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Performance and emission analysis of diesel engine using karanja oil biodiesel blend with Butanol

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ABSTRACT

In 21st century energy demand was increased by reason of development of Industries, population, amount of vehicles. But availability of fuel is not satisfied. In other routes to solve the energy demand and control the pollution under using of alternative fuels. The usage of fossil fuel is causes to more pollution and change environmental conditions. The use of biodiesel is one of the major solution for this kind of problems. Our project work is used Karanja biodiesel for potentiate the diesel. The Karanja oil is readily available in India and it has more potential to use as alternative fuel in diesel engine without modification. Experimental is going conduct to study the performance and emissions characteristics of biodiesel; additive used biodiesel and compared with diesel. Similarly, the properties like calorific value, flash point, viscosity and fire point also going to study.

INTRODUCTION

Karanja oil



Fig. 1 Karanja oil & seeds

Karanja oil is derived from the seeds of the Millettia pinnate tree. It is more effective to use with biodiesel blends with additives. It will increase the performance and efficiency of the diesel. It is easily available in our country.

Butanol

Butanol (also called butyl alcohol) is a four-carbon alcohol with a formula of C_4H_9OH , which

occurs in five isomeric structures (four structural Isomers), from a straight-chain primary alcohol to a branched-chain tertiary alcohol; [1] all are a butyl or isobutyl group linked to a hydroxyl group (sometimes represented as $BuOH$, $n-BuOH$, and $i-BuOH$).

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These are *n*-Butanol, 2 stereoisomers of sec-Butanol, isobutanol and tert-butanol. Butanol is primarily used as a solvent, as an intermediate in chemical synthesis, and as a fuel. It is **CI engine**

sometimes also called bio Butanol when produced biologically and petro Butanol when produced from petroleum; those two names refer to very same substance, but highlight the different origin.

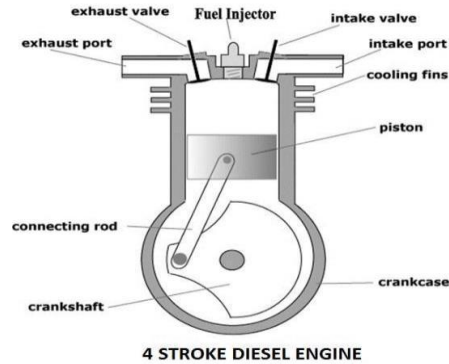


Fig. 2 Cut section of IC engine

CI stands for compression ignition. Diesel engines work by compressing only the air. This increases the air temperature inside the cylinder to such a high degree that atomized diesel fuel injected into the combustion chamber ignites spontaneously. The original diesel engine operates on the "constant pressure" cycle of gradual combustion and produces no audible knock.

LITERATURE REVIEW

Performance of an internal combustion engine fuelled with eleven different diesel/biodiesel blends. The results show that the B100 NO_x emissions are greater than B40 for 4500 W of electrical load. But, for small electrical loads meaningless discrepancies was observed between the fuel blends. In this study, NO_x emissions could be considered independent of the diesel/biodiesel blends. In addition, the results show that improving the electrical load, the NO_x emissions were also increased for all of the tested fuel mixtures. This is due to high temperature levels achieved inside the engine cylinder when electrical load increases. [1]

The biodiesel preparation from Karanja oil The conversion was 92% at 600c. The fuel properties like viscosity, density, flash point fire point and

calorific value of the transesterified product (biodiesel) compare well with accepted biodiesel standards i.e. ASTM and German biodiesel standards. The viscosity of biodiesel oil is nearer to that of diesel and the calorific value is about 12% less than that of diesel. More lubricating than diesel, so it increases the life of engines, Biodegradable, Nontoxic. High flash point and hence safe to transport and store, Oxygenated fuel and hence clean burning. Low viscosity and hence improved injection and atomization, Cetane no. of esters is greater, reduced emissions, 90% reduction in cancer risk, Provides domestic, renewable energy. [2]

The Jatropa- Dimethyl Ether Fuel Blends on a DI Diesel Engine reported that brake thermal efficiency is increased with blends of jatropa dimethyl ether (BDE5, BDE10 and BDE15) compared to neat jatropa oil operation. The Brake specific fuel consumption is increased in the case of jatropa -dimethyl ether blends compared to neat jatropa oil. The CO and HC emissions were reduced with the use BDE fuels, compared to neat jatropa oil for all load condition. The NO_x emission was decreased with addition of dimethyl ether. [3]

Using renewable and biodegradable fuels; reducing global warming due to its closed carbon

cycle by CO₂ recycling; increasing lubricity; and reducing substantially the exhaust emissions of carbon monoxide, unburned hydrocarbons, and particulate emissions from diesel engines. However, there are major drawbacks in the use of biofuel blends as NO_x tends to be higher, the intervals of motor parts replacement such as fuel filters are reduced and degradation by chronic exposure of varnish deposits in fuel tanks and fuel lines, paint, concrete, and paving occurs as some materials are incompatible. Here, fuel additives become indispensable tools not only to decrease these drawbacks but also to produce specified products that meet international and regional standards like EN 14214, ASTM D 6751, and DIN EN 14214, allowing the fuels trade to take place. Additives improve ignition and combustion efficiency, stabilize fuel mixtures, protect the motor from abrasion and wax deposition, and reduce pollutant emissions, among other features. Two basic trends are becoming more relevant: the progressive reduction of sulfur content and the increased use of biofuels. [4]

The load increases, brake specific fuel consumption decreases to the minimum of at 70% load and then increases for all the fuel samples tested. This can be correlated to the conclusion that the brake power increases as the load increases. The specific fuel consumption (SFC) for B5, B10, B15, and B20 is more or less equal to that of diesel. The SFC for B40, B60, B80 and B100 are continuously increasing and they are less than the SFC for diesel. This may be due to the lower calorific value of biodiesel than diesel. As the load increases, brake thermal efficiency increases upto 70% load and then decreases for all the fuel samples tested. The low brake thermal efficiency for B60, B80 and B100 may be due to the lower HHV and the increase in fuel consumption. [5]

Among them 20% Karanja oil methyl ester (KOME) was found highly comparable and even superior in many properties with unblended petroleum diesel. The specific gravity, flash and fire points, cloud and pour points and kinematic viscosity were slightly higher than that of diesel, whereas the Diesel Index was much higher and the smoke point was slightly lower. The optimum parameters for using KOH as catalyst were 45mL methanol, 1.5 g catalyst, temperature 80 °C and

reaction time of 60 min. Among the blends 20% KOME showed better performance characteristics than others. It had better break thermal efficiency, SFC, Indicated thermal efficiency. In the case of emission characteristics of 20% blend the NO_x were slightly more, understandably this was due to higher specific gravity of the fuel. [6]

Analysis of an unmodified diesel engine fuelled with Honge oil and its blends with diesel. Engine tests have been conducted to get the comparative measures of Specific Fuel Consumption (SFC), Total Fuel Consumption (TFC), Heat Supply (QS), Brake Thermal Efficiency (BTE) and Indicate Thermal Efficiency (ITE). Results were compared with each other and finally best blend ratios are optimized. The proportions by volume: 95% diesel 5% Honge oil; 90% diesel 10% Honge oil; and 80% diesel 20% Honge oil. For comparison purposes, test runs were carried out for the pure diesel fuel. Experimental results show that the performance of the engine which is fuelled with honge oil blends is comparatively higher than Diesel fuel. [7]

Analysis of single cylinder diesel engine operating With Pongamia oil and its blend reported that Transport vehicles greatly pollute the environment through emissions such as CO, CO₂, NO_x, unblunt or partially burnt HC and Particulate emissions. This paper presents the results of emission analyses carried out in an un modified diesel engine fuelled with Pongamia oil and its blends with diesel. Four blends were obtained by mixing diesel and Pongamia oil in the following proportions by volume: 95% diesel 5% Pongamia oil; 90% diesel 10% Pongamia oil; and 80% diesel 20% Pongamia oil. For comparison purposes, test runs were carried out for the pure diesel fuel. NO_x, HC, CO, CO₂ emissions at different loads were found to be higher for diesel, compared to B5, B10, B20 blends. [8]

Analyzed the effect of isobutenol on brake thermal efficiency, brake specific fuel consumption, cylinder pressure, heat release and exhaust emissions were studied. It was found that brake thermal efficiency is increased with increase in blend percentage both with 5% and 10% isobutenol. Addition of isobutenol shows negative impact on Brake specific fuel consumption (BSFC) which decreased with blend percentage

while it increases with isobutenol percentage.CO emissions and smoke capacity decreased significantly while NO_x emissions decreased marginally with the increase. [9]

The method was to perform the reactions under relatively moderate conditions, which could avoid thermal degradation of the methyl esters. Through the analysis of variance of the experimental results, reaction time and temperature, as well as their interaction effect were found to significantly affect the yields. The reactions with glycerol and supercritical methanol produced methyl esters such as methyl palmitate and methyl oleate as well as oxygenated compounds that can be used as fuel additives. [10]

METHODOLOGY

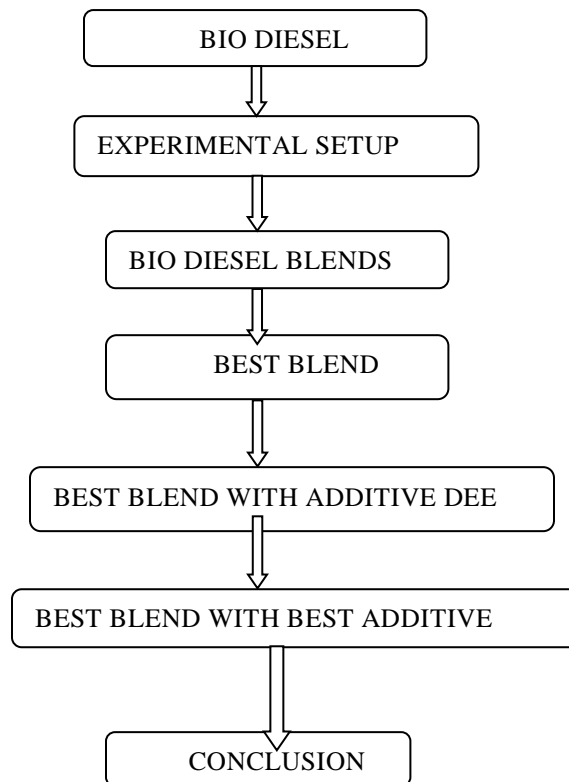


Fig. 3 Methodology flow chart

PROBLEM IDENTIFICATION

Nowadays consumption of diesel is very high, Cost is high. It causes environmental pollution and affects humans, plants and animals. It also causes climate change and cause global warming. For reducing these problems we prepare the mixture of biodiesel additive with diesel to reduce pollution .For these problems we conduct the experiment of using Karanja oil biodiesel with diethyl ether additive in CI engine. Because the Karanja oil is more effective compare to other and the low cost. Also using diethyl ether additive to reduce more amount of emission gases and improve the performance of the engine.

EXPERIMENTAL SETUP

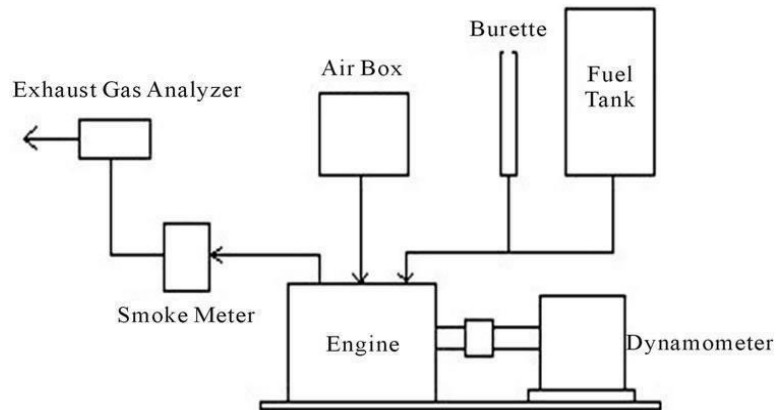


Fig. 4 Experimental Setup

PERFORMANCE CALCULATION

PROPS	DIESEL	B20	C4H9-5%	C4H9-10%	C4H9-15%
CV(KJ/Kg)	45625	3556	3760	3970	4270
$\rho(\text{Kg/m}^3)$	830	804	800	798	790
η_{BT} (%)	11.1	0.202	98.4	97.40	97.8
η_{MECH} (%)	40.29	98.151	0.118	0.102	0.122
η_{INT} (%)	47.97	0.178	0.120	0.108	0.125

CONCLUSION

Based on the review, the lot scope is available for doing experimental work in the area of alternative fuels. The main drawback of bio diesel is high viscosity and low Cetane number. This may

be reduced by Tran's esterification process. After the Trans esterification process, biodiesel used as fuel in diesel engine without any modification and also the performance and emissions characteristics of biodiesel similar to standard diesel.

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