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"AN EXPERIMENTAL INVESTIGATION ON PERFORMANCE CHARACTERISTICS OF DIESEL ENGINE USING PALM OIL BIO-DIESEL AS AN ALTERNATE FUEL"

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ABSTRACT:

Today energy consumption for human life in the form of fossil fuels has been a matter of great concern. There is a need to increase energy supplies to meet basic needs and to do it in a way that promotes sustainable development it is needed to increase energy supplies to meet basic needs. Bio-diesel is an attractive alternative fuel which is renewable, non-toxic, reduces carbon monoxide and hydrocarbon emission due to higher content of oxygen. The aim of this study is to assess the performance characteristics of diesel engine using various bio-diesel blends as a fuel. The important properties calorific values, kinematic viscosity, flash point, pour point of different oil are compared with diesel standards. In the present work palm oil is blended with diesel in different proportion and used for conducting the performance test on single cylinder four stroke diesel engines at varying load conditions. The Various parameters such as thermal efficiency, specific fuel consumption are recorded. These results are compared to those of pure diesel. These results are again compared to the other results of neat oils and their blends available in the literature for validation. It is concluded that the usage of neat bio-diesel has a great impact in reducing the dependency of India on oil imports.

Keywords: *Alternate fuel-Palm oil, biodiesel blends, diesel engine, performance characteristics.*

1. INTRODUCTION

India is one of the fastest developing countries with a stable economic growth, which multiplies the demand for transportation in many folds. Fuel consumption is directly proportionate to this demand. India depends mainly on imported fuels due to lack of fossil fuel reserves and it has a great impact on economy. India has to look for an alternative to sustain the growth rate. Bio-diesel is a promising alternative for our Diesel needs. With vast vegetation and land availability, certainly bio-diesel is a viable source of fuel for Indian conditions. Recent studies and research have made it possible to extract bio-diesel at economical costs and quantities. The blend of Bio-diesel with fossil diesel has many benefits like reduction in emissions, increase in efficiency of engine, higher Cetane rating, lower engine wear, low

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fuel consumption, reduction in oil consumption etc. Indian scientists searched for an alternate to diesel fuel to preserve global environment and to withstand economical crisis. So, vegetable oils from plants both edible, crude non-edible and Methyl esters (Bio-diesels) are used as alternate source for Diesel oil. Bio-diesel was found as the best alternate fuel, technically and environmentally acceptable, economically competitive and easily available.

2. PROPERTIES OF PALM OILS USED IN TEST ENGINE

Palm oil has pleasant odour and taste. It is stable and resistant to rancidity. The colour of palm oil varies from yellow to deep orange. Inter esterification of palm oil produces two fractions. Palm oil obtained at low melting point called “Olein” and the oil obtained at high melting point called “Stearin”. Oil palm fruits are oval-shaped sessile drupes. Palm oil contains some triglyceride species, which are completely saturated. The iodine value of palm oil is lower (44-58) when compared to other vegetable oils because of high proportion of saturated fatty acids. Palm oil is solid at ambient temperature and fluid in tropical and subtropical climates with certain fractions held in crystalline form. It is used in manufacturing plastics, fibers and soaps. It is available in Asia, Africa, Indonesia, Nigeria and Malaysia.

Palm Sterin oil (%)	Diesel (%)	Density (gm/cc) at 400 C	Viscosity(cst) at 300 C
100	0	0.92	38
75	25	0.90	34
50	50	0.87	25
25	75	0.84	16
0	100	0.81	6

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Property	Diesel
Density(gm/cc)at 40^0C	0.830
Viscosity(cst)	5.0
Flash point(^{0}C)	57
Fire point(^{0}C)	65
Calorific values(KJ/Kg)	42000
Cetane number	50

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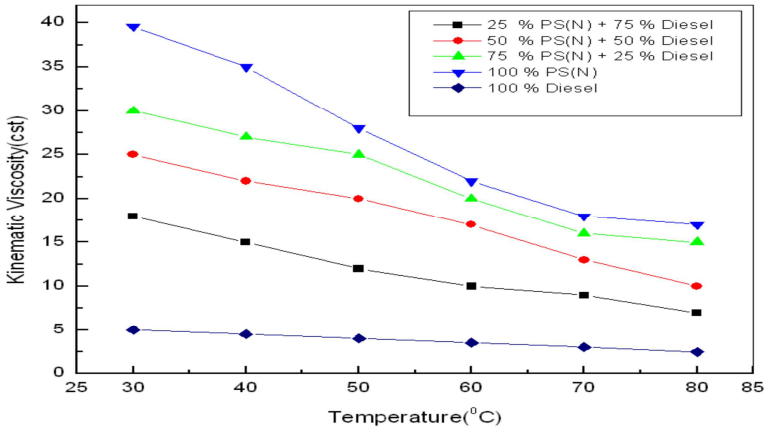

Variation of Viscosity of Palm Stearin oil and its blends With Temperature

3. EXPERIMENTAL WORK

The details of the experimental set up are presented in this chapter. The information about the engine, components, instrumentation and controls used in test engine are described.

The Engine chosen to carry out experimentation is a single cylinder, four stroke, vertical, water cooled, direct injection computerized Kirloskar make CI Engine. This engine can withstand higher pressures encountered and also is used extensively in agriculture and industrial sectors. Therefore this engine is selected for carrying experiments.

SPECIFICATION OF TEST RIG

Number of cylinders	01
Number of Strokes	04
Fuel	Diesel
Rated Power	5.1 KW/7 hp @ 1500 RPM
Compression Ratio	17.5:1
Dynamometer arm length	185 mm
Dynamometer Type	Eddy current
Type of cooling	Water cooled

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4. EXPERIMENTAL PROCEDURE

The experiments are conducted for variable loads like 0, 1.5, 3.5, 4.5 and 5.2 KW at rated speed, with injection pressure of 210 bar and cooling water exit temperature at 65^0C. Three blends palm oil such as 25%, 50%, 75% and 100% (neat oils) are used in this experimentation.

The vegetable oils and their blends with diesel are heated externally to a required temperature as stated earlier before injecting into the test cylinder. The engine was sufficiently warmed up and stabilized before taking all the readings. All the observations recorded were replicated thrice to get a reasonable value. The performance parameters such as Brake Thermal Efficiency(ηB.Th.), Brake Specific Fuel Consumption(bsfc), Exhaust Gas Temperature(EGT) and Volumetric efficiency(ηVol.)

5. RESULTS AND DISCUSSIONS

Engine Performance parameters of Palm Stearin Oil and its Blends:

Brake Thermal Efficiency: Fig.1 Shows the variation of Brake Thermal efficiency with Brake power output for Palm Stearin oil and its blends with Diesel in the test engine. For 25% blend of Palm Stearin slightly lower Brake thermal efficiency compared to diesel. Neat palm stearin oil has lower Brake thermal efficiency at all loads. Maximum efficiency obtained at 4.5Kw load i.e. 32.45%. For diesel it is 34.10%. At 4.5 kw load, Brake thermal efficiency of neat Palm stearin oil is lower by 4.83% compared to diesel. This is due to lower calorific value, high viscosity coupled with density of the fuel.

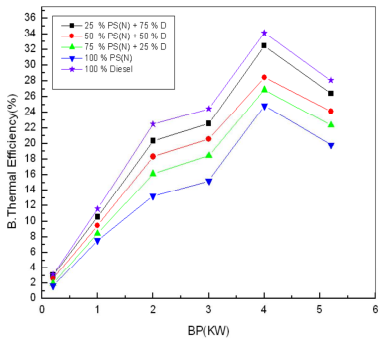

Fig.1

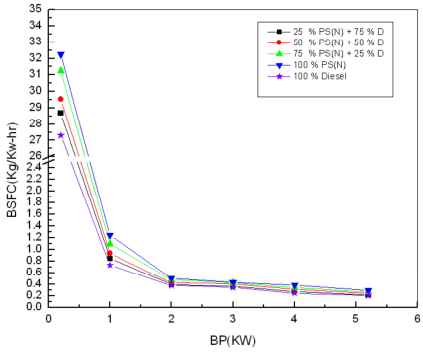

Fig.2

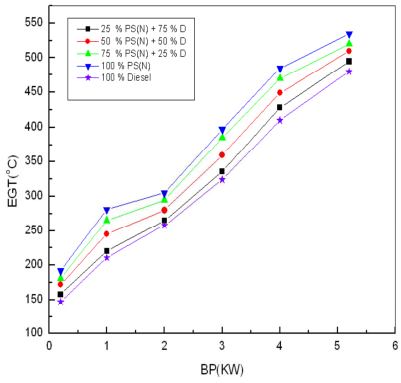

Fig.3

Brake Specific Fuel Consumption: Fig.2 Shows the variation of Brake specific fuel consumption with Brake power output for Palm Stearin oil and its blends with Diesel in the test engine. Neat Palm Stearin oil has higher bsfc compared to diesel. 25% blend of Palm Stearin oil has lower bsfc compared to all other blends. At rated load, bsfc for 25% blend and neat Palm Stearin oil are 0.225 Kg/kw-hr and 0.295 Kg/kw-hr, where as for diesel it is 0.210 Kg/Kw-hr. At rated load, bsfc for 25% blend and neat palm stearin oil is higher by 7.14% and 40.47% respectively compared to diesel. This is attributed to high viscosity of the fuel.

Exhaust Gas Temperature: Fig.3 Shows the variation of Exhaust Gas temperature with Brake power output for Palm Sterin oil and its blends with diesel in the test engine. 25% blend of Palm stearin has lower EGT compared to all other blends for all loads. EGT for all the blends and diesel increases from no load to rated load. Neat Palm stearin oil has the highest EGT at rated load compared to all other blends. EGT at 25% blend of Palm Stearin oil shows the best performance due to reduction of exhaust heat loss.

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6. CONCLUSION

Considering the need for alternate fuels, the experimental investigations are carried out in the present work in order to run the existing diesel engines with non-edible vegetable oils. The Performance parameters of engine such as Brake thermal efficiency, volumetric efficiency are decreased, Brake specific fuel consumption and Exhaust gas temperature are increased for all neat oils and their blends compared to those of diesel. This is because of high viscosity coupled with lower heating value of the fuels.

7. FUTURE SCOPE WORK:

Investigations can to be carried out on emission & combustion characteristics in high speed multi cylinder engine.

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