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Effect of Diethyl ether with Diesel on Performance and Emission Characteristics Of Diesel Engine

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Abstract— With ever growing Stress on environmental pollution and future oil supplies, the global community is seeking non-petroleum based non conventional fuels, along with more advanced energy technologies to increase the efficiency of energy use. The most promising alternative fuel will be the fuel that has the greatest potential towards society. The major impact areas include greenhouse emissions; non-petroleum feed stocks, efficiencies, fuel availability, economy, and safety. In view of the same Compared to some of the other leading alternative fuel diethyl ether appears to have the largest potential impact on society, and should be considered as the fuel of choice for eliminating the dependency on petroleum. DEE can be used as a clean high-efficiency compression ignition fuel with reduced NOX and other harmful emissions. DEE has long been known that a cold starting aid for a diesel engines. This paper presents the findings of fundamental diesel emissions and performance parameters.

Keywords—Diethyl ether(DEE), Performance, Emissions, Power, Blend

I. INTRODUCTION

Improvement of bio-fuels as an alternative and renewable source of energy for transportation has become critical in the national effort towards maximum self-reliance the corner stone of our energy security strategy. Bio- fuels like ethanol and bio-diesel being environment friendly, will help us to conform to the stricter emission norms. International experience has demonstrated the advantages of using ethanol and methanol as automotive fuel.

Internal combustion engines are one of the important forms of prime movers, which run essentially on fuels. IC engines can be divided into two main profiles namely petrol and diesel based engines otherwise called spark ignition engines and compression engines. Compression ignition engines due to their inherit fuel economy, easiness in operation, maintenance and long life, find wide usage in the fields of transportation, marine, earth, moving machines, industries power generation and agriculture. Better part load performance and improved emission characteristics have made it popular automobile engines for various cars and trucks. In India, the number of CI engines is so large that the bulk of available petroleum is consumed in the form of Diesel fuel. Diesel engines are broadly used in medium and heavy duty application because of their lower fuel combustion, higher Compression Ratio, thermal efficiency and lower emission compared with gasoline engines. Depletion of petroleum derivatives increases the research interest in the area of alternative fuels.

Ethanol can be easily converted through a dehydration process to produce diethyl ether (DEE), which is an excellent compression-ignition fuel with higher energy density than ethanol. DEE as a significant component in a blend or as a complete replacement for diesel fuel. According to the survey DEE was recently reported to be a low emission, high quality diesel fuel replacement, but the testing is limited on engine. Emission levels from automobiles is a major threat to the society as harmful gases releases to the atmosphere disturbs the health of the people. The major effects from various pollutants are shown in below table.

Table 1.1: Health effects from pollutants

Pollutants	Cause	Effects
CO	Incomplete combustion	Heart disorders
HC	When carbon molecule fails to burn	Drowsiness, coughing
NO	High-pressures	Morbidity, bronchitis

II. METHODOLOGY

- To study the various properties of diethyl ether and comparison with diesel
- Performance characteristic of various blend percentage of diethyl ether with diesel.
- To study the emission parameters by varying air fuel ratio

III. EXPERIMENTATION

1. Testing of Fuel Properties:

The various properties of DEE & Diesel are identified by using various instruments or Apparatus like Calorimeter, Saybolt Viscometer, Pensky Marten, Hydrometer etc. As the cetane number of DEE is much higher than Diesel plays a vital role in reducing knocking/detonation of an diesel engine. But the energy density is less in DEE as compared to Diesel. The properties comparison is shown in below table.

Table: 3.1 Properties comparison between Diesel and DEE

Property	Diesel	Diethyl ether
Cetane number	40-60	>120
Auto ignition temp(°c)	245	181
Viscosity	2.3	0.24
Sp. Gravity	0.85	0.71
Density(gm/ml)	0.83	0.71
Lower calorific value(KJ/Kg)	42,500	33,800
Flash point (°c)	51	-45

2. Engine:

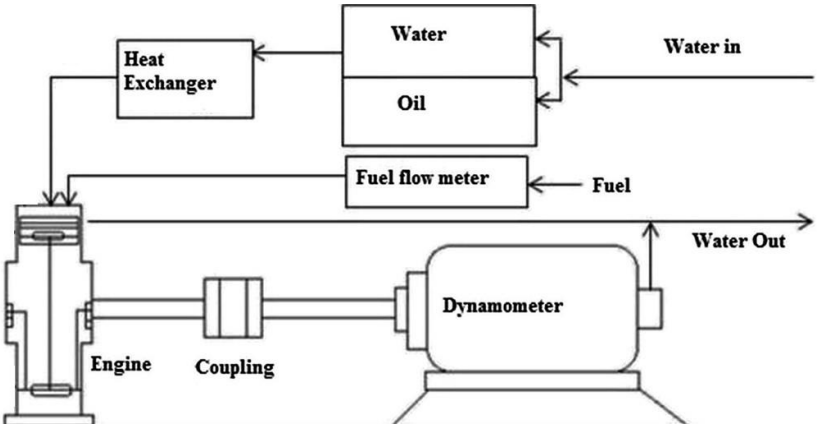

Fig. 3.1: Engine set up

The engine set up is as shown in above fig. the engine is coupled with dynamometer for testing performance under varying load conditions.

Table: 3.2 Engine Specification

MODEL	GL-400
Bore(mm)	86
Stroke(mm)	63
Displacement(cm^3)	395
Compression ratio	18:1
Oil sump capacity(lit)	1.2
Dry weight (kg)	45
Maximum torque(nm)	1.7
Rpm	3600

The testing of engine is with respect to Diesel and different blends of DEE for various performance and emissions testing.

IV. RESULTS AND DISCUSSION

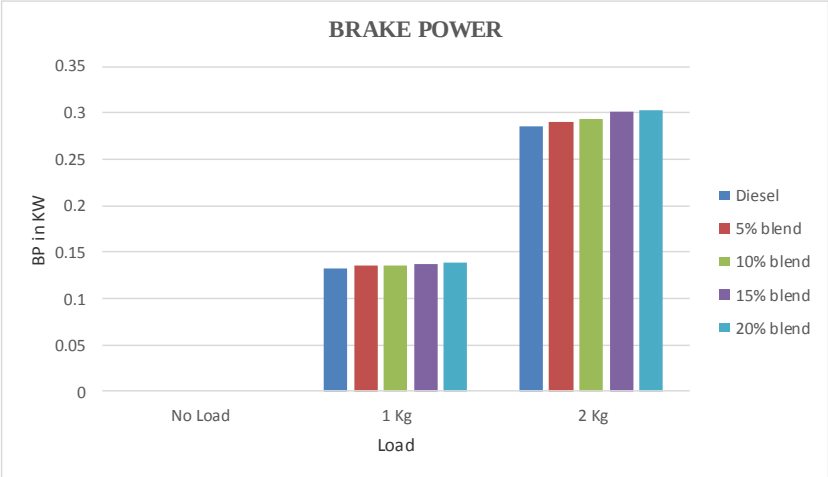

Fig.4.1: Brake Power vs Load

With respect to light loads there is no much variation will be seen in BP between Diesel and other blends of DEE. As the load increases a slight difference will be seen between diesel and other blends of DEE. Similar fashion the brake thermal efficiency vs Load, A/F Ratio vs Load etc., will be calculated/drawn.

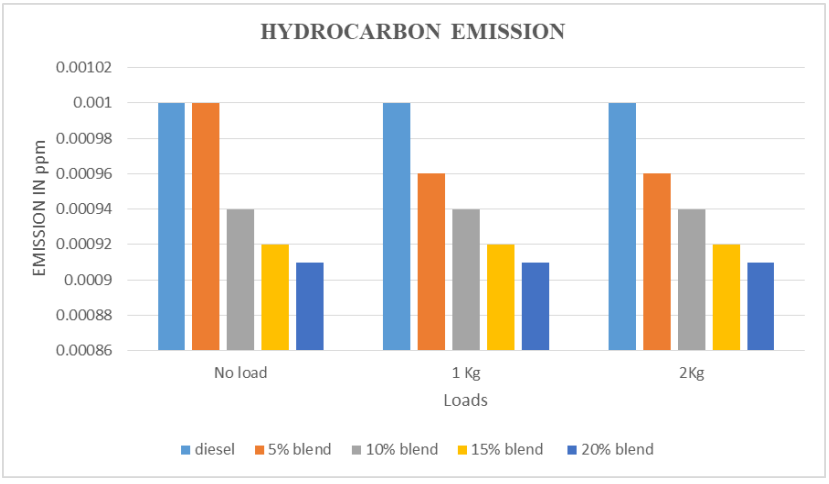

Fig.4.2: Hydrocarbon Emission vs Load

As the blend % of DEE increases the HC emissions decreases, and the same trend will be there with respect to varying loads

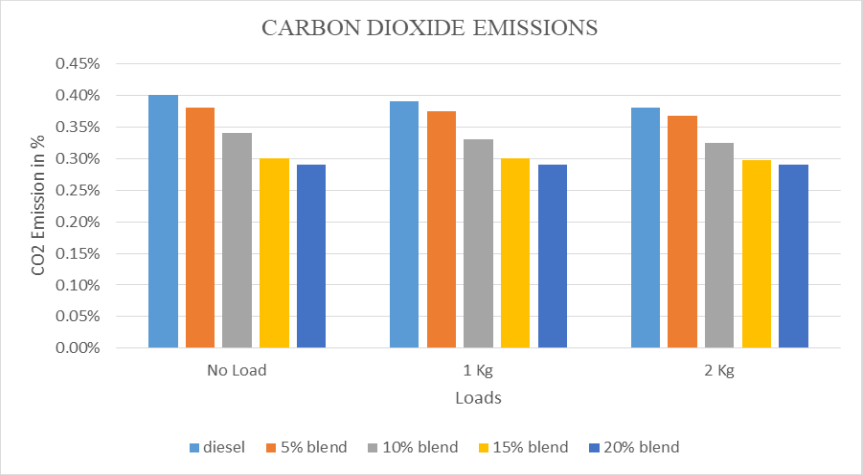

Fig.4.3: CO_2 Emission vs Load

As the blend % of DEE increases the CO_2 emissions decreases, and the same trend will be there with respect to varying loads.

V. CONCLUSION

The literature survey indicates DEE as a promising alternative for diesel. Additional information is needed wrt to latest technologies of diesel engines for different emissions. Direct effect of DEE on human health needs to be explored.Even after the transesterification the properties of diesel and DEE is not the same and even the performance parameters and emission results also varies. Finally it can be concluded that DEE blend with diesel can be used as an alternative for diesel.

VI. REFERENES

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