

Performance Testing and Comparison of Diesel with Alternative Fuel and Its Blend

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Abstract— In India, the C.I. Engine dominates the field of commercial transportation and agricultural machinery on account of its superior fuel efficiency. Due to rapid depletion of fossil fuels and environmental concerns, the use of biodiesel is rapidly expanding around the world, making it imperative to fully understand the impacts of biodiesel on the diesel engine combustion process and pollutant formation. The climatic and soil conditions of India are convenient for the production of bio diesel. The performance study of C.I. engine with diesel and biodiesel were carried out at different load, fuel characteristics, engine performance characteristics observed.

Keywords: Biodiesel, Vanaspati Oil, Diesel Engine

I. INTRODUCTION

In the populaces and expanded utilization of oil energizes, The rate of utilization of non- world, non-renewable energy sources responses are exhausting rapidly because of exponential development renewable energy sources like coal, petroleum, diesel, lamp oil and so forth.[1]

It increases usage day by day. Due to this increased usage of this fossil fuel increasing exhaust gas emissions like CO, CO₂. [1] As we know that there are limited non-renewable sources of fossil fuels all over world. In India, population growth increased rapidly.[1] There are more fossils fuels like petroleum product uses in automobile power plants, Due to this petroleum product increasing the pollutants like CO and NO_x. which are very harmful for environment and society.[1]

Biodiesel Production is the process of producing the bio fuel, biodiesel, through the chemical reactions. [3] This involves vegetable or animal fats and oils being reacted with short chain alcohols. [3] Bio diesel production is a current and scientific area for researchers due to continuous increase in the prices of petroleum fuels and environmental advantages. [3]

A. BIODIESEL AS A FUEL

Bio diesel made by synthetically responding (for example vegetable oil, creature fats) with a liquor Bio diesel generation is a cutting edge and innovative region for specialists because of steady increment in the costs of oil powers and ecological focal points.[2]

There are many non-edible oil available in India like Vegetable oil Linseed oil, Neem oil, Karanja oil, Jatropha oil palm oil etc. [2]

II. ADVANTAGES OF BIODIESEL OVER FOSSIL FUEL

Biodiesel is easy to use, biodegradable, nontoxic and essentially free of sulfur.

- It can be use in most diesel engines. [5]

- It emits less air pollutants and greenhouse gases other than nitrogen oxide. [5]
- It is easier to handle and has almost the same energy efficiency as petroleum diesel. [5]
- Biodiesel blends as low as B2 have been found to significantly reduce that amount of toxic carbon-based emissions. [5]
- With the increasing price of petroleum-based products, biodiesel is becoming an increasingly affordable option relative to petroleum diesel. [5]
- The use of biodiesel helps reduce dependent on limited fossil fuel reserves. [5]

Properties	Vanaspati Biodiesel
Calorific value (KJ/kg)	40000
Viscosity(mm ² /sec)	9.6
Sulphur content (%)	0.02
Pourpoint (c)	-3
Flash point (c)	70
Density (kg/m ³)	0.88
Cetane number	57.6

Table 1: Physical – chemical properties of vanaspati biodiesel

Properties	Palm Biodiesel
Calorific value (KJ/kg)	41000
Viscosity(mm ² /sec)	4.5
Sulphur content (%)	0.02
Pourpoint (c)	16
Flash point (c)	174
Density (kg/m ³)	0.85
Cetane number	55.3

Table 2: Physical – chemical properties of palm biodiesel

III. METHODOLOGY

4 Stroke single cylinder diesel engine is tested and performance is obtained for pure diesel and biodiesel



Fig. 3.1: 4-stroke Compression Ignition Engine

A. Specification of Diesel Engine

4 Stroke diesel engines having a loading system, a electrical brake dynamometer, water cooling system, engine base to minimize the vibration, a manometer, thermocouples for temperature measurement.

The specification of diesel engine in which experiment is performed is as follows.

Make	Field Marshal
Model	GD13
Number of cylinders	2
Number of strokes	4
Type of cooling	Water cooled
Rated power & speed	9.56Kw/13BHP@1500rpm
Cylinder bore & stroke	85mm & 110 mm
Diameter of orifice	15mm
Cubic capacity (cc)	1250
Compression Ratio	17.5:1
Fuel consumption (g/kw/h)	250

Table 3: Specification of diesel engine

IV. RESULTS AND DISCUSSION

The following performance curves shows the comparison between pure diesel, Palm biodiesel and Vanaspati Biodiesel

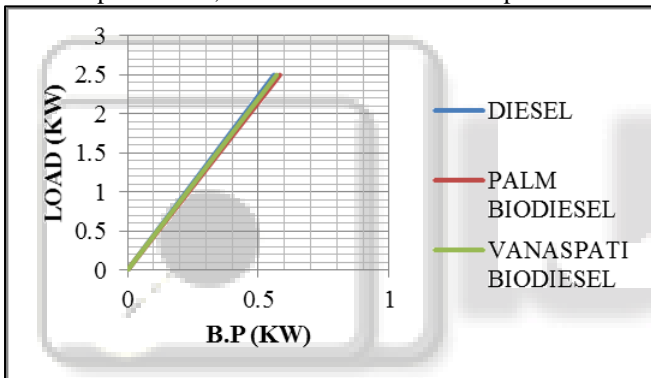


Fig. 4.1: Load v/s BP comparison

From the fig 4.1 we can see that pure diesel, palm biodiesel and Vanaspati biodiesel showing linear deviation of brake power with respect to load. Brake power doesn't get affected much by using different blends

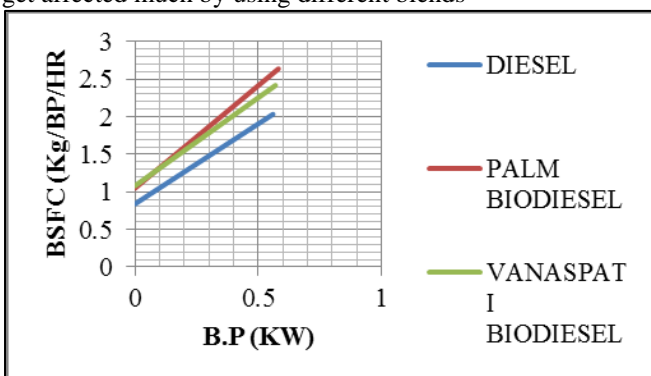


Fig. 4.2: BSFC v/s BP Comparison

From the fig 4.2 we can see that as the load increases the brake power also increases. Hence, as seen in graph, Palm Biodiesel has the highest Brake Power than other fuel when load is increased.

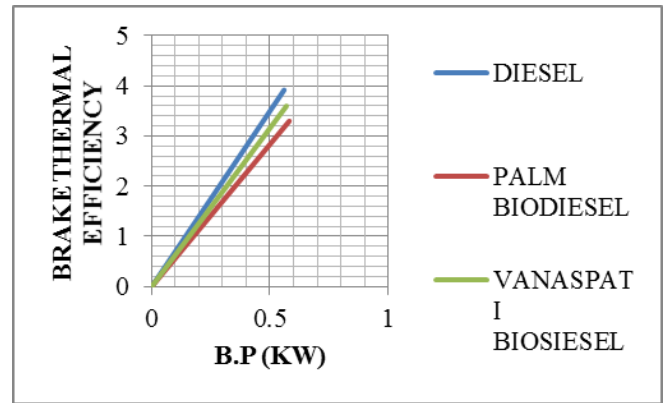


Fig. 4.3: Brake Thermal Efficiency v/s BP Comparison

From the fig 4.3 we can see that Brake Thermal Efficiency increases as the load for all fuel increases. Here, engine having Diesel showed the maximum Brake Thermal Efficiency compared to other fuel

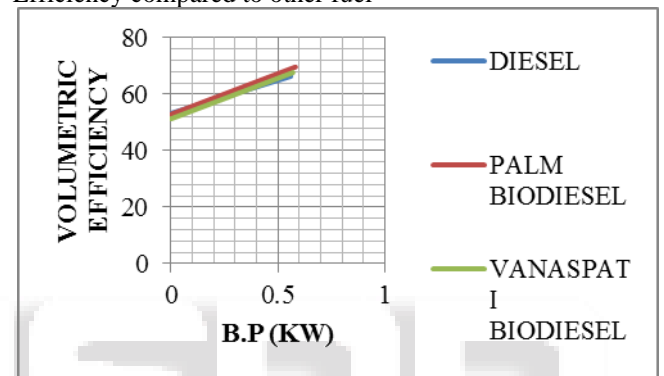


Fig. 4.4: Volumetric Efficiency v/s BP Comparison

From the fig 4.4, we can say that as increase in load the Volumetric Efficiency per unit power decreases accordingly for all fuels.

V. CONCLUSION

After doing all the calculations and plotting various graphs we hereby conclude that the fuel consumption is more in biodiesel compared to that of diesel when the load is same. But when the load on engine is increased the power produced by biodiesel is less than the power produced by diesel and B.S.F.C of diesel fuel is less then biodiesel. In spite of these the overall cost is less for biodiesel compared to diesel as the biodiesel is available at cheap rate yet the biodiesel gives almost equal performance on engine when used in place of diesel.

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