Performance And Emission Characterstics Of Ci Engine Fuelled With Mango Seed And Jatropha Biodiesels

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Abstract- *The purpose of using alternatives to Diesel fuel in internal combustion engines becomes a necessity as the environmental problems of fossil fuels as well as their depleted reserves. In this study, a dual biodiesel blend, mixture of two different kinds of biodiesel namely mango seed oil and jatropha in diesel was considered for evaluation in a single cylinder diesel engine at various mixing ratios (such as B10, B20, B30) with varying loads. The influences of blends on CO, CO2, HC, NOx and smoke capacity were investigated by emission tests. The brake thermal efficiency of blends was found 2.1% lower than diesel. The emissions of hydro carbon (HC) of dual biodiesel blends were higher than that of diesel. Nitrogen oxides (NOX) are decreases 497ppm at maximum load with compared to diesel. B20 is better due to reduction in emission parameter and has 0.9% highest brake thermal efficiency compared to other Biodiesel blends.*

Keywords- Dual fuel, Mango seed oil, Jatropha oil, Brake Thermal Efficiency, NOX.

I. INTRODUCTION

Now day's petroleum products are very insufficient due to large increasing of automobiles for human comfort.Inorder to reduce the small amount of petroleum products, alternative fuels are added .These alternative fuels have obtained from the vegetable oils are eco-friendly and available is more because it is renewable. The alternative fuels produced from edible and non-edible sources such as mango seed oil, sunflower, jatropha, palm, mustard, soybean ground nut …etc these are also called biodiesels. On the other hand the fossil fuel combustion accumulating continuously greenhouse gases into the atmosphere is responsible for the global warming. Hence there is need to find some alternate fuel ,which can produced from the available local resources such alternative fuel are alcohol, ethanol, vegetable oils, biodiesel etc. The present experimental work was held on Mango seed and Jatropha oil.

Many studies have been conducted on engine performance and emission characteristics using different biodiesels but in this study dual alternatives fuels are added to the diesel The use of biodiesel-diesel blends in CI engines leads to the reduction in NO_X emissions during the combustion process These results could be explained by low aromatic content and presence of high oxygen content

II. BIODIESEL PRODUCTION

Biodiesel can be produced through a transesterification. Pure oils are not suitable for diesel engines because they can cause the carbon deposits and pour point problems and they can also cause the problems like engine deposits, injector plugging, or lube oil gelling. So to use the oils in the diesel engines, they are chemically treated and that chemical process is known as transesterification process, where the crude of vegetable ,fat waste cooking oil get reacts with alcohol (methanol or ethanol) in the presence of catalyst(NaOH or KOH) which gets biodiesel and glycerol.

III. TRANSESTERIFICATION PROCESS

A.Jatropha oil

The crude Jatropha oil, one litre is taken in a beaker is kept on a heater and heated up to 70^0C. The mixture of 250 ml of methyl alcohol and 5 mg of NaOH (methoxy solution) is poured into the heated jatropha oil and continuously stirred with a magnetic stirrer for 6 hours. After this store the fuel separately in funnel for 15-16 hour. This leads glycerol to settle bottom of the flask and jatropha biodiesel to come up. Figure:1shows separated biodiesel can be taken in bottle.

Fig.1 Jatropha biodiesel after transesterification

B.Mango Seed oil

Figure:2 shows Mango seed biodiesel has taken in bottle after transesterification. The crude mango seed oil and methanol–sodium hydroxide mix were reacted. Sodium hydroxide was used as catalyst for the reaction. Stirrer and temperature controller in the reactor tank helped to speed up the reaction. The reaction was carried out at 70^0C. The final product methyl ester and glycerol were separated, neutralized and distilled for excess methanol. Methyl ester was washed with hot water and further separated to obtain mango biodiesel (MSB)

Fig.2 Mango seed biodiesel after transesterification

IV. BIODIESEL BLENDS PREPARATION

The preparation of mango seed and jatropha biodiesel blends with different proportions to diesel.B10 (50ml MS+50ml JR+900ml Diesel), B20 (100ml MS+100ml JR+800ml Diesel),B30(150ml MS+150ml+700ml Diesel) as shown in Fig.3, where MS is mango seed,JR is jatropha biodiesel.

Fig.3 Biodiesel Blends of different mixing ratios B10, B20, B30

V. EXPERIMENTAL SETUP

Figure:4 shows the experimental setup. The setup consists of single cylinder, four stroke, Diesel engine connected to eddy current Type dynamometer for loading.The major specifications of the engine are shown in Table.3. Provision is also made for interfacing airflow, fuel flow, temperatures and load measurement.. Rota meters are provided for cooling water and calorimeter water flow measurement. The setup enables study of engine performance for brake power, indicated power, frictional power, BMEP, IMEP, brake thermal efficiency, indicated thermal efficiency, Mechanical efficiency, volumetric efficiency, specific fuel consumption, A/F ratio and heat balance. Lab view based Engine Performance Analysis software package “Engine soft” is provided for on line performance evaluation. A computerized Diesel injection pressure measurement is optionally provided. test rig engine consists of the fuel supply system for diesel and bio-diesel on both fuel, water cooling system, lubricating system and direct fuel injection, a high pressure fuel pump is used. Figure:5 shows the schematic diagram of the engine test rig. Engine was directly coupled to dynamometer, exhaust gas temperature measured by thermocouple which is indicated readings on digital display, load applied by eddy current dynamometer at constant speed 1500 rpm to evaluate performances some operating parameter like speed, power output and fuel consumption was measured. To measure the emissions AVL DI GAS 444 N(Five gas analyzer) analyzer is used in which HC, CO,CO2,NOX are obtained. To measure smoke AVL 437C SMOKE METER is connected to the engine exhaust.

Engine Make	Kirloskar
Power	5HP
Speed	1500rpm
No.of.cylinders	1
Bore(D)and Stroke(L)	87.5*110mm
Compression ratio	17.5:1
Type ignition	Compression ignition
Methods of loading	Eddy current method
Orifice dia	20mm
Method of starting	Crank shaft
Method of cooling	Water

Fig.4 Experimental setup of the engine

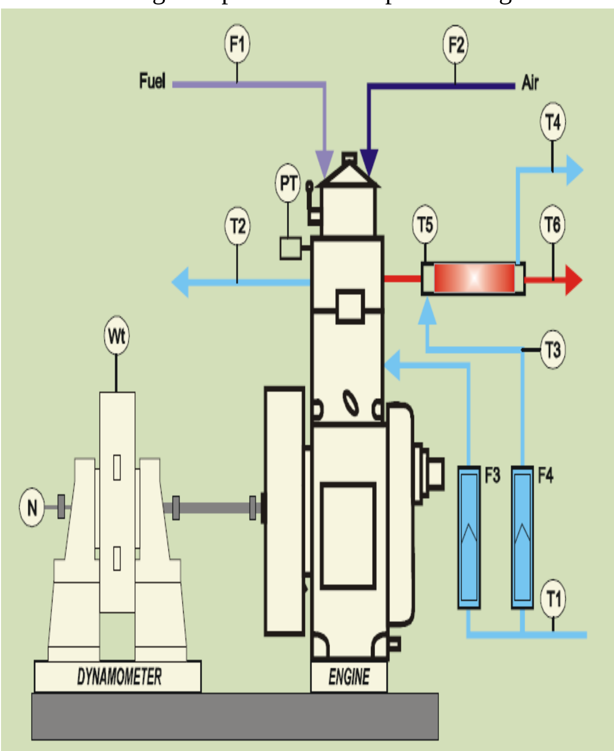

Fig.5 Schematic diagram of the engine test

Table:1 Specifications of an Engin

VI. RESULTS AND DISCUSSION

Performance Characteristics

A. Brake Specific Fuel Consumpstion(BSFC)

Brake specific fuel consumption (BSFC) is the ratio of mass flow and the Brake power (BP).BSFC variation of the biodiesel and its blends with respect to load of the engine.Figure:6 represents the BSFC of the engine for B20(MS+JR) is 0.01 Kg/KW.hr decreases when compared to B10(MS+JR) and B30(MS+JR) at maximum load. It is due to lower heating higher viscosity and density than diesel..

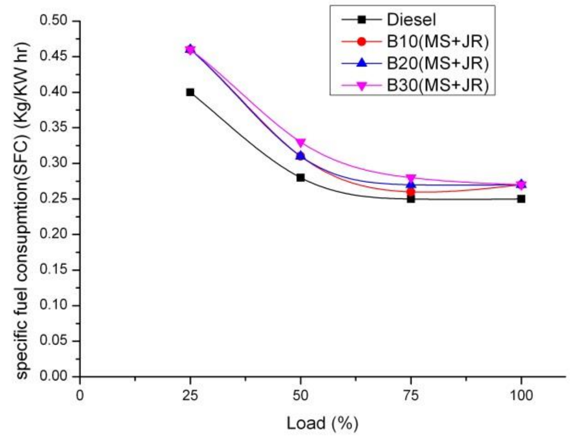

Fig.6 Variation of BSFC with Load

B. Brake Thermal Efficiency (BTE)

Brake thermal efficiency (BTE) is the ratio of brake power of the engine and to the mass of fuel consumption. BTE of B10(MS+JR),B20(MS+JR),B30(MS+JR) decreases 2.1% with increasing of load on engine with compare to diesel as well as decreases with increasing the level of biodiesel blends as shown in Fig.7. BTE is decrease because biodiesel with high viscosity and density with lower calorific value corresponding to the diesel at maximum load BTE is almost nearer values for all blends

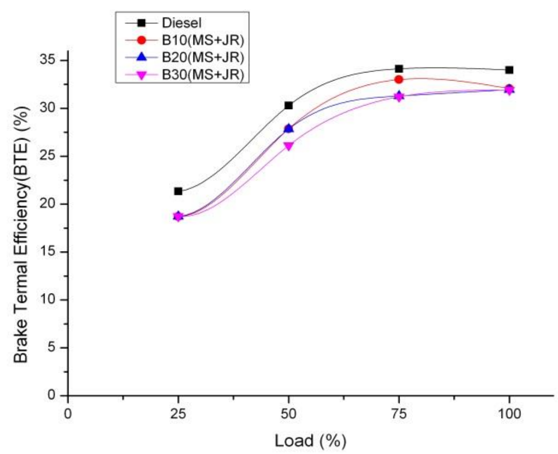

Fig.7 Variation of BTE with Load

C. Mechanical Efficiency (Mech.Eff)

Mechanical efficiency is to the brake power and the indicated power produce in the cylinder.Figure:8 represents the Mechanical efficiency of B10(MS+JR),B20(MS+JR),B30(MS+JR) at minimum load 31.7% increases to maximum load 65.7% for all blends. But mechanical efficiency of biodiesel blends decreases compared to the diesel

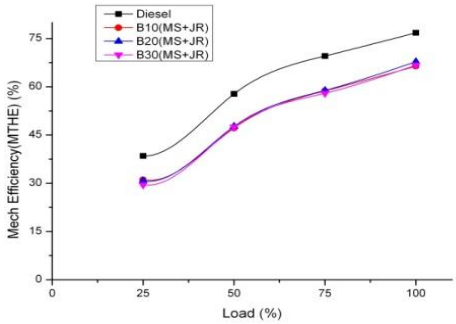

Fig.8 Variation of Mechanical eff with load

Emissions Characteristics

A. Hydro carbons (HC)

Hydro carbons (HC) emissions will increases with increase of load. Figure.9 shows at maximum load HC emissions of B10(MS+JR),B20(MS+JR),B30(MS+JR) are 1.2ppm,6.1ppm,and 15.3ppm high than diesel. This is due to the high fuel density and viscosity. The dual Biodiesels and blends generally exhibit lower HC emission at lower engine loads and higher HC emission at higher engine loads. This is because of the relatively less oxygen available for the reaction when more fuel is injected into the engine cylinder at high engine load. The lower calorific value and the higher viscosity of biodiesel oil result in the highest HC Emissions.

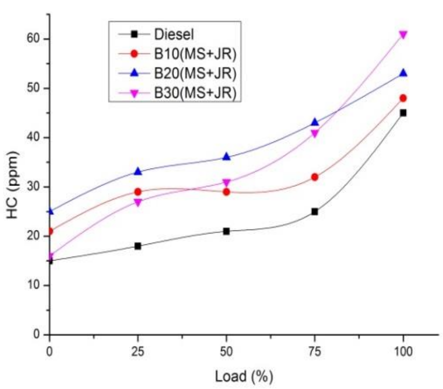

Fig.9 Variation of hydro carbons with load

Nitrogen oxides (NO_X)

Figure.10 shows the NO_x emissions at maximum load of B10(MS+JR),B20(MS+JR) and B30(MS+JR) are1678ppm, 1616ppm and (1552ppm) is reduced for all mango seed and jatropha blends (B10, B20, and B30) with compared to diesel at maximum load (2052ppm).This is because of lower temperature and pressure in the combustion chamber. At maximum load B30(MS+JR) has 1552ppm lower emissions of NO_x compared to the other blends B10, B20 and Diesel (2052ppm).

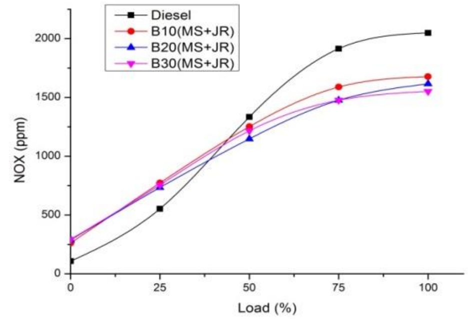

Fig.10 Variation of Nitrogen oxides (NO_X) with load

C. Smoke capacity (SMOKE)

Smoke capacity is very low at minimum load condition, but at maximum load smoke capacity is rises than diesel.B30(MS+JR) decreases the smoke capacity with increase in load ,At maximum load B30(MS+JR) has blend has 69.9% gives less smoke emission than diesel (76.6%) as shown in Fig.11 .This is because of low viscosity and density decrease the exhaust smoke.

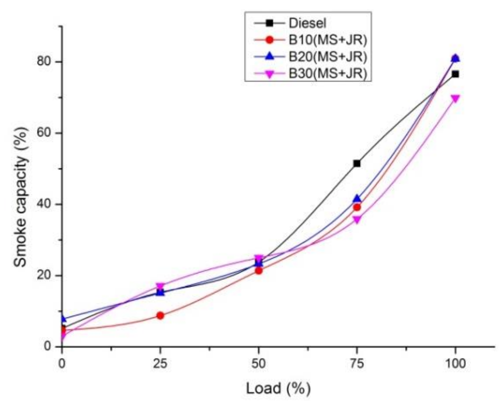

Fig.11 Variation of smoke with load

VII. CONCLUSION

The setup consists of single cylinder, four stroke, Diesel engine connected to eddy current type dynamometer for loading.

- Brake specific fuel consumption (BSFC) of biodiesel blends (mango seed and jatropha) has more than diesel at maximum and minimum loads.
- Brake thermal efficiency (2.1%) decreased compared to diesel (34%).
- Biodiesel blends NOx reduction is more compared to diesel at maximum load is 497ppm.

Smoke Capacity of biodiesel blend B30(MS+JR) has 6.7% reduced than Diesel

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