

Optimizing the Catalyst Type, Catalyst Concentration, and Methanol-to-Oil Molar Ratio of Darak (Rice Bran) Oil Extracts Transesterification for Maximum Biodiesel Yield

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This study focuses on efficient biodiesel production using rice bran oil as a renewable resource, aiming to determine the optimal conditions for transesterification. The free fatty acid content as oleic of the rice bran oil is 2.6%. This study utilized response surface methodology to determine the optimal condition of the rice bran oil extract transesterification reaction for biodiesel production. The factors that determine how expensive biodiesel production is were studied. These factors are the catalyst concentration and methanol-to-oil molar ratio as the continuous factors and catalyst type, which is between sodium hydroxide or potassium hydroxide as the categorical factor. Response surface analysis of variance was used to determine the significance of these factors and their interactions that affect the transesterification process. The model equation determined that the best operating conditions for sodium hydroxide would be 6.3:1.0 methanol-to-oil molar ratio and 0.3% catalyst concentration (based on RBO wt%). In comparison, the best operating conditions for potassium hydroxide are 7.8:1.0 methanol-to-oil molar ratio and 0.9% catalyst concentration (based on RBO wt%). The compounds present in the biodiesel produced are all fatty acid methyl ester (FAME) and it was detected by gas chromatography-mass spectrometry. The model derived can predict the expected biodiesel yield when the methanol-to-oil ratio and catalyst concentration are manipulated. This model showed a reasonable agreement with the experimental results, showing that this model and study can be utilized for industrial optimization of biodiesel production.