PERFORMANCE CHARACTERISTICS OF SINGLE CYLINDER DI DIESEL ENGINE BY USING DI-ETHYL ETHER AS AN ADDITIVE WITH DIESEL ETHANOL BLEND

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Abstract— **Increase in the number of automobiles worldwide leads to depletion of the petroleum resources and increase in pollution. In order to overcome these issues the research works are going on alternate fuels. among the alternate fuels methanol and ethanol are more effective. This study investigate the performance characteristics of DI-diesel engine by using an additive with diesel ethanol blend. The experiment on diesel engine is carried in two phases . in first phase 10% ethanol and 90% diesel is used as a fuel. and in second phase 10% Di-ethyl ether as constant ethanol and diesel in various proportions by volume and then investigate the performance and emission characteristics of diesel engine at different load conditions.**

***Index Terms*— Alternate fuels , diesel engine ,ethanol, diesel , Di-ethyl ether**

I. INTRODUCTION

The usage of compression ignition engines increased in recent decades as an alternate power source for vehicles. So that the usage of diesel fuel increased day by day this results in the depletion of petroleum resources. There is a need to search for an alternate fuel and to reduce the usage of petroleum fuels. Most of the countries imports petroleum products from other countries . We can produce ethanol and methanol from agricultural feed stocks such as sugar cane , potato ,cassava and corn. Ethanol is best suited for diesel engines as an alternate fuel. To improve engine performance an additive Di-ethyl ether is combined with diesel ethanol blend. If we use more than 15% of Di-ethyl ether in diesel engines increases knocking tendency. 10% of Di-ethyl ether is used with diesel ethanol blend like 80% D+10% E,70% D+20% E,60% D+30% E and 50% D+40% E by volume. All the experiments are conduct at a constant speed of 600 rpm by varying the load and then data obtained is used to know the performance parameters.

Manuscript received Sep, 2015.

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II. EXPERIMENTAL SETUP AND METHODOLOGY

The engine is supplied by Field Marshal engine Ltd. It is a single cylinder DI diesel engine, four stroke, water cooled engine

Experimental set up is shown in figure.

Figure-1:Experimental setup

The specifications of the engine are given below

Table 1

Company name	Field Marshal
Engine	Four Stroke, Single cylinder, water cooled, direct injection diesel engine
Rated power	4.416KW / 6HP

ISSN: 2278 – 7798

Bore(D)	114.3mm
Stroke(L)	139.7mm
Speed(N)	650rpm
Fuel	Diesel
Calorific value	43000 KJ/Kg
Specific gravity of diesel	0.8275
Air tank orifice diameter	20mm
Type of loading	Rope Brake drum dynamo meter
Equivalent, brake drum diameter	0.4mm
Compression ratio	16.5:1

The propertiesof the diesel ,ethanol and DEE are

Table 2

Properties	Diesel	Ethanol	DEE
Kinematic Viscosity at 40°C (cst)	3.52	4.96	0.23
Density at 15°C (Kg/m3)	830	850	714
Flash point (°C)	49	92	40
Calorific Value(KJ/Kg)	43000	43300	33900
Specific Gravity	0.8275	0.85	0.714

In this work diesel-ethanol blend is combined with an additive. Additive proportion is kept constant and varying proportions of diesel-ethanol blend is used to run the engine.DEE is also best suited additive for cold starting in diesel engines and gasoline engines. The storage of DEE is easy and it reduces storage problems. The data obtained from the experiments are used to calculate the performance of diesel engine. The performance parameters studied are Brake Specific fuel consumption, Brake thermal efficiency, Indicated thermal efficiency and exhaust emissions.

III RESULT AND DISCUSSION

Brake specific fuel consumption

The variations of Brake Specific Fuel Consumption for various brake power of Diethyl ether and ethanol diesel blend at various proportions are shown in the below graph. With respective to brake power the Brake Specific Fuel Consumption decreases. The B.S.F.C value for ethanol diesel blend is high compared with additive ethanol diesel blend. For 10% additive with 10% E and 80% D and also for 20% E and 70% D the B.S.F.C value decreases when compared with other blends.

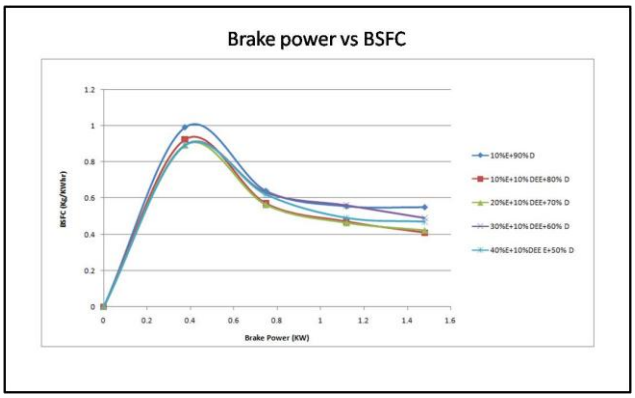

Figure2: Brake power vs BSFC

Brake Thermal Efficiency

The variations of Brake Thermal Efficiency for various brake power of Diethyl ether and ethanol diesel blend at various proportions are shown in the below graph. With respective to brake power the Brake Thermal Efficiency values increases. The Brake Thermal Efficiency values for ethanol diesel blend is low compared with additive ethanol diesel blend. For 10% additive with 30% E and 60% D Brake Thermal Efficiency values are high when compared with other blends.

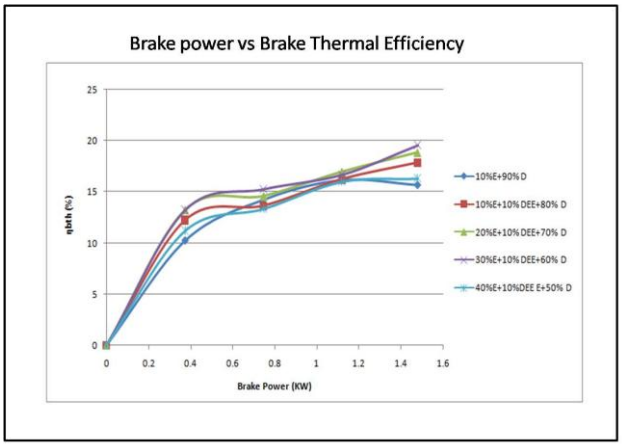

Figure3: Brake Power vs Brake Thermal Efficiency

Indicated Thermal Efficiency

The variations of Indicated Thermal Efficiency for various brake power of Diethyl ether and ethanol diesel blend at various proportions are shown in the below graph. With respective to brake power the Indicated Thermal Efficiency values increases. The Indicated Thermal Efficiency values for ethanol diesel blend is low compared with additive ethanol diesel blend. For 10% additive with 40% E and 50% D Indicated Thermal Efficiency values are near by when compared with ethanol diesel blend .For remaining additive ethanol diesel blends the Indicated Thermal Efficiency values are increase when compared with ethanol diesel blend. Complete combustion helps in higher output and higher efficiency. Ethanol contains higher oxygen content helps in complete combustion.

ISSN: 2278 – 7798

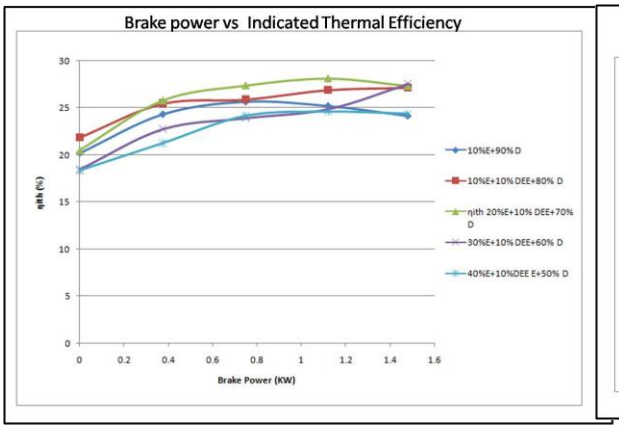

Figure4 Brake power vs Indicated Thermal Efficiency

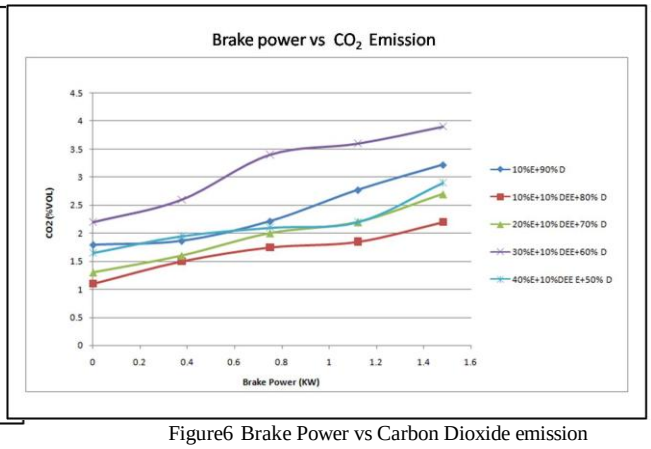

Figure6 Brake Power vs Carbon Dioxide emission

Carbon Monoxide Emission

The variations of Carbon Monoxide Emission for various brake power of Diethyl ether and ethanol diesel blend at various proportions are shown in the below graph. With respective to brake power the Carbon Monoxide Emission values increases. The CO emissions for 10% additive ,10% E and 80% D and also for 10% additive 20% E and70% D are high when compared with ethanol diesel blend. The CO emissions for 10% additive ,30% E and 60% D and also for 10% additive 40% E and50% D are low when compared with ethanol diesel blend.

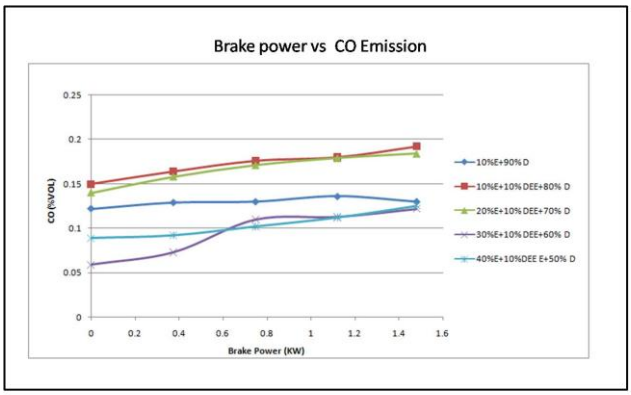

Figure5 Brake Power Vs Carbon Monoxide

Carbon Dioxide Emission

The variations of Carbon Dioxide Emission for various brake power of Diethyl ether and ethanol diesel blend at various proportions are shown in the below graph. With respective to brake power the Carbon Dioxide Emission values increases. The CO2 emissions for 10% additive , 30% E and 60% D are high when compared with ethanol diesel blend. The CO2 emissions for all other additive ethanol diesel blends are low when compared with ethanol diesel blend.

Hydro Carbon Emission

The variations of Hydro Carbon Emissions for various brake power of Diethyl ether and ethanol diesel blend at various proportions are shown in the below graph. With respective to brake power the Hydro Carbon Emission values increases. The Hydro Carbon emissions for all additive ethanol diesel blends are low when compared with ethanol diesel blend. The Hydro Carbon emissions increases due to lack of oxygen content, incomplete combustion.

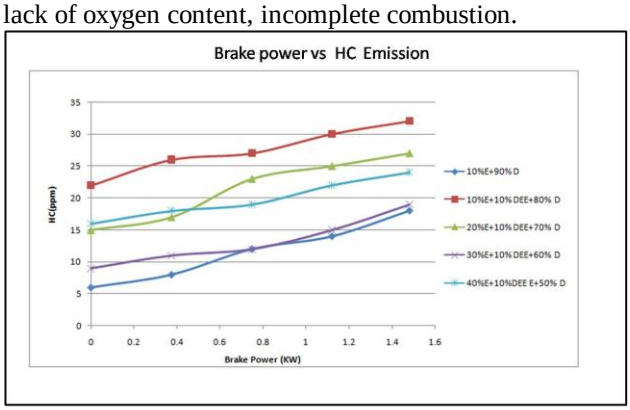

Figure7 Brake Power vs Hydrocarbon emission

IV CONCLUSION

The engine was made to run on ethanol diesel blend mode and additive ethanol diesel blend mode. The performance and emission characteristics of the engine are investigated. The following conclusions were obtained.

1. The brake thermal efficiency of the engine for additive ethanol diesel blends are high when compared with ethanol diesel blend.
2. The indicated thermal efficiency of the engine for additive ethanol diesel blends are high when compared with ethanol diesel blend.
3. Carbon monoxide emissions of the engine for additive ethanol diesel blends are low when compared with ethanol diesel blend.
4. Carbon dioxide emissions of the engine for additive ethanol diesel blends are low when compared with ethanol diesel blend.
5. Hydrocarbon emissions of the engine for additive ethanol diesel blends are high when compared with ethanol diesel blend.

ISSN: 2278 – 7798

From the above results the main conclusion is additive ethanol diesel blends are suitable for diesel engines as they give better performance and lesser emissions.

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ISSN: 2278 – 7798