Comparison Of Performance Characteristics Of Diesel Engine Fuelled With Raw Coconut Oil Blends And Diesel

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ABSTRACT

Compression Ignition (C.I) engines belong to the family of I.C. engines, which use diesel as fuel. Conventional Diesel contains various Hydro carbons which show adverse effects on the environment. Also continuous dependency on the conventional fuels leads to their depletion. So, emphasis was laid on searching of alternate fuels which can give similar performance, easily available and show less or zero toxic effects. They are called GREEN FUELS or BIO FUELS.

There are different types of Bio fuels. Coconut oil is one of them. Usually vegetable oils are subjected to a process called "Transestrification", to convert raw oil into Bio diesel.However, in this experiment, raw coconut oil is taken and blended with conventional diesel and used in the diesel engine, so as to compare its performance when it is run by diesel oil and raw coconut-diesel blends.Blends such as B10, B20, and B40 are used separately to run the diesel engine and parameters such as Brake thermal efficiency (BTE), Brake specific fuel consumption (BSFC), Brake Power (B.P), are calculated for each blend. Emissions are also observed for each blend. Among all blends, B10 showed better performance in terms of Brake thermal Efficiency andBrake specific fuel consumption (close to the values of 100% diesel) and B40 in terms of smoke emissions.

Key words:C.I Engine, raw coconut oil, diesel, biofuel, BSFC, BTE

1. INTRODUCTION

There is a considerable growth in the usage of I.C. Engines in the modern world. The extensive use of energy operated devices in domestic, industrial, transport and agricultural sectors have resulted in the overall economic development of the society.

The electric power used in rural and urban areas is being generated using the fossil and static energy resources like Petroleum oils, coal, and atomic energy and to a limited extent by hydro power.Globally about 40% of the world's energy needs are met by using petroleum Products. It is estimated that the world's oil consumption would increase from 70 million barrel per day to 95 million barrel per day in the next decade.

The purpose of this work is to compare the performance of diesel engine when it is fuelled with raw coconut oil blends and conventional diesel. On the other hand, there were many investigations to know the performance of Coconut Methyl Ester (COME).P.Venkateswara Rao, B.V.Appa Rao,D.Radha Krishna [1] proved that there is a decrease in the emission levels with increase in Veg oil content due to the oxygen availability. In the application of COME to diesel engine [2], it was found that Brake mean effective pressure decreases as the mixing ratio of COME increases.

Researchers were successful in declaring that coconut oil blends can be used safely in C.I. Engines [3] without modification of the engine. Also it is interesting and useful to note that coconut oil increases the lubricity [4] of the fuel by 36% thus reducing wear and tear of the engine. Raw Vegetable oils can be used [5] as fuel in C.I engines directly or in blends. A study on different vegetable oils [6] revealed that coconut contains maximum oil content of about 64-65 %, compared to others.

2. PREPARATION OF COCONUT OIL

In the preparation of coconut oil, first meat is grated, dried and then pressed to extract coconut oil. The lower iodine value of coconut oil, compared to other vegetable oils works favorably.Coconut oil is used in oil lamps, cooking, manufacturing, treatment for diseases. And research activities on the use of vegetable oil as fuel substitute have already been done as early as the 1970s using coconut oil in Philippines.

2.1 Preparation of coco- diesel blends:

Coconut oil is blended with Conventional diesel in the following proportions, for conducting the performance test on C.I.engine**.**

Table 2.1

Notation	Diesel %	Raw Coconut oil %
B 10	90	10
B 20	80	20
B 40	60	40
D 100	100	0

3. **PROPERTIES OF COCO-DIESEL BLENDS**

Table 3.1

S.No	Property	100% Diesel	100% Coconut oil	B10	B 20	B 40
1	CalorificValueKj/kg	42500	37260	42380	42156	41587
2	Specific gravity	0.83	0.921	0.834	0.841	0.853
3	Flash point	58	245	69	87	96
4	Kinematic Viscositycst @ 40º	3.9	26.1	3.93	3.98	4.5

Viscometer for finding the viscosity of oil

Abel's apparatus for finding Flash point

4. EXPERIMENTAL SET UP

For conducting the performance test, a single cylinder, and water cooled diesel engine was used. A brake drum is directly coupled to the engine fly wheel and a belt brake is wound around the drum. Top ends of the belt are connected to spring balance S1 & S2.The load to the engine can be varied by rotating the hand wheel provided.

Diesel Engine Test Rig

Table 4.1 Specifications of Test Engine:

Engine	4 stroke single cylinder
Make	Kirloskar
BHP	5 HP
RPM	1500
Fuel	Diesel
Bore	80 mm
Stroke Length	110 mm
Starting	Cranking
Method of cooling	Water cooled
Method of Ignition	Compression Ignition

5. RESULTS AND DISCUSSIONS

The performance characteristics of a diesel engine at various loads from no load to full load, when fuelled with raw coconut –diesel blends and 100 % conventional diesel are discussed as below.

5.1 Brake Specific Fuel Consumption (BSFC)

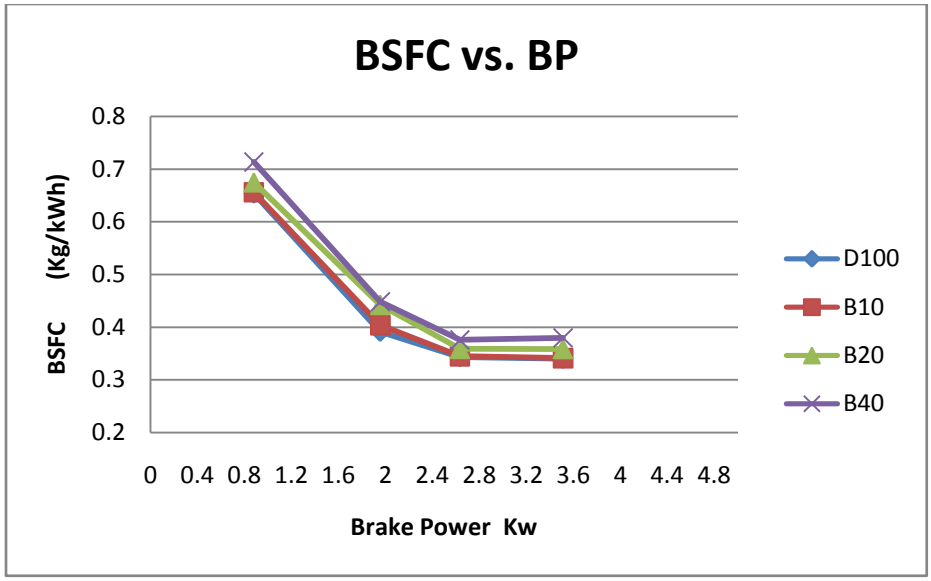

Figure 5.1: effect of Brake Power on BSFC

The variation of BSFC with respect to Brake Power for different blends at various loads is shown in Figure 5.1. It is clear that BSFC for blends B20 and B40 are higher than base line conventional diesel where as for B10, it is very close to D100 (at most 1 % variation).

The reason for increase in BSFC from D100 to B40 is due to the lower Calorific value of the fuel. Since there is a variation in Calorific value of each blend, more fuel is consumed to produce required output. Among B10, B 20, and B 40 blends, B 10 showed better performance.

5.2 Brake Thermal Efficiency (BTE)

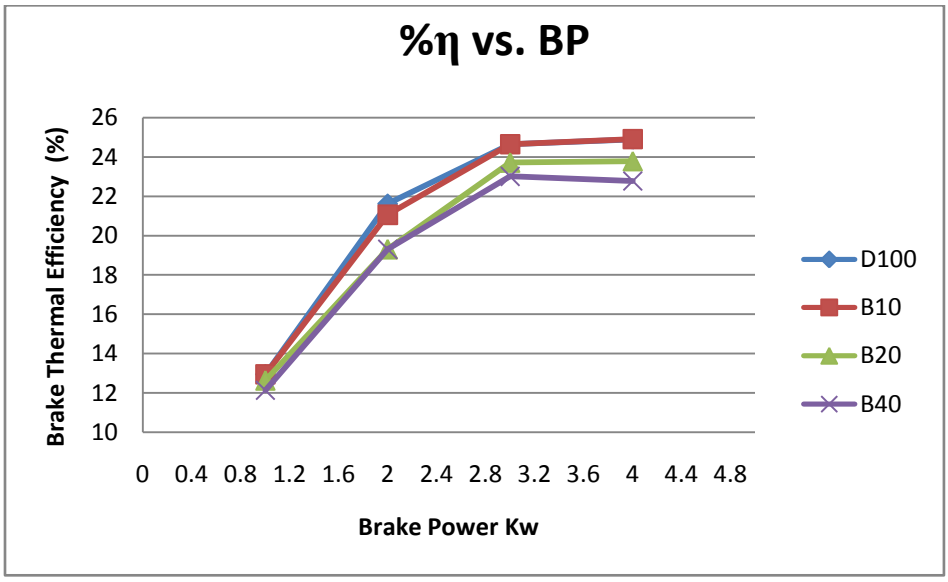

Figure 5.2 Effect of Brake Power on BTE

Figure 5.2 shows the variation of Brake Thermal Efficiency with respect to Brake Power for different blends at various loads. We can observe the trend of efficiency for all coconut-diesel blends, along with D100.

B10 blend showed its performance same as D100 where as B20 and B40 gave poor results. So, in terms of BTE, B10 is the better blend compared to B20 & B40.

5.3 Smoke Intensity

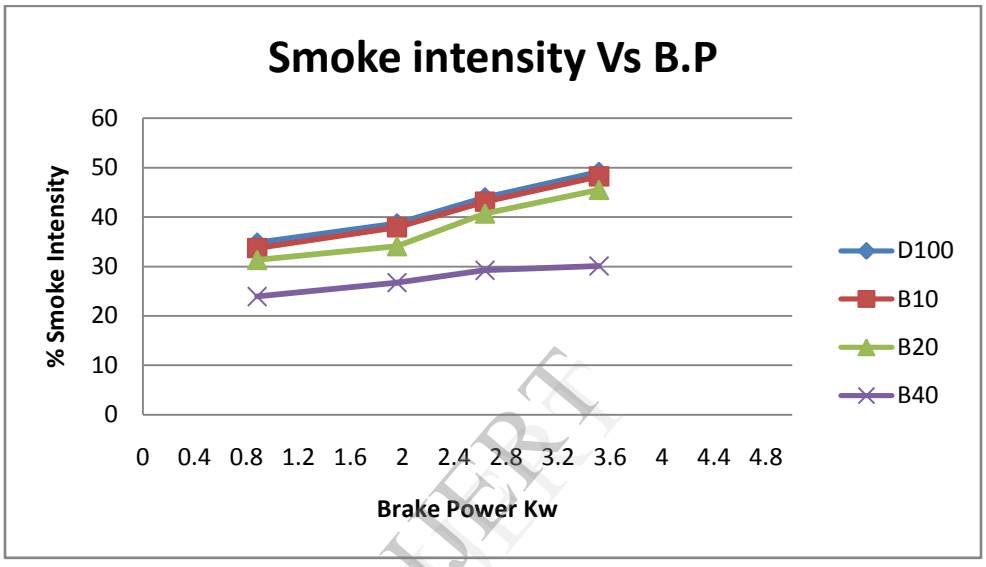

Figure 5.3 Effect of Power on Smoke

Figure 5.3 shows the variation of exhaust smoke with respect to brake power for raw coconut oil blends and diesel. It is noted from the graph that smoke intensity decreases from D100 to B40. This is because of the proportionate increase in the raw coconut oil which results in better combustion through better fuel atomization in the combustion chamber. B40 can be considered as best blend in case of smoke intensity.

CONCLUSIONS

The main experimental results are summarized as follows.

- B10 has efficiency very close to D100 at all loads and thus can be considered as suitable blend among the three.
- The BSFC for B10 is very close to D100 almost at all loads
- It is clearly noted that smoke decreases drastically as the proportion of coconut oil increases, and B40 is taken as the best blend with respect to smoke intensity.

NOMENCLATURE

BP	-	BRAKE POWER
BSFC	-	BRAKE SFECIFIC FUEL CONSUMPTION
BTE	-	BRAKE THERMAL EFFICIENCY
D100	-	100% DIESEL
B10	-	10% COCONUT OIL& 90% DIESEL
B20	-	20% COCONUT OIL &80% DIESEL
B40	-	40% COCONUT OIL &60% DIESEL

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