

Ferric Sulphate Catalyzed Esterification of High Free Fatty Acids Content Used Coconut Oil for Biodiesel Synthesis

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Abstract : Feedstock with high free fatty acids (FFAs) content can be successfully employed for biodiesel synthesis once the high FFA content is reduced to the desired levels. In the present study, the applicability of ferric sulphate as the solid acid catalyst for esterification of FFA in used coconut oil was evaluated at varying catalyst concentration and methanol:oil molar ratios. 1.25, 2.5, 3.75 and 5.0% w/w $\text{Fe}_2(\text{SO}_4)_3$ on oil basis was used at methanol:oil ratios of 3:1, 4.5:1, and 6:1 and at the reaction temperature of 60 °C. The FFA reduction increased with the increase in catalyst and methanol:oil molar ratios while the time requirement to reach the esterification equilibrium reduced. Satisfactory results for esterification could be obtained within a small reaction period in the presence of only a small amount of $\text{Fe}_2(\text{SO}_4)_3$ catalyst concentration and at low reaction temperature, which then can be subjected for trans-esterification process. At the end of the considering reaction period the solid $\text{Fe}_2(\text{SO}_4)_3$ catalyst could be separated from the reaction system. The economics of the $\text{Fe}_2(\text{SO}_4)_3$ catalyzed esterification of high FFA content used coconut oil for biodiesel is at favorable conditions.

Keywords : biodiesel, esterification, ferric sulphate, Free fatty acids, used coconut oil

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