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# PRODUCTION OF BIODIESEL FROM JATROPHA, RICE BRAN AND WASTE COOKING OIL

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**Abstract**

The world is facing crisis due to lack of resources and vehicles are increase day by day. But the energy sources are limited and decreasing gradually. This situation faces to find out an alternative fuel for diesel engine. Biodiesel is an alternative fuel for diesel engine. This paper involves the prospect of making biodiesel from jatropha oil, rice bran oil and waste cooking oil. Jatropha is renewable plant but not edible and wildly growing hardy plant in arid and semi-arid region. The seeds of jatropha contain 50-60% oil.Rice is one of the most crops cultivated in India but it contains fatty acid (more than 3%) which is not edible.India is second largest country to produce rice. Rice Bran Oil (RBO) does not require any special cultivation since it is a by-product of the rice milling process. Waste Cooking Oil (WCO) which contains large amounts of free fatty acids produced in restaurants. WCO is having relatively low cost as compare to fresh oil and easily available at various hotels and restaurants. Oil was transesterified with methanol using sodium hydroxide(NaOH) as catalyst to obtain bio-diesel by Mechanical Stirrer production technique was carried out. Results which obtained are significantly comparable to pure diesel and gives better performance than conventional diesel fuel.

***Key Words:*** *Biodiesel, Transesterification, Mechanical stirrer, Economics.*

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## 1. INTRODUCTION

As the population is increases, the consumption of fuel in the world is increasing rapidly and it affect the global economy of all the countries, so this factor force all the countries to find an alternative fuel to reduce or even replace petroleum based oil.

Alternative renewable fuels have the potential to solve many of the current social problems and concerns, from air pollution and global warming to other environmental improvements and sustainability issues. It has been found that the vegetable oils are promosing fuels because their properties are nearly similar to that of diesel. It can be used as fuel in C.I. engine without any modification in existing engine.

It is a domestic, renewable fuel for diesel engine, which is free from sulfur and aromatic compounds and derived from natural oil like Jatropha oil, RBO and WCO. Biodiesel has an energy content of about 12% less than petroleum-based diesel fuel on a mass basis. It has a higher molecular weight, viscosity, density, and flash point than diesel fuel. By Transesterification these oil can be converted into biodiesel.

### 1.1 Biodiesel

Biodiesel is an alternative fuel similar to conventional or ‘fossil’ diesel. Biodiesel can be produced from vegetable oil, Jatropha, Rice Bran and waste cooking oil. The process used to convert these oils to Biodiesel is called Transesterification. This process is described in more detail below. The largest possible source of suitable oil comes from oil crops such as Rice Bran. Most biodiesel produced at present is produced from waste vegetable oil sourced from restaurants, chip shops, industrial food producers. Though oil straight comes from the agricultural industry represents the greatest potential source it is not being produced commercially. After the cost of converting it to biodiesel has been added on it is simply too expensive to compete with fossil diesel. Waste vegetable oil can often be sourced for free or sourced already treated for a small price. The waste oil must be treated before conversion to biodiesel to remove impurities. The result is Biodiesel produced from waste vegetable oil can compete with fossil diesel.

## 2.TRANSESTERIFICATION

The Transesterification process is the reaction of a triglyceride with methanol to form esters and glycerol. A triglyceride has a glycerine molecule as its base with three long chain fatty acids attached. The characteristics of the fat are determined by the nature of the fatty acids attached to the glycerine. The nature of the fatty acids can in turn affect the characteristics of the biodiesel. During the esterification process, the triglyceride is reacted with alcohol in the presence of a catalyst, usually a strong alkaline like sodium hydroxide. The alcohol reacts with the fatty acids to form the mono-alkyl ester, or biodiesel and crude glycerol. The vegetables oils can’t be used directly in the diesel engine. Several problems

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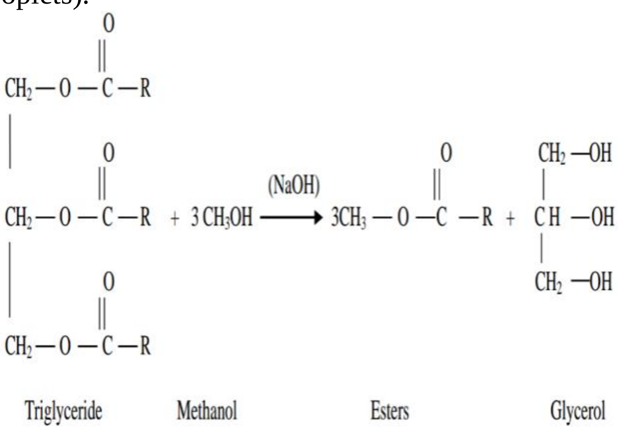
crop up if unmodified fuel is used and viscosity is the major factor. It has been found that transesterification is the most effective way to reduce the viscosity of vegetable oils and to make them fit for their use in the present diesel engines without any modification.

**2.1 Production of Bio-diesel by Transesterification Process**

Oil was heated to (50-55˚c).Then 25ml of methanol & NaOH 1% Of weight is mixed with that. The mixture is heated for a hour. Then it is poured in the separating funnel. After 3hrs the mixture separates into two layers. Top layer is methyl ester & bottom layer is glycerol. The top layer is separated, & then washed twice with (hot distilled water at 100˚c). The washed esters were filtered using sodium sulphate (powder) for removing water droplets).



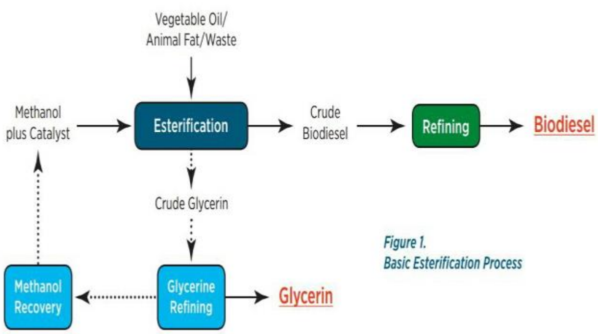




**Fig-2: Two layers of biodiesel**

**Fig-3: Finished biodiesel**

**2.2 Properties of Fuel**

| Properties | Jatropha | RBO | WCO | Diesel |
|---|---|---|---|---|
| Density ($kg/m^3$) | 932.92 | 884 | 889.9 | 800-900 |
| Calorific Value (kcal/kg) | 9124.07 | 11084 | 10748 | 10987 |
| Kinematic Viscosity (cSt) | 52.76 | 37.548 | 5.16 | 2.04-3.23 |
| Flash Point(℃) | 174 | 75 | >120 | 68-94 |

**3. BLENDING OF BIODIESEL WITH DIESEL**

Biodiesel can be blended and used in many different concentrations. The most common are: B6 to B20 (6% to 20% biodiesel blended with petroleum diesel) and B5 (5% biodiesel, 95% petroleum diesel). B100 (pure biodiesel) is typically used as a blend stock to produce lower blends and is rarely used as a transportation fuel

**B20**

B20 is a common biodiesel blend in the India. B20 is popular because it represents a good balance of cost, emissions, cold-weather performance, materials compatibility, and ability to act as a solvent. Most biodiesel users purchase B20 or lower blends from their normal fuel distributors or from biodiesel marketers. Regulated fleets that use biodiesel blends of 20% (B20) Using B20 and lower-level blends does not require engine modifications. Engines operating on B20 have similar fuel consumption, horsepower, and torque to engines running on petroleum diesel. B20 with 20% biodiesel content will have 1% to 2% less energy per gallon than petroleum diesel but most B20 users report no noticeable difference in performance or fuel economy. Biodiesel has some emissions benefits, especially for engines manufactured before 2010. For engines equipped with selective catalytic reduction

(SCR) systems, the air quality benefits are the same whether running on biodiesel or petroleum diesel. However, biodiesel still offers better greenhouse gas (GHG) benefits compared to conventional diesel fuel. The emissions benefit is roughly commensurate with the blend level; that is, B20 would have 20% of the GHG reduction benefit of B100.

**4. RESULTS & DISCUSSION**

**4.1 Influence of reaction temperature on conversion efficiency**

After the performance it was observed that the maximum yield of ester is obtained at 60°C. As further increment of temperature it tends to loss of methanol and accelerates saponification of the glycorides hence decreases the conversion efficiency.

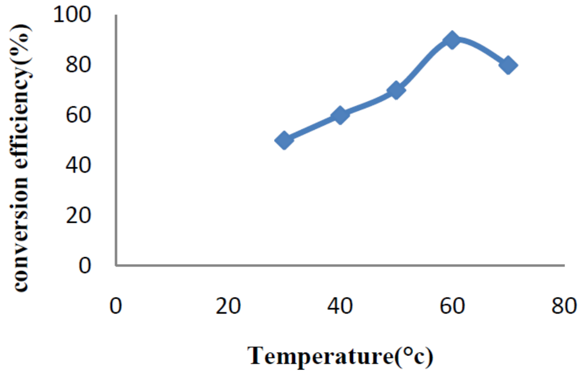



**Fig-4: Reaction temperature vs conversion efficiency**

**4.2Influence of reaction time on conversion efficiency**

It was observed that as the reaction time increases the conversion efficiency also increases but the best process is that which give the best result in shortest period of time.Result obtained from this experiment 45-60 min is sufficient to completion of reaction.

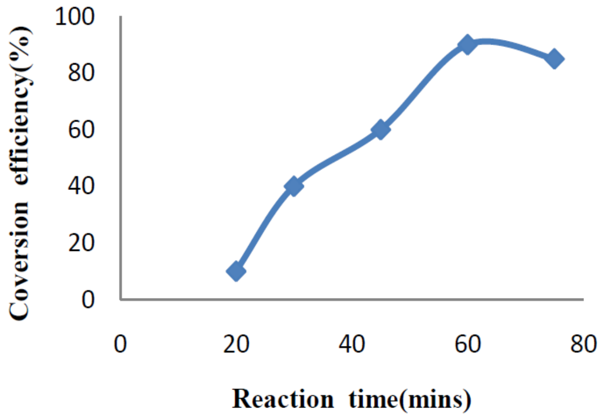



**Fig-5: Reaction time vs conversion efficiency**

**5. CONCLUSION**

Availability of rice in India is high whereas 33 million hectares of wasteland is available and can be effectively used for cultivation of Jatropha plant. The huge amount WCO is dumped in India per year so we can utilized all these oil for production of biodiesel.

Blending of biodiesel with diesel is possible only upto 20% more than 20% blend need to modification in diesel engine. By blending 20% of biodiesel with diesel will help India to save $7.3x10^7$ tones biodiesel per year. After the performing experiment on this we were observed that the properties of biodiesel is much similar to that of diesel hence we can safely use in existing C.I. engine .

This will helps India to become independent in the fuel sector by adopting bio-fuel as an alternative to petroleum fuels.

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