

## SIIC028

### COMPARATIVE STUDY: SYNTHESIS OF BIODIESEL FROM WASTE COOKING OIL USING ONE-STEP AND TWO-STEP OF TRANSESTERIFICATION

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#### **Abstract:**

Fuel demand is growing while the fossil fuels, cause their degradation and increasing their market value in the world. Climate change and air emissions caused by burning of fossil fuels face the problem with increase the greenhouse effects. So it created by the use of the fossil fuels, the focus had been paid to biodiesel production as alternative way to petrodiesel. Biodiesel is an eco-friendly synthetic diesel fuel that derived from renewable energy generated from the vegetable oil, animal fats and waste cooking oil. The present biodiesel processing process is the transesterification method of the inedible oil with the addition of alcohol and the presence of catalyst to faster the rate of reaction. The transesterification reaction mechanism is highly sensitive to parameters and oil quality such as free fatty acid (FFA) content, density, kinematic viscosity, acid value and flash point. Others parameters that involved in the reaction are temperature, alcohol to oil ratio, concentration catalyst, and reaction time. This research attempts to carry out a comparative study of the transesterification methods (one-step and two-step) for the production of biodiesel from waste cooking oil by analysis 120 journal articles about biodiesel from trusted sources. The optimum parameter for one-step base catalyzed transesterification is temperature at 60°C with the concentration 1.013 wt.% KOH and molar ratio methanol to oil 6.5:1 for 20 minutes reaction time. For two-step acid base catalyzed transesterification, this method will handled at temperature 58°C with the molar ratio 10:1 and concentration H<sub>2</sub>SO<sub>4</sub> at 1.0 wt.% for 1 hour 5 minutes the response time.

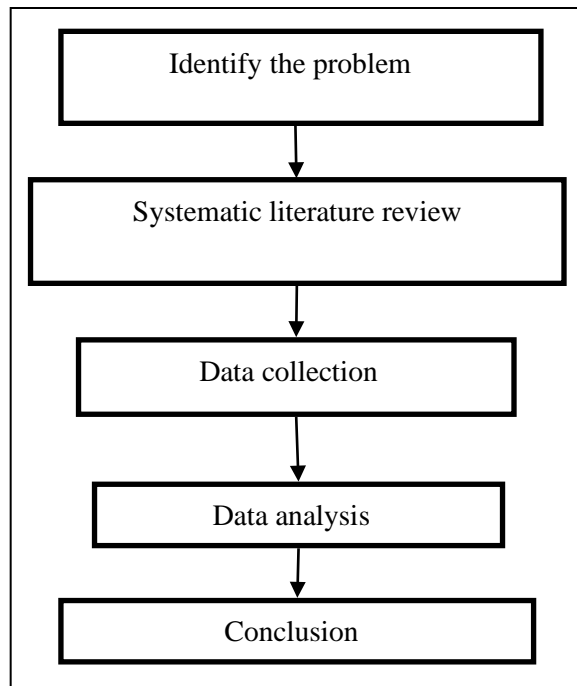
#### **Keywords:**

Waste cooking oil, One-step base catalyzed transesterification, Two-step acid base catalyzed transesterification, Biodiesel, Yield

#### **Objectives:**

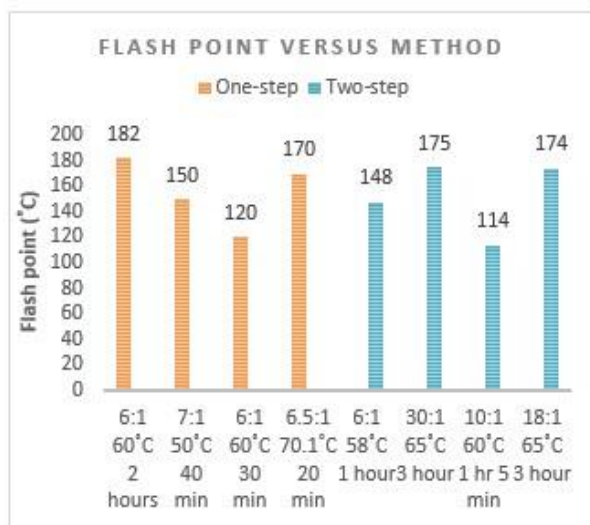
- To compare the result yield of biodiesel produced from waste cooking oil and quality of biodiesel based on one-step base catalyzed transesterification and two-step acid base catalyzed transesterification method.
- To find the optimum condition for both methods based on existing comparison result.

#### **Methodology:**

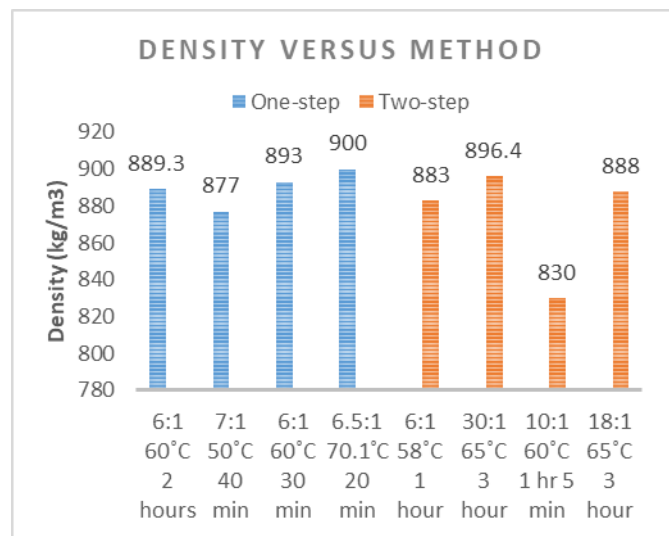


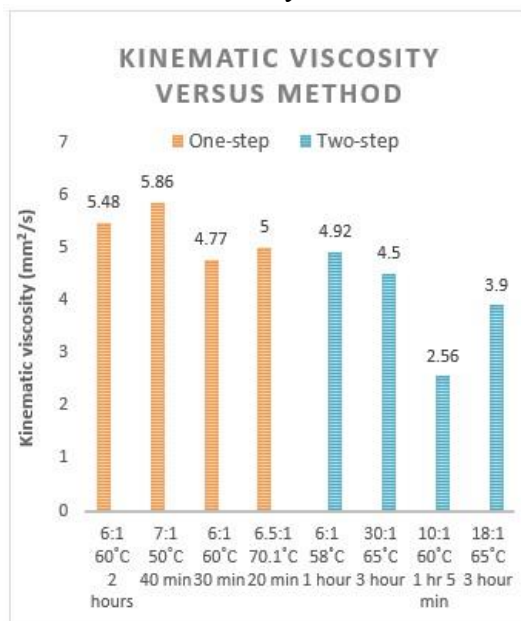
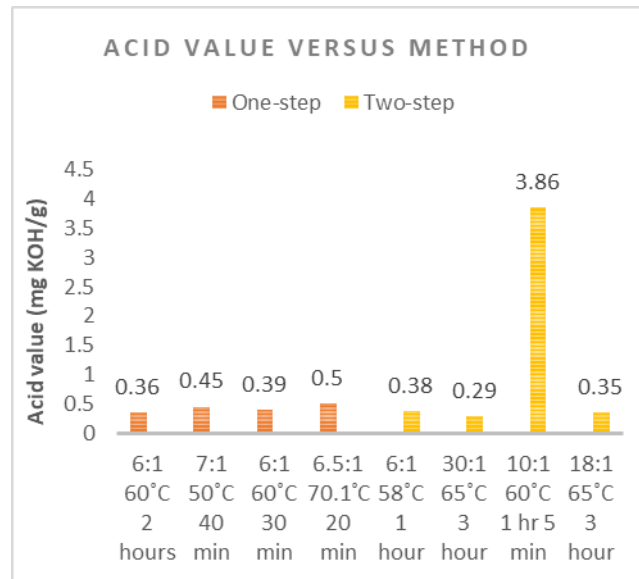
**Results:**

*Flash point versus method*



*Density versus method*



**Kinematic viscosity versus method****Acid value versus method****Optimum parameter condition for one-step base and two-step acid base catalyzed transesterification**

Condition	One-step base catalyzed transesterification	Two-step acid base catalyzed transesterification
Temperature	60°C	58°C
Molar ratio (methanol: oil)	6.5:1	10:1
Catalyst concentration	1.013 wt.%	1.0 wt.%
Reaction time	20 minutes	1 hour 5 minutes

**Conclusion:**

Based on theory, two-step acid base catalyzed transesterification produce greater amount of yield compare with one-step base catalyzed transesterification because the value of FFA when proceed with the esterification is the lowest, so transesterification can occur easily with the high yield. But in this review researcher, it find that method one-step base catalyzed transesterification can obtain the highest amount of yield biodiesel which is 99.34% compared 95.6% yield for two-step transesterification. It maybe the operating parameter for the two-step acid base catalyzed transesterification is not accurately suitable for the conversion yield biodiesel such the molar ratio, temperature or the reaction time. Almost all the biodiesel produce is followed the European Biodiesel standard (EN 14214) for acid value and only one or two biodiesel that had exceed the limit range of standard. So, for both method transesterification, the biodiesel is acceptable. Generally waste cooking oil contain the high value of FFA and it need to pre-treatment the oil before use in transesterification process. So two-step acid base catalyzed is most preferred method. The optimum parameter for one-step base catalyzed transesterification is temperature at 60°C with the concentration 1.013 wt.% KOH and molar ratio methanol to oil 6.5:1 for 20 minutes reaction time. For two-step acid base catalyzed transesterification, this method will handled at temperature 60°C with the molar ratio 10:1 and concentration H<sub>2</sub>SO<sub>4</sub> at 1.0 wt.% for 1 hour 5 minutes the response time.