

Juthagate Thienmethangkoon 2008: Biodiesel Production from Waste Frying Oil via Two-step Catalyzed Process. Master of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Assistant Professor Manop Charoenchaitrakool, Ph.D. 160 pages.

This project was conducted because of the concern in energy crisis and the environmental problems. The aim of this project was to investigate the optimum conditions in biodiesel production from waste frying oil. Since the waste frying oil used in this study contains 1.01% of free fatty acid, biodiesel production via two-step catalyzed process is appropriate. In the first step, sulfuric acid was used as a catalyst for the esterification reaction of free fatty acid and methanol in order to reduce the free fatty acid content to be approximate 0.5%. In the second step, the product from the first step was further reacted with methanol using potassium hydroxide as a catalyst for producing methyl ester. In this research, design of experiments was carried out using the statistical software program MINITAB, and the results were analyzed using response surface methodology. It was found that in both steps a full quadratic model was able to predict the methyl ester content with more than 95% confidence limit. Moreover, the optimum conditions for biodiesel production based on the statistical software program was obtained when using methanol to oil molar ratio of 6.05:1, 0.68 wt% of sulfuric acid, reaction temperature of 51°C with a process time of 60 min in the first step, followed by using molar ratio of methanol to product from the first step of 9.09:1, 1 wt% KOH, reaction temperature of 55°C with a process time of 60 min in the second step. The percentage methyl ester in the obtained product was found to be 90.56%. In addition, it was found that the viscosity, density, flash point, cloud point, pour point and acid value of the produced biodiesel were in the acceptable ranges according to the department of energy (Thailand) standards for community biodiesel.

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