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Research Article

CHARACTERIZATION OF A DIESEL ENGINE OPERATING WITH IGNITION IMPROVER AS A FUEL ADDITIVE IN BIODIESEL BLEND

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ABSTRACT

Unique Resembling the well ordered consumption of world oil saves, rise the unrefined petroleum cost and consequences for natural contamination of expanding fumes outflow there is a dire requirement for reasonable option fuel for diesel motors. The present investigation covers the stage I, these tests are led on a four stroke single barrel water cooled coordinate infusion diesel motor with consistent speed by utilizing diesel and fundamental information is created through fluctuating burdens. In second stage, test investigation has been done on a similar motor with same working parameters by utilizing the Jatropha oil methyl esters mix with an extent J30 by expansion of DEE (Die Ethyl Ether)(Ignition improver) 5 ml, 10 ml to discover the execution and discharges parameters. The fundamental motivation behind start improver is to enhance the burning procedure and lessen the discharges. The version and discharge parameters got in the above tests were thought about in line fundamental diesel information. The mix J30 with start improver 10 ml demonstrates decreased discharges like CO, HC, NOX, smoke thickness and enhanced effectiveness like brake warm productivity, BSFC.

INTRODUCTION

Utilization of the petroleum products increments universally step by step, to satisfy the vitality prerequisite of the world, there is a need to discover an option determination. In the fields of transportation, modern advancement and farming, oil powers assume an indispensable part. Petroleum derivatives are fast exhausting a direct result of augmentation in fuel utilization. To substitute the diesel fuel with a fitting option fuel, for example, biodiesel many research works are going on. Extraordinary compared to other accessible sources to satisfy the vitality prerequisite of the world is Biodiesel. Non-consumable sources, for example, cotton seed Oil, Jatropha Oil, Mahua Oil, Jatropha Oil, and Karanja Oil have been investigated for biodiesel fuel generation. In the current circumstances, numerous scientists have put a few endeavors to utilize different wellsprings of vitality as nourish in existing diesel motors. Numerous specialists have watched that biodiesel mix gives more prominent warm productivity and emanation parameters. Among the distinctive procedures open to diminish fumes emanations from the diesel motor while utilizing biodiesel, the utilization of start improvers is directly engaged as a result of the upside of an upgrade in fuel effectiveness while decreasing unsafe fumes discharges (Deepak and Avinash, 2007; Venkateswara, *et al.*, 2008; Jayant, *et al.*, 2007; Gumus, 2008; Oner and Altun, 2009; Mani, *et al.*, 2009; Hirkude and Padalkar, 2012).

BIODIESEL PRODUCTION AND BLENDS

Trans-esterification of jatropha oil is made out of warming of oil, expansion of KOH and methyl liquor, blending of blend, partition of glycerol, washing with refined water and warming for evacuation of water. The biodiesel (JOME) so delivered was blended with diesel in changing extents like D100, J30, J30+D69.5+DEE 5 ml with the assistance of an

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attractive stirrer. The principle motivation behind the DEE is to enhance start and warm proficiency alongside diminishment in emanation parameters (Table 1).

PROPERTIES OF FUEL

The important properties of Jatropha raw oil, JOME, J30 are compared with the diesel were shown in the Table 2.

EXPERIMENTAL SETUP

The game plan comprising of a 4-stroke diesel single barrel motor alongside mechanical brake drum is settled to the motor fly wheel. A different board load up is utilized to settle burette with stop clock execution examination is, to top off the recognized diesel fuel mix into the fuel tank mounted on the board outline.

Table 1. Preparations of blends

Blend	Diesel (%)	Biodiesel (%)	Improver (ml)
D100	100	-	-
J30	70	30	-
J30+D69.5+DEE 5 ml	69.6	30	5
J30+D69+DEE1 0 ml	69	30	10

Table 2. Properties of raw jatropha oil in comparison with diesel

Property	Jatroph a Raw Oil	JOME	Diesel	J30
Specific Gravity	0.927	0.877	0.830	0.854
Kinematic Viscosity (mm / sat 40°C)	36.50	10.72	2.6	5.036
Calorific Value(kJ/kg)	34000	35500	42500	39950

the motor is begun and enabled it to balance out at 1500rpm. Presently stack the motor in venture of quarter, half, three fourth and full loads and enable the motor to balance out at each heap. (Note all the required parameters showed on the computerized markers which are mounted on the board like, speed of the motor from advanced rpm pointer, stack from the spring balance, fuel utilization from burette, amount of wind stream from manometer. Likewise, fumes gas is sent into fumes gas analyzer. for the examination of discharge display specific diesel fuel mix. Sct-g-5 multi gas analyzer (5 gasses) depends on infrared spectrometry innovation with flag contributions from an electrochemical cell (Chhetri, *et al*., 2008; Chikara and Jaworsky, 2007; Miura, *et al*., 2010; Song, *et al*., 2007; Xing, *et al*., 2010).

Non-dispersive infrared measurement techniques are used for NOX, CO_2, O_2, CO and HC gases. Load the engine step by step and note down corresponding parameters. Switch off the fuel knob which is available on the panel after the experiment. The experimental setup is shown in (Fig. 1), Gas Analyzer in (Fig. 2) and Tables 3 and 4.

RESULTS AND FINDINGS

The experiments performed on a 4-stroke Diesel Single cylinder water cooled engine at constant speed 1500 rpm with blends by adding ignition improver and varying loads. Various performance parameters such as brake specific fuel consumption, brake thermal efficiency and various emission parameters in the sense of smoke density, unburned hydrocarbons, carbon monoxide and oxides of

Fig. 1 Experimental setup.

Fig. 2 Gas analyzer.

Table 3. Specifications of the experimental setup

Engine	**4- Stroke Single Cylinder**
Make	Kirloskar
BHP	5hp
Rpm	1500
Fuel	Diesel
Bore	80 mm
Stroke Length	110 mm
Starting	Cranking
Working Cycle	4-Stroke
Method of Cooling	Water Cooled
Method of Ignition	Compression Ignition

Table 4. Specifications of the gas analyzer

1	CO	0 to 9.98% vol. Res. 0.01%
2	HC	0 to 20000 ppm. (Propane) Res. 1 ppm
3	CO_2	0 to 20.00% vol. Res. 0.10%
4	O_2	0 to 25% Res. 0.01%
5	Lambda	0.200 to 1.800% Res. 0.001%
6	Air /Fuel	0 to 30:1 Res.1

nitrogen are discussed below (Moncada, *et al.*, 2001; Yan, *et al.*, 2011; Hua, *et al.*, 2002; Rae, *et al.*, 2009; Wang, *et al.*, 2011; Wang, *et al.*, 2012).

Brake Thermal Efficiency

The progressions of brake warm effectiveness with brake control is appeared in (Fig. 3) from the chart it is watched that as the Brake Power increments there is significant increment in the BTE. The BTE of diesel at full load is 32.82% while the mixes of J30 is 34.79%, J30+D69.5+DEE 5 ml is 35.69%, J30 + D69 + DEE 10 ml is 37.80%, among the three the most extreme BTE is 37.80% which is acquired for J30+D69+DEE 10 ml. The BTE of JOME is increments up to 5.91% as contrasted and ideal mix at full load condition. The change in effectiveness of brake warm parameter

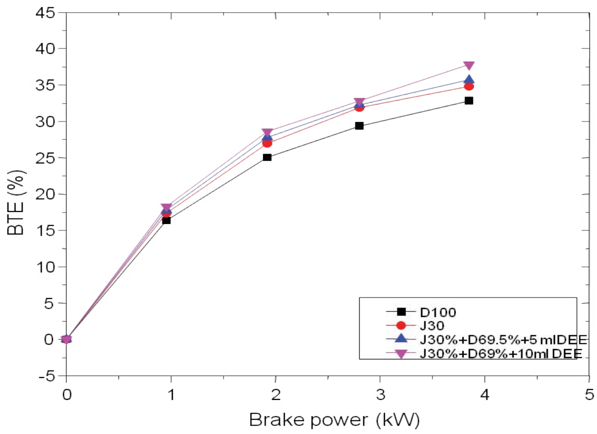

Fig. 3 Variation of brake thermal efficiency with brake power.

is principally because of better burning because of adding start improver it impacts to diminish the thickness of JOME.

Brake Specific Fuel Consumption

The variation of brake specific fuel consumption with brake power is shown in (Fig. 4). The plot it is observed that as the load increases the fuel consumption decreases, the minimum fuel consumption is for J30+D69+DEE 10 ml is 0.246 as to that of J30 is 0.259. The BSFC of after adding ignition improver of JOME is decreases up to 2.7% as compared with optimum blend (J30) at full load condition. At full load condition the BSFC obtained are 0.26 kg/kW-hr, 0.259kg/kW-hr, 0.251 kg/kW-hr and 0.247 kg/kW-hr for fuels of diesel, J30, J30 + D69.5 + DEE 5 ml and J30 + D69 + DEE 10 ml respectively.

Smoke Density

The variation of smoke density with brake power is shown in (Fig. 5). The plot it is observed that the

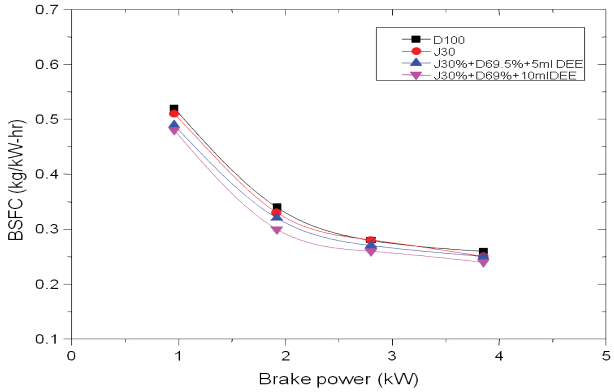

Fig. 4 Variation of BSFC with brake power.

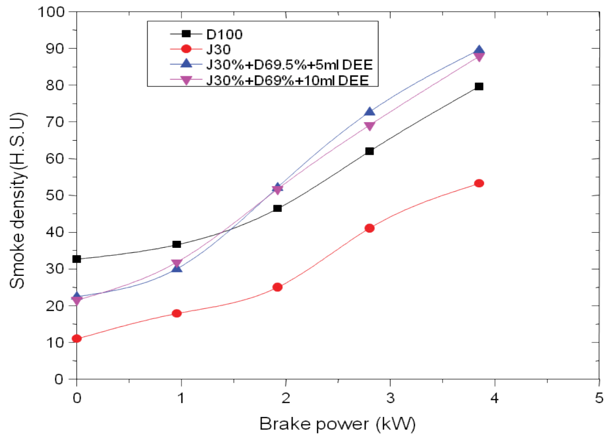

Fig. 5 Variation of smoke density with brake power.

smoke is nothing but solid soot particles suspended in exhaust gas. The variation of smoke level with brake power at various loads for different blends like J30, J30+D69.5+DEE 5 ml, and J30+D69+DEE 10 ml tested fuels. At full load condition the smoke density obtained are 79.6 HSU, 53.26HSU, 89.49 HSU and 87.89 HSU for the fuels of diesel, J30, J30+D69.5+DEE 5 ml and J30+D69+DEE 10 ml. It is observed that smoke is lower for optimum blend at full load conditions compared to ignition improver blends. It is due to heavier molecular structure and atomization becomes poor and this leads to higher smoke emission in the scene of adding ignition improver.

Carbon Monoxide Emission

The variation of CO emission with brake power is shown in (Fig. 6). The plot it is observed that is interesting to note that the engine emits more CO for diesel as compared to biodiesel blends under all loading conditions. The CO concentration is decreases for the blends of J30+D69.5+DEE 5 ml and J30+D69+DEE 10 ml for all loading conditions. At full load condition the CO emission obtained are 0.07%, 0.10%, 0.09% and 0.09% for the fuels of diesel, J30, J30+D69.5+DEE 5 ml and J30+D69+DEE 10 ml respectively. At lower biodiesel concentration, the oxygen present in the biodiesel aids for complete combustion. However as the biodiesel concentration increases, the negative effect due to high viscosity and small increase in specific gravity suppresses the complete combustion process, which produces small amount of CO.

Unburned Hydrocarbon Emission

The variation of HC emission with brake power is shown in (Fig. 7). The plot it is observed that the HC emission variation for different blends is indicated. At full load condition the unburned hydrocarbons are obtained 58 ppm, 53 ppm, 21 ppm and 17 ppm for the fuels of diesel, J30, J30+D69.5+DEE 5 ml and J30+D69+DEE 10 ml respectively That the HC emission decreases with increase in load and it is almost decreases for adding ignition improver blends where some traces are seen at no load and full load. The reason behind due to charge homogeneity and higher oxygen availability, the unburned hydrocarbon level is less in the case of JOME.

Oxides of Nitrogen Emission

The variation of NO_X emission with brake power is shown in (Fig. 8). The plot it is observed that for different blends is indicated. The NO_X emission for all the fuels tested followed an increasing trend with respect to load. At full load condition the NO_X emissions obtained are 1236 ppm, 1135 ppm, 812 ppm and 667 ppm for the fuels of diesel, J30, J30+D69.5+DEE 5 ml and J30+D69+DEE 10 ml respectively. The higher average gas temperature, residence time at higher load conditions could be the reason behind this emission. A reduction in the

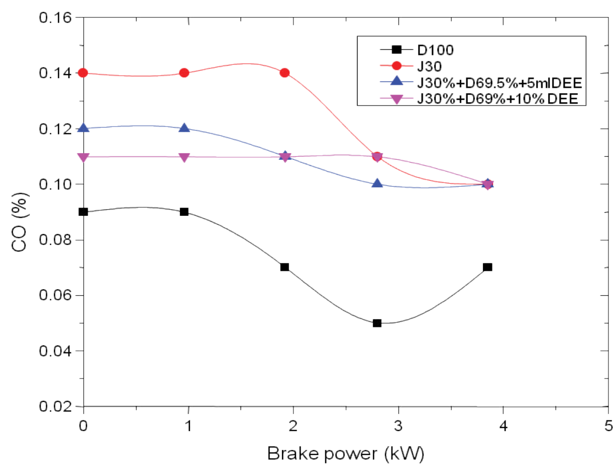

Fig. 6 Variation of carbon monoxide with brake power.

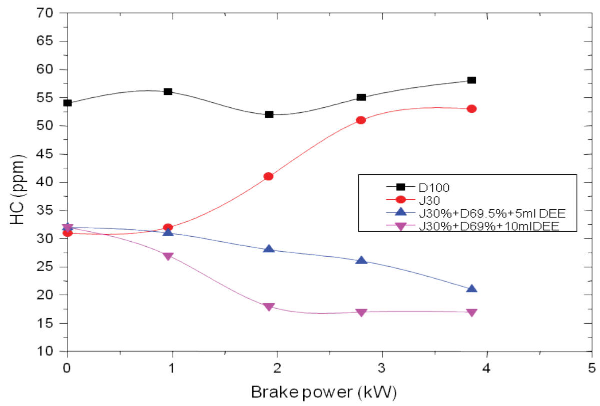

Fig. 7 Variation of unburned hydrocarbons with brake power.

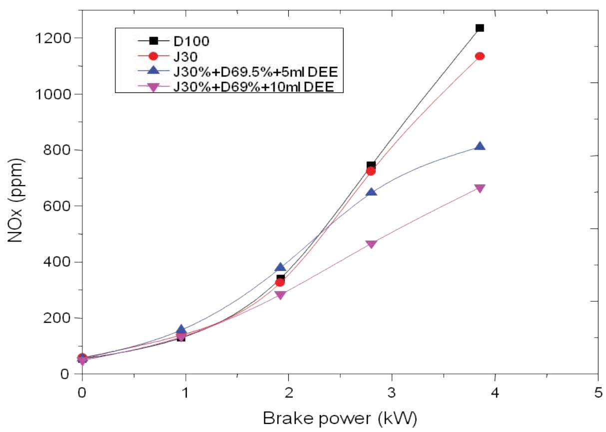

Fig. 8 Variation of NOX with brake power.

emission for all getting after adding the ignition improver blends as compared to optimum blend was noted. With increase in the JOME content of the fuel, corresponding reduction in emission was noted and the reduction was remarkable for J30+D69.5+DEE 5 ml and J30+D69+DEE 10 ml.

The maximum brake thermal efficiency for blended fuels with added ignition improver J30+D69+DEE 10 ml (37.80%) was higher than that of J30 and diesel. The brake thermal efficiency increased in 8.65%, 15.17% compared with J30 and diesel. Brake specific fuel consumption is decreases in blended fuels with added ignition improver. In J30+D69+DEE 10 ml fuel the BSFC is lower than the J30 and diesel .The decreased in BSFC in 5.01% and 7.54%. Significant reductions were obtained in unburned hydrocarbons emissions with J30+D69+DEE 10 ml blend compared with J30 and diesel. Unburned hydrocarbons were decreased by 67.92%, 70.68% compared to J30 and diesel at maximum load of the engine.

CONCLUSION

The investigations are carried out on the same engine with addition of diethyl ether (DEE) (ignition improver) 0.5 ml, 10 ml to blend J30, J30+D69.5+DEE 5 ml, J30+D69+DEE 10 ml find out performance and emissions parameters and compared with optimum blend and diesel base line data. Out of this 10 ml volume addition of ignition improver (J30+D69+DEE 10 ml) shows best results in performance and emissions parameters.

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