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ALTERNATIVE FUELS AND PERFORMANCE OF CI-ENGINE RUNNING ON NEEM OIL AND BIO-DIESEL BLENDS.

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ABSTRACT

Alternative fuels are derived from resources other than petroleum. Some are produced domestically, reducing our dependence on imported oil, and some are derived from renewable sources. Often, they produce less pollution than gasoline or diesel. The Development of Alternative Fuels was motivated by the "Twin Crisis" they are Increasing Environmental Pollution and Reducing Fossil Fuel Reserves, the Alternative Fuels have been developed for Auto industry-Power Industry and Jet Propulsion Industry.

In the present investigation experimental work study on performance parameters of neem oil, neem biodiesel and their blend is carried out on a CI diesel engine. Neem oil was converted to biodiesel by transesterfication process. Neem biodiesel and neem oil were blended with diesel in varying proportions (10%, 20%, and 30% by volume). Test was conducted at different injector opening pressure i.e. 200 bar and 220 bar. The performance parameters evaluated were brake thermal efficiency, brake specific fuel consumption and brake power. Considering brake thermal efficiency as the parameter, it is seen that B20 at 220bar has higher thermal efficiency then diesel and N20 at 200bar showed slightly lower but comparable thermal efficiency with diesel. not much variation in cylinder peak pressure was observed in either injector pressure.

Introduction

In the current energy scene of fossil fuel, renewable energy sources such as biodiesel, bio-ethanol, bio-methane, and biomass from wastes or hydrogen have become the subjects of great interest. These fuels contribute to the reduction of dependence on fossil fuels. In addition, energy sources such as these could partially replace the use of those fuels which are responsible for environmental pollution and may be scarce in the future. For these reasons they are known as "alternative fuels". Vegetable oil cannot be directly used in the diesel engine for its high viscosity, high density, high flash point and lower calorific value. So it needs to be converted into biodiesel to make it consistent with fuel properties of diesel. Alternativefuelsare any materials or substances that can be used as fuels, other than conventional fuels. Some of the well-known alternate fuels include biodiesel, bio-alcohol (methanol, ethanol, and butanol), chemically stored electricity, hydrogen, non-fossil natural gas, vegetable oil, and other biomass sources.

ALTERNATIVE FUELS IN USE TODAY

- Compressed Natural Gas (CNG)
- Liquefied Petroleum Gas (LPG)
- Gasohol (Gasoline + Alcohol)
- E-Diesel (Diesel + Ethanol)
- Straight Vegetable Oils (SVO)
- Hydrogen
- Hythane(Hydrogen + CNG)
- Alcohols (Ethanol and Methanol)
- Liquefied Natural Gas (LNG)
- Biodiesel

Biodiesel:- Biodiesel is an esterifiedfuel made from Vegetable Oils such as Soya bean, Mustard, Sunflower, Corn, Palm, Castor, Jatropha, Karanjia, Neem.

The neem oil plant is a fast growing plant with long productive life span of 150 to 200 years, its ability to survive on drought and poor soils at a very hot temperature of 44°C and a low temperature of up to 4°C has been reported (Karmakar et al., 2011), and its high oil content of 39.7 to 60% (Martín et al., 2010; Narwal etal., 1997). A mature neem tree produces 30 to 50 kg fruit every year (Karmakar et al. 2011). It contains a high percentage of monounsaturated fatty acids (C16:1,C18:1), a low proportion of polyunsaturated acids (C18:2,C18:3) and a controlled amount of saturated fatty acids (C16:0, C18:0) (Wang et al., 2011). The aforementioned characteristics of neem oil plants and its fatty acid composition of the oil make it to be a useful renewable source for biodiesel production.

Experimental data:- The study was conducted to investigate the performance of a stationary single cylinder diesel engine running on neem oil and neem biodiesel blended with diesel with varying proportion of 10%, 20%, and 30% by volume and also on diesel fuel alone. Diesel fuel results were considered as base line data for comparison of performance parameters.

Different blends for the testing are:- .

. N10: 10% pure neem oil and 90% diesel by volume.

N20: 20% pure neem oil and 80% dieselby volume.

N30: 30% pure neem oil and 70% dieselby volume.

B10: 10% neem biodiesel and 90% dieselby volume

B20: 20% neem biodiesel and 80% dieselby volume.

B30: 30% neem biodiesel and 70% dieselby volume.

Fuel Properties: Table 1: Properties of neem oil, neem biodiesel and diesel.

Fuel/Properties	Kinematic viscocity	Flash point	Density (gm/cc)	Calorific value	Carbon residue
Diesel	4	44	0.830	42000	-
Neem Oi	3.11(400˚C)	236	0.970	35125*	-
Neem Biodiesel	4.937	160	0.920	39000*	0.09

Table 2: Calculated density and calorific value of different blends.

Sl.no	Blend	Density	Calorific value
1	N10	0.84	41313
2	N20	0.858	40225
3	N30	0.872	39938
4	B10	0.837	41700
5	B20	0.844	41400
6	B30	0.851	41100

* taken from literature survey data.

Comparison of brake thermal efficiency for diesel-neem oil blends:

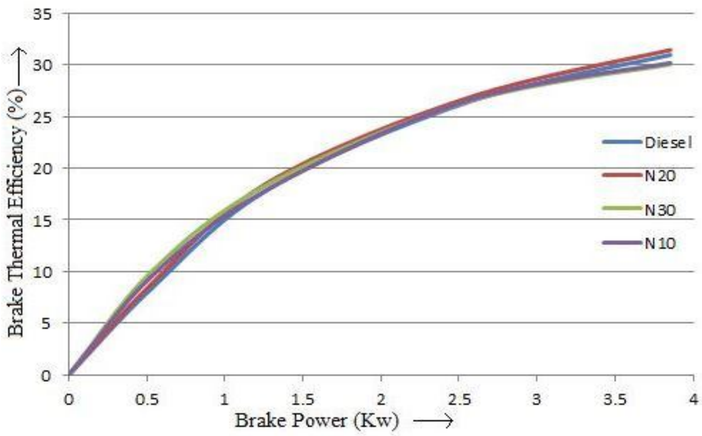

Fig 1:Brake thermal efficiency vs Brake power at 200 bar injector opening pressure

It can be observed that curve for all blends overlap with diesel. There is not much variation in BP vs BTH character. At higher load thermal efficiency of N20 is slightly higher than diesel and low for N10.

Comparison of peak pressure at varying loads for neem oil blends at different injection pressure:

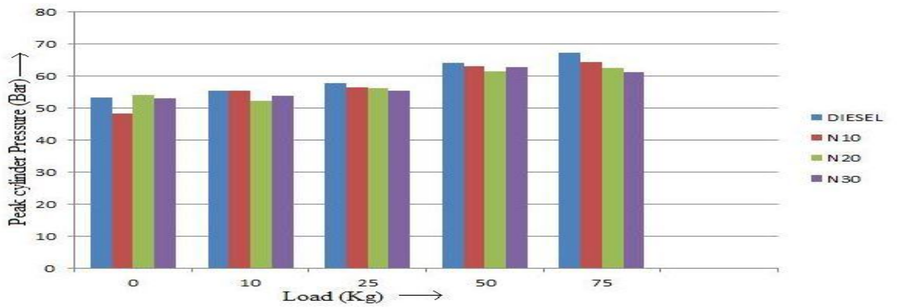

Fig 2:Peak Pressurevs Load at 200 bar injector opening pressure

It is clear from the fig that at 220 bars and zero load the peak pressure rise for N20 is greater than diesel, whereas at higher loads the peak pressure decreases. Pressure rise at higher load decreases with the increase in percentage of pure neem in the blends.

Comparison of brake thermal efficiency for diesel-neem biodiesel blends:

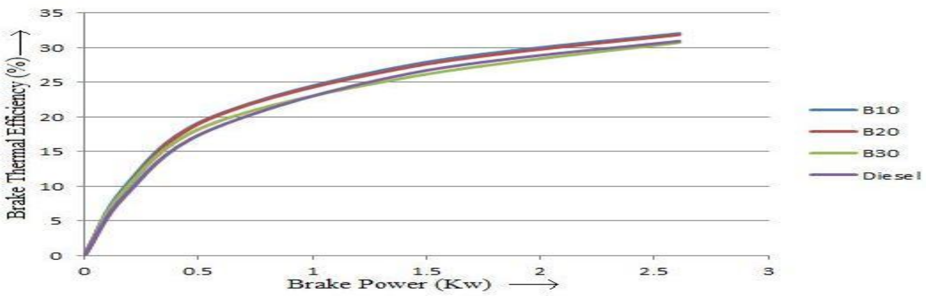

Fig 3: Brake thermal efficiency vs Brake power at 220 bar injector opening pressure

It can be observed from the figure that the curve for B10 and B20 shows slightly high thermal efficiency at high loads followed by B30 and diesel. At low loads curve overlap each other, but as load increases curves starts to separate. Among all blends of neem oil B10 shows good brake thermal efficiency.

Comparison of peak pressure-load for neem biodiesel blends at different injection pressure:

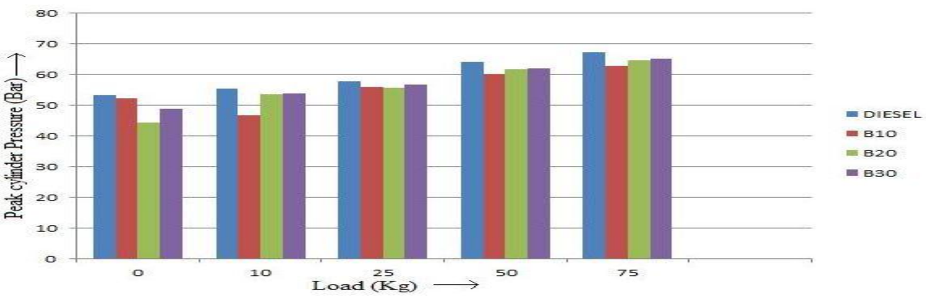

Fig 4: Peak pressure vs Load at 220 bar injector opening pressure

Above graph shows the relation between load and cylinder peak pressure at an injection pressure of 220 bars. It can be seen that peak pressure for diesel is higher than neem biodiesel blends at all loads. Initially at 0% load B10 has higher peak pressure as compared to B20 and B30. From 10% load peak pressure for B20 and B30 is higher than that of B10.At 10% load it can be seen from the graph that peak pressure for B10 decreases and then goes on increases as the load increases. From 10% load, peak pressure of B10 and B20 is almost same. At 25% load, diesel and all biodiesel blends have almost same peak pressure.

Comparison of Brake thermal efficiency for best blend: Let us consider brake thermal efficiency as the base for selecting substitute of diesel. From fig 1 we can see that in the injection opening pressure N20 has same thermal efficiency as that of diesel for 200 bar pressure. When comparing N20 at two injection pressure we see that at 200 bar injection opening pressure is more comparable with diesel. Now by observing fig 3 we can see that B20 has same thermal efficiency as diesel, at 220 pressures. From fig 3:- at 220 bar pressure B20 curve almost overlap with the diesel curve.

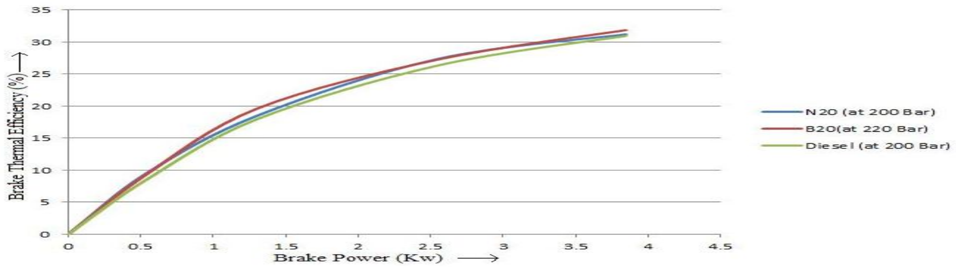

Fig 5: Brake thermal efficiency vs brake power

From above comparison graph it is clear that brake thermal efficiency of N20(at 200 bar) and B20(at 220 bar) are greater then diesel. At all range of loads B20 at 220 bar, has higher brake thermal efficiency than diesel and N20.

Hence B20 at injection pressure of 220 bar can be used as an alternate to diesel.

CONCLUSIONS

Based on the above study made on blend of neem oil and neem biodiesel considering diesel parameters as base, following observations are made:

- Filtered neem oil (biodiesel) can be substitute of diesel because the properties like calorific value, density and viscosity are very much comparable with diesel.
- At 200 bar injection pressure diesel had highest peak pressure followed by B30, B20 and B10 this trend remain same as the load increases. Among all blends cylinder pressure of B20 and B30 were almost same as diesel at all loads.at 220 injection pressure all blends of biodiesel has comparable value as diesel at 25% load. At 0% load B20 had least cylinder pressure.
- Brake thermal efficiency of all neem oil blends wassame at both 200 bar and 220 bar pressure. Not much variation was observed with change in load.
- It is observed that the there is no variation in peak pressures for neem oil blends and neem biodiesel blends. But in case of neem oil blends, the peak pressures is highest at 200 bar. In case of neem biodiesel blends the peak pressure at 200 bar and 220 bar is almost same.
- we can conclude that B20 at injection pressure of 220 bar can be used as an alternate for diesel.

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