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ORIGINAL ARTICLE

Preparation Of Biodiesel From Various Non Edible Oil Seeds And Its Characterization

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ABSTRACT:

Due to deflecting fossil energy resources, biofuel will be prominent sources for satisfying today's transport needs .Among many others, the main advantages of boifuel are their potential to reduce greenhouse gas emission and their contribution to energy security. Due to fast depleting reserves of petroleum fuels, researcher worldwide have been working to find their substitutes, which are renewable, environment friendly and possibly economically competitive. In this direction, biofuels offers attractive promise. Although considerable amount of research work has been done on the use of esterifies vegetable oil (biodiesel), on different researcher they were worked on different CI engine. At present the biofuels sector is going through oil and some analysts question whether biofuels will be able to keep their promises. The eventual outcome will depend on the policies that countries have already put in place and those that may be implemented in the future. The purpose of this present work to prepared biodiesel from various non edible oil (mahua, cotton seed and karanja) and compared with base line fuel diesel .

KEYWORDS:

non edible oils, transterification, properties.

1. INTRODUCTION

New and renewable alternative fuels as a substitute for petroleum-based fuels have become increasingly important due to environmental concerns, unstable costs and transportation problems. One of the renewable alternative fuels is bio-diesel, which is domestically produced from new or used vegetable oil and animal fat. Oil or fat reacts with alcohol (methanol or ethanol). This reaction is called transesterification. The reaction requires heat and a strong catalyst (alkalis, acids, or enzymes) to achieve complete conversion of the vegetable oil into the separated esters and glycerin. During the transesterification reaction, glycerin is obtained as a by-product. It is used in pharmaceutical, cosmetic and

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other industries .

Diesel engines are the most efficient prime movers. From the point of view of protecting global environment and concerns for long-term energy security, it becomes necessary to develop alternative fuels with properties comparable to petroleum based fuels. Unlike rest of the world, India's demand for diesel fuels is roughly six times that of gasoline hence seeking alternative to mineral diesel is a natural choice [1]. Alternative fuels should be easily available at low cost, be environment friendly and fulfill energy security needs without sacrificing engine's operational performance. For the developing countries, fuels of bio-origin provide a feasible solution to the twin crises of fossil fuel depletion and environmental degradation. Now bio-fuels are getting a renewed attention because of global stress on reduction of green house gases (GHGs) and clean development mechanism (CDM). The fuels of bio-origin of water. Commonly found fatty acids in vegetable oils are stearic, palmitic, oleic, linoleic and linolenic acid.

The Role Of Biodiesel In Energy Contribution:

Recognizing access to energy by the poor as a major barrier to the rapid growth prospects of India as well as its vulnerability to volatile international oil prices, the Government of India has, in recent times, provided major emphasis to biofuels, in particular, jatorpha-derived bio-diesel. Public sector oil companies have offered an assured by-back process for bio-diesel at 25 rupees per litre11. A detailed project report recently prepared under the ministry of Rural Development identified various end-uses for non-edible SVOs (Strait vegetable oils) produced from plants, such as jatropha, including their direct use for transport applications and power generation on a decentralized basis apart from conversion of the SVOs to bio-diesel for purpose of blending with petro-diesel.

Large tracts of wasteland can be placed under such plantations for production of bio-diesel. Under alternate assumptions of productivity of such plantations and efficiency much as 40 % of India's diesel requirements by the year 2030.

As such, prima facia, bio-diesel seems to have the potential to contribute significantly to India's energy security. However, a clear choice needs to be made on priorities of use of the SVO produced from plants such as jatropha. The use of SVO for decentralized applications, with R and D, could go a long way in securing access to energy in the remote rural areas, either in the form of a fuel providing motive power or for conversion into electricity to feed into local mini-grids. Alternatively, the SVO could be converted into bio-diesel for purpose of blending into petro-diesel, thereby saving foreign exchange.

2. LITERATURE REVIEW:

Need: The increasing industrialization and motorization of the world has led to a steep rise for the demand of petroleum-based fuels. Petroleum-based fuels are obtained from limited reserves. These finite reserves are highly concentrated in certain regions of the world. Therefore, those countries not having these resources are facing energy/foreign exchange crisis, mainly due to the import of crude petroleum. Hence, it is necessary to look for alternative fuels which can be produced from resources available locally within the country such as alcohol, biodiesel, vegetable oils etc. Biodiesel is a renewable, domestically produced fuel that has been shown to reduce particulate, hydrocarbon, and carbon monoxide emissions from combustion.The increasing focus on the environmental impacts of fossil fuel based power generation has led to increased research with the aim of reducing emissions and improving combustion efficiency. Much of this work is driven by the increasing interest into alternative fuels such as biodiesel, alcohol, chemically stored electricity, hydrogen, non-fossil methane, non-fossil natural gas, oil, and other biomass sources

A.S. Ramadhas et al prepared a biodiesel form rubber seed oil. They took a round bottom flask of 500cm3 was used as laboratory scale reactor for their analysis. The oil in the flask was heated on a hot plate having magnetic stirrer arrangement. The mixture was stirred at same speed for all test runs. The temperature maintained for whole esterification process is between 40 & 500 C . Alcohol to vegetable oil molar ratio is one of important factor that affect the conversion efficiency of the process. They found out that the molar ratio of 9:1 was give maximum easter yield. After the reaction completed the product are allowed to separate into two layers. The lower layer contains impurities and glycerol. This top layer is separated and purified using distilled water. Hot distilled water is sprayed over the ester and stirred gently and allowed to settle in the separating funnel. The lower layer is discarded and upper layer (purified biodiesel) is separated.

They observed that viscosity and density of methyl easter of rubber seed oil was found to be very close to diesel. The flash point of biodiesel is higher than diesel. The CV of biodiesel is found to be slightly lower than diesel.

L.C. Mehar et al prepared a biodiesel form karanja oil. They were took a 200ml of karanja oil was measured and charged into the reactor. The KOH-MeOH solution was added to the close reaction vessel. Once the reaction was complete two major product exist i.e. glycerin and biodiesel. The final biodiesel layer required washing with tap water in order to remove the excess catalyst and methanol. After washing the final product was heated to remove moisture from biodiesel.

They were getting that viscosity and density of methyl easter of karanja oil are found to be 5.43cst and 889kg/m3. The flash point and pour point is found to be 1160C and 15.80C.

A. Siva Kumar et al prepared biodiesel from cotton seed oil. The transesterification process of cottonseed oil was performed using 5g Sodium methaoxide as catalyst and 100ml methyl alcohol per 1 litre pure cotton seed oil. First, the cottonseed oil was heated to about 65-700C in a reactor with a capacity of about 40 litres. Then, the catalyst was mixed with methyl alcohol to dissolve and added to the heated cotton seed oil in the reactor. After the mixture was stirred for 1 h at a fixed temperature of about 700C, it was transferred to another container and the separation of the glycerol layer was allowed. Once the glycerol layer was settled down, the methyl ester layer, formed at the upper part of the container, was transferred to another vessel. After that, a washing process to remove some unreacted remainder of methanol and catalyst was carried out, using distilled water and blown air. Then, a distillation process at about 1100C was applied for removing the water contained in the esterified cottonseed oil. Finally, the produced cottonseed oil methyl ester (CSOME) was left to cool down.

They observed that Kinematics viscosity and flash point of CSOME are higher than those of diesel fuel. A maximum of 76% BD production was found at 20%methanol and 0.5% NaOCH 3 at 550C reaction temperature

3. METHODOLOGY

Biodiesel is one of the promising fuel for future energy need. Biodiesel is prepared from three non edible oil seed as per following methodology. Collection of Seeds: Seeds are collected from Bhandara and Gondia forest region.

Extraction of oil from Seed: Oils extracted from seeds using oil impeller. The yields various seed are as follows.

Table 1: Yields of oils

Seeds (3 kg)	Yields (ml)
Mahua	900
Cotton seed	900
karanja	1000

Preparation of biodiesel:

Biodiesel fuel can be define as a medium chain of fatty acids and comprise mainly of monoalky l fatty acid esters. The chemical process used for the production of methyl ester from crude oil is known as transesterification.

$$R\text{-}COOH + CH3OH \xrightarrow{NaOH} R\text{-}COO\text{-} CH3 + Glycerol$$

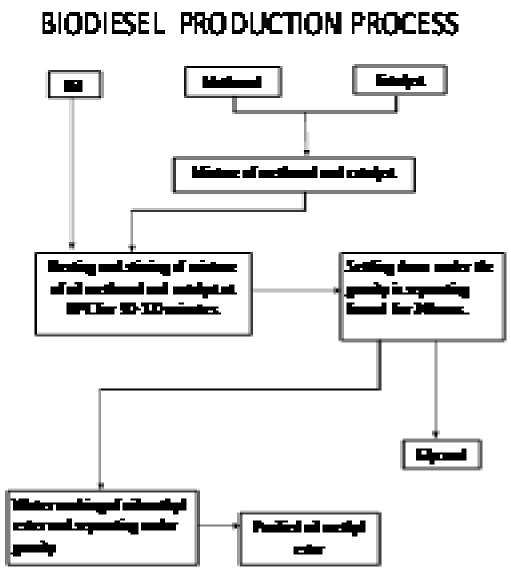

Figure1: flow chart of biodiesel production

Esterification Procedure

A round bottom flask of 1000ml is used as for present analysis. The oil in the flask is heated on a hot plate having magnetic stirrer arrangement. The mixture is stirred at same speed for all test runs. The temperature maintained for whole esterification process is between 60 & 700 C . Alcohol to vegetable oil molar ratio is one of important factor that affect the conversion efficiency of the process. During experiment oil to alcohol ratio and catalyst uses as shown in table 2. After the reaction is completed the product is allowed separation. The lower layer contains impurities and glycerol. This top layer is separated and purified using distilled water. Hot distilled water is sprayed over the ester and stirred gently and allowed to settle in the separating funnel. The lower layer is discarded and upper layer is separated.

	Mahua seed	Cotton seed	Kranja seed
Oil/alcohol	10:1	10:1	10:1
Catalyst (gm)	3.5	3	6
Temp. (^{0}C)	65-67	65-67	65-70
Revolution (rpm)	600	650	600
Time (sec)	95	95	90

Table 2: Parameter variable for biodiesel preparation from various oils

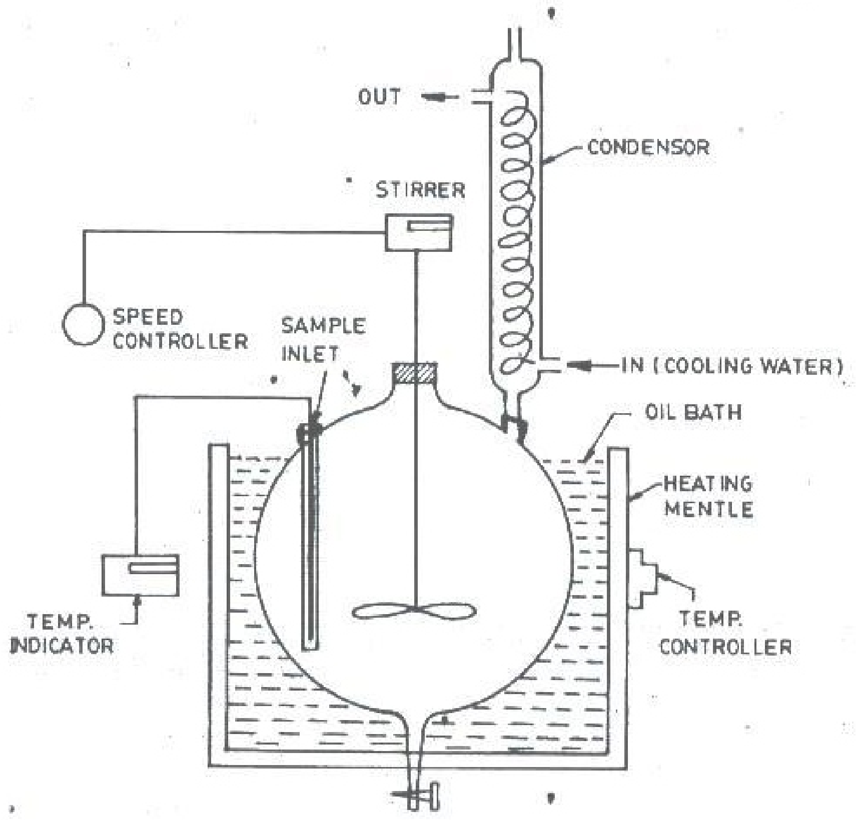

Figure2: Schematic diagram of transesterification process

Characterization of oil properties: In the present investigation the non edible oils are chosen as a alternative for producing biodiesel and used as fuel in CI engine. The oils have less heating value than that of diesel due oxygen content in their molecules. The viscosity of oil is several times higher than that of diesel. The high viscosity of oils leads to problems in pumping and atomization in injection system of diesel engine. The combination of high viscosity and low volatility of oils causes poor cold engine, start up misfire and ignition delay. Hence it is necessary to bring their combustion properties closer to diesel. This fuel modification is mainly aimed to reducing the viscosity of oils to get rid of the flow related problems. The important properties of oils are shown in table3.

property	Karanja Oil	Cotton seed oil	Mahua oil
Density (kg/m^3)	958	948	951
Calorific value (KJ/kg)	31045	30246	31007
Viscosity (cst)	41.8	33.5	38.4
Flash point (^0C)	232	234	186

Table 3: properties of oils

a) Viscosity: The resistance to flow exhibited by fuel blends is expressed in various units of viscosity. It is a major factor of consequence in exhibiting their suitability for the mass transfer and metering requirements of engine operation. Higher the viscosity results low volatility and poor atomization of oil during injection in CI engine, that results in incomplete combustion and ultimately carbon deposits on injector nozzle as well as in the combustion chamber.

b) Specific gravity: It is the ratio of the density of a fuel to the density of water at same temperature. With it other properties could be judged. The density of the fuels was measured by means of a capillary stopper relative density bottle of 25ml capacity.

c) Calorific value: Calorific value of a fuel is the thermal energy released per unit quantity of fuel when the fuel is burned completely and the products of combustion are cooled back to the initial temperature of the combustible mixture. It measures the energy content in a fuel. This is an important property of the biodiesels that determines the suitability of the material as alternative to diesel fuels.

d) Flash and Fire point: Flash point is the lowest temperature corrected to standard atmospheric condition at which application of a test flame causes the vapour of a specimen to ignite under specified conditions of test.

Fire point is the lowest temperature at which a specimen will sustain burning for 5 seconds. These two parameters have great importance while determining the fire hazard (temperature at which fuel will give off inflammable vapour). Flash point and fire point of the samples were measured by Cleveland open Cup Tester (followed by the specifications IP 36, ASTM D92, IS: 1448).

e) Cloud point and Pour point: Cloud point is that temperature, expressed as multiple of 100C, at which a cloud or haze of wax crystals appears at the bottom of the test jar when the oil is cooled under the prescribed conditions. Pour point is the lowest temperature, expressed as multiple of 30C at which the oil is observed to flow when cooled and examined under prescribed conditions.

These two temperatures are of great importance in knowing the behavior of fuels in a cold weather. These properties are determined by standard instrument for measuring cloud and pour point apparatus followed by Ip15.

Characterization of biodiesels:

The important properties of biodiesels are found out and compared with that of diesel and shown in table 4. It can be seen that the properties of biodiesel are quite similar to diesel.

Property	KME 100	CSME 100	MME 100	DIESEL
Density (kg/m^3)	900	905	903	850
Calorific value (KJ/kg)	33995	33413	33727	42000
Viscosity (cst)	5.43	6.1	5.58	4.1
Flash point (^0C)	204	200	174	51

Table 4: properties of biodiesel

4. RESULT:

The result shown that transestrification improve the important fuel properties like specific gravity, viscosity and flash point.

1: The viscosity of is biodiesel is slightly higher than the diesel and it is found that 5.43cst for karanja biodiesel , 6.1cst for cotton seed biodiesel and 5.58 cst for mahua biodiesel.

2: The density of biodiesel is found that 900 kg/m3 for karanja biodiesel, 905 kg/m3 for cotton seed biodiesel and 903 kg/m3 for mahua biodiesel which is higher than diesel.

3:The calorific value of biodiesel is lower than the diesel and it is found that 33995 KJ/kg for karanja biodiesel, 33413 KJ/kg for cotton seed biodiesel and 33727 for mahua biodiesel.

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