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Experimental Investigation of Performance Parameter of Diesel Engine Operating On Methyl Tertiary Butyl Ether (MTBE)

Mukesh kumar Bunkar[1], Nitin Shrivastava[2], Vipin Shrivastava[3]
Dept. of Mech. Engg, University Institute of Technology, RGPV- Bhopal, India

Abstract: *This study investigated the performance parameters of direct injection diesel engine using methyl tertiary butyl ether (MTBE) blended with diesel. The entire investigation performance of diesel engine is carried in two phases using the 100% diesel in the first phases and the MTBE blended with diesel fuels in the second phase. The MTBE blended diesel fuels are prepared in the different proportions of 5 % & 10 % MTBE blends. The experimental performance consists of a diesel engine coupled with rope brake dynamometer. All the experiments are perform at a constant speed of 1500 rpm by varying the load and then data obtained from the experiments are used to evaluate the performance parameters of diesel engine. It is investigated that the brake thermal efficiency (BTE) of diesel engine using MTBE blends were decreased as the amount of blends increased in diesel. The BTE of diesel engine using 5% and 10% blends are 25.26 % & 24.65 % respectively that is less from 26.35% than that of diesel. The brake specific energy consumption of 5 & 10 percent of MTBE blends consumed higher energy in comparison to diesel fuel during tested on diesel engine. It is investigated that the brake specific fuel consumption of diesel engine using MTBE blends are increased for all brake load than that of diesel fuel.*

Keywords: *MTBE, Diesel Engine, Performance.*

I. Introduction

Diesel engines have been commonly used in recent decades as an alternative power source for light or heavy duty vehicles because of the economical and environmental reason. Therefore the worldwide diesel fuel consumption has increased with the populations soured form diesel engine [1, 2]. In normally, the performance enchantment the diesel engines are prominently achieved by three methods such as engine modification, fuel adulteration and exhaust gas treatment. Most of the researchers have put their valiant efforts on fuel adulteration techniques as they do not require any major hardware modification. The effect of fuel adulteration of the conventional fossil fuel (diesel) has been materialized on incorporating some metallic additives [3, 4], oxygenated additives [5] and ignition enhancement additive [6]. The oxygenated additives such as Dim ethyl Carbonate (DMC), ethylene glycol mono-acetate, 2- Methoxyethyl acetate, Diethyl Ether (DEE), Methyl Tetra Butyl Ether (MTBE), Dim ethyl Ether (DME), have been blended with diesel fuel in various proportions and achieved better performance and emission characteristic in a diesel engine. The combustion pressures and temperatures of the 5 vol % MTBE blend are similar to or a very little lower than that of neat diesel fuel. However, the 10 and 15 volume % MTBE blends show considerable decreases in the combustion pressures and temperatures [7].

The emissions such as unburned Hydrocarbon and CO emissions are also reduced for the MTBE blended diesel fuels due to the shortened ignition delay and complete combustion compared to that of neat diesel operation. Sivakumar et al. observed the lower blends of MTBE and found that MTBE can be considered as a potential diesel additive for the enhancement of brake thermal efficiency and considerable reduction unburned Hydrocarbon, CO and smoke in diesel engine [8].

II. Experimental Setup and Methodology

Experimental set up is shown in Figure 1

Fig 1 Experimental setup

The Specifications of the experimental setup are given in Table 1

Table.1 Technical Specification of test engine

Company and Model	Kirloskar oil Engine , SV1
Type	Single cylinder, 4- Stroke, diesel engine
Bore	87.5mm
Stroke	110mm
Rpm	1500rpm
Rated power	8 HP
Type of cooling	Water cooled
Compression ratio	16.5:1

The fuel properties are shown in Table 2

Table.2 Properties of diesel and biodiesel

Properties	**Diesel**	**MTBE**
Specific gravity (gm/cm^3)	0.836	.7404
Calorific value (kJ/kg)	42850	35108
Cetane number	48	-
Density(kg/l),(g/cm^3)	.836	.7405
Boiling point (°C)	154.30	55.2

Melting Point(°C)	-30 -18	-108°
Chemical formula	$C_{14}H_{22}$	$C_5H_{12}O$
Flash point (°C)	56	-28.2
Fire point (°C)	64	480
Carbon (%)	86	-
Hydrogen (%)	14	-

The MTBE is blended with diesel fuel with the proportions of 5 % and 10 % by volume using a measuring cylinder. The blends of MTBE and diesel fuel are subjected to diesel engine and find that the performance of diesel engine using these blends. The performance parameters studied are fuel consumption, Brake specific fuel consumption, Brake specific energy consumption, and Brake thermal efficiency.

III. RESULT AND DISCUSSION

3.1 Fuel Consumption (FC)

Figure 2 shows the Variation of fuel consumption for neat Diesel, 5 and 10 percent blends of MTBE. It was resulted that the fuel consumption of diesel fuel is higher when the MTBE blends are used 5% and 10%. As load is increased the FC is slightly increased in comparison to neat diesel. The FC of 5% and 10 % consumed 5% and 10% more fuel as compared to conventional diesel fuel.

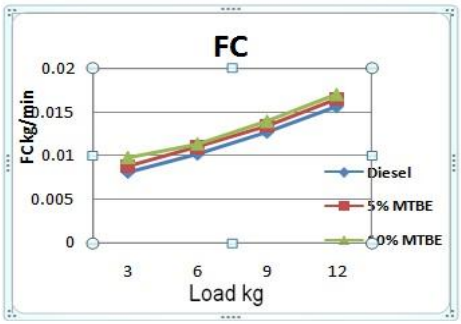

Figure 2. Variation of fuel consumption with load

3.2 Brake Specific Fuel Consumption (BSFC)

Figure 3 shows the Variation of brake specific fuel consumption for Diesel, 5% & 10% MTBE blends. The brake specific fuel consumption is an essential parameter to compare engines and determine of fuel efficiency of an engine. It was resulted that the brake specific fuel consumption (BSFC) is higher than the diesel fuel when the MTBE blends are used 5% and 10%. The BSFC slightly decreased with increased the load. The BSFC of 5% and 10 % consumed approximately 4% and 7% more fuel than that of diesel fuel.

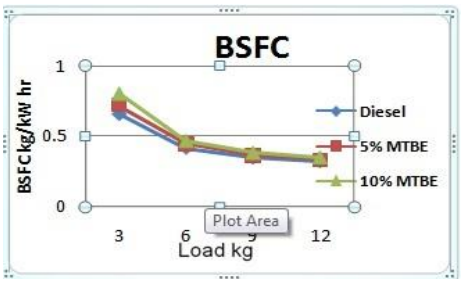

Figure 3. Variation of Brake Specific fuel consumption with load

3.3 Brake Specific Energy Consumption (BSEC)

Figure 4 shows the Variation of brake specific energy consumption for Diesel, -5% & 10% MTBE blends. It was resulted that the brake specific energy consumption is higher than that of diesel fuel when the MTBE blends are used 5% and 10%. The BSEC slightly decreased with increased the load. The BSEC of 5% and 10 % consumed 5.34% and 9% more as compared to diesel fuel.

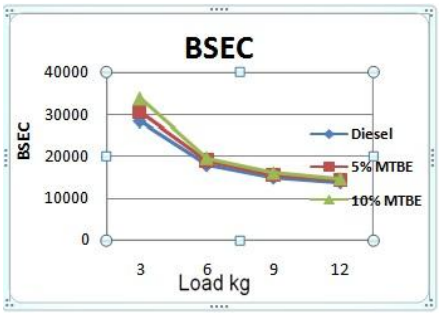

Figure 4. Variation of Brake specific Energy Consumption with load

3.4 Brake Thermal efficiency (BTE)

Figure 5 shows the variation of BTE (Brake thermal efficiency) for 5% and 10% MTBE blends. It is investigated that when the 5% and 10% MTBE blends are used in diesel engine decreased brake thermal efficiency approximately 4-7% than that of diesel fuel. The result showed of 10% MTBE blend the poor thermal efficiency in comparison to neat diesel and 5 % blends.

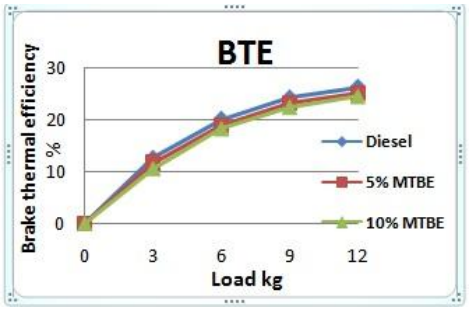

Figure 5. Variation of Brake Thermal Energy with load

IV. Conclusion

The performance of MTBE blended diesel fuel are evaluated for signal cylinder direct injection diesel engine. It is concluded that the brake thermal efficiency of MTBE blends are is decreased by varying load and brake specific energy consumption of diesel engine are increased as the blends are increased in diesel.

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