

Surface Enhanced Hematite (Fe_2O_3) from Natural Sand as Catalyst in Biodiesel Production

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Abstract

Iron sand is a natural material that is easy to obtain. In this study, extraction of iron oxide material from locally available iron sand in the form of hematite (Fe_2O_3) was carried out. Co-precipitation method was employed using hydrochloric acid and ammonium hydroxide. The characterization methods for the catalysts were XRD, SEM, EDXRF, FTIR and Magnetic susceptibility. The EDXRF result shows that the Fe_2O_3 is the major constituent having 58.512% composition followed by SiO_2 (4.95%) and Al_2O_3 with (1.87%). According to XRD analysis, 76% of the sample appeared as hematite and 23% as orthoclase. Furthermore, the extracted Fe_2O_3 was used as a catalyst for biodiesel production from used cooking oil using four level factorial Box-Bahken Design (BBD) RSM analysis. The variables studied are the catalyst loading (0.25-2.00g), oil: methanol molar ratio (1:3-1:9), reaction temperature (40-90°C) and duration of reaction (30-200m). The results revealed that all parameters are influential on the transesterification experiment for the biodiesel production. The biodiesel produced was characterized by FT-IR, basic back titration and ASTM methods. Optimization of reaction parameters was performed and a maximum yield of 97.3% was obtained using the conditions of 1.125g catalyst load, 6:1 methanol to oil ratio, 115 minutes reaction time and reaction temperature of 65°C. After one cycle of catalyst regeneration, a 92% yield was obtained. Interestingly when a transesterification reaction was performed under suggested conditions from the model, a yield of 97.3% was obtained which agree with the predicted value of the model.

Early Career Scientist

NO, I am not an early career scientist.

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