

Bio-Diesel Preparation from Cooked Oil & Testing Physical Properties

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Abstract— The main purpose of this project is to reduce the usage of fossil fuel in our day to day life by replacing the alternative fuels. The biodiesel is the one of the promising fuel that is being used in diesel base engine as substitute to the conventional diesel. It is the fuel obtained by the trans- esterification reaction of crude oil extracted from various edible and non-edible sources. These sources include vegetable oils, animal fats, and renewable sources of plants namely palm, coconut, sesame, corn, Fever nut seed, olive, sunflower, soybean, peanut etc. Cooked oil is used as raw material for the preparation of the Bio-Diesel. One of the major reason for selecting cooked oil as raw material is, disposal of cooked oil is challenging task and it also impacts on environment. The cooked oil is converted into the usable Bio-Diesel. The cooked oil is filtered and mixed with Sodium hydroxide and Methanol to form an esterification reaction and gives a Bio-Diesel. The physical properties of prepared Bio-Diesel is tested in laboratory.

Keywords— WCO (Waste Cooked Oil)¹, FFA(Free Fatty Acid)², Trans esterification³, Glycerol⁴, Wash water⁵, Sanitizer liquid⁶.

I. INTRODUCTION

Diesel is one of the most commonly used petroleum based fuel due to its high thermal efficiency. Use of diesel as an energy source is not only limited to transportation but it's also been extended to industrial and agricultural equipment's. Hence the scarcity of high cost and fast depletion of the energy source is the major challenge. It is very important to find a renewable energy source. To overcome these problems there is a need to go for the alternate fuels, which can be used with existing working conditions of the engine. Over last few decades biodiesel is been one of the promising alternate fuel which is being tested and given satisfactory performance. Hence lots of researches have been carried out in the field of biodiesel for performance evaluation in diesel engine.

1. Waste Cooked Oil:

Cooked oil is used as main raw material for research work. When cooking oil heated repeatedly, oil changes its physical appearance like dark in color and increased viscosity. This results in increasing the Fatty Acid content. Due to heating of oil it undergoes chemical reactions such as oxidation, hydrolysis and polymerization and disposal of waste cooked oil is really challenging job for Restaurants and food processing industries. Waste cooked oil can't be directly disposed as it affects the soil properties and can be drawn into underground water and causes the water pollution.

Instead of disposing waste cooked oil it can be converted into use-full Bio-Diesel. Blended diesel results in reduction of air pollution compared to conventional diesel.

II. OBJECTIVES :

- To reduce the impact of waste Cooked oil on environment.
- Extraction of Bio-Diesel from cooked oil.
- To study the physical properties of Bio-Diesel.
- To convert the waste Cooked oil into usable Bio-Diesel.

III. LITERATURE SURVEY :

- Sulaiman Haji Hassan & Nurrul Rahmah Mohd Yusoff has conducted experiment on four stroke CI engine to evaluate engine performance using waste cooking oil, for physical properties.
- L. Razzaq , M.A. Mujtaba , M.A. Shahbaz , Sad Navaz has conducted experiment on Poor cold flow characteristics of biodiesel.
- Yolanda Potion, Laura Faba, Eva Diaz, Salvador Ordonez has conducted experiment on four stroke CI engine to evaluate engine performance using waste cooking oil, by the results Max biodiesel yield obtained was 32.9 % at the optimal load conditions.

IV. METHODOLOGY :

The collected WCO from restaurants is kept for settling of 24hrs and the oil is filtered to remove the foreign particles. FFA value of filtered WCO determined by titration process, then the WCO is converted into the Bio-Diesel using Trans-esterification.

Fig 1 : Trans-esterification unit



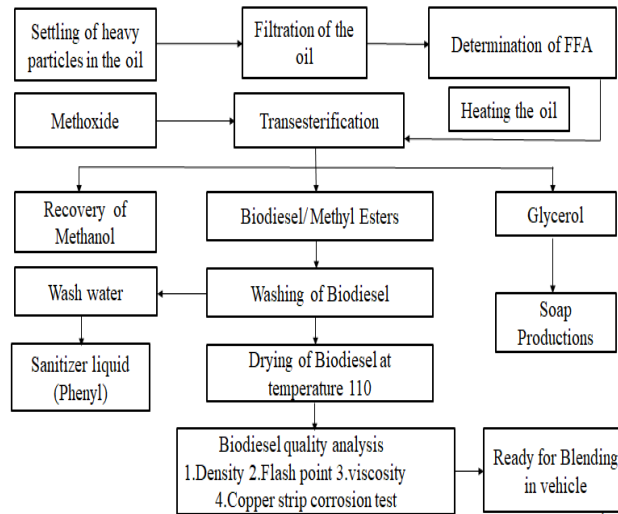


Chart 1: Methodology

1. Bio-Diesel preparation procedure:

- Collection of WCO from restaurant and keep it for settling of 24 hrs.
- Filtration of oil by laboratory filter paper to remove foreign particles.
- Heating of oil up to 60°C.
- Determination of FFA by Titration Process. We achieved FFA value of 3.98%.

$$FFA = \frac{28.2 \times 0.1 \times \text{burette reading}}{\text{sample weight}}$$

- After getting FFA value next step is trans-esterification.
- Heat oil up to 65°C and add Methanol & Sodium Hydroxide.
- Keep mixture circulation for 4 hours, after circulation keep mixture for settling to remove crude Glycerol as by product.
- To remove methanol and NaOH washing is done with hot water until pH of wash water turns to normal water pH value (water pH=7). Wash water can be used as sanitizer liquid.
- To remove the water particles from prepared Bio-Diesel, heat the oil up to 120°C.
- Cool the Bio-Diesel to room temperature.

V. RESULTS :

5.1 Density: Density of the Bio-Diesel is tested by using the Hydrometer.

Density of Bio-Diesel = 0.875 gm./cc

5.2 Viscosity: Viscosity is calculated by using Red Wood viscometer.

Viscosity of Bio-Diesel = 9.52 centistokes

5.3 Flash Point: Flash Point is calculated by using the Cleveland’s open cup apparatus.

Flash Point = 127⁰C

5.4 Calorific value: Calorific value is calculated by Bomb Calorimeter.

Calorific value = 8954 kcal/kg

Properties	Diesel	Bio-Diesel
Density	0.81 gm./cc	0.875 gm./cc
Flash Point	65 ⁰ C	127 ⁰ C
Viscosity	4.36 centistokes	9.52 centistokes
Calorific Value	10800 kcal/kg	8954 kcal/kg

Table 1: Compared physical properties of Diesel & Bio-Diesel.

VI. CONCLUSIONS :

1. Cooked oil used as raw material with a FFA value of 3.98% can directly converted into Bio-Diesel by the trans esterification method.
2. The physical properties of the Bio-Diesel met the properties of diesel.

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