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Emission and Performance Characteristics of VCR Engine with Pumpkin Seed Bio Diesel Blends

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Abstract: ***The objective of the present study is to analyze the emission and performance characteristics at different compression ratio in VCR diesel engine using pumpkins seed. Bio diesel is prepared by trans-esterification process in biodiesel plant. Blends (20%, 40% and 60%)of pumpkin seed biodiesel and diesel blends are prepared and test were conducted at the load conditions (3-12 kg) The enforcement criterias like exhaust emissions, brake thermal efficiency(BTE) and Brake specific fuel consumption (BSFC) been assessed and analyzed. And experimental results shows BSFC is same for diesel and biodiesel blends and at higher loads, 40% biodiesel blend has efficiency closer to the diesel,*** NO_X ***emission in biodiesel blends have same at different loads,*** CO_2 ***emissions gradually increases with increasing load.***

Keywords: Pumpkin seed biodiesel, VCR, Esterification

I. INTRODUCTION

In the recent times alternate to fossil fuels has been receiving great awareness due to government policies about the polluting nature of fossil fuels and also depletion of fuel reserves [1]. Another important aspect is rise in crude oil prices is also paved way for the search for alternate to petroleum oils. In the alternate fuel research we are concentrating more on the biodiesel or methyl esters procured from herbaceous plants oils by means of trans-esterification action [2-5]. Methanol is combined with pumpkin seed oil along with a catalyst to form glycerin & methyl esters. And these esters have similar characteristics when compared with diesel, even it could be passed down in diesel or piston engines in its scrap or raw form with or without alterations [6-7]. Esterificaton is done to reduce the viscosity, surface tension and density so that fuel injection is made comparable with diesel [8].

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In several countries some of the substitutes for diesel fuels are Rapeseed methyl ester, Jatropha methyl ester and Pon-gamia methyl ester. The addition of biodiesel is limited because it makes troubles during injection and atomization [9-10]. Since biodiesel is having lower heating values it is not possible to obtain the dupe power as diesel produced during high load condition.

Finally the effect of fuel blends at different loads, engine accelerations, compression speed and single cylinder performance characteristics are thoroughly organized and analyzed.

II. METHODS AND MATERIALS

Pumpkin seed oil is available in market as medicinal oil with some added ingredients, so it cannot be used for testing purpose in engines moreover the cost is also too high. So oil is purchased from the Cyrus enterprises Chennai, who is extracting oil for research purposes and biodiesel is prepared in biodiesel extraction plant. Figure 1 shows the process flow diagram pumpkin oil extraction and transesterification. Table 1 shows the properties comparison.

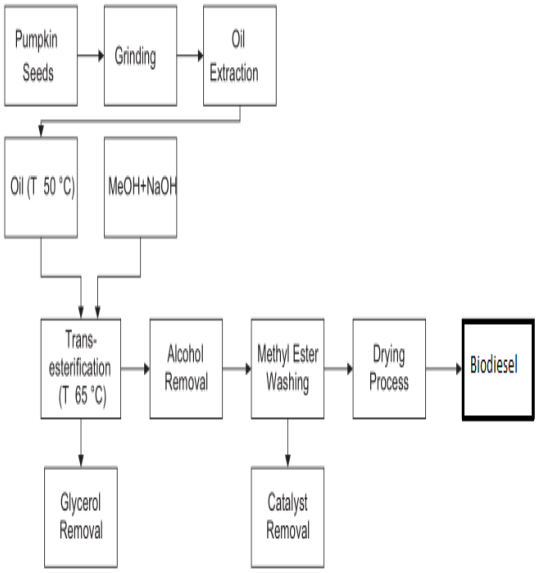

Fig. 1 Process flow diagram Pumpkin oil extraction and Transesterification

Table 1. Properties comparison

Property	Pumpkin Seed Oil	Diesel
Kinematic viscosity(40 °C),mm²/sec	35.6	3-5
Flash point, °C	>230	45-76
Sulphated ash content, t%	<0.01	-
Water content, mg/g	584	-
Pour point, °C	-12	-16
Net calorific value, MJ/kg	39	42-44
Density(15 °C), kg/m3	921.6	836-866

III. TEST ENGINE SETUP

Kirloskar mono barrel directs the inoculation where confining ignition diesel engine with variable compression ratio for conducting the experiment.

Engine is cooled by flowing water. Engine from this manufacturer is widely used in agricultural, pump sets and in farms. The engine is capable of withstanding high pressures during the testing. Table 2 shows the engine specifications.

Displacement - 661 cc
Speed - 1800 rpm
Power - 5.9 kW
Variable load - (3-12) kg,
Fuelinjection pressure - 200 bars
Cooling water exit temperature - 60^0C.
Compression ratio - 17.5:1

Table 2 Engine specifications

Manufacturer	Kirloskar
Type	Direct diesel injection
Rated power	6 – 8 hp
Fuel	Diesel
Number of cylinders	1
Bore * stroke	87.5 * 110
Cycle	Four stroke
Compression ratio	17.5:1
Speed	1800

IV. EXPERIMENTAL PROCEDURE

The biodiesel blends were made with the diesel in the ration of 2:8:4:6 in composition as biodiesel, diesel, biodiesel, diesel. Test were designed to conduct test starting from 3 kg, 6kg, 9kg and finally at no load condition. During this testing condition the compression ratio is 17.5 and engine speed is also kept constant. A standard run is made with the diesel to for comparison with the biodiesel blend characteristics.

V. RESULT AND DISCUSSION

From the graph 1 at 6kg load BSFC is same for diesel and biodiesel blends and at higher loads 20% blends shows higher value compared with plain diesel and 40%blends. BSFC gradually decreased at peak loads because of improved rate of fuel-air mixing at higher loads. Figure 2 and 3 shows the Performance of Brake SFC and BTE.

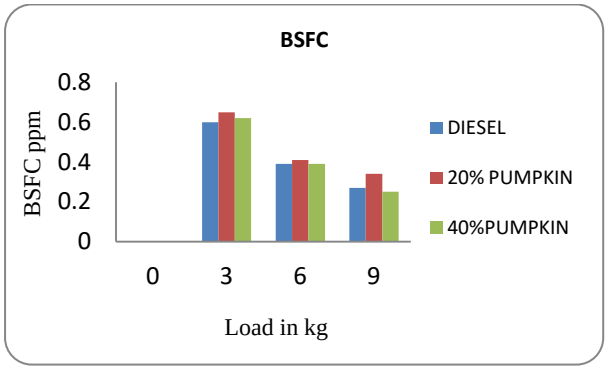

Fig. 2 Performance of Brake Specific Fuel Consumption

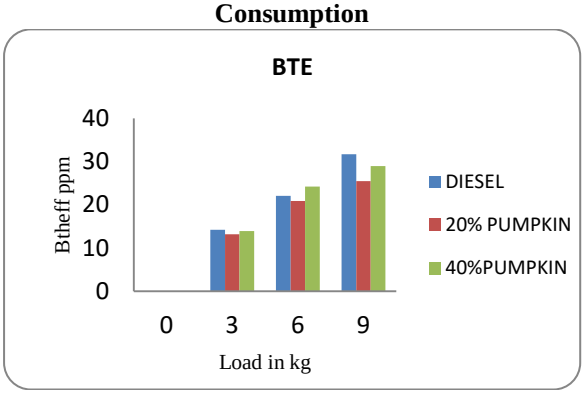

Fig. 3 Performance of BTE

The above graph 2 shows that diesel has better efficiency than blends of biodiesel but the margin is very low at lower loads and high at higher loads. 40% biodiesel blend has efficiency closer to the diesel but on the down side.

A. EMISSION PARAMETERS

The Unburned HC indicates the fuel is not properly burnt, it may be the reason in which higher cetane value of biodiesel attributed to shorter ignition delay. The plot shows that HC emissions are almost same at higher loads. Figure 4 shows the performance of unburnt HC.

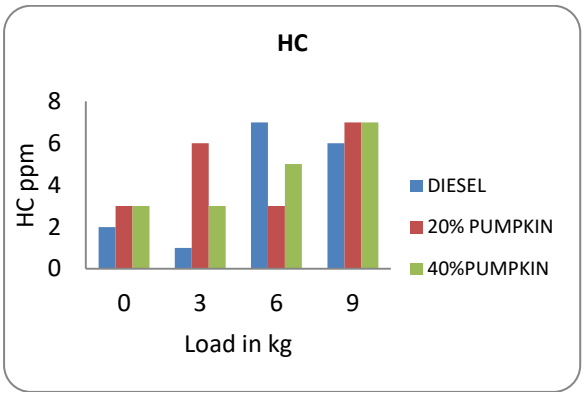

Fig. 4 Performance of Unburnt HC

The CO emissions plot shows it is more for biodiesel blends. It indicates the deficiency of oxygen during combustion process. Though biodiesel has more oxygen content it CO emissions is more compared with diesel. Figure 5 and 6 shows the performance of CO and carbon die-oxide.

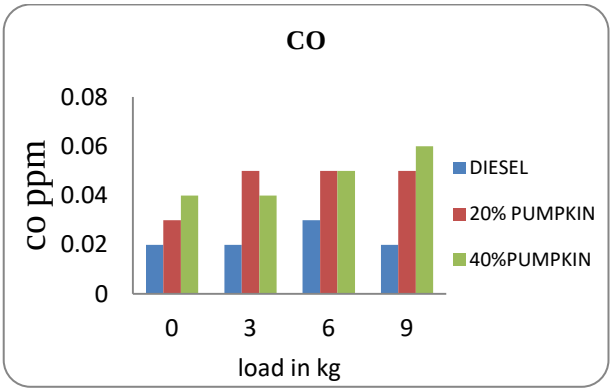

Fig. 5 Performance of CO

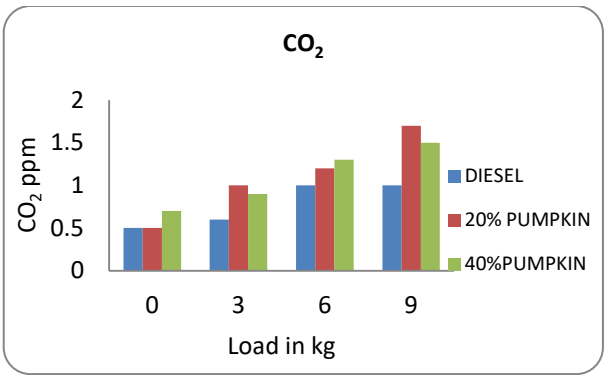

Fig. 6 Performance of Carbon die-oxide

Combustion chamber conveys the CO2 level by indicating the level of exhaustion of gas in the chamber. From the plot it is noted that at CO_2 emissions gradually increases with increasing load. At lower load burning of fuel is affected by poor disintegration that in turn affects the vaporization of fuel for burning. Figure 7 shows the performance of NO.

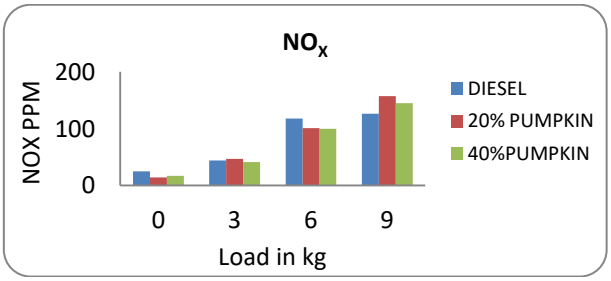

Fig. 7 Performance of NO

From the plot minimum NO_X is observed at lower loads and gradually increases with increasing loads. NO_X emission in biodiesel blends have same at different loads but somewhat less in 6kg payload. Stoichiometry is the section where the NOx development takes place and the thin flammable combustion are also occurred in this premixed phase.

VI. CONCLUSION

From the above inferences, the achievement characteristics of the biodiesel blends is quite alike to diesel. The 20% biodiesel blends can be substituted for diesel fuel with suitable additives. But in emissions characteristics biodiesel blends shows higher values than diesel. This can be reduced by preheating of the fuel and by employing a exhaust gas recirculation unit.

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