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Optimization Effect of Water Content and Bio-Surfactant Concentration on Water-In-Biodiesel Emulsion Stability using Response Surface Methodology

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Structured Abstract

Background: The incredibly long-lasting qualities and cost-effectiveness of biodiesel revolutionized their production in the nineteenth century. However, a recent study shows the drawbacks of biodiesel which is faces challenges related to stability. The study posits a strategic inquiry into water-in-biodiesel emulsions as a potential avenue to enhance the stability and performance of biodiesel formulations. This study utilized water content and bio-surfactant concentrations on the stability of water in oil emulsions.

Methods: Prior to commencing the biodiesel production process, preparatory investigation analyses are required to determine physicochemical characteristics. These parameters are the saponification value, acid value, molecular weight, free fatty acid concentration, and moisture content. Transesterification process used to produce biodiesel with the presence of CaO chicken eggshells as catalyst. The CaO catalyst was determined using XRD, FESEM, BET, FTIR and TGA instruments. The parameter used for water-in-biodisel emulsion stability by CaO catalyst was analysed by standard response surface methodology (RSM) with Box-Behnken Design (BBD). In this study, the operating parameters (independent variables) chosen for the statistical experiment design as follows: volume of biodiesel,volume of water content and amount of bio-surfactant.

Results: This study shows CaO catalyst was succesfully proven by using XRD and FTIR instruments. All the creaming index of emulsion samples were obtained. By using response surface methodology (RSM), the optimum of the concentration of water content and bio-surfactant on water-in biodiesel emulsions were determined. Based on the result obtained, the rsm models predict the optimum volume biodiesel, water content and bio-surfactant is 9ml,1ml and 0.3 g respectively.

Conclusion: In conclusion, the CaO based catalyst has demonstrated excellent catalytic performance for the esterification of biodiesel. The utilization of response surface methodology (RSM) could potentially be used for the stability of water-in-biodiesel emulsions.

Keywords: Water-in-biodiesel, Bio-surfactant,Water content, Response surface methodology (RSM)

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