodiesel development in Indonesia. Therefore, Kusum oil can serve as a cost-effective substitute for biodiesel production compared to palm oil. One way to save production costs is to use a heterogeneous catalyst derived from blood clam shell waste as a substitute for homogeneous catalysts. To reduce production costs, heterogeneous catalysts derived from blood clam shell waste can replace homogeneous catalysts. This study aims to analyze the optimal variation of blood clam shell catalyst for maximizing the yield of Kusum oil biodiesel using the Response Surface Methodology (RSM) in the transesterification process. Catalyst synthesis involves calcination at 900°C for 3 hours, with characterization using Scanning Electron Microscopy (SEM). Data analysis employs Optimal Costume Design (OCD) with one factor (catalyst variation) and one response (biodiesel yield). The factor used involves varying the catalyst from 2-6% w/v, with the response being the biodiesel yield. The research results indicate the highest yield at 92.07% with a blood clam shell catalyst variation of 6.82% w/v. The statistical equation model obtained is a cubic equation with an F-value of 4.34, a p-value of 0.037, R^2= 0.5912, and a lack of fit greater than 0.05, indicating a good model. The produced catalyst has an irregular morphology, bound together, forming large aggregates, suggesting that the transesterification process did not proceed well, and the biodiesel quality is below the SNI 7182:2015 standard.

Keywords: *Biodiesel, Blood Clam Shell, Catalyst, Kusum Oil, Response Surface Method (RSM)*