1. Introduction

In the present scenario the diesel engine is a popular prime mover for transportation and for industrial experiments. But in recent years the demand in energy has increased dramatically so the production of biodiesel which is renewable, biodegradable and non-toxic fuel can be extracted from vegetable oil can be considered as an alternative fuel used in the diesel engine. Therefore the biodiesel is having very good fuel properties better than diesel fuel so that the environment will be free from hazardous pollution. The biodiesel is having high flash and fire point temperatures than diesel fuels so it is safest among all alternative fuels. The present investigation is the Study of Performance and Emission Characteristics of a Diesel Engine Fuelled with Blends of Neem and Simarouba oils.

1.1 Simarouba (simarubaceae)

Simarouba commonly known as The Paradise Tree or King Oil Seed Tree. It belongs to simarubaceae family. The height of this tree will be 7-15m. In India, it is mainly found in Andhra Pradesh, Karnataka and Tamil Nadu etc. This tree can produce 2000-2500 kg seed/hectare-year.

1.2 Neem (mellia azadirachta)

Neem belongs to family azadirachta indica. Neem oil has extracted from the fruits and seeds of the neem. Neem oil can be in golden yellow, yellowish brown, reddish brown or bright red in colour. The content of neem oil varies from 300ppm to over 2500ppm depending on the extraction technology and quality of the neem seeds crushed. In India, neem oil is not used for cooking purpose so it can be used in different methods like extracting biodiesels, preparing cosmetics, etc.

Objectives:

- Free fatty acid test to find the amount of catalyst to be added
- Preparation of biodiesel.
- Measurement of the properties like density, flash point, fire point, viscosity, calorific value, specific gravity of the biodiesel and blends.
• Testing on diesel engine and Obtain performance characteristics like brake specific fuel consumption and brake thermal efficiency of the engine.
• Measurement of emission contents like NOx, CO2, CO, HC and SMOKE for different blends with diesel.
• Comparison of performance and emission characteristics of the engine with blends and pure diesel.

3. Methodology

3.1 Extraction of biodiesel oil

The manual oil expeller was used to extract the oil from the seeds which is having high pressure screw press. It also contains a stainless helical screw. Then the extracted oil was kept at room temperature in order to settle the solid particles down. Then the oil is filtered and heated to remove the unwanted particles in the oil. Finally, the oil is kept in the conical flask and sealed.

3.2 Measurement of free fatty acid

The measurement of free fatty acid is to measure the acid content in the oil. For measuring the FFA 1g NaOH is added with 1L of distilled water and taken in burette. Then 1g of sample oil in 10ml isopropyl alcohol in conical flask and add few drops of phenolphthalein is added. Titrate the sample till pale pink colour appears. 3.5g of NaOH per litre of oil is required.

3.3 Trans-esterification process

Biodiesels are prepared by trans-esterification process, where the triglycerides of oil are converted to their monoesters by the reaction of methanol in the presence of sodium hydroxide. This process is mainly used to reduce viscosity of triglycerides and to remove the impurities. The main procedure is Take 1000ml of both simarouba and neem oil in a beaker. Then calculate the amount of methanol and NaOH is called as methoxide. Add the catalyst in the beaker containing oil and place on the automatic magnetic stirrer and the process should be stirred continuously. Simultaneously the oil should maintain the temperature of 500 - 600°c. Allow the mixture to settle down and then transfer in separating funnel and leave it for 24 hours After the mixture to settle down for 24 hours, two layers will be obtained. One layer is biodiesel and other is glycerol. Remove the biodiesel and collect in separate flask.

3.4 Blending
The pure biodiesel is denoted as B0. The produced dual biodiesels is blended with diesel at different proportions as 0%, 10%, 20%, 30% and 40% and they are denoted as B10, B20, B30, and B40 respectively.

3.5 Emission specifications

Smoke meter is used for measuring the capacity of the exhaust from diesel vehicles. It consists of three units. One is a smoke chamber which contains the smoke column through which the smoke from the tail pipe of a vehicle is passed and smoke density is measured. The measuring electronics is clamped on at one end. Second one is the RPM adapter which measures the oil temperature. The exhaust gas to be measured is fed into the smoke chamber.

Five gas analyzer is used for testing the emissions from automotive engines. The instrument can measure carbon monoxide (CO), Carbon Dioxide (CO2), and Oxygen in percentage, and Hydrocarbons and Nitric Oxide (NOx) in ppm. The analyzer uses the principle of Non-Dispersive Infra-Red (NDIR) for measurement.

3.6 Engine specifications

The diesel engine test was conducted using kirloskar AV-1, 4-stroke single cylinder engine. Tests have been conducted at different blends of biodiesel with standard diesel, at an engine speed of 1500 rpm and varying load. The compression ratio and diameter of brake drum was set to 16.5:1 and 0.36m respectively.

4. Results and conclusion

The performance and emissions characteristics of diesel engine fuelled with biodiesel blends have been analysed, and compared with pure diesel fuel. The results of present work are summarized as follows:

- Dual biodiesel satisfies the important fuel properties as per ASTM specification of Biodiesel.
- The diesel engine performs satisfactorily on biodiesel fuel without any significant engine modifications.
- The brake thermal efficiency decreases with increase in percentage of biodiesel blends.
- The specific fuel consumption increases with increase in percentage of biodiesel blends due to the lower calorific value of biodiesel blends.
- The B10 shows good brake thermal efficiency in comparison with diesel. A little increase in fuel consumption is often encountered due to the lower calorific value of the biodiesel.
- The blend B10 having same engine output and lower change in emissions compared to diesel.
- Finally, in view of the petroleum fuel shortage, B10 blend biodiesel can certainly be considered as a potential alternative fuel.

* ~ * ~ *