The Performance and Emission Characteristics of a Diesel Engine Fueled with Neat Biodiesel

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Abstract— Due to increasing the demand for fossil fuels and more liberation of pollutants in environment, a number of renewable sources of energy have been studied worldwide. Non edible oil contains several unsaponifiable and toxic components, which make them unsuitable for human consumption. An attempt is made to assess the suitability of vegetable oil for diesel engine operation, without any modifications in its existing construction. Biodiesel is a clean and renewable fuel which is considered to be the best substitution for diesel fuels. In order to achieve this, biodiesel was prepared from the non-edible oil of Mahua oil by transesterification of the crude oil with methanol in the presence of NaOH as catalyst, and adding nano particles (TiO2, Al2O3). The important fuel properties of methyl esters of biodiesel produced from Mahua oil, like viscosity, flash point, fire point, calorific value etc., should be found out to compare with the properties of Indian standard biodiesel for its use.

Key words: Diesel Engine, Neat Biodiesel

I. INTRODUCTION

Biodiesel is simply a liquid fuel derived from vegetable oils and fats, which has similar combustion properties as regular petroleum diesel fuel. Biodiesel can be produced from straight vegetable oil, animal oil/fats tallow of waste cooking oil. Biodiesel is biodegradable, non-toxic, and has significantly fewer emissions than petroleum-based diesel when burned. Biodiesel is an alternative fuel similar to conventional or "fossil/petroleum "diesel. The process used to convert these oils to biodiesel is called transesterification. This process is described in more detail. The largest possible source of suitable oil crops such as soybean rapeseed, corn, and sunflower. At present, oil straight from the agricultural industry represent the greatest potential source, but it is not being used for commercial production of biodiesel simply because the raw oil is too expensive. After converting it to biodiesel the price is too high to complete with petroleum diesel. Waste vegetable oil can often be obtained free or treated .One disadvantage of using waste oil is it must be treated to remove impurities like free fatty acids (FFA) before conversion to biodiesel. Biodiesel produced from waste vegetable/animal oils and fats can compete with the prices of petroleum diesel without subsidies.

II. LITERATURE SURVEY

C.V.Mahesh, E.T.Puttaiah, they studied on performance and emission characteristics of non-edible oil (honge oil) as alternate fuel in CI engine. Energy conservation is important for most of the developing countries, including rest of the world. The rapid depletion in world petroleum reserves and uncertainty in petroleum supply due to political and economic reasons as well as the sharp escalations in the petroleum prices have stimulated the search for alternatives to petroleum fuels. The situation is very grave in developing countries like India which imports 70% of the required fuel, spending 30% of her total foreign exchange earnings on oil imports. Petroleum fuels are being consumed by agriculture and transport sector for which diesel engine happens to the prime mover. For the developing countries of the world, fuels of bio-origin can provide a feasible solution of the crises. The fuels of bio-origin may be alcohol vegetable oils, biomass and biogas. Some of these fuels can be used directly while others need to be formulated to bring the relevant properties close to conventional fuels. The power used in the agricultural and transportation sector is essentially based on diesel fuels and it is therefore, essential that alternatives to diesel fuels be developed. Non edible oils have capability to solve this problem because they are renewable and lead to reduction in environmental pollution. The direct use of non-edible oils as a diesel engine fuel is possible but not preferable because of their extremely high viscosity. Trans-esterified non edible oils (bio diesel) are promising alternative fuel for diesel engines studies have been carried out on the performance &emission characteristics of Honge oil Methyl Ester (HOME) and its blends with diesel oil are analysed in a direct injection CI engine. The properties of HOME thus obtained are comparable with ASTM biodiesel standards.

III. BIO DIESEL PREPARATION

Various researchers have discussed fairly extensively, the advantage of using vegetable oils as diesel. Such properties include liquid nature for transport, heat content, and that they are renewable and readily available. Though there are some disadvantages such as higher viscosity lower volatility and the reactivity of unsaturated hydrocarbon chains. Vegetable oils cannot often be used directly as an energy source in an engine due to the higher level of viscosity, the lower volatility and the reactivity of the unsaturated hydrocarbon chains with in oils. Direct use of vegetable oils has been deemed unsatisfactory as due to the high viscosity, Free Fatty Acid (FFA) content and matter of carbon deposits, their use has been limited to a considerable extent. Many technologies and methods has been employed to try and reduce the viscosity of oil; these include micro emulsion pyrolysis (thermal cracking), catalytic cracking and Tran's esterification. Bio diesel is used to replace diesel and is produced by transesterification of vegetable oil and waste fats hence, biodiesel can be defined as "mono alkyl esters of fatty acids derived from vegetable oil and animal fats" .It is the similarities in the constitution vegetable oils/animal fats and petroleum derived diesel that makes the vegetable oils suitable for conversion of biodiesel. The vegetable oils/animal fats are naturally insoluble in water and are hydrophobic substances. Their general make up consist of

one glycerol to three fatty acids their buy they are frequently referred to as triglycerides. The characteristics of the fats are influenced by the nature of fatty acids attached to the glycerine; the nature of the fatty acids can have a knock on the effect on the characteristics of biodiesel. The most commonly considered animal fats consist of those derived from poultry, pork and beef.While one research group reported on the conversion of animal fats for biodiesel, but then other group have argued that although animal fats are mentioned regularly, their uses are limited as some of the methods for converting vegetable fats are not applicable to animal fats due to the natural differences between the two types of the fats. Used vegetable fats can be recycled for biodiesel production, but the quality of the oil will have a knock on effect on the quality of the biodiesel produced.

IV. COLLECTION OF MAHUA SEEDS

Initially the seeds of the plants are collected from the grown tree, they are selected in that a way that exist homogenous in size. Seed collection is done during the ideal period that the maximum oil content is obtained for extraction.

V. DRYING PROCESS

The collected seeds of the plants are dried in son for about two days, seeds are maintained within particular period of the day in exterior because it is undesirable to keep them in cold environment.

VI. PREPARATORY PROCESS

After the seeds are sufficiently dried such that the water content in them is completely removed, they are subjected to preliminary preparatory process. In these phase, the dried seeds are broken and the interior part is taken for further processing. The shell is removed since it is not desirable for the overall process.

VII. EXTRACTION PROCESS

After the seeds are dried sufficiently, we had the oil by using the mahua seeds. We used chekku to get the oil from the seeds. Normally if we use 1 kg we can get 0.8 litres of the oil. Then the remaining filtered by-products can be used as medical purposes.

A. Raw Materials Required

1) Mahua oil
2) Lye (catalyst)
3) Methanol
4) Isopropyl Alcohol (for tests. Use 99% IPA)

VIII. TRANSESTERIFICATION

Transesterification is a kind of organic reaction where alcohol group in ester is substitute. It can also be reaction of vegetable oil/fat with alcohol to give ester and glycerol. The applicability of transesterification is not restricted to laboratory. Several relevant industrial processes use this reaction to produce different types of compounds. An example is the production of PET (polyethylene terephthalate), which involves a step where dimethyl terephthalate is Trans esterified with ethylene glycol in the presence of zinc acetate as catalyst. Furthermore, a large number of acrylic acid derivatives and produced by transesterification of methyl acrylate with different alcohols, in the presence of acid catalysts.

IX. FREE FATTY ACID TEST (FFA)

Fatty acids are the building blocks of fat sources in the living organisms. Fat or lipids are made up of 3 fatty acids attached to a glycerol backbone to make up a triglyceride. Since fatty acids are necessary to create essential building blocks such as triglycerides, they are rarely found floating alone within cells. When these acids are floating alone, they are referred to as fatty acids. Free fatty acids appear as lipids breakdown products and are therefore good indicators of degradation. There are many types of free fatty acids. They can be differentiated by the length of the carbon chain the presence and number of double bonds and the alignment of the carbons at the double bonds.

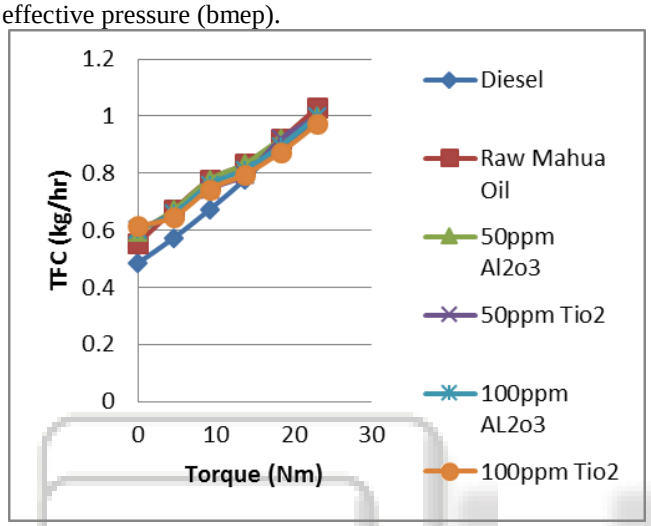
- The 5gm of fat is to be taken and added with 50ml of ethanol.
- The solution is heated till the bubbles come .
- 50ml of NaOH(0.1 N)poured in the burette.
- Next phenopthalein indicator of 2 drpos is to be added in the conical flask.
- Now the titration is to be started.
- When colour change occurs in the solution the titration is to be stopped as shown in fig.
- The burette readings are noted.

X. PREPARATION OF METH OXIDE SOLUTION

300 ml of methanol is to be filled in a beaker. 4.4 gm of NaOH pallets is to be dissolved in the methanol solution;it will act as catalysts foe trans-esterification process. The methoxide solution preparation. In this process karanja oil is made to react with methanol in the presence of base catalysts (NaOH).

XI. RESULTS AND DISCUSSION

The following section illustrates the results obtained from the performance and emission characteristics of the CI engine. The variation of specific fuel consumption with brake mean effective pressure (bmep).



XII. CONCLUSION

The performance and emission characteristics of neat diesel and diesel-biodiesel-ethanol blends with the addition of cerium oxide nanoparticles are investigated to evaluate the emission reduction potential on the single cylinder CI engine. The castor oil biodiesel prevents phase separation among diesel and ethanol blend and the stability of the blend with the addition of cerium oxide improves with high speed blending and ultrasonic bath stabilization technique. The specific fuel consumption is higher for the diesel-biodiesel-ethanol blends than neat diesel at all the brake mean effective pressures. The brake thermal efficiency of neat diesel is higher than diesel-biodiesel-ethanol blends at all the loads and a small improvement is observed with the addition of cerium oxide with diesel ethanol blends.

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