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INFLUENCE OF MGO ON EMISSIONS OF DI ENGINE USING BLENDS OF BIODIESEL

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ABSTRACT

With the technological development, the research over alternate fuels is increasing day by day in order to help the upcoming generation with a bright and greener future. In order to preserve the existing petroleum resources for future generation, it is necessary to soon switch to any alternate source which is easily available, renewable as well as environment friendly. In this paper I would like to highlight upon the usage of Diesel, Castor Oil and Nano Particles for a compression ignition engine and study the emission characteristics of this fuel at different mixing ratios and analyze the different levels of residue particles.

Keywords: compression engine, mixture ratio, petroleum resources.

1. INTRODUCTION

The various research works going on the use of bio fuels, one of the researchers has performed a comparative experimental study for determining the effect of fuel properties on the constructive characteristics of some pieces of a current common rail injection system used in light duty diesel vehicles. Results showed that the use of the ethanol-biodiesel-diesel blend produced a similar effect on the durability on the injection pump components studied and on the injector nozzle as that produced by diesel fuel [1].

Biodiesels are used in diesel engines without making any alterations to the engine. The ethanol mix biodiesel is widely researched and experimented with various compositions and their performance is noted down. Isopropanol is also being added to mixture. Experimental results showed that the ethanol addition reduced CO, soot and SO2 emissions, but it increased the NOx emission and power reductions. It was also found that increasing the injection pressure decreased CO and the smoke emissions [2].

Ethanol being widely used as a blend in biofuels, it is being researched extensively. During analysis, special emphasis is placed on the factors such as stability, viscosity and lubricity, safety and materials compatibility critical to the potential commercial use of these blends. The effect of the fuel on engine performance, durability and emissions is also considered. But maintaining vehicle safety with these blends may entail fuel tank modifications and work is required in specifying acceptable fuel characteristics, confirming the long-term effects on engine durability, and ensuring safety in handling and storing ethanol–diesel blends [3].

In the ongoing research for searching a suitable biofuel in order to replace the non renewable resources, in 1996 an oil-soluble organo-metallic iron combustion catalyst was developed for turbine engines. It included oil-soluble magnesium to reduce vanadium deposits and corrosion which resulted in significant reduction of smoke in the exhaust of engines operating in steady state and non-equilibrium start-up conditions. The same biofuel when used for steam boilers and compression-ignited reciprocating engines, it was noted that it promotes complete and more efficient combustion in the engine, resulting in increased power, improved fuel economy and radically reduced smoke emission. The iron-magnesium combination acts synergistically to give greater activity than expected [4].

In the research works it is also been seen the influence of a ferrous picrate based homogeneous combustion catalyst on fuel consumption and smoke emission of a laboratory diesel engine. On analysis, it was noticed that the brake specific fuel consumption and smoke emission decreased as the dosing ratio of the catalyst doped in the diesel fuel increased. At a certain point, the brake specific fuel consumption was reduced by from 2.1% to 2.7% and the smoke emission was reduced by from 6.7% to 26.2% at the full engine load. The results indicated that the potential of the fuel saving at light load [5].

In a recent study where ethanol with Palm Stearin Methyl-Ester oil as additive has been carried out in a CI diesel engine to study engine power, torque, break specific fuel consumption, break thermal efficiency and exhaust gas temperature with the diesel – ethanol blend with addition of small amount of biodiesel (PSME). The study was tested using diesel blended with ethanol at certain mixing ratios. From the experiment it was shown that the brake thermal efficiency of the engine increased for B40 blend for medium load capacity and showed that the exhaust gas temperature for B10 ratio is near the diesel fuel. The exhaust temperature for diesel fuel was higher compared to any mixing of the blended fuel. Brake specific fuel consumption of all ethanol Methyl-ester, diesel blends were lower compared with diesel at full load [6].

Apart from the various blends which are being tested day by day with different additives, different methods of producing them are also been found. Some of the biodiesel production techniques are supercritical

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methanolysis, ultrasonication method and microwave technique by which maximum biodiesel can be produced. The new approach of using nano particle in biodiesel shows very good results in reducing the level of pollutant gases in the engine exhaust and increased performance without any engine modification. [7]

During the usage of Biodiesel, the particulate and high emissions of NO_x are the main problems. So, a mixture of acetal and regular diesel fuel has been tested in a heavy-duty diesel engine. The effect was a marked decrease in particle number and the estimated particle mass. However, the net effect was nevertheless a reduction in the emission of CO_2. The emissions of HC, CO, NOx, some aldehydes, and hydrocarbons were only slightly affected by the new fuel composition. An exception was the emission of acetaldehyde, which was almost quadrupled, probably reflecting the decomposition and oxidation of acetal to acetaldehyde. [8]

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In order to increase the performance characteristics of bio fuels, many Nano particles are being added. In one such experiment, the nanoparticle formation during exhaust analysis. Growth rates of nanoparticles at different exhaust dilution ratios and temperatures have been determined by monitoring the evolution of particle size distributions in the first stage of the dilution system. Thus, as carbon emissions from engines are reduced, nanoparticle formation and growth becomes more likely unless emissions of sulfuric acid and hydrocarbons are correspondingly reduced. [10]

2. EXPERIMENT

The experiments were conducted on a single cylinder Kirloskar build direct injection four stroke cycle diesel engine. Water cooled eddy current dynamometer was used for the experiments. The engine is equipped with crank angle sensor, cylinder pressure sensor, thermocouples to measure the temperature of water, air and gas, Rotameter to measure the water flow rate and manometer to measure air flow and fuel flow. The various parameters that govern the performance characteristics are Brake Power, total fuel consumption, exhaust gas temperature and Brake thermal efficiency.

The various samples of biodiesel are as follows:

Sample 1- 80% diesel + 200% Castor oil + 50ppm Magnesium Oxide nanoparticles (200 Bar)

Sample 2- 80%diesel + 20% castor oil + 50ppm Magnesium Oxide nanoparticles (220 Bar)

Sample 3- 80%diesel + 20% castor oil + 50ppm Magnesium Oxide nanoparticles (240 Bar)

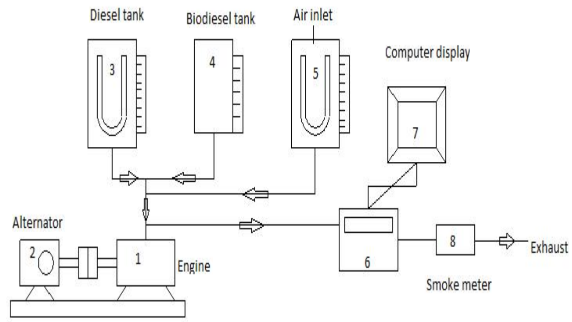

Figure-1. Engine setup.

3. RESULT AND DISCUSSIONS

After the detailed experimental analysis for the emission characteristics of the biodiesel at different composition ratios the following graphs shall be plotted as the emission curves.

A. Brake power vs carbon monoxide

When all the three samples were compared on the basis of their amount of carbon monoxide released based on the experimental analysis it was seen that in sample one the brake power is higher when compared to sample two and three. Because the CO emission can be reduced by supplying excess oxygen in to the combustion chamber. By increasing the pressure from 200bar to 240bar, the CO emission was very high than that of the diesel fuel. This can be reduced by supplying excess oxygen during combustion or increasing the oxygen content in bio-fuels.

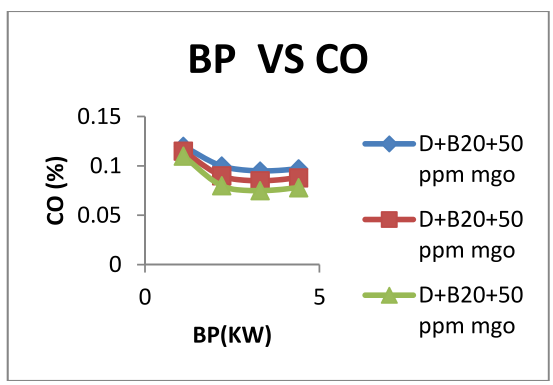

Figure-2. Brake power vs. carbon monoxide.

B. Brake power vs carbon dioxide

It can be observed that the amount of carbon dioxide released based on the experimental analysis it was seen that in sample three the amount of CO_2 released is maximum when compared to sample one and two. This leaves a remarkable significance over the emission characteristics of the biofuel.

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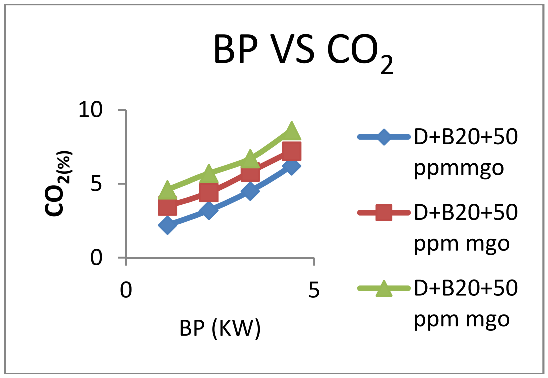

Figure-3. Brake power vs. carbon dioxide.

C. Brake power Vs. hydrocarbon

The Figure 6.20 shows the Unburned Hydro Carbon emission for various pressure levels from no load to full load conditions. When all the three samples were compared on the basis of their amount of Hydrocarbon released based on the experimental analysis it was seen that in sample three at 240bar, it is higher when compared to sample one and three at 200 and 220bar. For pure diesel, the HC varies from 10 ppm to a maximum of 28 ppm at full load level. In this investigation the minimum of 26ppm HC obtained at 200bar pressure compare to 220 and 240bar.

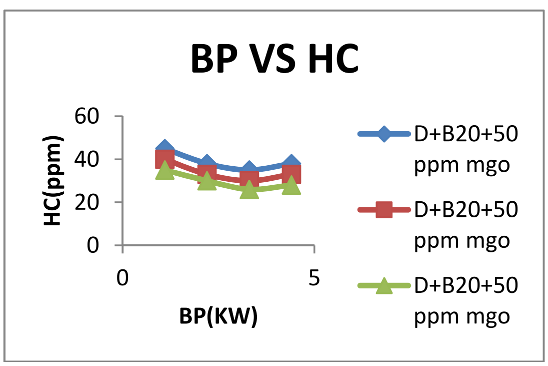

Figure-4. Brake power vs. hydrocarbon.

D. Brake power vs NO_x

When all the three samples were compared for the variation of NO_x with brake power. It can be observed that NO_x decreases more for sample 1 at 200bar compare to sample two and sample three in the pressure levels of 220bar and240bar. It was seen that in sample one the amount of O_2 released is more when compared to sample one and two. This leaves a remarkable significance over the emission characteristics of the biofuel. The pure diesel fuel emits higher NOx from 100 ppm to 750 ppm from no load condition to full load condition compared with other blended fuels. The maximum NO_x 250ppm obtained at 240bar.

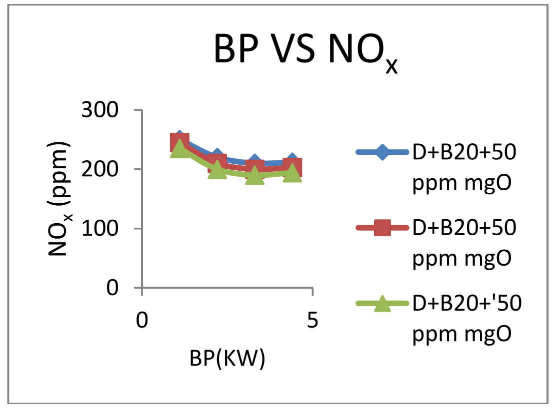

Figure.5. Brake power vs. nitrous oxide.

E. Brake power vs smoke opacity

Figure-1.6 represents the smoke opacity at 200, 220 and 240 bar pressure levels. When all the three samples were compared on the basis of their smoke opacity values, based on the experimental analysis it was noted to be higher in sample three at 240bar when compared to sample one and two. This leaves a remarkable significance over the emission characteristics of the biofuel.

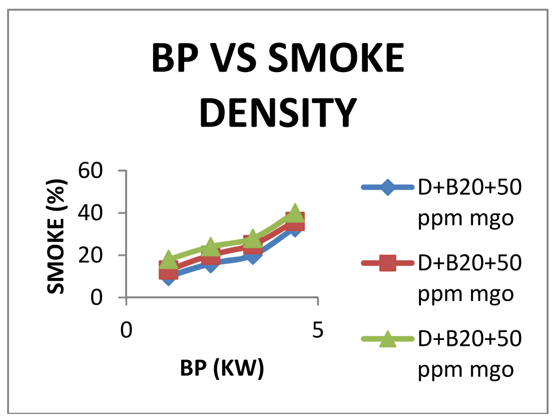

Figure-6. Brake power vs. smoke opacity.

4. CONCLUSIONS

After the successful experimental analysis of the biofuel of various pressures, the best sample which gave the most positive outcomes is sample 2.

Comparision of emission characteristics of pure diesel with that of sample one (80% diesel + 20% Castor oil + 50ppm Magnesium Oxide) at 200bar gives lower value of NO_x Un burnt hydrocarbon than pure diesel. The lower value of Hydrocarbon content in the emission shows efficient burning of fuel. The value of CO emission has also been reduced, which also corresponds to the effective burning of the fuel.

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