Performance and Emission Characteristics of Dual Fuel CI Engine

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Abstract: ***The present concern on energy demands, cause a growing interest on different fuels, for a sustainable solution, typical engines befittingly changed and experimented for favorable results. This context the present work dealt a newer approach as LPG as primary fuel and diesel DEE as pilot fuel. LPG gas presents a very promising alternative to diesel oil since they are having similar properties. The LPG has a low cetane number, therefore DEE added to the LPG to enhance cetane number. With the cetane improver, stable Diesel engine operation over a good range of the engine loads was possible. In this work, we studied the emissions of Diesel-LPG-DEE blends at completely different mixture and different loads. Experimental result showed that the thermal potency of LPG powered Diesel engine was equivalent to Diesel fuel operation. Exhaust emissions measurements showed that NOX and smoke could be significantly reduced with the blend of LPG, and DEE.***

Index Terms*: *Dual fuel engine, DEE, Exhaust emission, LPG

I. INTRODUCTION

Lot of efforts has gone into for achieving Infobahn improvement in improvement up automobile exhaust [1]. Still, a lot of enhancements square measure required to bring down the ever-increasing pollution because of automobile population [2]. In this study the Diesel engine needs small modification to run with LPG as dual fuel engine. The substantial edges displayed from the blends demonstrate the effectiveness of element accessibility within the fuel [3,4]

II. EXPERIMENTAL SETUP AND EXPERIMENTS

A single-cylinder, 4-Stroke, water-cooled diesel engine of 5.2 kW rated power is taken into account for the aim of experimentation. The technical engine specification is shown in Table1. Cooling water is circulated individually to the engine at the desired flow rates. Necessary provisions are created to manage and measure the flow rates of the air, fuel and the coolant. With the help of temperature indicator and smoke meter, the engine performance is tested. A smoke meter type AUL 437C with paper feed is used. The smoke meter is connected to the exhaust line. The exhaust smoke temperature and the opacity of smoke are measured.

Table 1 Engine specification

Designation	Single cylinder, four stroke, water cooled, diesel engine, kirloskar, mode TVI
Rated power	5.2kW@1500rpm
Bore * stroke	87.5*110mm
Compression ratio	17.5
Capacity	661cc
Fuel tank	15 lit cap. with graduated glass fuel metering column
Overall size	1.90*1.0*1.40m (L*W*H)
Weight (apprx.)	200k.g(max)
Smoke meter	AUL 437C with paper feed.

The overall experimental setup is shown in figure.1. In this work mixture of LPG, diesel-DEE to analyses the emission and characteristics of the engine. The LPG is inducted into the inlet manifold, along with diesel DEE is mixed in the inlet as shown in Figure.1

Figure 1 Engine overall view

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Figure 2 LPG inlet with control valves and Diesel-DEE fuel tank

The fuel tank and LPG inlet with control valves is shown in Figure 2; the maximum capacity of the tank is 2 lit. In this tank diesel and DEE fuel are filled in the ratio of 90% of diesel – 10%DEE mixture. The screw type control valve is used to control the LPG gas flow. The LPG gas flow rate and the pressure are measured by the use of flow meter.Figure 3(a) and Figure 3(b) shows the smoke meter and the varying load setup also showed. Here the load is varying from 0kg to 20kg, initially 0% load is provided, and the time for fuel consumption about 10cc of the mixed fuel is measured by using stop clock. The amount of air passing in the inlet manifold can be calculated by air flow manometer. The various temperatures like cooling water inlet and outlet and exhaust gas temperature was noted in thermocouple. Mass flow rate of coolant was measured by Rota meter.

Figure 3(a) Smoke meter

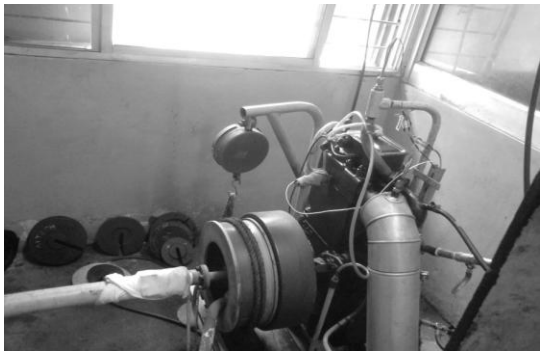

Figure 3(b) Load setup

III. EXPERIMENTAL RESULTS AND DISCUSSIONS

Brake thermal efficiency :

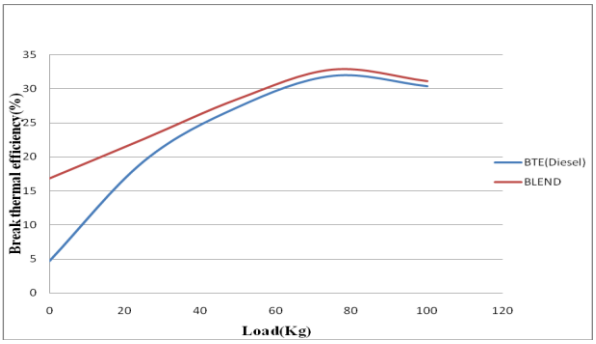

Figure.4. Variation of Brake thermal efficiency

Figure.4 shows the variation of brake thermal efficiency vs. Load. The results show that break thermal efficiency of diesel blend is always higher compared to pure diesel.

Specific fuel consumption:

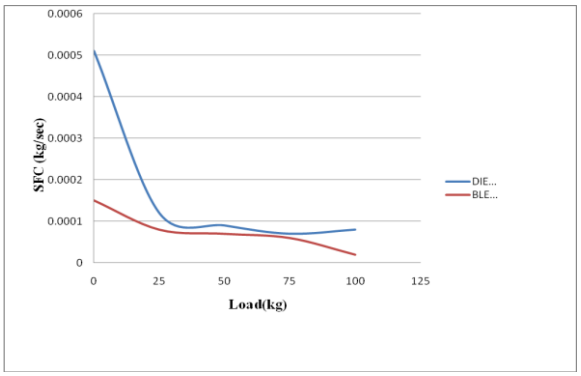

Figure.5. Variation of Specific fuel consumption

The variation of specific fuel consumption as shown above Figure.5 .It is evident from the graph shown above the specific fuel consumption of diesel is more at no load, but the fuel consumed for blend is much less in the ratio of 70.58%.so fuel consumed level for blend will be less for same condition as compared to diesel. There is also large variation in fuel consumed level for different loads in diesel. In blend the variation in fuel consumption is gradual. The exhaust gas temperature for diesel and blend is shown in figure.6 from the graph the exhaust gas temperature is lower in blend than diesel.

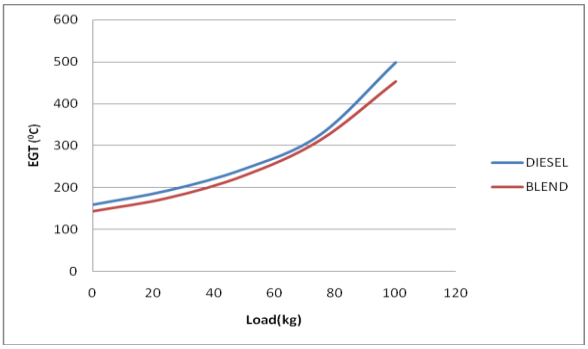

Figure.6. Variation of Exhaust gas temperature

Opacity:

The opacity percentage value of Diesel starts from a range of 30.2 and goes up to a value of 47.2, whereas the opacity percentage value for LPG, Diesel, Diethyl ether(DEE) mixture ranges from 7.5 to 28.9 ,which is a very low value compared to the pure Diesel.The smoke producing substance in blend is less which in turn let less opacity. It shown in Figure.7

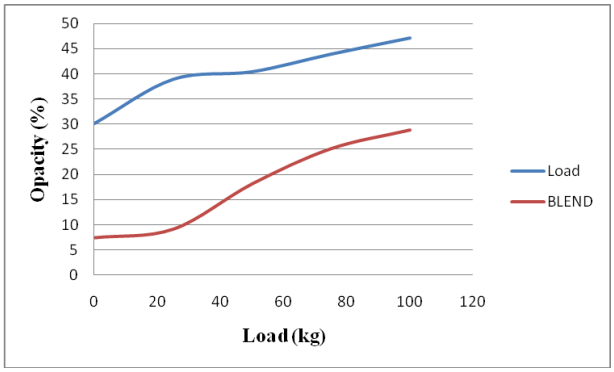

Figure.7. Variation of opacity

IV. CONCLUSION

The performance characteristics and opacity for diesel and blended diesel is studied for various load condition and the following observation had been carried out. Brake thermal efficiency of blend is more to compare diesel and the specific fuel consumption of blend is less compared to diesel, so the utilization of fuel for blend will be less for same operating condition than diesel. Opacity of any engine should be less for better performance and pollution control this condition is satisfied by blend fuel. The ratio of percentage combination of diesel and DEE can be varied for better performance with less specific fuel consumption and less opacity.

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