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Synthesis and Characterization of Chicken Manure Catalyst for Transesterification of Waste Cooking Oil to Fatty Acid Methyl Ester

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Structured Abstract

Background: Due to industrialization and a constantly growing population, fossil fuel usage is expanding globally. It is well known that fossil fuels are a significant source of greenhouse gases and other airborne contaminants like NO_2, SO_2, CO, particulate matter, and volatile organic compounds that contribute to ozone depletion, acid rain, and global warming. Biodiesel (FAME) is one of the renewable energy sources that could be used in place of conventional fossil fuels. Cost is the main obstacle to commercial FAME production because it is more expensive than fossil fuels.

Methods: To address these issues, research is being done on the production of FAME using the transesterification of waste cooking oil (WCO) with the presence of chicken manure (CM) catalyst. The physiochemical properties of the chicken manure catalyst were investigated using TGA, XRD, FESEM, and FTIR analyses.

Results: TGA revealed stability at high temperatures (900°C) with no significant weight loss, and $CaCO_3$ decomposition at 300°C. XRD confirmed the presence of CaO in the catalyst. FESEM showed smaller and more uniform particle morphology with increasing temperature. FTIR indicated CaO stretching at 712 cm^{-1} and a less intense peak for $CaCO_3$ at chicken manure calcinated 900°C. These findings provide insights into the catalyst's thermal stability, composition, morphology, and functional groups. The result shows that FAME yield of 81.77% was obtained at optimal methanol-to-oil ratio of 15:1 and a catalyst loading percentage of 7.5 wt.%.

Conclusion: The integration of waste cooking oil-based biodiesel is in line with Malaysia's SDGs, contributing to sustainable development in the economy, environment, and society. It aids in reducing pollution, mitigating emissions, improving energy security, and generating green employment opportunities. A comprehensive strategy is essential to ensure Malaysia's progress toward a sustainable energy future.

Keywords: Biodiesel production, CaO catalysts, transesterification, chicken manure, waste cooking oil

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