PERFORMANCE TESTING OF 4-STROKE SINGLE CYLINDER VARIABLE COMPRESSION S.I ENGINE WITH BLENDING OF PROPANOL WITH GASOLINE

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ABSTRACT –

Increasing global concern due to air pollution and to the limited oil reserves has generated much interest in the environmental friendly fuels alternative to petroleum based fuels, in particular for the transport sector in which the energy consumption depends almost exclusively on fossil fuels. Alcohols, because of their potential to be produced from renewable sources and because of their high quality characteristics for spark-ignition (SI) engines, are considered quality fuels which can be blended with fossil-based gasoline for use in internal combustion engines. . The performance parameters will investigate were Fuel consumption ,Brake specific fuel consumption and Brake thermal efficiency determine and exhaust emission such as carbon monoxide(CO),carbon dioxide(CO2), hydrocarbon (HC) and oxides of nitrogen (NOx) are also measured. The results shows that as the compression ratio increases actual fuel consumption decreases, BSFC also decreases and thus the brake thermal efficiency improved and the propanol at highest brake thermal efficiency obtained at compression ratio 9 and also reduction in percentage carbon monoxide, unburned hydrocarbons.

Index Terms :Fuel- Gasoline, Ethanol, Propanol, Performance parameter, Exhaust emission

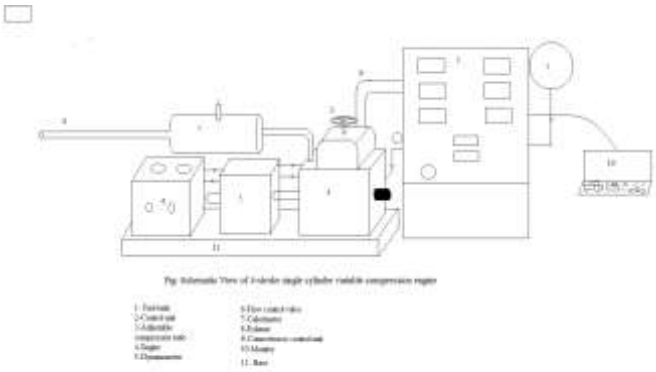
1. INTRODUCTION

Now a day environmental pollution increase day by day and it is now the essential issue that need to be reduced. The users of fuel is increased rapidly and the availability of natural fuel is ultimately non renewable. The fossil fuel are used to generate electricity, fuel for transportation (automobiles) and for provide heat. With an increasing word population the demand for energy has been increasing at a staggering rate and their sources of availability become limited. One of the serious problem facing the modern technological society is the drastic increase in environmental pollution by internal combustion engine. Mostly transport vehicles such as spark ignition engine and compression ignition engine are equally responsible for the emitting of different kinds of pollutants such as CO2,CO,HC, and NOx. Today the transport sector(Automobile) is increases and it is a major contributor to the net emission of greenhouse gases of which carbon dioxide is particularly important. The carbon dioxide emissions originate mainly from the use of fossil fuels, mostly gasoline and diesel oil in road transportation system. Although some originates from other types of fossil fuels such as natural gas(methane) and liquefied petroleum gas(LPG). A Hull et.el.(2006)[2] Studied on An alternative fuel for spark ignition engines. Alternative fuels have been used for standard spark ignition engines. The fuel which contain generic bio-components, maintain all the advantages of ethanol that is the ability to increase considerably the octane number of gasoline and to reduce the amount of harmful pollutants in the exhaust emissions of engines operating on such blends.. And he found that to reduce the amount of harmful pollutants in the exhaust emissions of engines operating on such blends. .In contrast with ethanol the new fuel components do not increase the vapor pressure of gasoline–ethanol blends, have a better tolerance to water, and do not increase the

fuel consumption. H S Farkade, A P Pathre(2012) By Using a Three alcohols are tried to investigate in two parts. Comparative study of methanol, ethanol and butanol on the basis of blending percentage is first part, followed by investigation of oxygen role on the basis of oxygen percentage in the blend. Her result shows that highest replacement of gasoline by butanol at 5 % of oxygen content, the performance of same oxygen percentage for other two alcohols are also better. Presence of oxygen gives more desirable combustion resulting into low emission of CO, HC and higher emission of CO2 as a result of complete combustion, higher temperature is also favorable for NO emission resulting higher emissions for it

2. Experimental Procedure

2.1 The set-up



Engine used are four stroke single cylinder variable compression engine. Having Bore of 70 mm. Stroke 66.7 mm, Displacement of engine are 256 cc Having compression ratio 4.6 to 9.0 .Cooling system are forced water cooling system have been used and the Ignition system are Electronic ignition system. Experimentation is carried out on Greaves MK-25 engine which is modified by tech-ed limited Banglore. Basically MK-25 was designed with f-shape combustion chamber which then replaced by over head piston, the up and down movement of piston causes change in clearance volume of engine resulting into change in compression ratio.

2.2 Experimental Procedure

Operating Procedure :-

1.First of all we have to prepare the blends of Ethanol with gasoline and second Blend of Propanol such as Pr5, Pr10 with Gasoline on the basis of Volumetric Composition. Individually taken Propanol blends respectively on flask and mixed it with the Gasoline. Poured the blend in the fuel tank

.Plug the mains cord and switch on the control panel so that all the indicators will display their respective readings .Start the water flow to the engine.Make sure that the temperature sensors are in their respective pockets.Start the engine by cranking with the use of handle.Allow it to stabilize the rated speed ie, 2600 or 3000 rpm .We have taken different readings based on different blends of Propanol.Run the software so that its starts displaying the respective data and also the calculated results in the display panel.Then log the data by clicking “

log data" for zero load, then one complete Zero load cycle data will be acquired.Repeat the same for different load like ¼ ,½ ,3/4 and full load .(max. load is 8 N-meter).After logging the full load data, click " stop " and view or print the Reports and graphs and exit.

Now bring back the load to zero and stop the engine by pulling the stop lever.Shut- off the water supply after about 15 minute then shut down the computer and switch off the mains.

3. Result

The effect of Propanol blend and ethanol blend with gasoline on SI engine performance and exhaust emission at variable compression ratio were investigated.

3.1Fuel consumption at various compression ratio ;

The effect of mass flow rate on variable compression ratio is shown below.

Fuel consumption at various compression ratio

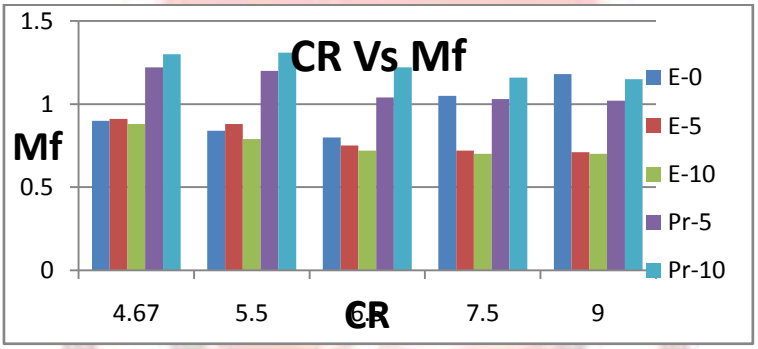


Fig 3.1 CR Vs Mf

As shown from the graph as increasing the compression ratio of an engine the mass flow rate of the engine is decreases. In pure gasoline mass flow rate is decreases up to C.R 6.5 after that it should be increases. Propanol blend shows the highest amount of mass flow rate as compare to ethanol blend.

3.2Brake Specific fuel consumption at various compression ratio :

The effect of pure gasoline, propanol blend with gasoline and ethanol blend at various compression ratio is shown below.Brake specific fuel consumption at various compression ratio

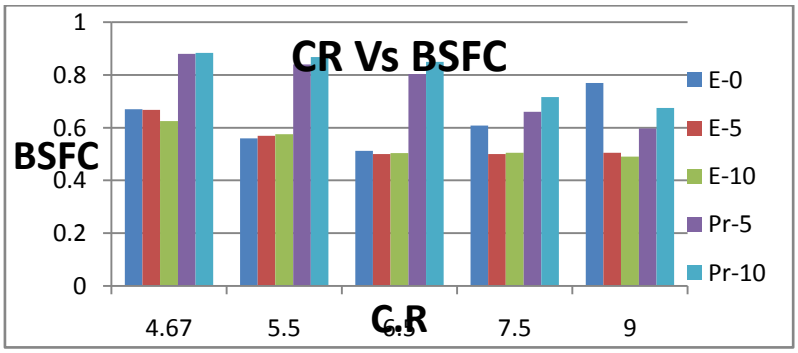


Fig 3.2 CR Vs BSFC

As shown from the graph as increasing the compression ratio from 4.67 to 9 the brake specific fuel consumption decreases as increasing an increment of compression ratio. Pr 5 % and Pr 10 % shows slightly higher BSFC as compare to pure gasoline and ethanol blends.

3.3Brake thermal efficiency at various compression ratio :

Brake thermal efficiency of pure gasoline ,ethanol blend and propanol blend at different compression ratio as shown below.

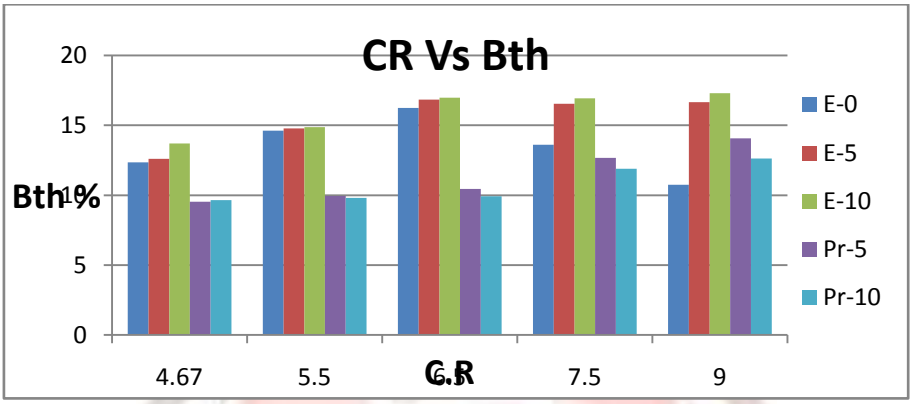


Fig 3.3 C.R Vs Bth

As shown in above figure as increasing the compression ratio the break thermal efficiency of engine increases with increasing the compression ratio with the use of pure gasoline, Pr5 % , Pr 10%. E 5% and E 10%. It is seen that upto compression ratio 6.5 as compression ratio increases brake thermal efficiency of gasoline increases and after compression ratio 6.5 brake thermal efficiency decreases. It is also seen that with the use of ethanol and propanol blend brake thermal efficiency increases at increased compression ratio.

3.4 Percentage Carbon monoxide at various compression ratio

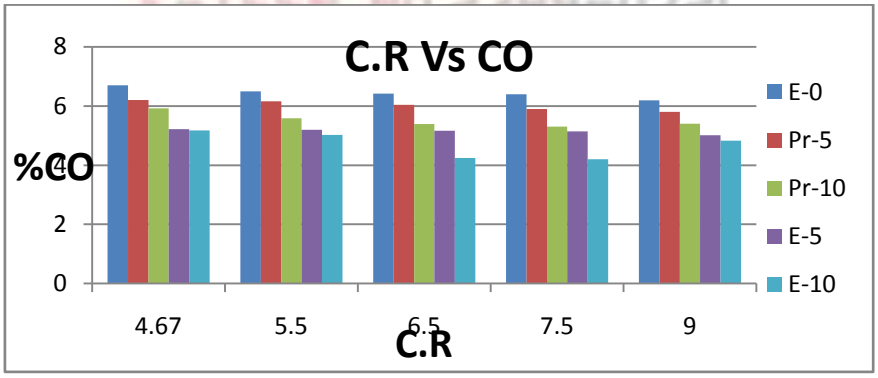


Fig 3.4 C.R Vs CO

As seen from the graph as increasing the compression ratio carbon monoxide emission decreases. Pure gasoline shows highest CO emission as compare to Propanol and Ethanol blend. In pure gasoline oxygen contents availability is negligible thus as increasing the blending percentage with propaol and ethanol increment

complete combustion will occure and result in there is reduction of percentage of carbon monoxide emission as due to the complete combustion of fuel.

3.5Percentage of carbon di-oxide at various compression ratio

%CO2 at various compression ratio

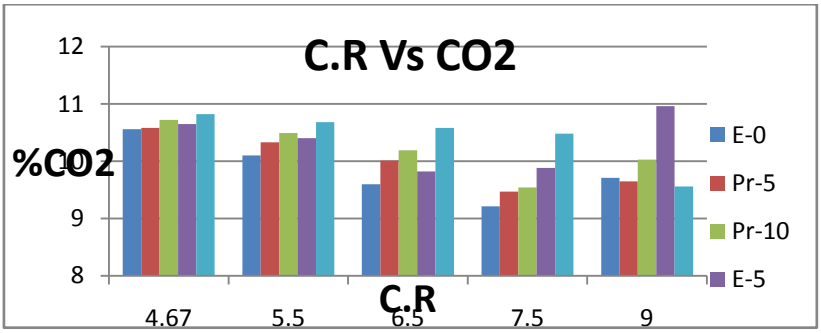


Fig 3.5 C.R Vs CO2

As shown from the above graph as increasing the compression ratio carbon dioxide emission decreases as incresesing the compression ratio. Pure gasoline have less CO2 emission as compare to the propanol and ethanol blends. This is because of pure gasoline content zero percentage of oxygen. And as increment of blends from propanol to ethanol oxygen content also increases thus complete combustion occur thus carbon dioxide emission also increases with increasing the percentage of blend and with the compression ratio.

3.6Oxides of Nitrogen (in ppm) at various compression ratios:

NOx at various compression ratio

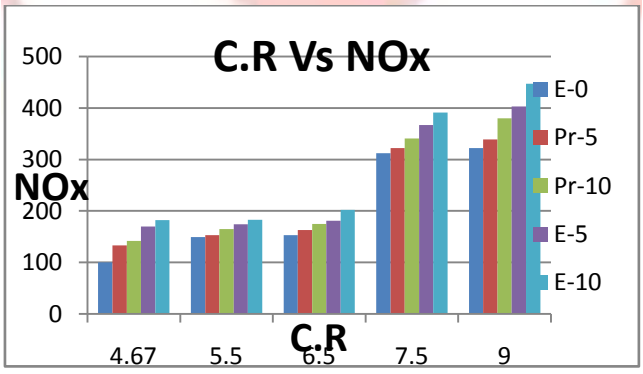


Fig 3.6 C.R Vs NOx

As shown in above figure, percentage of oxides of nitrogen produced in pure petrol is less than that it is in various alcohol blends such as Pr5, Pr10,E5, and E10. As the compression ratio increases the NOx(in ppm) also increases.

3.7Unburned hydro carbon (in ppm) at various compression ratios:

Reading of HC obtained at various compression ratio

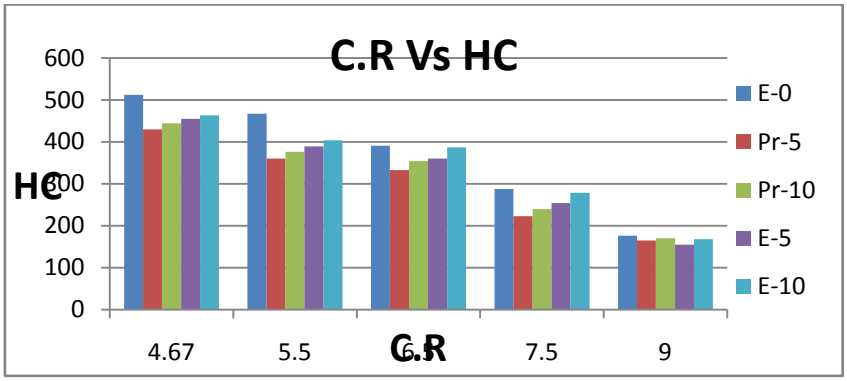


Fig 3.7 C.R Vs HC

As shown in above figure, unburned hydro carbons produced in pure petrol is more than that it is in various alcohol blends such as Pr5, Pr10, E5 and E10. Pure petrol contents zero percentage of oxygen content. As move from propanol and ethanol oxygen percentage are increased which results in complete combustion of fuel. As the combustion is complete there is reduction in unburned hydrocarbons in alcohol blends.

4. CONCLUSION

> Increasing compression ratio from 4.67 to 9.0, mass flow rate decreases for various blends (Pr5, Pr10,E5 and E10,).

>Increasing compression ratio results in decreasing the brake specific fuel consumption up to 6.5 compression ratio. Above 6.5 compression ratio, brake specific fuel consumption for pure gasoline increases.

> As compression ratio increases from 4.67 to 9.0, brake specific fuel consumption decreases for various blends (Pr5, Pr10, E5 and E10).

>Increasing compression ratio from 4.67 to 9.0, brake thermal efficiency increases for various blends (Pr5, Pr10, E5 and E10).

8.Increasing the blend percentage (5% to 10%) increases the brake thermal efficiency for E5 and E10 blends, but lower brake thermal efficiency for propanol blends.

>Increasing the compression ratio from 4.67 to 9.0 decreases the percentage of carbon monoxide and increases the percentage of carbon di oxide.

>Increasing the blend percentage from 5% to 10% for ethanol and propanol decreases the percentage of carbon monoxide and increases the percentage of carbon di oxide.

>Increasing the compression ratio increases the concentrations of oxides of nitrogen but decreases the concentrations of unburned hydrocarbons.

It is observed that propanol (5% and 10%) with gasoline can be used for higher compression ratios. From the graph it is seen that mass flow rate as well as brake specific fuel consumption decreases as the compression ratio increases. Also increased compression ratio increases brake thermal efficiency, reduction in percentage carbon monoxide, unburned hydrocarbons.

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