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PERFORMANCE ON SPARK IGNITION ENGINE USING ETHANOL AND PETROL BLENDS

Sandip Shyamsundar Gadewad[1], Pankaj Mishra[2], Abhishek Bhandari[3]

Student[t], Department of mechanical Engineering, NRI Institute of Research And Technology Bhopal,

sandipgadewad@gmail.com

Asst. Prof., Department of mechanical Engineering, NRI Institute of Research And Technology Bhopal,

pakajhnmishra@yahoo.com

Asst. Prof., Department of mechanical Engineering, NRI Institute of Research And Technology Bhopal,

abhishek.bhandari08@gmail.com

ABSTRACT

Ethanol which is one of the best alternative to fossils fuel as well as Environmentally cleaner, used with other blended fuel or in its own, in different proportions. this ethanol produce many ways like from sugarcane, agricultural waste, corn, etc. Ethanol is widely used as an alternative fuel or an effective additive of gasoline due to the advantage of its high octane number and its self-sustaining concept, which can be supplied regardless of the fossil fuel. As a result, vast study has been carried out to study its effects on engine performance and emission. in this experimental study ethanol- blends Gasoline in a different ratios and as a result shows that, carbon monoxide (co),emitted from exhaust of 4-stroke SI engine lower into environment. i.e. after blends Ethanol-Gasoline mixture emission of carbon monoxide (co) reduces. in this experimental studies Ethanol-blends Gasoline have been used in 4-stroke single cylinder SI engine for performance and analysis under full load. In this experimental studies we can measure Torque, Break Power (BP),Break specific fuel consumption(BSFC), Break specific Energy consumption(BSEC),Thermal Efficiency, by using the experimental data.

Keywords: Ethanol, Gasoline, Single Cylinder 4-Stroke SI engine, AVL Five gas analyzer

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1. INTRODUCTION

An Experimental setup has been developed with four stroke petrol engine, to study various fuel blended consist of petrol as primary fuel & ethanol as secondary fuel. In this experiment we mainly considered lower percentage blends to higher percentage blends. The main purpose of this project is found that carbon Monoxide (co) is reducing & checks the blended emission of ethanol blends used & Gasoline (Petrol) emission. As we know now a day's Gasoline fuel or crude oil is limited hence some alternate should obtained and by adding the ethanol into petrol (Gasoline) it provide good alternate fuel.

ethanol is not only renewable fuel but also colorless liquid with mild characteristics odors; ethanol can be produce from sugarcane, agricultural residues, woody bio-mass or waste. However, the simple process of chemically derived from ethylene or ethane. Ethanol is easily mixed other fuel like petrol or diesel and also it can be used as transportation fuel even in its original form. In the world now-a-days everyone looking forward for ethanol as not only renewable fuel but also it reduces carbon-monoxide (co) in the air and automatically it helps to reduces global warming.

If we add ethanol in gasoline fuel octane number increases in blended fuel and reducing carbon dioxide (co2) emission, by changing distillation temperature. Today crude oil reserves are limited in nature and these are decrease day by day. So we need that future availability of energy and also reduce co2 emissions. In that way we need for utilization of regenerative fuels.

Use of ethanol as a fuel for SI engine. Same advantage over gasoline such as high latent heat of evaporation, better anti-knock characteristics and also improve thermal efficiency with increasing compression ratio. Ethanol reduces

heating value as comparing with gasoline fuel. Because of ethanol contain oxygen in it as a result it is used as fuel in a SI engine.
The use of ethanol in automobile was used at the Henry ford's time, in 1970 oil crises ethanol plays important role as a alternate fuel but at that time ethanol produce by Biomass. Recently ethanol termed as a non petroleum origin, octane boosting properties with oxygenates strength to fuel.
According to renewable fuel association, the volume of ethanol produced in the US increased by 22 fold between 1980 to 2005. Recently compulsory use of ethanol 10% concentration in the fuel and some states up to 20% concentration in the fuel of ethanol is compulsory.

In recent years several researches have been carried out to the influence of methanol and ethanol on the performance of spark ignition engines .Alvydas Pikunas, Saugirdas Pukalskas & Juozas Grabys] 2003 [presented The study showed that when ethanol is added, the heating value of the blended fuel decreases, while the octane number of the blended fuel increases .Also the results of the engine test indicated that when ethanol–gasoline blended fuel is used, the engine power and specific fuel consumption of the engine slightly increase (1). Effect of ethanol–unleaded gasoline blends on engine performance and exhaust emission was studied by M .Al-Hasan [2003] . The study showed that blending unleaded gasoline with ethanol increases the brake power, torque, volumetric and brake thermal efficiencies and fuel consumption, while it decreases the brake specific fuel consumption and equivalence air–fuel ratio .The 20 %vol. ethanol in fuel blend gave the best results for all measured parameters at all engine speeds(2). M .Abu-Zaid, O .Badran, and J .Yamin study describes the performance tests were carried out, at variable speed conditions, over the range of 1000 to 2500 rpm, using various blends of methanol-gasoline fuel. M.V .Mallikarjun and Venkata Ramesh Mamilla made an Experimental study in four). D.Balaji experimented and a four stroke, single cylinder SI engine was used for conducting his study .Performance tests were conducted for fuel consumption, volumetric efficiency, brake thermal efficiency, brake power, engine torque and brake specific fuel consumption, using unleaded gasoline and additives blends with different percentages of fuel at varying engine torque condition and constant engine speed .The result showed that blending unleaded gasoline with additives increases the brake power, volumetric and brake thermal efficiencies and fuel consumption addition of 5% isobutanol and 10% ethanol to gasoline gave the best results for all measured parameters at all engine torque values .
In this paper we studied the effect of ethanol –gasoline blend, ethanol –gasoline blend and mixture ethanol-methanol –gasoline blend, also compare between the Depletion of fossil fuels and environmental pollution has led researchers to anticipate the need to develop bio-fuels(5).

2. METHOD

The project experiment was carried out on Single Cylinder 4-Stroke constant speed SI engine. It consists of following components:-

1. Fuel tank
2. Engine
3. Rope brake drum type dynamometer
4. Manual loading arrangement
5. AVL Five gas analyzer

Engine Specifications

- Maker- Grieves ltd.
- Type- Single Cylinder 4-Stroke SI engine
- Rated Power- 2.2 KW
- Rated RPM- 3000
- Stroke- 66.7 mm
- Bore- 70 mm
- Compression ratio- 4.7
- Capacity- 256 cc

- Arm length- 0.1036 m

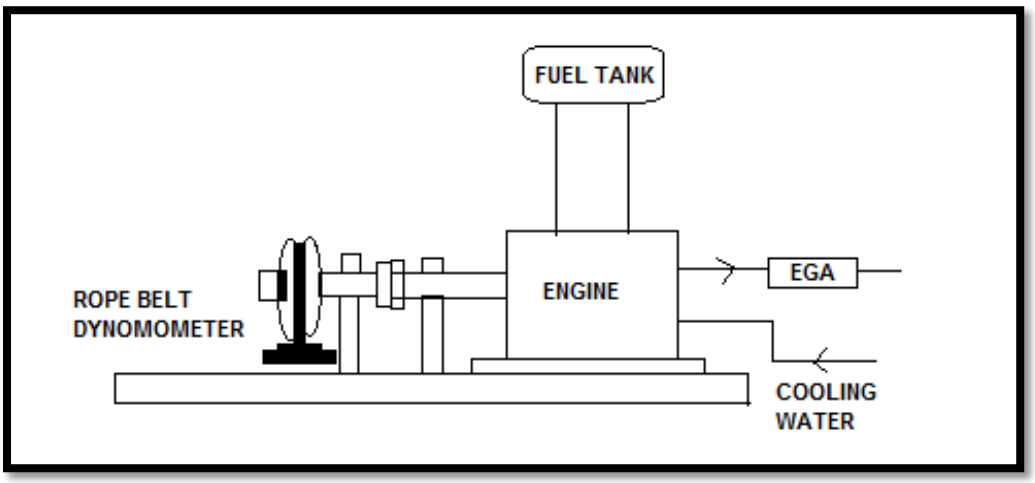

Fig. Single Cylinder 4-Stroke constant speed SI engine

3. PROCEDURE

Initially the procedure of experiment starts with filling the fuel tank available then we start five gas analyzer, It takes half an hour to starts, after it starts, we starts generator with the help of rope at no load condition & as soon as engine starts we supply the water to dynamometer for cooling purpose. The motor is provided with air fin for cooling so no need to supply water to motor.

We run the engine for few minutes before reading were taken to ensure stable operation. Once it is ensure the engine is running properly, we start taking readings. We measure the time required for 20ml of fuel with the help of stop watch & burette which is connect to the fuel tank, then we place knob inside the exhaust manifold & put it for a while until the stable reading of emission are shown by the analyzer and not down the reading Obtained. The reading obtained is time per 20ml of fuel consumed and emission of carbon monoxide, carbon dioxide, hydro carbon and nitrogen Oxide at no load condition. This procedure is repeated for different load. The load is carried out manually in the manner 1 kg, 2 kg, 3 kg, 4 kg and 5 kg. With these readings one type of fuel is completed. Then you're off the engine after above set of readings are obtained for about 1 hour allowing it to cool for its proper functioning. Then repeating the procedure for another blended mixture and proper care was taken like mixing the ethanol and petrol, just before the experiment is carried out in order not to form much water to avoid corrosion problem. Each type of blend was used for reading in tree times, so as to minimize error, the procedure is carried out for the fuel E5, E10, E15, E20,E25 ,E50, E75. The reading obtained with the graph as shown in result and discussion in the next section.

Calculation for Fuel Sample Calculations for SI Engine

1. Fuel consumption in kg/sec

$$\text{fuel consumption rate} = \frac{\text{fuel consumption}}{\text{time}} \quad \text{kg/sec}$$

2. Torque in NM

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$$\text{Torque} = \text{force} * \text{arm length}$$

3. Break power in kw

$$\text{bp} = \frac{2 * \pi * N * T}{60000}$$

4. Break specific fuel consumption kg/kwh

$$\text{bsfc} = \frac{\dot{m}_f}{\text{bp}}$$

5. Break mean effective pressure in bar

$$\text{bmep} = \frac{\text{bp} * 60}{L * A * N * K}$$

6. Break thermal efficiency:

$$\eta_{bth} = \frac{\text{bp}}{\dot{m}_f * C_v}$$

7. Break specific energy consumption:

$$\text{bsec} = \text{bsfc} * \text{calorific value}$$

3. RESULTS

3.1 As we see from the graph above the carbon monoxide emissions is decreasing with ethanol blends as compared to petrol emissions

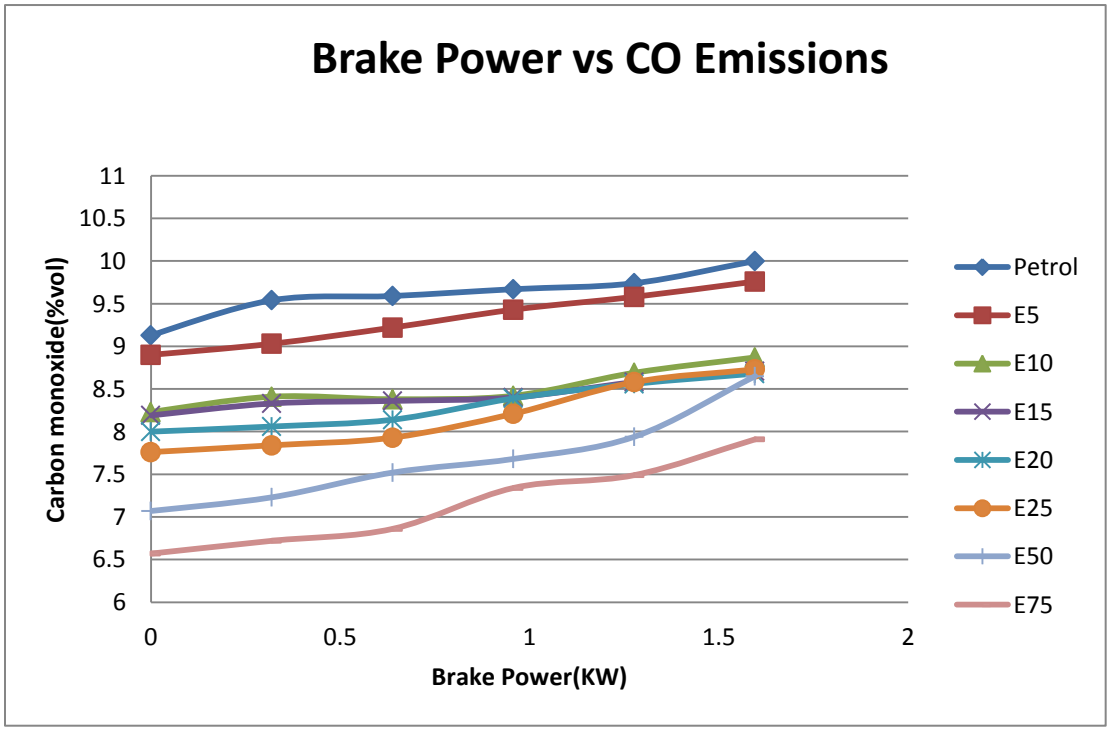

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Fig.3.1 Brake Power vs CO Emissions

3.2 We see the Carbon dioxide emissions are increasing with the increase in ethanol blends as compared to petrol emissions. This is because of complete combustion.

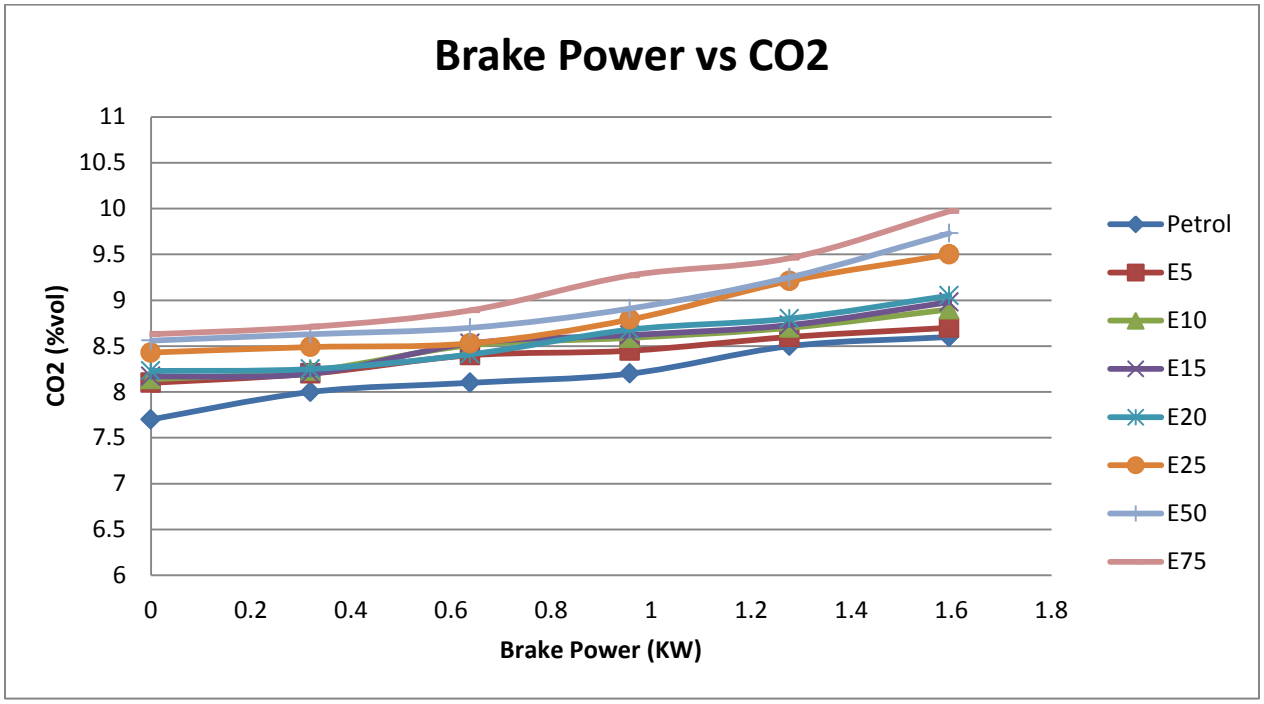

Fig. 3.2 Brake Power vs CO2

3.3 We see from the above graph of Hydrocarbons emission the ethanol blends usage increases the HC emissions as compared to Petrol emissions. The lower percentage ethanol blending gives almost similar emissions to petrol as shown for E5, E10 and E15.

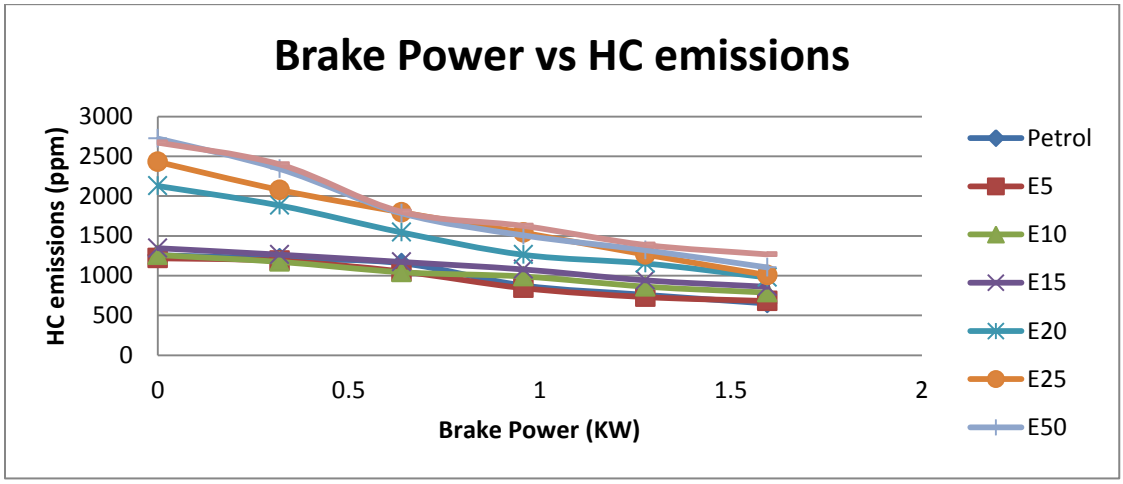

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Fig. 3.3 Brake Power vs HC emissions

3.4 The Nitrogen oxides emissions are almost similar to petrol as compared to lower ethanol blends while it increases as the percentage of blending increases. These are the readings and the respective graphs of the emission gases obtained during the experiment.

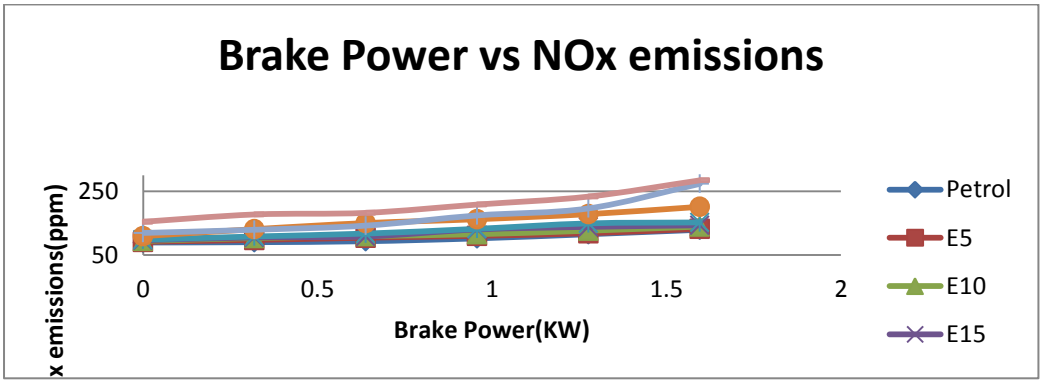

Fig. 3.4 Brake Power vs NOx emissions

Now the calculation part of the experiment along with the time required for 20 ml fuel consumption of all the blends of ethanol along with petrol solely are as follows-

4. CONCLUSION

The blended of ethanol is excellent alternative fuel also it is eco friendly and amount of emission is minimum. By adding blended mixture the efficiency increases or nearly equal, it will surely increase while we increase compression ratio. Ethanol blend in petrol then the percentage of carbon monoxide (CO) decreases. Mainly this study was carried out to study the performance of SI engine at lower percentage blends along with couple of higher percentage blends were tested.

Using various percentage blends of ethanol the following main changes to engine performance of emission and comparison with petrol operated engine with increasing ethanol percentage emission of carbon monoxide decreases but CO2 increases because of the complete combustion, hence nitrogen oxide increases. As compare with petrol hydrocarbon emission into environment also increases but we can decrease quickly by increasing load.

In case of E10 break specific energy consumption (BSEC) is lower at initial loading and little bit increase by higher load. BSEC is of E15 and E5 almost same as petrol. E25 remaining higher and E15 and E75 remains slightly lower as compared with E25and E20 while we increasing break thermal efficiency of E10 and is equal to for E5 and E15. The efficiency of E25 was found to be lowest and for higher percentage it was lower. Thus efficiency increases with load increases.

From the above experiment it is clear that if we can optimized as E10 might be the best blame to be used in order to achieve good efficiency and minimum emission for lower compression ratio while engine is running at higher RPM at constant speed and intermediate percentage blending results in lower as in case of E25.

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