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Production of Biodiesel from Waste Cooking Oil

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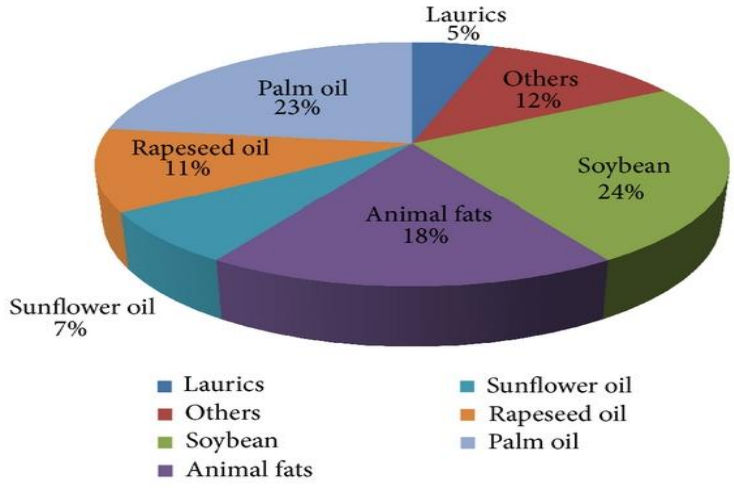
Abstract: *Because of the high cost of raw materials, the cost of biodiesel generated from virgin vegetable oil by transesterification is greater than that of fossil fuel. Waste cooking oil has recently been utilised as a feedstock to reduce biofuel costs. Acids, bases, and lipase are commonly utilised as catalysts in this process. Lipase's use in biodiesel synthesis is limited due to the high cost of lipase catalysts. Because of its inexpensive cost and rapid reaction rate, NaOH is commonly utilised as an alkaline catalyst. In waste cooking oil with a high proportion of free fatty acid, the alkaline catalyst combines with the free fattyAcid and generates soap through the saponification reaction. It also cuts down on biodiesel conversions. Waste cooking oil is processed with acid catalyst to undergo esterification reaction, which also needs high operating conditions, in order to minimise the quantity of fatty acid concentration. Various aspects impacting the biofuel manufacturing process have been detailed in this review study, including reaction rate, catalyst concentration, temperature, stirrer speed, catalyst type, alcohol utilised, alcohol to oil ratio, free fatty acid content, and water content..*

Keywords: Production of Biodiesel from waste cooking oil.



I. INTRODUCTION

The world's energy usage is steadily growing. This has resulted in the depletion of fuel supplies such as petroleum. Biodiesel is a petroleum-free alternative. It has the same qualities as fossil fuel diesel, but it is more biodegradable and emits less pollutants. A chemical process using vegetable oil or animal fat, alcohol, and a catalyst produces biodiesel. Edible vegetable oil is the most common feedstock for transesterification. However, this places a hardship on underdeveloped countries that rely on this oil for cooking. The solution to this problem would be to make biodiesel from used vegetable oil. Used vegetable oil is a by-product of fritter stores, hotels, and restaurants. The stores that offer these fritters have a thriving business.

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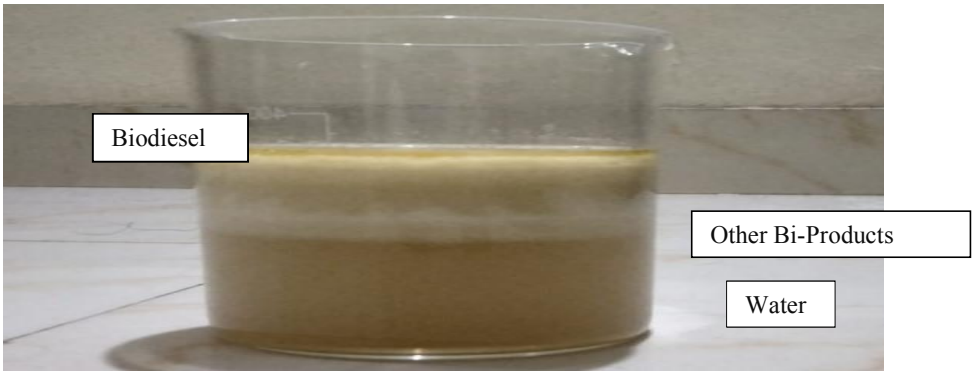

II. LITERATURE REVIEW

In comparison to diesel fuel, plant oils have a high viscosity. These can be used as an alternative fuel to operate a diesel engine; however they cause issues such as injector coking, dilution of engine oil, and deposits in different sections of the engine when the engine is driven for long periods of time. The process of esterification by converting the oils to bio-diesels, these oils lower viscosity to a great amount. This is a paper about examines the impact of various variables on the production and conversion of oil to biodiesel. Derived from rice bran oil A molar ratio of 6:1 resulted in excellent bio-diesel conversion and production. For a reaction time of 4 h, a molar ratio of 4:1 was equally excellent, while for a reaction time of 6 h, a molar ratio of 4:1 was equally good. Waste cooking oil (WCO) is typically cheaper than diesel and has much less impact on food-chain, so its use as biodiesel can reduce the cost of diesel run operations. Recycling part of the waste oils in the form of biodiesel can reduce the need of diesel fuel and increase profitability of the establishment. The techno-economic feasibility of such operation in case of a FFR in Dhaka has been investigated. CH3OH (methanol) and NaOH (sodium hydroxide) as base catalyst are mostly used in this process because of their lowest costs, higher reaction rates and higher yields. From the WCO generation of about 80 lites per week, yield for biodiesel production is considered in the range of 80-90%. Single-stage transesterification (SST) process is the cheapest and the easiest of the different methods. The cost of chemicals can be further minimized by recycling of CH3OH and NaOH in this SST process. The possible 35-40% CH3OH and 80-90% NaOH recoveries were considered for a alcohol to oil molar ratio of 5:1 of the reactants

III. METHODOLOGY

Biodiesel is made through a chemical process called transesterification in which the glycerin is separated from the fat or vegetable oil. The process leaves behind two products - methyl esters (the chemical name for biodiesel) and glycerin (a valuable byproduct usually sold to be used in soaps and other product. Following are steps given below.

A. Feedstock Waste Cooking Oil

The creation of waste cooking oil will be a function of the frying temperature and length of use, as well as the frying material utilized, as shown in Fig. 1.4.1. The used oil sample came from a fryer that was used to fry potatoes and other vegetable-based foods. Twenty-five litters of oil samples were obtained from a collecting drum where waste cooking oil was collected once a day for about one week. The oil sample is thought to be typical because it was taken from waste oil that had been kept for 8-10 weeks. During the frying process, temperatures ranged from 1300 to 1750 degrees Celsius. This temperature is similar to the temperature used to cook French fries (1400C-1800C).

B. Free Fatty Acids (FFA)

The relationship between FFA and process is depicted in Fig. 1.4.1 by a flow chart. If the FFA content is less than 2%, the process can go immediately to transesterification; however, if the FFA content is greater than 2%, the procedure must begin with the esterification step to lower FFA. The acid value of waste cooking oil was calculated to estimate the free fatty acid concentration and to predict how much acid catalyst and methanol would be required to drive the acid

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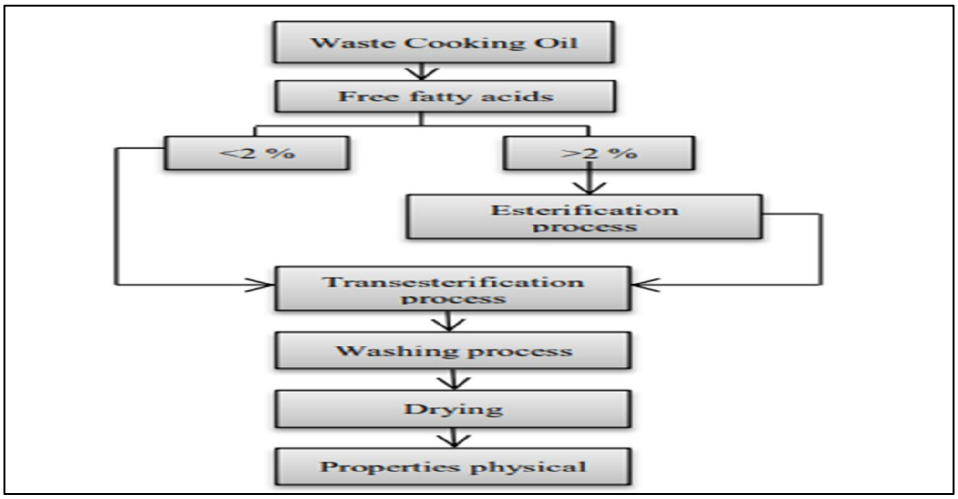
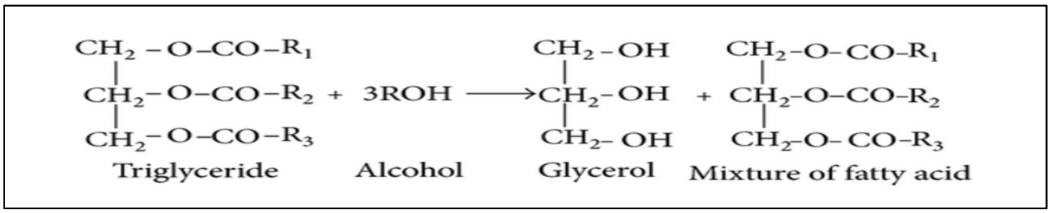
esterification chemical toward methyl ester synthesis. 0.5 to 1.5 percent (depending on the weight of free fatty acid in the oil) of pure (95-98 percent) sulphuric acid should be employed as a catalyst, according to previous studies. According to the BP monograph, the acid value titration method was utilised.



Process

Transesterification

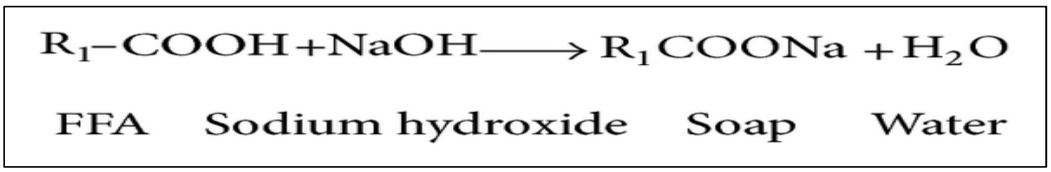
Transesterification occurs when triglycerides react with alcohol in the presence of a base catalyst. Triglycerides are transformed to diglyceride, monoglyceride, and eventually glycerol in this procedure. Transesterification process work as to reduce viscosity in biodiesel. Triglycerides make up the majority of vegetable oil.



Process of Transesterification

Saponification Reaction (Seperation-1)

If vegetable oil contains free fatty acid, it will react with homogenous base catalyst to form soap and water. The top methanol and bottom oil layers of the biodiesel took 3 hours to separate. The effective basic esterification biodiesel has two distinct layers. Methanol made up the majority of the upper layer. After the water was removed, the bottom layer was mostly triglyceride product esterification. These mechanisms lower free fatty acid levels to less than 2%. Methanol has a lower density than the bottom triglyceride.



Saponification Reaction

Hydrolysis Reaction (Seperation-2)

Water generated either from vegetable oil or formed during saponification reaction will hydrolyze triglyceride to form more free fatty acid. The generated biodiesels were let to sit for at least 8 hours after the transesterification process and

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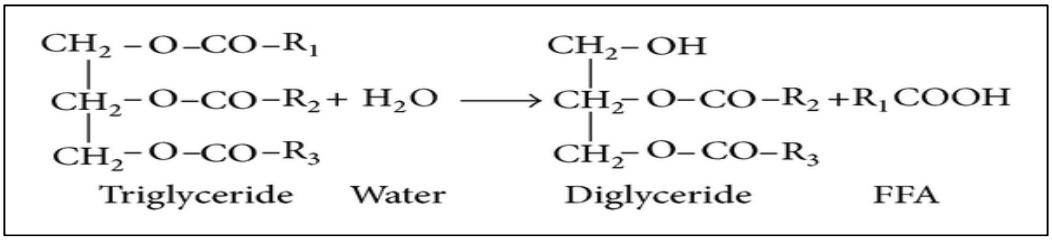
any methanol evaporation. The top (methyl ester) and bottom (glycerol) layers of the biodiesel samples were separated using separations. In the successful basic transesterification biodiesel samples, two layers were clearly visible.



Hydrolysis Reaction

OBJECTIVE

1. To form Biodiesel from waste cooking oil.
2. To make environment friendly fuel.

IV. ADAVANTAGES

1. Biodiesel is the only alternative fuel that may be used in any diesel engine that hasn't been changed. Biodiesel can be stored in the same way as petroleum diesel can.
2. Biodiesel can be used alone or blended with petroleum diesel in any ratio.
3. Because Biodiesel is more lubricating than petroleum diesel fuel, it can improve the life of diesel engines while having no effect on fuel consumption, auto ignition, power output, or engine torque.

V. SCOPE

- Global food and feed costs have risen as a result of increased biofuel demand. Biofuels will very certainly be included in a portfolio of remedies to high energy prices, which will also include conservation, more efficient energy usage, and the use of other fuels.
- Biodiesel is an advanced kind of biofuel generated from an animal or vegetable fat based renewable fuel, similar to petrol and fossil diesel. Even leftover cooking oil (UCO) might be utilised to make biofuel and would be ideal for diesel automobiles.

VI. CONCLUSION

Biodiesel is the most rapidly increasing biofuel; however it has a lower starting point than ethanol. Biodiesel production is more dependent on oil-based feedstock and land availability than bioethanol. Current production costs are a huge concern; current output would result in enormous deforestation and increased food prices. Because our advanced conceptual methods can utilise any second generation feedstock with high energy extraction, they have the potential to boost Biodiesel production. The present focus should be on using proven technologies to use inexpensive biomass and biowaste as feedstock to make cost-effective biodiesel that can compete with petroleum resources. The widespread usage of biodiesel in India will soon become a reality.

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