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Performance and Emission Characteristics of Candlenut and Soapnut Biofuels

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Abstract*: *There is a need to find out an alternate fuel rather than fossil fuel which are depleting in very faster rate and to meet the power crisis in the planet .For the bio diesel production, we can exploit in a long list of trees, shrubs and herbs. In such a way, the mixture of the bio diesels such as candlenut seed and soap nut oil which is used as a fuel for diesel engines. It is significantly comparable to pure diesel in which the results are obtained. So that, it has been experimentally investigated in the influences of blends on break power, consumption of specific fuel, exhaust temperatures, brake thermo efficiency and air gasoline ratio and it was compared with mineral diesels. The comparable fuel properties from bio diesel such as candlenut and soapnut oil with the diesel. With suitable blends the work is transported to find the discharge aspect of biodiesel.

***Keywords* : *BTE, BSFC, Candlenut oil, Soapnut oil, NOx, Co*.**

I. INTRODUCTION

A liquid fuel is obtained from cooking oil, non-edible oils and animal fats called biodiesel, which can be used in CI machines. The American Society for Testing and Materials defines biofuels as long-chain mono alkalic esters, from fatty acids to renewable resources for diesel engines. This is also referred to as PN, where my number is the percentage of biodiesel in the mix. For example: B P denotes 15'- 15% and 85% diesel fuels, where P100 is pure biofuels.

- Raw materials used for biodiesels are used for cooking oils and fat residues.

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A. DEMERITS OF BIODIESEL

- As it has lower calorific value, it has slightly increased amount of fuel consumption.
- It may be inconvenient for cold climate as it as higher freezing point when separated with diesel fuel.
- As it is less stable, it can't be stored for long term.
- In its pure form, it can degrade plastics, rubber gaskets and hoses, so Teflon replacement is recommended.
- Biodiesel can dissolve the deposited some other contaminants and sediments of diesel fuel. It is later flushed by biofuel which may cause issues in injection system and nerves. So cleaning of tanks is recommended before filling with bio diesel.

This problem can be reduced easily when biodiesel and diesel fuel blends properly.

B. MERITS OF BIODIESEL

- Renewable fuels (Edible oils, non edible oils and animal fats).
- Low toxicity than diesel fuels.
- Biodiesel doesn't emits sulphur dioxide (so2)
- Very high flash point (100c) emissions.
- It emits low amount of contaminants like particulate matter, aldehydes, carbon monoxide, and polycyclic aromatic hydrocarbons.
- Diesel mixture can be blended at any rate; mixed fuels can be mixed during fuel delivery of vehicles.
- Biodiesel very good in lubricant properties.
- For conventional diesel engines, biodiesel is the only alternate fuel.
- Raw materials used for biodiesels are used for cooking oils and fat residues.

II. MATERIALS AND METHODS

Edible non edible oils, oils, animal fats and short chain alcohols are the raw materials for bio diesel.

The most commonly used worldwide oil for biofuels are

- PALM – Asian and central American counties
- SOYBEAN – Argentina and U.S.A.
- RAPESEED – European union countries

Sunflower, peanuts, linseed used non edible oils, animal fats and Edible oils, are also known raw material for biodiesel. Methanol and ethanol is commonly used alcohol in biodiesel. It can play important role in production and trading. The using of non-edible oil is studied for several years.

III. LITERATURE SURVEY

PRASAD VIJENDLAet.al [1] he experimentally proved that biodiesel of pongamia and madhurca oils on diesel Kirloskar engine and find out that 20% of hybrid edible oil and 80% can be used as alternative fuels without any changes in the engine with lower amount of CO and HC emissions and minimum power loss.

And he has concluded that the thermal efficiency of blend A-Diesel 90%, pongamia 50% and mustard oil 5% were slightly higher than the neat diesel.

PREMDAS NALLURDI.et.al [2] He has conducted some tests with a four-stroke, single-cylinder, oil-cooled VCR engine with pure diesel with different proportions of palm and Jatropha biodiesel. His results show higher calorific values of the fuel, leading to more power brakes with lower viscosity. He is finished with a low mixture of dual biofuels and can be used as fuel without any change in the engine.

A.M.RATHOD.et.al [3] He has investigated the performances characteristics and mechanical properties of two biodiesel with are extracted from pongamia pinnate oil and neem. He concluded that two oils are mono ester is produced from using transesterification process and can be used as fuel without any changes in engine system.

SRINIVAS KOMMANA .et.al [4] He states that there is replacement of diesel with biofuels with eucalyptus oil blend and palm oil has chosen. It is combining with palm oil, methyl ester in 10, 5 and 15 by volume respectively. The experiments are conducted in variable compression engine with blended diesel, stating that the properties are similar closer to the pure diesel.

CHETAN.et.al [5] He has investigated that multi-blended fuels namely jatropha and pongamia can used as fuel in CI engine. On starting up the engine there is no problem and there is no engine work done which is running at 1500 rpm.

SUNDAR.et.al [6] He has conducted the experiments in two phases in the first phase of work only with biodiesel. And in the second phase he has studied and done experiments to find the combustion and performance aspects of mesco, merbo with diesel blends. He concludes that calorific values of fuel are less and viscosity is very high which leads to lower brake power.

SRINIVAS RAO.et.al [7] has explained about the methyl ester palm kernel oil blends which is used on a single cylinder Di diesel engine for the experimental investigation. He proved and concluded that the eucalyptus oil with the methyl ester palm kernel oil nearly 50% increases the engine performance without any emissions.

M.SENDIL KUMAR.et.al [8] Investigation by Senthil Kumar on the methyl esters of Jatropha oil as a fuel in CI engine. Thermal efficiency is slightly reduced by increasing the temperature of an exhaust gas. Hydrocarbon emissions are reduced and CO increases as compared to diesel fuel.

M.J.NYE.et.al [9] Transit engine test using methyl ethyl and butyl esters and reported that best results were obtained using methyl esters in short term engine with laboratory.

PUHAN.et.al [10] In his previous work he has tested diesel with Mahua Oil Ethyl Ester and shows a comparable increase in thermal efficiency with clean diesel. He claims that this is mainly the chemical composition of the Mahua Oil Ethyl Ester, which leads to the combustion process. The viscous Mahua oil ethyl ester (6.2 mm2 / v 40 8c) is higher than the Mahua oil methyl ester (5.2 mm2 / v 40 8c).

G ANTONY CASMIR JAYASEELAN.et .al [11] To study the combustion characteristics, emission and performances of a constant speed direct injection diesel engine using Watermelon Seed oil – the output diesel which fuses on various loads and additive n-butanol. An experiment underwent with combinations of different fusions of watermelon seed oil with diesel such as B20, B40 on various loads, and the result of which was competed with pure diesel fuel. The result tells that Brake Thermal Efficiency (BTE) for watermelon seed oil with additive n-Butanol and its fusion has low BTE that of the diesel. There were a notice of Carbon Monoxide (CO), Hydrocarbon (HC) and NOx emission. There were also a tangible amount of smoke emission and decrease of combustion properties such as high pressure and heat frequency for watermelon seed oil and diesel fusion on full load. He proves that the lower blends of watermelon seed oil can be used in engine without any alterations.

R.SENTHIL.et.al [12] The major pollutants are nitrogen oxides, particulate, hydrocarbon and carbon monoxide. This causes severe adverse effects on health and environment. In this paper an attempt has been made to modify to combustion process by adding fuel additives with the diesel fuel. The peroxide and hydrocarbon based fuel additives are used in different proportions along with the diesel fuel. Results show that fuel with peroxide based additives produce better performance than that without additives. The additives by volume of 0.15% in diesel it gives good efficiency and emits lower amount of NOX and particulates.

VENKATESAN.M et al. [13] He has experimented with JOME with compressed natural gas (CNG) on a four-stroke diesel engine. Parameters such as BSFC, BDE emissions CO, CO2, HC, NOx and smoke opacity at three injection pressures of 80,200 and 220 bar, two injection times 27 degrees BDDC and 31 ° B .TDC are also tested. He experimentally demonstrated that the performance at 200 bar pressure during the injection of 31 ° BDTC was excellent.

IV. EXPERIMENTAL SETUP

The experiments are conducted in a Kirloskar (vcr) engine. Other fuels like LPG or ethanol can also be used in VCR besides petrol. In agricultural field the Kirloskar engine is most commonly used engine not only in agricultural it also used in pump set from machinery and other medium scale purposes. It has some construction that helps the engine to withstand the high pressure which occurs the tests. Necessary modification can be done in cylinder head and piston crown. The experiments are done four different load conditions 0, 3.0, 6.0 and 9.0 K.W. With constant speed under different load conditions, it controls rate of fuel flow as load increases. To measure the cylindrical pressure and the cylinder head surface to mount a piezo electric pressure transducer to the provision.

The characteristics of the engine were valued in terms of brake power and thermal efficiency and the emissions of the characteristics of the engine were evaluated in the terms of BTE and BSFC. The emissions terms like HC,CO2, CO and oxides of nitrogen. The maximum pressure of heat is releases and combustion of characteristics in terms. The heat release is emulative. Combustion is the duration of delay period. The performance of the combustion and the emission of the attributes are compared with the results of baselines in CI engine.

V. RESULT AND DISCUSSION

A. CO

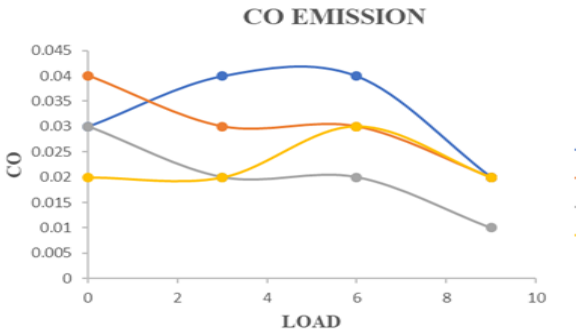

Fig. 1. CO Emission.

From this above Fig.1 shows the CO emission, Blend A (5% of candlenut oil and 5% of soapnut oil + 90% of diesel), Blend B (10% of candlenut oil and 10% of soapnut oil + 80% of diesel) and Blend C (15% of candlenut and 15% of soapnut oil + 70% of diesel) has been tested. In that , Blend A and Blend B is nearer to the diesel in co emission at the maximum load.

B. HC

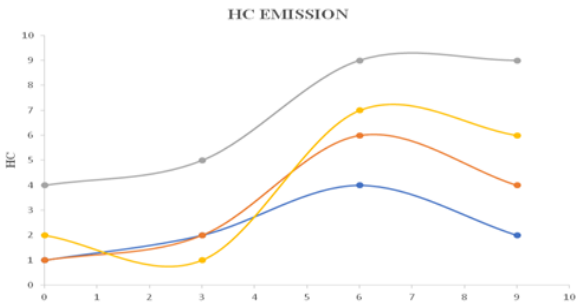

Fig. 2.HC Emission.

From this above Fig.2 shows the HC Emission, Blend A (5% of candlenut oil and 5% of soapnut oil + 90% of diesel), Blend B (10% of candlenut oil and 10% of soapnut oil + 80% of diesel) and Blend C (15% of candlenut and 15% of soapnut oil + 70% of diesel) has been tested. In that, Blend A and Blend B is nearer to the diesel in HC emission at the maximum load.

C. Co2

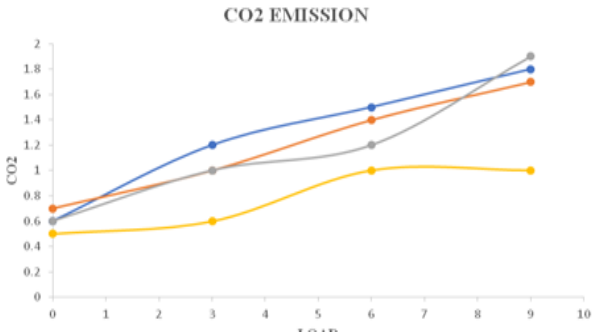

Fig. 3.CO2 Emission.

From this above Fig.3. CO2 Emission, Blend A (5% of candlenut oil and 5% of soapnut oil + 90% of diesel), Blend B (10% of candlenut oil and 10% of soapnut oil + 80% of diesel) and Blend C (15% of candlenut and 15% of soapnut oil + 70% of diesel) has been tested. In that, Blend B is nearer to the diesel in CO2 emission at the maximum load.

D. NOX

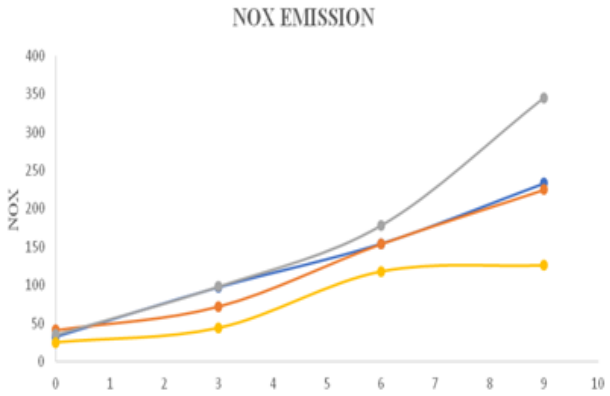

Fig. 4.NOX Emission.

From this above Fig.NOX Emission, Blend A (5% of candlenut oil and 5% of soapnut oil + 90% of diesel), Blend B (10% of candlenut oil and 10% of soapnut oil + 80% of diesel) and Blend C (15% of candlenut and 15% of soapnut oil + 70% of diesel) has been tested. In that, Blend A and Blend B is nearer to the diesel in NOX emission at the maximum load.

E. SMOKE DENSITY

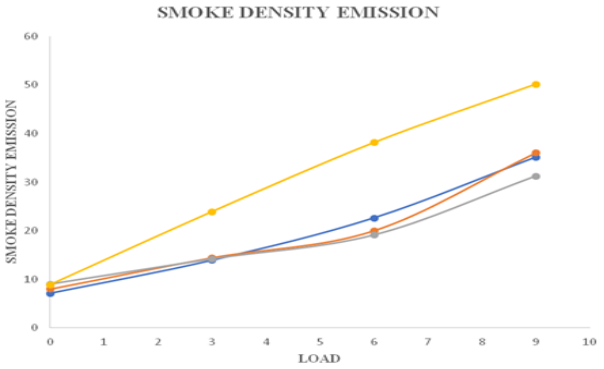

Fig. 5.Smoke density Emission.

From this above Fig.5 shows the smoke density Emission, Blend A (5% of candlenut oil and 5% of soapnut oil + 90% of diesel), Blend B (10% of candlenut oil and 10% of soapnut oil + 80% of diesel) and Blend C (15% of candlenut and 15% of soapnut oil + 70% of diesel) has been tested. In that, Blend B is nearer to the diesel in smoke density emission at the maximum load.

F. BTF

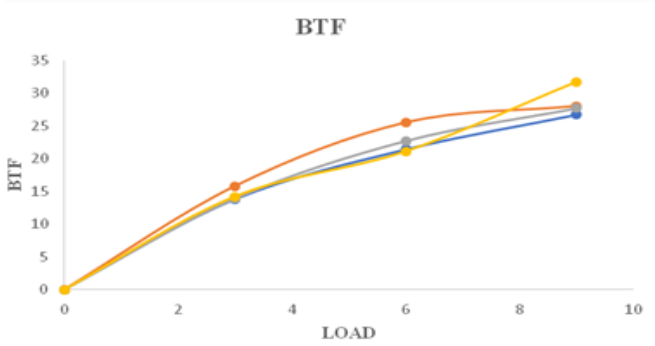

Fig. 6.BTF.

From this above Fig.6.shows BTF.6, Blend A (5% of candlenut oil and 5% of soapnut oil + 90% of diesel), Blend B (10% of candlenut oil and 10% of soapnut oil + 80% of diesel) and Blend C (15% of candlenut and 15% of soapnut oil + 70% of diesel) has been tested. In that, Blend B is nearer to the diesel in BTF at the maximum load.

G. BSFC

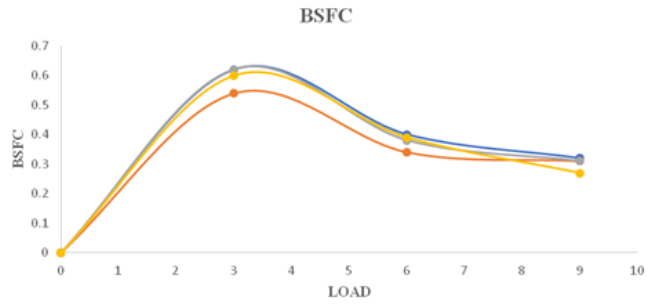

Fig. 7.BSFC.

From this above Fig. 7 shows the BSFC, Blend A (5% of candlenut oil and 5% of soapnut oil + 90% of diesel), Blend B (10% of candlenut oil and 10% of soapnut oil + 80% of diesel) and Blend C (15% of candlenut and 15% of soapnut oil + 70% of diesel) has been tested. In that, Blend B and Blend C is nearer to the diesel in BSFC at the maximum load.

VI. CONCLUSION

The experiments were conducted for blends of on a

- Blend A (5% of candlenut oil and 5% of soapnut oil + 90% of diesel).
- Blend B (10% of candlenut oil and 10% of soapnut oil + 80% of diesel).
- Blend C (15% of candlenut and 15% of soapnut oil + 70% of diesel).

For different load conditions mass flow rate and emission is recorded in three different fuel samples. VCR engine running at fixed speed of 1500 rotation per minutes with a CR of 17:1 at an injection pressure of 200 bar. The parameters like brake thermal efficiency (BTE) and brake specific fuel consumption (BSFC) were calculated. Research work in biodiesel has attracted wide attention in the world due to its non toxicity, renewability, bio degradability, and environmentally eco friendly benefits. And it can used as another gasoline in diesel engine. And this study shows that performance of two biodiesels candlenut oil and soapnut oil blended with various diesel ratios where reducing the dependence on fossil fuels. The efficiency and emission of Blend A, Blend B and Blend C were tested in VCR engine. Finally in blend B it can be utilise as bio fuels in the replacement of diesel without considering any Kirloskar changes.

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