International Conference on Advances in Materials, Computing and Communication Technologies
In Association with International Journal of Scientific Research in Science and Technology
Volume 9 | Issue 1 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)

Comparison of Oxygenated Additives on the Performance of Di Diesel Engine

Jesu Antony Pradeesh A.[1], Jaya Venkatesh R.[2], Hirthik Joel.E[1], Ajantharaj .A[1]

[1]U.G. Student, Department of Mechanical Engineering, National Engineering College, Kovilpatti, Tamil Nadu India

[2]Assistant Professor, Department of Mechanical Engineering, National Engineering College, Kovilpatti, Tamil Nadu India

ABSTRACT

Development in the field of alternative fuel is essential from the last decade in order to create the green environment and to solve the concern over the fossil fuels. Biofuels like alcohols and biodiesel are proposed as oxygenated additives for Internal Combustion Engines to control the emission and as better alternative for fossil fuel. In this work alcohol is blended with diesel and an attempt is made to increase the efficiency of the diesel engine and to reduce the emissions. For the above Methanol and Propanol are used for the study. They are blended separately with diesel at the Concentrations of 10%, 15%, 20% & 25%. Performance and emission characteristics are obtained experimentally in four stroke diesel engine. The results were compared to select the better oxygenated additive having the benefits such as reduction in emission, increase in efficiency of engine and low fuel consumption.

Keywords— Oxygenated Additives, Diesel Engine, Performance and Emission Characteristics.

I. INTRODUCTION

For the past few years, many researchers aim to widen the usage of alternative fuel sources, most notably biofuels to make evolution in economic and environmental concerns of fossil fuels. Diminishing petroleum reserves and increasing prices, as well as continuously rising concern over energy security, environmental degradation and global warming have been identified as the most influential environmental ones.

Motor vehicles running on fossil fuels, in particular diesel vehicles are major sources of street level air pollution in many cities. To improve air quality, more and more stringent emission regulations have been implemented for reducing exhaust emissions from new diesel vehicles. One of the possible ways to reduce exhaust emissions from existing diesel vehicles is through improvement of the fuel being used or using alternative fuels. Recently, the emission of CO_2 has also attracted greater and greater attention. To reduce CO_2 emission, biofuels such as alcohols and biodiesel have been proposed as alternatives for internal combustion engines.

II. METHANOL AND PROPANOL

The objective of the present work is to review the literature regarding the impacts of alcohol/ diesel blends on the exhaust emissions of compression ignition engines. The biofuels that are considered in the present study are

a) Methanol [2], and

b) Propanol [4]

Methanol, also known as methyl alcohol, wood alcohol, wood naphtha or wood spirits, is a chemical with formula CH_3OH. It is the simplest alcohol, and is a light, volatile, colourless, flammable, and liquid with a distinctive odour that is very similar to but slightly sweeter than ethanol (drinking alcohol). At room temperature it is a polar liquid. [11]

Isopropyl alcohol is miscible in water, alcohol, ether and chloroform. It is insoluble in salt solutions. Unlike ethanol or methanol, isopropyl alcohol can be separated from aqueous solutions by adding a salt such as sodium chloride, sodium sulphate, or any of several other inorganic salts, since the alcohol is much less soluble in saline solutions than in salt-free water.

III. BLEND PREPARATION AND ITS PROPERTIES

The diesel- alcohol blend is prepared by mixing the appropriate proportions of the alcohol and diesel with continuous stirring operation. The Magnetic stirrer as shown in Fig.1 is used for stirring the blend continuously.

Fig 1: Magnetic Stirrer

For example, in order to prepare a M10 blend of 500ml.450ml of diesel is taken in a conical flask and kept in the magnetic stirrer device. A magnetic strip in dropped into the flask and the speed of the circulation is adjusted in the stirrer. Gradually the 50ml of methanol is poured into the conical flask and the stirring operation is done for 15-20 min.

Fuel Properties	Flash Point	Fire Point	Density kg/m³	Specific Gravity	Calorific value kJ/kg
Diesel	62	84	833	0.833	45000
Methanol	11	17	791.8	0.791	22700
Propanol	12	18	786	0.786	33600
Diesel +M10	33	45	830.1	0.830	42770
Diesel +M15	33	42	827.8	0.827	41655
Diesel +M20	33	39	824	0.824	40540
Diesel +M25	32	37	822	0.822	39425
Diesel +P10	34	45	827	0.827	43860
Diesel +P15	34	43	825	0.825	43290
Diesel +P20	33	41	822	0.822	42720
Diesel +P25	32.5	39	820	0.820	42150

TABLE I : FUEL PROPERTIES

IV. EXPERIMENTAL WORK

A) Introduction:

The details of the experimental set up are presented in this chapter. The information about the engine, components, instrumentation and controls used in test engine are described.

B) Experimental set-up:

Fig.2 shows the photograph of the experimental set up. [4]

Fig 2: Single cylinder four stroke diesel engine test rig.

Diesel engine:

The Engine chosen to carry out experimentation is a single cylinder, four stroke, vertical, water cooled, direct injection computerized Kirloskar make CI Engine. This engine can withstand higher pressures encountered and also is used extensively in agriculture and industrial sectors. Therefore this engine is selected for carrying experiments.

C) Tests To Be Carried Out In The Engine

i. Performance Test:

The engine is allowed to run for 10 min for reaching the steady state. At constant speed and by varying the loads by 0,5,10, 15 and 20 kg the time taken for 10ml of fuel consumption is noted.

ii. Emission Test:

The engine is allowed to run for 10 min for reaching the steady state. Then the exhaust gas analyzer is connected as shown in Fig. 4.4. The emission characteristics are obtained by inserting the exhaust gas sensor probe into the silencer of the engine.

D) Experimental Procedure

The engine was allowed to run with neat diesel at a various load for nearly 10 minutes to attain the steady state constant speed conditions. Then the following observations were made.

i. The flow of water is maintained constant throughout the experiment.

ii. The load and speed indicators were switched on.

iii. The engine was started by cranking after ensuring that there is no load.

iv. The engine is allowed to run at the rated speed of 1500 rev/min for a period of 10 minutes to reach the steady state.

v. The fuel consumption is measured by a stop watch.

vi. Smoke readings were measured using the Smoke meter at the exhaust outlet.

vii. The NO_x emission was measured using exhaust gas analyzer.

viii. Then the load is applied by adjusting the knob, which is connected to the eddy current dynamometer.

ix. Experiments were conducted using neat diesel, diesel + Methanol and diesel +Isopropyl alcohol, the above procedure is adopted.

V. RESULT AND DISCUSSIONS

The experimental investigations are carried out using the results obtained from diesel fuel, diesel + methanol blends and diesel + propanol blends on the test engine. The results are compared by plotting the graphs as

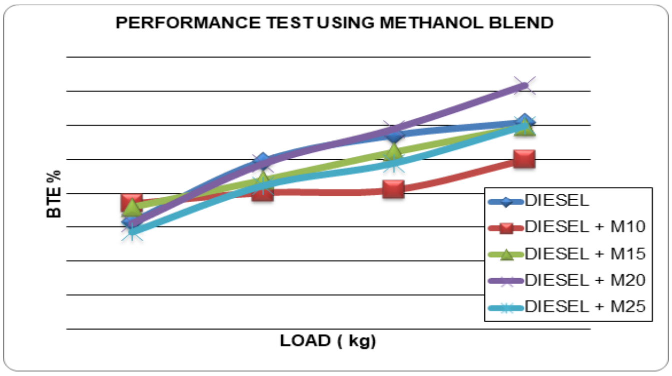

Fig. 3 Variation of B.T.E with LOAD for Diesel - methanol Blends

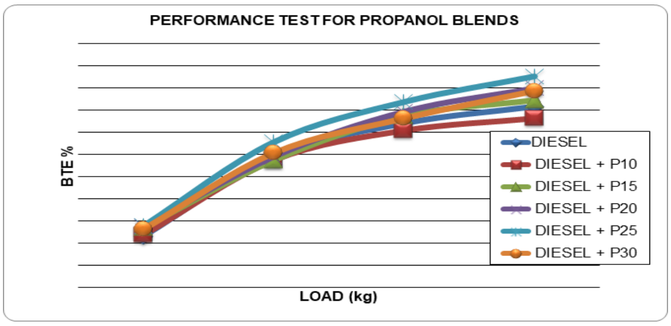

Fig.4Variation of B.T.E with LOAD for Diesel-Propanol Blends

Fig 3 & 4 shows the variation of Brake Thermal Efficiency with load for Alcohol blends with Diesel in the test engine. Maximum Brake thermal efficiency is obtained for propanol. Brake thermal efficiency for 30% Propanol gives a good result compared with other alcohol and neat diesel. This is attributed to lower calorific value, high viscosity coupled with the density of the fuel.

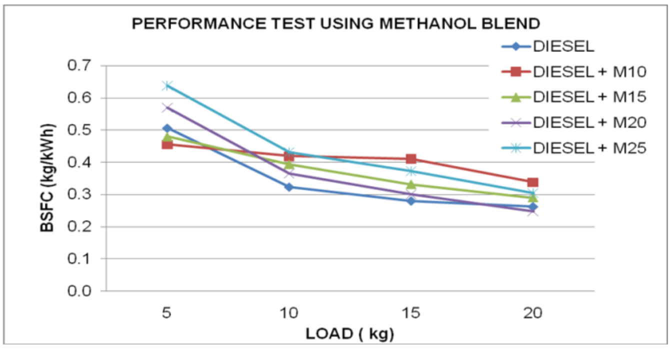

Fig.5 Variation of BSFC with LOAD for Diesel-Methanol Blends

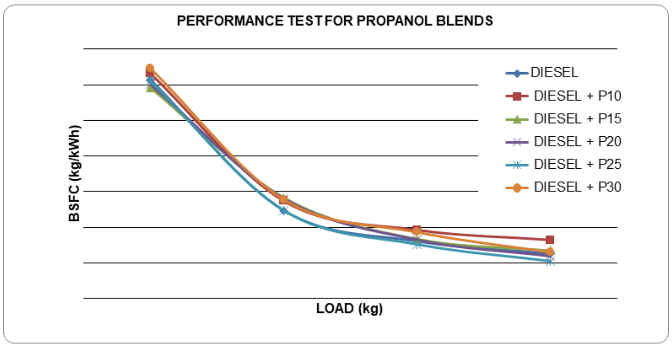

Fig.6 Variation of BSFC with LOAD for Diesel-Isopropyl alcohol Blends

Fig 5 & 6 shows the variation of brake specific fuel consumption with load for diesel with alcohol blends in the test engine. The various alcohol blends has almost same BSFC compared with diesel.25% and 30% of propanol has the lowest BSFC compared to its other blends. At rated load, bsfc of alcohol blends are slightly higher than diesel. This is due to higher viscosity of fuel.

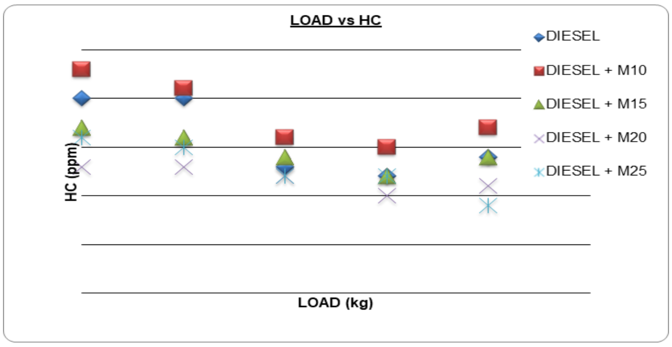

Fig.7 Variation of HC with LOAD for Diesel with Methanol Blends

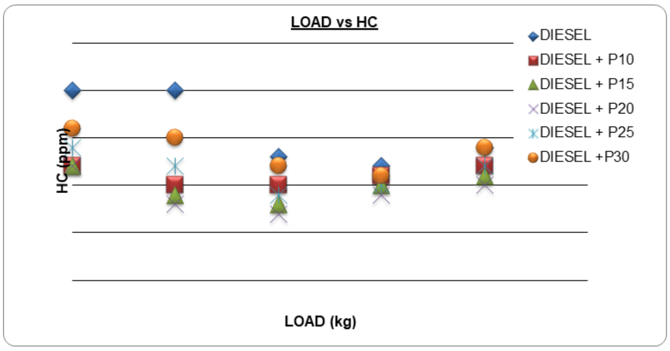

Fig.8 Variation of HC with LOAD for Diesel with Propanol Blends

Fig.7 & 8 shows the variation of Hydro Carbon emission with load for alcohol blends with Diesel in the test engine. 20% Methanol blend and 20 % Propanol blend has low emission of HC at all loads, because of the higher concentration of oxygen the local richness of air fuel mixture is reduced at the time of combustion.

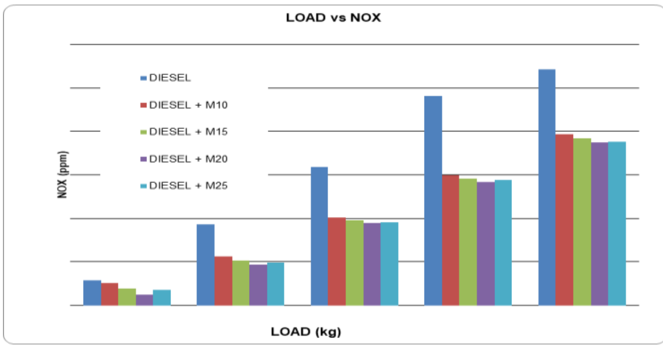

Fig..9 Variation of NOx with LOAD for Diesel with Methanol Blends

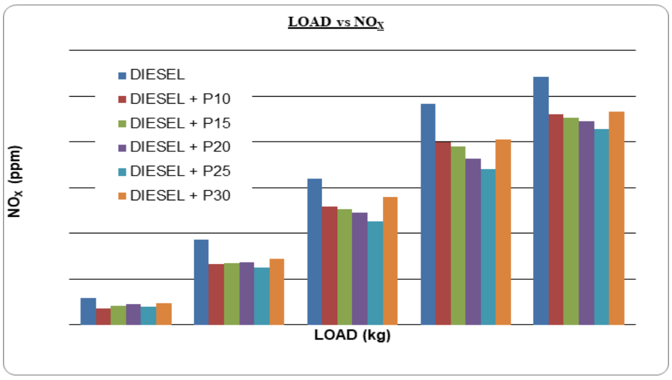

Fig.10 Variation of NOx with LOAD for Diesel with isopropyl alcohol Blends

Fig. 9 & 10 shows the variation of Nitrogen Oxide emission with load for alcohol blends with Diesel in the test engine. Diesel has higher NO_x emission compared to all other blends. NO_x emission for 20 % blend of methanol has low value compared with diesel at all loads. NO_x emission for 25% blend of isopropyl alcohol at full load is 725 ppm, whereas for diesel it is 964 ppm. The difference is 239 ppm. i.e. isopropyl alcohol NO_x emission is lower by 24.8% compared to diesel. Lower peak combustion temperature in the combustion chamber influences this factor.

VI. CONCLUSION

Considering the need for alternate fuels, the experimental investigations are carried out in the present work in order to run the existing diesel engines with biofuels (alcohols). From the results that are obtained in this compared analysis, the diesel using alcohol blends reduces the pollution in the environment and it also improves engine efficiency.

Overall results are:

1. Brake thermal efficiency of engine is increased by 13.6% & 20.4% when using the blends of 25% Isopropyl alcohol and 20% Methanol respectively at rated loads.
2. Brake specific fuel consumption of alcohols blends are slightly increased and are result of delay in ignition process.
3. Brake power of engine almost remains the same for all alcohol blends implemented.
4. CO emission is reduced 45% & increased by 40% when blends of 20% Isopropyl alcohol and 25% Methanol are used respectively.
5. CO2 emission is reduced 17.5% & 30% when blends of 20% isopropyl alcohol and 20% Methanol are used respectively.
6. NOx emission is reduced by 24.8% & 30% when blends of 25% Isopropyl alcohol and 20% Methanol respectively.
7. Compared to other blends 80% diesel 20% Methanol gives the best possible results in the analysis.

VII. REFERENCES

[1]. A.R. Patil and S.G. Taji, Effect of oxygenated fuel additives on diesel engine performance & emission: A review, IOSR Journal of Mechanical and Civil Engineering, March 2012.

[2]. T. Yusaf, I. Hamawand, P. Baker and G. Najafi , The effect of Methanol- Diesel blended ratio on CI engine performance.

[3]. Gaurav Dwivedi, Siddharth Jain , & M.P. Sharma , Impact of Biodiesel and its Blends with Diesel and Methanol on Engine Performance.

[4]. T.Balamurugan & R. Nalini , Effect of blending Alcohol with Diesel on Performance , Combustion and Emission Characteristics of Four Stroke Diesel Engine- An Experimental Study.

[5]. C.Mishra, N.Kumar, B.S. Chauhan, H.C. Lim, M. Padhy(2013)," Some Experimental Investigation on use of Methanol and Diesel blends in a Single Cylinder Diesel Engine", IJRETR Vol.2, No.1, PP: 01-16. Emissions", IJESRT, ISSN: 2277-9655, 897-899.

[6]. M. Santhosh, G. Balaji (2014)," The effect of additives on diesel engine

[7]. Ramesh.K,Amirthagadeswaran.K.S,Geen Paul.V(2012). "Bio-diesel development process from Calophyllum Inophyllum Seeds" Proceedings of Advanced Mechanical Sciences.

[8]. V.M. Domkundwar (2002), "Internal Combustion Engines", Dhanpat Rai & CO. (P) LTD.

[9]. Agarwal AK, (2007), Biofuels (alcohols and biodiesel) applications as fuels in internal combustion engines.

[10]. L.Hajba, Z.Ella, E. Nagy, J. Hancsok (2011)," Properties of diesel alcohol blends", Hungarian Journal, Vol-39, PP:(349-352).

[11]. www.methanex.com/methanol/techsafetydata.htm.

[12]. www.thermalfluidscentral.org.

[13]. www.enwikipedia.org/wiki/isopropyl_alcohol