"PREPARIATATION OF BIODIESEL FROM JOJOBA OIL AND BABASSU OIL METHYLE ESTER TESTED FOR CI ENGINE"

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Abstract :

The depletion of fossil fuels increasing demand for petroleum fuels promoted extensive research on alternative sources of energy for internal combustion engines. In this paper we study preparation of biodiesel from jojoba oil and babassu oil. Babassu oil is transparent, light yellow oil extracted from the seeds of the babassu palm and due to its high saturated fatty acid composition (83%), it is considered a non-edible oil. Biodiesel is alternative fuels has been widely studied as alternative for diesel fuel due to its merits such as lower sulfur, lower aromatic hydrocarbon and higher oxygen content Potential non edible feedstock for biodiesel is now being taken in to careful consideration for the purpose of continuing biodiesel production while not negatively affecting the food issue. the aim of this study is to observed the process of preparation of biodiesel. Which is used in CI engine

I. INTRODUCTION

The major percentages of energy used in the world today are generated from possible fuel sources. These fossil fuels are non-renewable resources. They are the major contributors and sources of green house gases, air pollution and global warming. Unavailability of petroleum diesel the demand for petroleum diesel is increasing day by day hence there is a need to find out an appropriate solution. Biodiesel is a clean burning alternate fuel, produced from renewable. Resources and used vegetable oils, both edible and non edible. It can be used in compression ignition (diesel) engines with little or no modifications. Biodiesel is simple to use, biodegradable, nontoxic and essentially free of sulphur and aromatics.. Ethyl esters of babassu oil can synthesize by alkaline catalysis to make the green production of biodiesel with simple methods and available technology.

Babassu oil is transparent, light yellow oil extracted from the seeds of the babassu palm and due to its high saturated fatty acid composition (83%), it is considered a non-edible oil. Transesterification using ethanol is a valid alternative to using methanol because of ethanol's lower toxicity and the higher yield on weight compared to methanol. Statistical methodology can apply to optimize the transesterification reaction, which is promoted by ultrasonic waves and mechanical agitation. The use of biodiesel in conventional diesel engines results in substantial reduction of unburned hydrocarbons, carbon monoxide and particulate matters. Its higher cetane number improves the ignition quality even when blended in petroleum diesel. Transesterification is the process of using an alcohol (e.g. methanol, ethanol or propanol), in the presence of a catalyst, such as sodium hydroxide or potassium hydroxide, to break the molecule of the raw renewable oil chemically into methyl or ethyl esters of the renewable oil, with glycerol as a by-product. Transesterified oils have proven to be a viable alternative diesel engine fuel with characteristics similar to those of Diesel fuel. Its physical and chemical properties required for operation of diesel engine are similar to petroleum based diesel fuel. Just like petroleum diesel, biodiesel operates in compression-ignition engines. Transesterification is a chemical reaction that aims at substituting the glycerol of the glycerides with three molecules of monoalcohols such as methanol thus leading to three molecules of methyl ester of vegetable oil. Normally most of the oils are converted into biodiesel esters using the base catalysed transesterification method. But there are certain exceptional cases wherein direct trans-esterification cannot be performed. Such cases appear in raw vegetables oils (Non edible oil) like Jojoba oil, babassu oil, Jatropha and salvadora oil, etc because these raw vegetable oils posses high free fatty acid (FFA). For determining whether the raw vegetable oils can be trans-esterified directly the acid value is the most important property that must be known.

Literature Review

1.**Amol M. Ramning et.al.** prepared biodiesel from neem oil which is non-edible oil. In the second stage process treated oil were converted to Neem oil methyl ester. The fuel calorific value of neem oil methyl ester (biodiesel) was found to be comparable to those of petro diesel. For any fuel the most important property is its calorific value. Among all biodiesel prepared from different feed stock, the calorific value of Neem oil methyl ester (Biodiesel) is nearest to petro diesel. Conversion to continuous processing should improve the economics of the process, as the improved mixing should generate a better product (rendering the downstream separation processes easier), at lower residence time (reduction in reactor volume). These improvements can decrease the price of biodiesel, making it a more realistic competitor to petro-diesel.

2 A.S.Silitonga et.al compared properties of jatropha curcas, calophyllum inophyllum and ceiba pentandra oil. These three crude vegetable oils have high viscosity which are jatropha curcas, calophyllum inophyllum and ceiba pentandra oil. Besides, the high acid values of these three oils. Thus, a two-step catalyzed and neutralization process was needed to produce the biodiesel from crude oil. The characteristics and the physicochemical properties of these three crude oils were determined. production of biodiesel from non-edible feedstocks is more attractive than in the past and switch grass have emerged to be very promising feedstocks for biodiesel production. Therefore, three potential biodiesel feedstocks which are CJCO, CCIO and CCPO are proposed in this study.

3 Budania et.al described PM-engine concept that has the potential to realize a near-zero emission engines under both part and full load operational conditions. In a conventional DI engine the in-cylinder flow structure and turbulence play an important role for the mixture formation and combustion processes. In the case of the PM-engine the role of the intake system is to supply a required mass of air in to the cylinder. The fuel spray (even if high injection pressure is used) is immediately destroyed and the spray impulse are spreads over the large specific surface area and over entire volume of the PMcombustion chamber. First experiments have also indicated very effective secondary atomization to be present for the liquid jets injected onto the PMsurface. The temperature control is directly driven by the heat recuperation in the porous medium (heat capacitor).

4 Benjamin T.A et.al. did experiment on Jatropha Biodiesel testing in a single cylinder direct-injection diesel engine to investigate the operational parameters of a small capacity diesel engine under six engine loads. Each blend was tested on a short term basis of three hours. The result shows that the brake thermal efficiency increased for all tested blends at lower engine loads and decreases at higher engine loads. The study shows that diesel reference fuel exhibited superior performance characteristics when compared to biodiesel jatropha blends in terms of brake power, specific fuel consumption, brake thermal efficiency, air/fuel ratio and volumetric efficiency while biodiesel jatropha blends demonstrated better performance for exhaust gas temperatures and percentage heat loss to exhaust. Furthermore, for the biodiesel jatropha blends, B100 gave best optimum result due to its relatively high brake thermal efficiency and low specific fuel consumption despite its high percentage of heat loss to flue gases.

5 B. JothiThirumal have conducted experiments on a 0.5 litre DI Diesel engine to reduce the NOx emission with after- treatment system. CO is reduced by using Magnesium Sulphate & Sodium Chloride catalyst SCR with methyl ester of neem oil. There is a reduction of by volume with Potassium Silicate – Sodium Chloride, Zinc Sulphate-Sodium Chloride catalysts. Smoke is reduced by using Magnesium Sulphate & Sodium Chloride catalyst SCR with methyl ester of neem oil. In order to study the emissions reduction potential of different catalysts experiments with Methyl Ester of Neem oil (MEON) have been conducted at various loads. For maximum engine load, the NOx emission without SCR is a maximum at 610 p.p.m and it is reduced when Catalyst (zinc sulphate-sodium chloride) is used. With the catalyst potassium-sodium the emissions are reducted.

6 Bobade S.N. and Khyade V.B. have suggested that the karanja oils can be used as a source of triglycerides in the manufacture of biodiesel by transesterification reaction. The biodiesel from refined vegetable oils meets the Indian requirements of high speed diesel oil. But the production of biodiesel from edible oil is currently much more expensive than diesel fuels due to relatively high cost of edible oil. There is a need to explore non edible oils as alternative feed stock for the production of biodiesel non-edible oil like karanja. It is easily available in many parts of the world including India and it is cheaper compared to edible oils. Production of these oil seeds can be stepped up to use them for production of biodiesel. The production of biodiesel from this non edible oil provides numerous local, regional and national economic benefits. To develop biodiesel into an economically important option in India some innovations required for modification into the process to increase the yield of ester. After this demoisturisation of oil they removed available wax, carbon residue, unsaponificable matter and fiber. These are present in a very small quantity and carried out some important tests of oil.

7 Dhruva D et.al. prepared Rice bran oil methyl ester from crude rice bran oil by using three stage transesterification processes. In the first two stages, H2SO4 was used as an acid catalyst to reduce the free fatty acid (FFA) level to less than 1%. In the third stage, NaOH was used as an alkaline catalyst to complete the transesterification reaction with methanol. Fuel properties such as viscosity, gross calorific value, flash and fire points were compared with conventional diesel oil to study their usefulness as compression ignition fuel. The characteristics fuel properties of RBOME blends were found to deviate more from those of diesel oil with the increasing in the percentage of methyl ester in the blend. The viscosity of RBOME was within the recommended limit. Blending the RBOME with diesel oil further brought the properties closer to those of diesel oil. RBOME may be blended with diesel oil because the blends seem to have some of the major fuel characteristics, such as viscosity, and heat of combustion were close to those of diesel oil. The use of blend of diesel with RBOME may be restricted to lower proportions of RBOME as the higher proportions of RBOME tend to deviate further from diesel in their properties.

8 Doddabasawa et.al. described various important fruit crop widely distributed in West Indies and native of the tropical Americas. The sugar apple has been widely planted in home gardens of South Florida because of its high quality fruit and good adaptation to the area. Some fruit is found in local markets but commercial production is on a very limited scale. The common name of the Annona squamosa L. is custard apple. The color of the fruit is pale green to blue green with a deep pink bluish in some verities. The flesh is light fragrant and sweet, creamy white to light yellow. Soap formation leads incomplete transesterfication and makes separation of glycerol difficult. Determination of free fatty acid decides the transestrification process and catalyst to be used. The higher moisture content may lead to complications for FFA test. The presence of higher moisture will show the higher FFA. Higher FFA requires 2 stage transesterification process and more quantity of chemicals and reagents. The moisture content of the custard apple seeds was calculated and was found to be 4.5%. It was affordable content.

9 Gaurav PauL experimentally investigated and compared with simulated data using Diesel-RK software. The experiments were carried out using pure diesel (B0) and pure jatropha biodiesel (JB100) as fuels. The performance characteristics shows that brake specific fuel consumption (BSFC) increases and brake thermal efficiency decreases with the use of jatropha biodiesel.. Combustion characteristics show an increase in peak cylinder pressure and a decrease in ignition delay period. The use of jatropha biodiesel in a conventional diesel engine decreases its torque and brake thermal efficiency, the decrease being more with increase in the biodiesel share in the blends. BSFC increases with the percentage of biodiesel in the blended fuels. Cylinder peak pressure increases and ignition delay period decreases with the increase in biodiesel share in the blended fuels. Use of jatropha biodiesel increases the NOx emission compared to pure diesel. This is due to the higher oxygen content of jatropha and the higher temperature obtained due to complete combustion of the biodiesel.

10 G. Venkata et.al.(2015) showed biodiesel as alternative fuel and widely used as alternative for diesel fuel due to its merits such as lower sulfur, lower aromatic hydrocarbon and higher oxygen content. The brake thermal efficiency increased with B10 and B20 but reduced with B30. The brake specific fuel consumption and exhaust gas temperature were increasing with the percentage of rice bran biodiesel in the blends. The brake thermal efficiency and exhaust gas temperature increased but brake specific fuel consumption reduced and reversed trend was observed injection pressure for all the fuels tested. The brake thermal efficiency, brake specific fuel consumption and exhaust gas temperature with the blends B10, B20 and B30 was higher than that of the diesel fuel at all injection pressures. The rice bran biodiesel can be used as a substitute for the diesel fuel in diesel engines. The exhaust gas temperature was increasing with the percentage of rice bran biodiesel in the blends and also with injection pressure.

11 Omkaresh.B.R et.al.(2015) Described biodiesel which having better properties among three is tested for their use as a substitute fuel for diesel engine. Tests have been conducted on engine for different blends of biodiesel with standard diesel, at an engine speed of 1500 rpm, fixed compression ratio 17.5, fixed injection pressure of 200bar and varying brake power. The cloud point of Custard Apple biodiesel is less than biodiesels of Karanja and Mauha, hence it may cause less problems in start of engine in cold climates. The Kinematic viscosity, Flash point and Density of produced biodiesel is high compared to conventional diesel. Hence the biodiesels are blended with diesel in required proportions to reduce the fuel properties to conventional diesel range. The NOx emission increases when CI Engine fuelled with biodiesel and its blends compared to conventional diesel. This is one of the major drawbacks of biodiesel and The overall study of Engine performance and emission evaluates that B20is the most suitable blend among various blends of Custard Apple biodiesel that can replace conventional diesel.

Objectives of the study:

- To study production techniques of biodiesel.
- To produce the Biodiesel from Jojoba oil and Babassu oil
- To study performance, emission and combustion characteristics of biodiesel tested in CI engine.
- To find amount of Jojoba oil and Babassu oil biodiesel which can be blended diesel for optimum performance.
- To evaluate the advantages and disadvantages of jojoba and babassu oil as a biodiesel.

To compare jojoba oil and babassu oil biodiesel with conventional fuel.

RESEARCH METHODOLOGY

3.3 Theoretical framework

This is an empirical type of research, which is based on experimentation or observation. The effect of biodiesel on engine power and torque will be measured. To study the effect of pure biodiesel on engine power, with biodiesel (especially with pure biodiesel), engine power will drop due to the loss of heating value of biodiesel. However, the results may show some fluctuation. Some power loss is also important factor need to consider. The loss of heating value of biodiesel will be compared to diesel, because of power recovery. that the respective average decrease of torque and power values of our need to measure. Due to viscosity and density and heating value the observation will show that the brake torque loss for B100 biodiesel relative to diesel at specific rpm as the results of variation in heating value. The content of biodiesel blended with diesel results in the difference in engine power performance, which has become the commonsense. Engine power will decrease with the increase of content of biodiesel.

The biodiesel produced can be stored in its pure form or mixed with petroleum diesel. The mixing can be done by splash blending, injection blending or simply pouring the two products together and agitating. The standard storage procedures used for petroleum diesel can be used for biodiesel blends up to B20 (B20 is defined as 20% biodiesel and 80% petroleum diesel by volume) Fuel consumption of an engine fueled with biodiesel becomes higher because it is needed to compensate the loss of heating value of biodiesel . The difference in fuel consumption between diesel and pure biodiesel will be calculated in mass, and in volume because of higher density of biodiesel. Observatory experimentation of biodiesel testing for B10, B20, B40, B60, B80 and B100 fuels on a 3-cylinder, 4-stroke, DI diesel engine. Further increasing engine load for all kind of fuels (B5, B20, B50, B100 and diesel). Further BSFC values at full load will be compared with value at partial loads for biodiesel compared to diesel. The effect of injection timing and injection pressure on fuel consumption for biodiesel will investigated experimentally. Different efficiency of biodiesel from the experiments babassu and jojoba oil will be observed. The break thermal efficiency is also considered.

Use of biodiesel instead of diesel fuel cause change in PM emissions. Smoke formation occurs at the extreme air deficiency. Air or oxygen deficiency is locally present inside the diesel engines. It increases as the air to fuel ratio decreases. The smoke emissions are measure with increase in the load for all compression ratios, as the formation of smoke is strongly dependent on the load . For biodiesel operation the smoke values will reduce because of the atomic bounded oxygen which helps in better combustion, thus reducing the smoke. Some researcher had reported that the decrease in smoke for JB20, JB50, JB100, BB20, BB50 and BB100 are measured. Formation of NOx is dependent on the operating temperature of the cylinder and the oxygen availability. Advance in injection and thus advance in combustion for biodiesel affect NOx emissions higher the cetane number of biodiesel shortens ignition delay and thus combustion advances. The CO emissions will reduce when diesel is replaced by pure biodiesel. For the jojoba and babassu methyl ester (B100) and its blends (B20, B40, B60 and B80) compared to diesel. CO emissions of blends reduce due to increasing in oxygen content. It will show that commonly the CO emissions may reduce when using biodiesel due to higher oxygen content and lower carbon to hydrogen ratio in biodiesel compared to diesel.

HC emissions for biodiesel will be measured with the increase of biodiesel content. If we get good results every time from small-scale tests, even by using oil from these two sources, then it's time to scale up the process to provide our fuel needs. When considering scale-up operations, it is important to evaluate our specific fuel needs. If we are planning to distribute the fuel to family and friends, or if our intention is to use it in expensive machinery, we must ensure that the processor is capable of producing quality fuel.

Limitations:

1. Biodiesel may solidify at low temperature.
2. Area of research is limited to Babassu oil and Jojoba oil.
3. Current price of biodiesel is higher than conventional fossil fuel.
4. These trees are not cultivated everywhere so oil is not available in all reasions.

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