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Experimental studies on characteristics of C.I engine by using fish oil as an alternative fuel

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ABSTRACT

The worldwide fuel crisis in year of 1970 has formed alertness between several countries of their weakness to the oil embargoes as well as shortage. Significant thought was alert on growth of an alternative fuel source such as diesel fuel and Blends of fish oil is investigated as well as establish to be technically possible. Therefore there is changed attention in the fish oil diesel blends by particular highlighting in the diesel engine. While taking into consideration AF is used in diesel engine. The principle of the paper is to evaluation this issue with specified reference to security as well as allocation. Performance features like brake thermal efficiency (BTC), specific fuel consumption (SFC), fuel power, and brake power of blended fuels were calculated and compared with gasoline fuel. These blends were namely B20, B30, B40, B50. The Performance parameters were quantified predicated on effective completion of engine standard tests carried out on a diesel engine tested a four stroke engine and variable speed C.I. Engine with eddy current dynameters. It can be culminated from the results that B30 & B40 are the most preferable blends for use in four stroke engine. The result is accomplished that the 8:3 percentage of the diesel as well as fish oil is most professional proportions.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Newer Trends and Innovation in Mechanical Engineering: Materials Science.

1. Introduction

In general, biodiesel can be produced from any of the following: pure vegetable oil rendered animal fat, or waste cooking oil and greases [1–2]. Straight safe to eat vegetable oil such as sunflower or olive oil, rape seed oil, palm oil and soya bean oil can be used to prepare biodiesel as fuel in diesel engines. Non edible oils, used for preparation of the bio fuel, such as rubber, pongamia oil and neem oil [3–5].

The Bio fuel subsidy in the United States have been necessary on the following grounds: energy freedom, a decrease in greenhouse gas emissions, improvement in rural growth related to bio fuel plants and farm income support [6–8]. The first of these assumes that greenhouse gas emission and high crop price are joint objectives and the second assume that the fuel liberty and high crop prices are the joint objective. At last, we infer the social motivation to pay for bio fuel service [9–10]. This in turn to allow us to suggest the subsidy schedule that maintains social preference and provide a higher motivation for farmers to choose production of cellulosic materials. This is mainly applicable since the 2007 energy act sets a renewable fuels standard that relies a lot on cellulosic bio fuel but does not specify a higher per gallon incentive to producers [10–14].

2. Materials & methods

2.1. Fuels

The fuels are equipped by adding the diesel, fish oil of various proportions like 8:3, 7:4, 6:5, and 5:6 then their calorific value, viscosity, density, fire point and flash point be initiate. The performance individuality is initiate by various fuel blends. The proportion of the fuel is taken and pouring into tank. At opening the safety measures like checking the fuel level and appropriate connection are noted. Then rated power, speed and density are found. The engine is in progress at constant speed and time utilize for utilization of 25 cc fuel is monitored by help of stop watch.

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2.2. Methods

The alternate fuel learning is completed with help of four stroke diesel engine. The engine speed is set at 1500 rpm and loaded to the test. The behavior of biodiesel and mixtures was done by trials. The Biodiesel look to an outstanding alternative way to diesel. The Residents was presentation high-quality interest and different mixture to the diesel and fish oil on various proportions like 8:3, 7:4, 6:5, and 6:6. The biodiesel individually utilized the methyl ester of rubber seed oil.

2.3. Diesel engine Specification

The 4 - stroke cylinder is utilized to contribute do to an experiment. The engine is operating on the standard and control of diesel and fish oil specifications to the engine is summarizing in the Table 1. In addition to the data to engine implements was composed to adding to a everyday log of on the whole fuel usage, operation mode and operator surveillance.

Table 1
Specification for four stroke diesel engine.

Specification	Diesel engine
Manufacturer name	Kirloskar
Engine speed	1500 rpm
Engine power	7.4 kW
Horse power	5 Hp
Stroke	139.7 mm
Compression ratio	5:1–23:1
Method of cooling	Water
Dynamometer	Eddy current

3. Experimental procedure

Ahead of initiating the engine experiments, oil level, fuel tank, coolant and various conditions of engine is check and start the engine at low rpm then achieve steady state. After that speed of the engine is raised slowly up to the level of 1500 rpm. Mean time, the dynamometer analyzers and various measurements are carried on with appropriate preparations. When engine is got stable state and preparations for the measurements was completed.

The load level was used at five levels and they are 3, 5, 7, 9, and 11 Amps load respectively.

At engine speed in all load conditions was set for the constant engine speed of 1500 rpm. In every load condition, the measurements like fuel consumption, intake air temperature, engine coolant temperature, crank angle, air fuel ratio, exhaust gas temperature, combustion pressure, fuel injection timing, smoke emission, carbon monoxide (CO) emission, and hydrocarbon (HC) emission are considered. The engine is used in experiment is four-stroke engine, obviously at constant speed. The engine is experienced at speed of 1500 rpm. The readings were noted throughout the experiments for estimate of thermal efficiency, BFSC and other characteristics.

Table 2 displays various characteristics of the diesel, fish oil and Bio-diesel. The various properties of biodiesel compositions (B10, B20, B30, B40, B50) are tabulated. It concludes that fish oil has the maximum flash point of above 150 deg C, the blended biodiesel have the maximum fire point of 108 deg C, fish oil has the maximum density of 0.930, the fish oil has the maximum kinematic and dynamic viscosity 56.86, 54.15 respectively (Table 3).

With reference to the above tabular column the flash and fire point of diesel rises after blending with fish oil and various blend

Table 2
Flash point, Fire point, Viscosity, and Density readings.

Parameters	Diesel	Fish oil	Bio-diesel	B10	B20	B30	B40	B50
Flash point deg C	46	Above 150	88	50	53	56	59	64
Fire point deg C	54		108	61	64	68	71	76
Density(ρ) g/cc	0.830	0.930	0.916	0.840	0.848	0.858	0.869	0.880
Kinematic viscosity centistroke	3.52	56.86	30.26	4.079	5.4642	7.0282	7.863	9.2575
Dynamic viscosity centipoises	2.905	54.15	26.62	3.426	4.637	6.0382	6.841	8.165

Table 3
Calculation of B30: D70 (Biodiesel 30% and Diesel 70%).

S. no	Load (Amp)	Voltage (volt)	Current (Amp)	Time taken for 10 cc fuel consumption tf(sec)	Brake power (kw)	Total fuel consumption (kg/hr)	Specific fuel consumption (kg/kw-hr)	H mech (%)	H Bth (%)
1	0	220	1	63.46	0.22	0.475	2.159	10.57	3.79
2	3	220	3	52.22	0.66	0.577	0.875	26.19	9.36
3	5	220	4.5	45.60	0.99	0.661	0.668	34.73	12.26
4	7	220	6.5	40.06	1.43	0.753	0.526	43.46	15.55
5	9	220	8.5	35.85	1.87	0.841	0.456	50.14	18.20

Table 4
Calculation of B50: D50 (Biodiesel 50% and Diesel 50%).

S.no	Load (Amp)	Voltage (volt)	Current (Amp)	Time taken for 10 cc fuel consumption tf(sec)	Brake power (kw)	Totalfuel consumption (kg/hr)	Specific fuel consumption (kg/kw-hr)	η mech (%)	H Bth (%)
1	0	220	1	64.56	0.22	0.4712	2.140	9.09	4.30
2	3	220	3	51.63	0.66	0.5892	0.893	23.07	10.34
3	5	220	4.5	44.97	0.99	0.6765	0.683	31.03	13.51
4	7	220	6.5	39.84	1.43	0.7635	0.534	39.39	15.33
5	9	220	8.5	35.78	1.87	0.8502	0.455	45.94	20.30

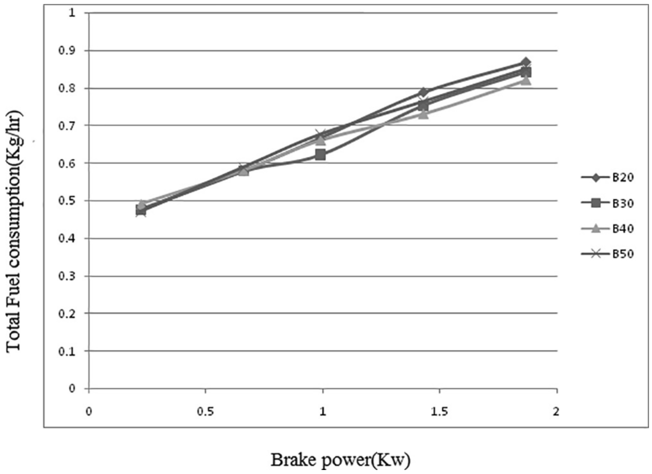

Fig. 4.1. Brake Power Vs Tfc.

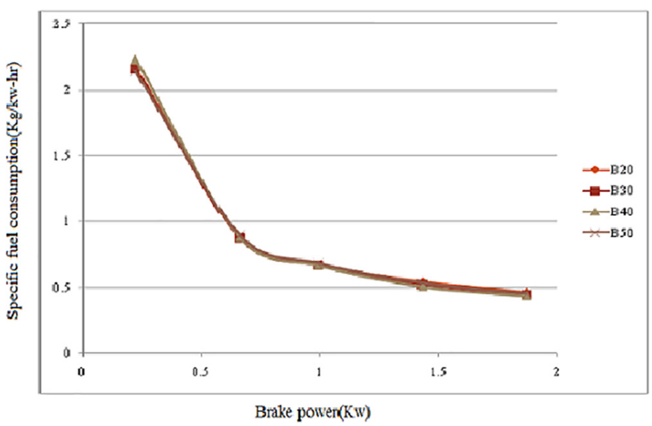

Fig. 4.2. Brake Power Vs SFC.

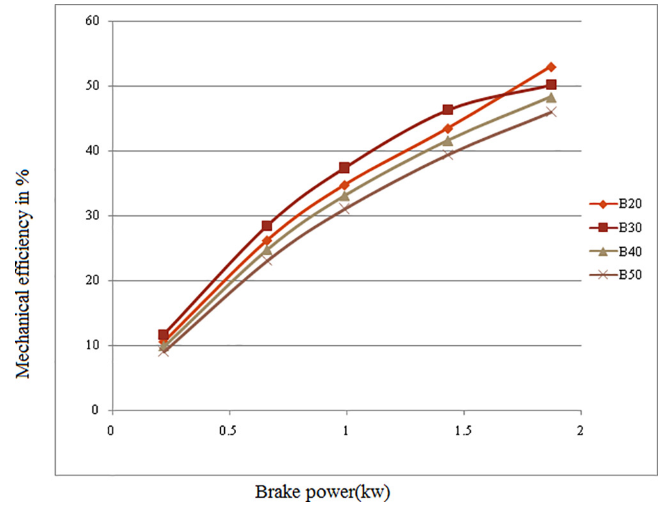

Fig. 4.3. Brake Power Vs Mechanical Efficiency.

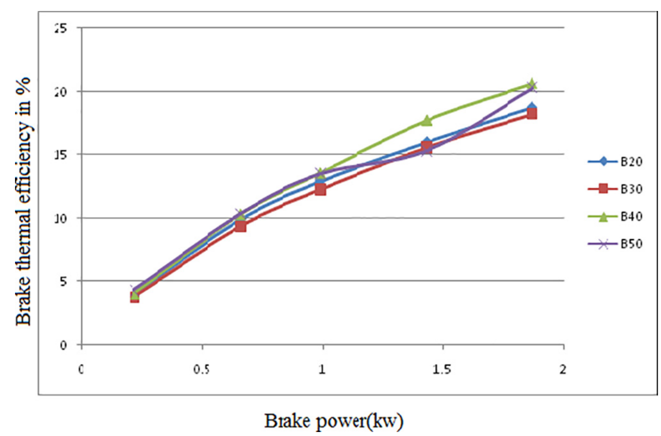

Fig. 4.4. Brake Power Vs Brake Thermal Efficiency.

properties are compared to find the optimum proportion of blend (Table 4).

4. Result and discussion

4.1. Brake power vs total fuel consumption

Comparison of total fuel consumption characteristics of various proportions (B20:D80, B30:D70, B40:D60, B50:D50) of Fish Oil and diesel blend is shown in the graph given below (Fig. 4.1).

4.2. Brake power vs SFC

Comparison of Specific Fuel Consumption characteristics of various Proportion (B20:D80, B30:D70, B40:D60, B50:D50) of Fish Oil and diesel blend is shown in the graph given below (Fig. 4.2).

4.3. Brake power vs mechanical efficiency

Comparison of mechanical efficiency characteristics of different proportions (B20:D80, B30:D70, B40:D60, B50:D50) of Fish Oil and diesel blend is shown in the graph given below (Fig. 4.3).

4.4. Brake power vs brake thermal efficiency

Comparison of brake thermal efficiency characteristics of various proportion (B20:D80, B30:D70, B40:D60, B50:D50) of Fish Oil and diesel blend is shown in the graph given below (Fig. 4.4).

From the results we conclude that the 7:4 and 6:5 proportions of the diesel and fish oil blend shows approximately same brake thermal Efficiency at low load and 8:3 proportions give high brake thermal efficiency in upper loads its about 35%.

The lowly brake thermal efficiency is at 7:4 proportions and about 23% at upper load. The 6:4 proportions illustrate the lowly brake thermal efficiency in low load. The steady add to in the brake thermal efficiency is seeing at 8:3 proportions of the diesel and fish oil blend. The 7:4 and 6:5 proportions give the lower performance amongst the various proportions.

The subsequent conclusion was noted behind conduct the experiments based on the mechanical efficiency:

- The mechanical efficiency is zero at the No load condition.
- 8:3 proportions the mechanical efficiency is higher on low load.
- 8:3 proportions give higher mechanical efficiency at all kind of loads.
- Here there is a steady amplify in mechanical efficiency on 8:3 proportions.

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The Subsequent inference was noted after conduct the experiment based on the SFC:

- SFC is regularly declining when load increase.
- 8:3 proportions give low SFC at maximum load of 0.464 kg/KW-hr.
- 7:4 proportions give higher SFC on maximum load in addition to 6:5 proportions gives higher SFC on low load.

5. Conclusion

The 8:3 proportions of the diesel in addition to fish oil blends has an improved brake thermal efficiency than the new blends at superior load. It is used to achieve a development of 1.3 to 2.5% compare to the other blend. The lesser concentrations of bio diesel blends establish to get better thermal efficiency. B10 bio diesel blend give a good upgrading brake thermal efficiency of the diesel engine. The 8:3 proportions of the diesel and fish oil blend give high mechanical efficiency. It indicates of improving just about 2.3 or 4% while compare to the other blend. The mechanical efficiency is low in the 9:4 proportions of diesel and fish oil blend and high in 8:3 proportion. The higher the concentration of bio diesel blend, upper is the reduction of smoke density in the exhaust gas. As a result it's suggested that the 8:3 proportions is the most excellent character in diesel.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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