# Preparation of Bio-Diesel from Waste Sunflower Oil

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**Abstract -** *Bio diesel is an alternative fuel to conventional to fossil diesel. Biodiesel can be produced from vegetable oil, animal oil or fats and also from waste cooking oil. The largest possible source of suitable oil comes from oil crops such as palm, ripe seed: soya bean or sunflower. The fossil fuel resources are depleting in an alarming way due to the ever increasing demand. Biodiesel provides an alternative solution for fossil fuel. Mostly biodiesel is produced from non-edible oil seed and various vegetables oil like palm oil, soybean oil, sunflower oil, jatropha, cotton seed etc. Biodiesel is environmental friendly fuel as the emission are less harmful.*

*Waste cooking oil provides a cheaper way of biodiesel production. Recycling of waste cooking oil for biodiesel production provides economic viability. In this paper we use waste sunflower oil for biodiesel production through single stage trans esterification process. For trans esterification process we use NaOH as catalyst. We have blended biodiesel in the following grades: - B10, B20, B30*

***Key Words:*** *Biodiesel, Transesterification, Glycreol, sunflower oil etc…*

## 1. INTRODUCTION

Fossil fuel is a nonrenewable resource. As per the utilization of fossil fuel goes in the present condition it can be finished within decades. The use of fossil fuel is increasing in day todays life as per the need of energy production required. Now we are living in the stage at which we should think of new energy resources. Bio diesel is an alternative fuel to conventional to fossil fuel. Biodiesel can be produced from vegetable oil, animal oil or fats and also from waste cooking oil. The largest possible source of suitable oil comes from oil crops such as cotton seed, soya bean or sunflower. The cost for the raw materials too expensive and the post production for the preparation for the biodiesel will be more than the fossil fuel, so we comes with an alternate solution , by using waste vegetable oil as a better source for the preparation of biodiesel. Biodiesel has many environmental benefits. The main benefits is of bio diesel is low emission of aromatic components. The advantages of vegetable oils compared to diesel fuel are ready availability, renewability, lower sulphur and aromatic content. Vegetable oil does not harm environment as it does not contain sulphur and therefore problems associated with sulphurous emissions can be reduced effectively. By using biodiesel as an alternative fuel main advantage is we don't want to modify existing engine designs.

S.G. Bojan1 et al [1] – Studied about producing Biodiesel from High Free Fatty Acid Jatropha Curcas Oil. Nada E.M. Elsolh et al [2] – Studied about the manufacture of Biodiesel from the used vegetable oil. The methods used for biodiesel production from used cooking oil are similar to that of conventional Trans esterification processes. Selection of a particular process depends on the amount of free fatty acid and water content of the used cooking oil.

## 2. PROJECT DESCRIPTION

### 2.1 PROCESS OF PREPARATION OF BIODIESEL:

Biodiesel preparation is based on FFA Value (Free Fatty Acid Value). If the FFA value is greater than 2%, it requires an additional process called esterification to reduce the FFA value to 2%.

- Take 10ml of waste sunflower oil should be examined.
- Use 15% of ethanol (50ml) + 0.1M solution of potassium hydroxide
- If sample does not dissolve in cold solvent, heat the flask slowly until the sample dissolves
- Add 1ml of phenolphthalein solution and titrate with 0.1M KOH until solution become pink, after shaking for 30 seconds

Acid value =5.61n/w
n= amount of 0.1M KOH required
w=Weight in g of substance

- Esterification

It is one of process in biodiesel. It work to reduce FFA if FFA more than 2%. An acid-catalyzed esterification process before the base-catalyzed transesterification process will eliminate most of the free fatty acids from the vegetable oil. Sulphuric acid (95 – 98%) is used in esterification process depend on waste cooking. In these experiments the sulphuric acid was first mixed with methanol before adding to the waste cooking oil. After adding the ethanol / sulphuric acid and waste cooking oil the magnetic stirrer were used to mix the solvents. This was then heated to about 60° C for 2 hours. A higher temperature and speed of stirrer ingrate of esterification to convert free fatty acid to methyl ester.

- Separation 1

Separation needed 3 hour to get the top ethanol and bottom oil layers of the biodiesel. Two layers could clearly be seen in the successful basic esterification biodiesel. The top layer was mainly ethanol. The bottom layer was mainly triglyceride product esterification after remove the water. These processes to reduce free fatty acid until below 2%. The density of the ethanol is less than the bottom triglyceride.

- Transesterification

Transesterification process work as to reduce viscosity in biodiesel. This process can be directly if FFA less than 2% show. Sodium hydroxide was used as catalyst in this process. The amount of catalyst had an impact in the conversion of esters during the Transesterification process. The reaction was carried out using 1% of catalyst concentration. Before Transesterification process Sodium hydroxide was first mixed with methanol together in one container before adding to the waste cooking oil. After adding the methanol / sodium hydroxide and waste cooking oil were mixed the solvents. This was then heated to about 60° C for 1 hour.

- Separation 2

Transesterification process and any methanol evaporation the resultant biodiesels were left to lie for at least 12 hours. Separations were used to separate the top (methyl ester) and bottom (glycerol) layers of the biodiesel samples. Two layers could clearly be seen in the successful basic Transesterification biodiesel samples. The top layer was mainly composed of free fatty acid methyl esters. The bottom deposit was mostly made up of glycerol, salts, soap and other impurities.

## 2.2 COMPONENTS

- WASTE SUNFLOWER OIL

Waste sunflower oil is the oil that is used effectively from restaurants, small scale cottage industries etc.


**FIG-1**: Waste Sunflower Oil

- MAGNETIC STIRRER

A magnetic stirrer or magnetic mixer is a laboratory device that employs a rotating magnetic field to cause a stir bar (also called "flea") immersed in a liquid to spin very quickly, thus stirring it. The rotating field may be created either by a rotating magnet or a set of stationary electromagnets, placed beneath the vessel with the liquid. Since glass does not affect a magnetic field appreciably (it is transparent to magnetism), and most chemical reactions take place in glass vessels (laboratory flasks), magnetic stir bars work well in glass vessels. On the other hand, the limited size of the bar means that magnetic stirrers can only be used for relatively small (under 4 liters) experiments. They also have difficulty in dealing with viscous liquids or thick suspensions. Magnetic stirrers are often used in chemistry and biology. They are preferred over gear-driven motorized stirrers because they are quieter, more efficient, and have no moving external parts to break or wear out (other than the simple bar magnet itself). Because of its small size, a stirring bar is more easily cleaned and sterilized than other stirring devices. They do not require lubricants. They can be used inside hermetically closed vessels or systems, without the need for complicated rotary seals. Magnetic stirrers may also include a hotplate or some other means for heating the liquid.


**FIG 2-** Magnetic Stirrer

- STIR BARS

A stir bar is the magnetic bar placed within the liquid which provides the stirring action. The stir bar's motion is driven by another rotating magnet or assembly of electromagnets in the stirrer device, beneath the vessel containing the liquid. Stir bars are typically coated in Teflon, or less often in glass. Glass coatings are used for liquid alkali metals (except lye, which will eat through glass) and alkali metal solutions in ammonia. Both coatings are chemically inert and do not contaminate or react. They are bar shaped and often octagonal in cross-section (sometimes circular), although a variety of special shapes exist for more efficient stirring. Most stir bars have a ridge around the center (called a pivot ring) on which they rotate. The smallest are only a few millimeters long and the largest a few centimeters. A stir bar retriever is a separate magnet on the end of a long stick (usually coated with teflon) which can be used to remove stir bars from a vessel.

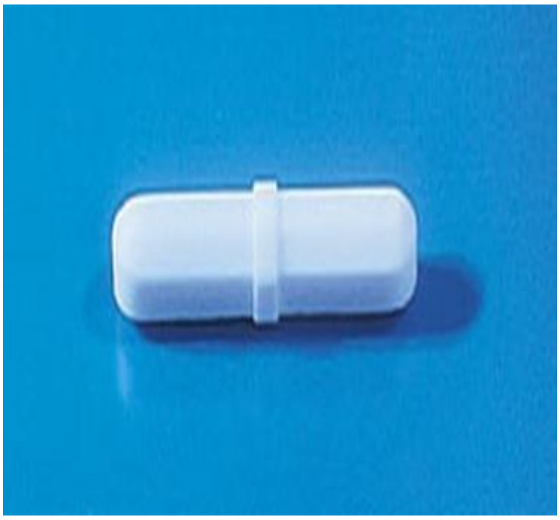


**FIG 3-** Stir Bar

- WATER BATH

A water bath is a device used in the laboratories to incubate samples in water maintained at a constant temperature.

**FIG 4-** Water Bath

- ETHANOL

Ethanol, also commonly called alcohol, spirits, ethyl alcohol, and drinking alcohol, is the principal type of alcohol found in alcoholic beverages, produced by the fermentation of sugars by yeasts.

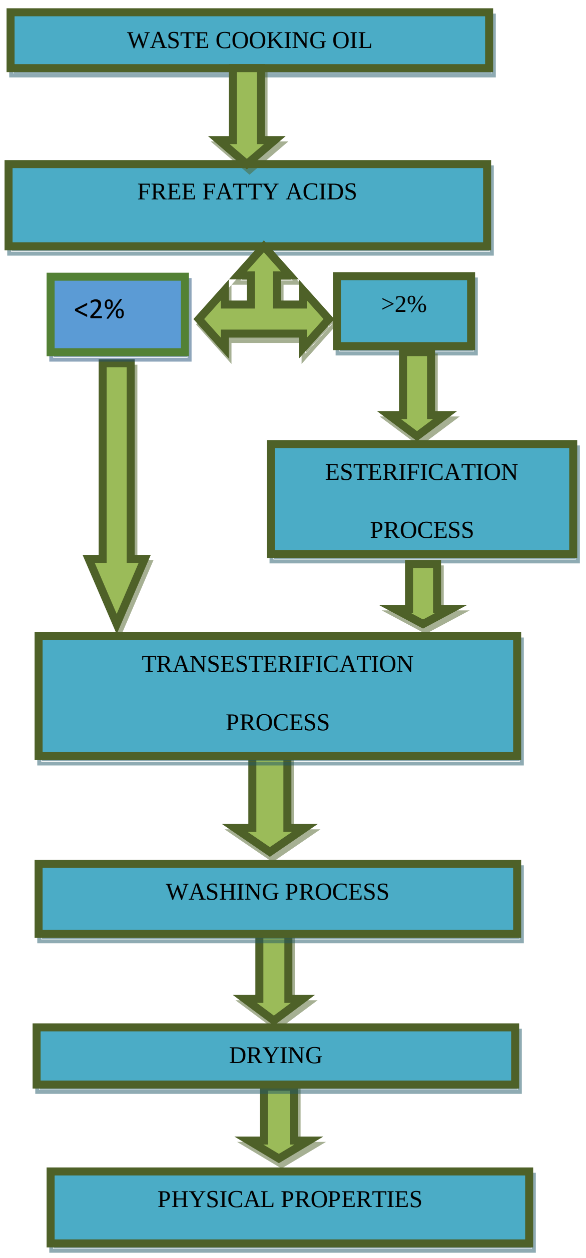
- CATALYST:

Alkaline catalyst used for Transesterification process is generally sodium hydroxide. The catalyst quantity for each process varies on oil quantity. For double stage process the acid catalyst sulphuric acid is employed. All the chemicals required for the process are brought from the chemical lab, Nehru College Of Pharmacy, Trissur. Sodium hydroxide, also known as caustic soda, or lye, is an inorganic compound with the chemical formula NaOH. It is a white solid and highly caustic metallic base and alkali salt which is available in pellets, flakes, granules, and as prepared solutions at a number of different concentrations. Sodium hydroxide forms an approximately 50% (by weight) saturated solution with water. Sodium hydroxide is soluble in water, ethanol and methanol. This alkali is deliquescent and readily absorbs moisture and carbon dioxide in air. Sodium hydroxide is used in many industries, mostly as a strong chemical base in the manufacture of pulp and paper, textiles, drinking water, soaps and detergents and as a drain cleaner.

Worldwide production in 2004 was approximately 60 million tonnes, while demand was 51 million tonnes. Pure sodium hydroxide is a whitish solid, sold in pellets, flakes, and granular form, as well as in solution. It is highly soluble in water, with a lower solubility in ethanol and methanol, but is insoluble in ether and other non-polar solvents. Similar to the hydration of sulphuric acid, dissolution of solid sodium hydroxide in water is a highly exothermic reaction in which a large amount of heat is liberated, posing a threat to safety through the possibility of splashing. The resulting solution is usually colorless and odorless with slippery feeling upon contact in common with other alkalis.

**FIG 5-** NaOH Flakes

## 3. METHODOLOGY




## 4. RESULT AND DISCUSSION

We have done the experiment successfully. Obtained bio-diesel from the waste sun-flower oil. We blend the biodiesel in various ratios B20 and B30 with diesel. The various results obtained for bio-diesel and its various ratios are recorded below.

| Parameters | Diesel | Bio-diesel | B10 | B20 | B30 |
|---|---|---|---|---|---|
| Density (kg/m³) | 830 | 890 | | 820 | 880 |
| Flash point (⁰c) | 52 | 120 | | 58 | 62 |
| Fire point (⁰c) | 60 | 135 | | 64 | 70 |
| Viscosity (mm²/s) | 2.5 | 3.5 | | 2.6 | 2.8 |

**TABLE 1-** Observations

## 5. CONCLUSIONS

The Waste Sunflower Oil is a large source for the production of Bio diesel. After the multiple times of use of oil, it have been disposed by restaurants, houses, cottage industries etc. By collecting the oils from such sources, India can easily tap its potential and produce biodiesel in a large scale. Using straight vegetable oils as a fuel substitute is an option, but in future more advanced engines may be required to cope up with these crude oils. However at the current time and for a transition period to a cleaner fuel system biodiesel is a viable option. Biodiesel will not incur large costs for a new infrastructure as the storage and distribution will be the same as the diesel infrastructure. The process for the production of biodiesel is not very complicated and initial investment is also very less. The cost of biodiesel production is directly related to the cost of the seed, expelling cost, seed cake sale, biodiesel production cost and cost recovery from glycerol sale.

Potential future targets include areas such as marine and agricultural application and home heating. This project is basically a new form of energy for future generations.

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