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PERFORMANCE TEST ON ALTERNATE FUEL IN CI ENGINE

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Abstract:
The main objective of this research is to give a better alternative fuel in terms of Bio diesel instead of diesel. This Bio Diesel is typically made by waste cooking oil with the addition of some additive called n-butanol. It is safer than petroleum diesel because it is less combustible. Use of biodiesel also results in reductions of unburned hydrocarbons, carbon monoxide (CO), and particulate matter. CO emissions using biodiesel are substantially reduced, on the order of 50% compared to most petrodiesel fuels.

The loss in power when using pure biodiesel is 5–7%. Unsaturated fatty acids are the source for the lower oxidation stability; they react with oxygen and form peroxides and result in degradation by-products .The performance of the engine will increased by using this Bio-diesel. The world reserves of primary energy and raw materials are obviously, limited

Keywords: alternative fuel, Bio Diesel, less combustible, primary energy

1. INTRODUCTION
1.1GENERAL

` The concept of using biofuels in diesel engines was originated from the demonstration of the first diesel engine by the inventor of diesel engine ‘‘Rudolf Diesel” at the World Exhibition in Paris in 1900 by using peanut oil as a fuel. However, due to abundant supply of petro-diesel, R&D activities on vegetable oil were not seriously pursued. The rapid depletion, rising prices, uncertain supplies and ever-increasing requirement of petroleum products have triggered an intensive search for fuel alternatives, particularly for internal combustion engine applications. The concern for a cleaner environment has given further impetus to this search.

1.2 BIOFUELS

Biofuels are renewable fuels that are produced predominantly from domestic biomass feedstock, or as a by-product from the industrial processing of agricultural or food products, or from the recovery and reprocessing of products such as agricultural crop wastes and residues, wood wastes and residues, aquatic plants, animal wastes, municipal wastes, and other waste materials. There are several reasons for biofuels to be considered as relevant technologies by both developing and industrialized countries. These include energy security, 2 environmental concerns, foreign exchange savings, and socioeconomic issues related to the rural sector.

1.2.1 Biodiesel

Biodiesel is the methyl or ethyl ester of the fatty acid made from virgin or used vegetable oils (both edible and non edible) and animal fat and other sources such as waste cooing oil. AME used as fuel is specified in DIN EN 14214 and ASTM D6751 standards. Fuel equipment manufacturers (FIE) have raised several concerns regarding biodiesel, identifying FAME as being the cause of the following problems: corrosion of fuel injection components, low-pressure fuel system blockage, increased dilution and polymerization of engine sump oil, pump seizures due to high fuel viscosity at low temperature, increased injection pressure, elastomeric seal failures and fuel injector spray blockage. Pure biodiesel has an energy content about 5–10% lower than petroleum diesel. The loss in power when using pure biodiesel is 5–7%. Unsaturated fatty acids are the source for the lower oxidation stability; they react with oxygen and form peroxides and result in degradation by-products, which can cause sludge and lacquer in the fuel system. As biodiesel contains low levels of sulphur, the emissions of sulphur oxides and sulphates, major components of acid rain, are low. Use of biodiesel also results in reductions of unburned hydrocarbons, carbon monoxide (CO), and particulate matter. CO emissions using biodiesel are substantially reduced, on the order of 50% compared to most petrodiesel fuels. The exhaust emissions of particulate matter from biodiesel have been found to be 30% lower than overall particulate matter emissions from petrodiesel. The exhaust emissions of total hydrocarbons (a contributing factor in the localized formation of smog and ozone) are up to 93% lower for biodiesel than diesel fuel.

1.2.3 Pongamia

Millettia pinnata, also known as the Pongam Oiltree or Pongamia, is a leguminous, oilseed-bearing tree that has been identified as a candidate for non-edible vegetable oil production.

Pongamia plantations for biodiesel production have a two-fold environmental benefit. The trees both store carbon and produce fuel oil. Pongamia grows on marginal land not fit for food crops and does not require nitrate fertilizers. The oil producing tree has the highest yield of oil producing plant (approximately 40% by weight of the seed is oil) while growing in malnourished soils with high levels of salt. It is becoming a main focus in a number of biodiesel research organizations. The main advantages of Pongamia are a higher recovery and quality of oil than other crops and no direct competition with food crops. However, growth on marginal land can lead to lower oil yields which could cause competition with food crops for better soil.

1.2.4 Biodiesel to hydrogen-cell power

A micro reactor has been developed to convert biodiesel into hydrogen steam to power fuel cells.

Steam reforming, also known as fossil fuel reforming is a process which produces hydrogen gas from hydrocarbon fuels, most notably biodiesel due to its efficiency. A micro reactor or reformer, is the processing device in which water vapour reacts with the liquid fuel under high temperature and pressure. Under temperatures ranging from 700 – 1100 °C, a nickel-based catalyst enables the production of carbon monoxide and hydrogen

$$\text{Hydrocarbon} + H_2O \rightleftharpoons CO + 3\,H_2 \text{ (Highly endothermic)}$$

Furthermore, a higher yield of hydrogen gas can be harnessed by further oxidizing carbon monoxide to produce more hydrogen and carbon dioxide:

$CO + H_2O \rightarrow CO_2 + H_2$ (Mildly exothermic)

2. EXPERIMENTAL SET-UP AND METHODOLOGY

2.1 GENERAL

In this topic, the experimental set-up and methodology are discussed which are used to evaluate the performance and emission of a direct injection diesel engine using bio- fuels.

2.2 EXPERIMENTAL SET-UP

The schematic of the experimental set-up with instrumentation is shown in Figure 2.1. The experimental set-up is used for conducting experiments with biofuel blends. The test engine used was the Kirloskar TAF1 model. The specification of the engine is given in Appendix 1. A single cylinder four-stroke air-cooled diesel engine developing 4.4 kW at a speed of 1500 rpm was used for this work. This engine was coupled to a eddy-current dynamometer (Make:Saj test plant Pvt. Ltd, Model-AG10) with a control system. The cylinder pressure was measured by the hydraulic pressure transducer fitted on the engine cylinder head and a crank angle encoder (MakeKubler-Germany, Model 8.3700.1321.0360) fitted on the flywheel.

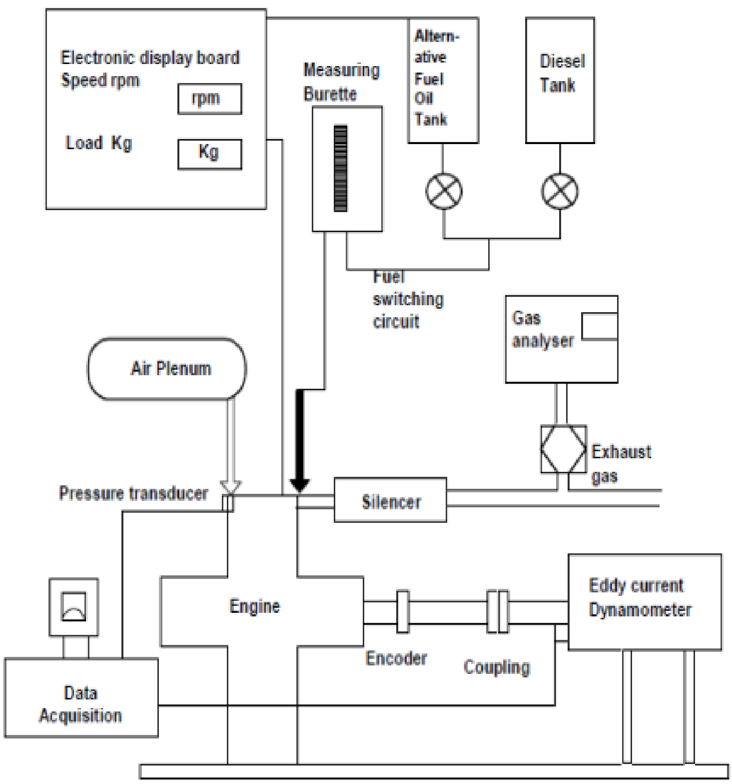

Figure 2.1 Schematic of Experimental Set up

Both the pressure transducer and encoder signal were connected to the charge amplifier to condition the signals. A charge amplifier was used to condition the signals for further processing. The exhaust emission from the engine was measured with the help of the AVL DI gas analyzer, and the smoke emission was measured with the help of the AVL 437C Smoke meter.

The specification of the exhaust gas analyzer and smoke meter are given ,the smoke emission was measured with the help of the AVL 437C Smoke meter. All the tests were conducted by starting the engine with standard diesel fuel only. After the engine warmed up, it was switched to the test fuels and their blends. At the end of the test, the fuel was switched back to standard diesel and the engine was kept running for a while before shut-down to flush out the test fuel from the fuel line and the injection system.

2.3 EXPERIMENTAL PROCEDURES

1. Check the coolant water supply to engine and dynamometer.
2. The fixed injection pressure of 210 bar was maintained.
3. The engine was insulated and tested at base line condition
4. The first stage tests were performed at constant speed.
5. The experiment were conducted at five load level viz. 3kg,6kg,9kg,12kg, 15kg.The required engine load percentages were adjusted by using the eddy current dynamometer.
6. The second part of the investigation was carried out by various blends.
7. The engine was allowed to run with particular blend at constant speed nearly 10min to attain the steady state condition at the lowest possible load.
8. The observations were made twice for average / concordance. 26
9. During the test trail the parameter such as fuel consumption, emission parameters were obtained.

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3. RESULTS&DISCUSSIONS

3.1 LOAD VS BRAKE SPECIFIC FUEL CONSUMPTION

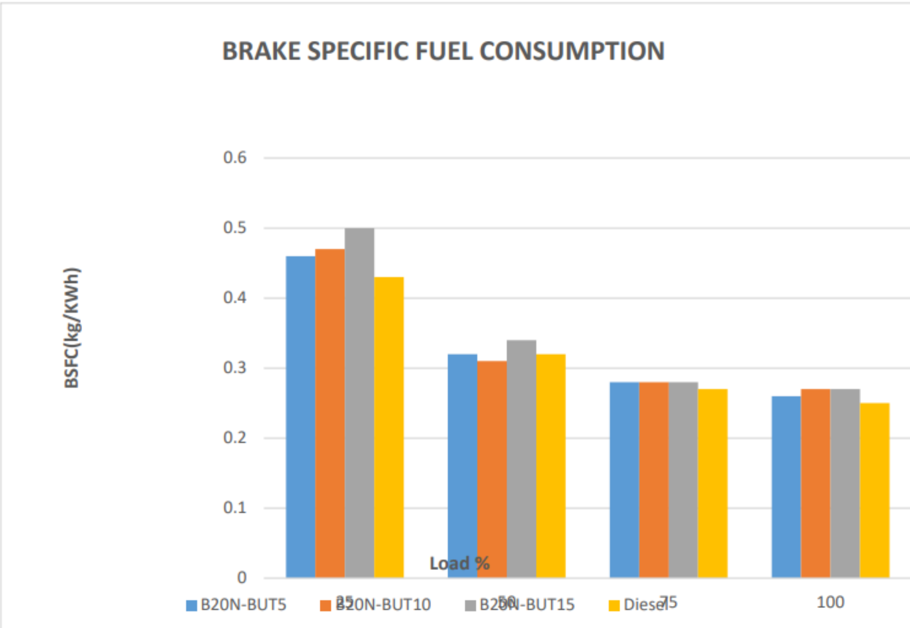

Figure 3.1 variation of Brake specific energy consumption with load

The different factors affecting the BSFC were fuel density, viscosity, heating value, and volumetric fuel injection system. The BSFC for all the fuels tested increases initially at low loads and at higher load conditions. The brake specific fuel consumption of the B20N-But5 and B20N-But10blend was lower than that of other blends. This may be due to better combustion, and an increase in the energy content of the blend. BSFC forB20N-But15 was higher than diesel due to lower heating value and increase in fuel density.

4. CONCLUSION

The current work has attempted to use biofuels, Waste cooking oil, N-butanol blends in a diesel engine and thereby, exclude the use of fossil diesel completely. By this measure, though the properties of biofuels are unique, the properties of the resultant blends are found to be mutually agreeable and conducive for operation in a diesel engine. Based on the study the following things are to be conclude .

1. The high cetane value of N-butanol and additive could compensate for the decreased cetane value.
2. The lower heating value of all the blends was found to be parto that of diesel fuel.
3. Reduced viscosity and increased volatility are the benefits of these blends.

4. Smooth engine operation was to be observed for all the blends and BSEC were also envisaged to be improved at full load condition

5. BTE of the engine was increased by 5% for B20N-Bu5 than diesel at full load condition

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