

Sujinna Karnasuta 2009: Biodiesel Production from Trap Grease Treating Cafeteria and Restaurant Wastewater via Two-Step Catalyzed Process Optimization Using Response Surface Methodology. Doctor of Philosophy (Environmental Science), Major Field: Environmental Science, College of Environment. Thesis Advisor: Associate Professor Vittaya Punsuvon, Ph.D. 127 pages.

The main purpose of this research was to develop a two-step biodiesel production technique from trap grease as a raw material to prevent water pollution and producing the environmentally friendly renewable energy reducing green house gas emission causing global warming. The developed technique was acid catalyzed esterification and alkali catalyzed transesterification. The special attention was paid to optimize the first step, the acid catalyzed esterification to reduce the free fatty acid content and the second step, the alkali catalyzed transesterification for converting be fatty acid methyl ester.

Trap grease contained high free fatty acid of 26.19 % and molecular weight of 846 g/mol with highest oleic acid component, could be reduced to less than 2 % of free fatty acid and amount of larger trap grease methyl ester by optimized two-step reaction conditions, which applied response surface methodology with using central composite design in acidic catalyzed esterification and alkali catalyzed transesterification of the two step catalyze process. The Optimum condition for the acidic catalyzed esterification was found as 0.43 v/v or 10:1 of methanol to oil molar ratio, 2.5 % v/v sulphuric acid concentration and 4 hours of reaction time. This optimum value gave a predicted acid value of 2.66 mg KOH/g or 1.30 % of free fatty acid. The optimum condition for the alkali catalyzed transesterification was as follows; 0.26 v/v or 6:1 of methanol to oil molar ratio, 1 % w/v potassium hydroxide concentration and 1 hour of reaction time. The maximum fatty acid methyl ester content under the optimum conditions of the variables was 95.49 %. Properties of trap grease biodiesel was 880.13 Kg/m<sup>3</sup> of density (at 15°C), 4.83 mm<sup>2</sup>/s of viscosity (at 40°C), 165°C of flash point, 0.54 mg KOH/g of acid value, 73.45 g Iodine/100 g of Iodine value which indicated that the trap grease biodiesel with this optimum condition in the two-step catalyzed process had properties satisfying both biodiesel standard of ASTM D 6751 and EN 14214.

This developed biodiesel production technique could used for biodiesel production in pilot plant from the low-cost feedstock as trap grease, hence this could decrease biodiesel cost and solving environmental problem on wastewater and the technique has encouraged environmental concern. Overall, the trap grease biodiesel is environmentally friendly renewable energy.

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Thesis Advisor's signature