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ENGINE PERFORMANCE AND EMISSIONS CHARACTERISTICS WITH ETHANOL GASOLINE BLENDS

R.Karthikeyan
Assistant Professor
Dept of Automobile Engg.
Rajalakshmi Engineering College
Chennai, India

P.Pavan
Assistant Professor
Dept. of Automobile Engg.
Rajalakshmi Engg. College
Chennai, India

T.Sankaramoorthy
Assistant Professor
Dept. of Mechanical Engg
R.M.K. College of Engg & Tech
Chennai, India

S.Nagendharan
Assistant Professor
Dept. of Mechanical Engg.
Chennai Inst. of Tech.
Chennai, India

Abstract - Alternative fuels utilized in combustion engines has subjected to strict rules and regulation to protect the environment and control the emissions, reducing the usage of fossil fuels. Due to this reason ethanol has considered and better replacement over other fuels due its good chemical property. It has good corrosive nature and higher energy, less emission which helps to protect the environment. In this paper experiment investigation of ethanol gasoline blend has been prepared to increase the efficiency such as thermal efficiency, overall efficiency of an engine. The mixing ratio of gasoline and ethanol at different speeds with constant compression ratio was investigated in this study, which was utilised to quantify brake torque. It boosts torque output at lower engine speeds, such as under 4000 rpm. It's used to figure out how much hydrocarbon, nitrous oxide, and carbon monoxide are in the exhaust. This investigation reveals that gasoline has a higher thermal efficiency and fuel consumption than E2 and E4 blends. As a result, emissions in E2 and E4 are lower than in gasoline.

Keywords: internal combustion engine, ethanol, emissions, gasoline.

I. INTRODUCTION

Due to the rapid industrialization and the rise of fuel consumption, the world's oil reserves are estimated to run out in less than 50 years. [1]Ethanol is produced by fermenting and distilling sugarcane, grain, and other cellulosic materials. Its renew-ability and lower toxicity make it a better choice for gasoline.[2]Bio ethanol fuel increases the efficiency, lowers the combustion temperature, and the peak heat release rate of the engine. However, it also increases the brake specific fuel consumption.[3]This study mainly focuses on reducing CO and HC emission by 15-80% and 22-81% respectively. It has been observed that ethanol-gasoline mixing ratio can improve engine performance at low rpm.

E40 and E50 fuel deliver the best brake thermal efficiency. In addition, E20 to E40 provides the very best MBT at 71 to 100%.[4]The improved combustion duration and flame development angle due to the increase in water-in-ethanol volumetric content. This benefit was also achieved through the addition of low-cost water.[5] The best combustion efficiency was obtained at the stoichiometric region of the test vehicle. Higher vehicle speed and increasing alcohol gasoline blends led to a decrease in HC emissions.[6] The reduction in unburned HC emission levels with the use of alcohol gasoline blends extended the combustion efficiency of combustion engines.[7] It is believed that higher levels of particulate matter are produced by diffuse limited combustion in vehicles that are powered by ethanol because of the higher equivalence ratios. In terms of environmental benefit, E10W ethanol has a significantly lower CO_2 and HC emissions than E0. [8]

II. MATERIALS AND METHODS

The experiment was carried out on a four-stroke gasoline engine in Yamaha R15 bike with a compression ratio of 10.31:1. It was tested to use ethanol as its fuel. Total five fuel mixtures were

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studied for this study. The carbon content of gasoline varies among 4 to 11. It is also produced with dilute water. This component is usually connected to a chassis dynamometer. The data acquisition is done through a computer program known as Sportdyno. The load is provided to the dynamometer by coupling a motor with a reduction ratio. The test conditions are then varied to suit the different engine speeds. After the engine has warmed up for a few minutes, it is permitted to run. The fuel consumption is measured by weighing the number of test fuels consumed before and after the test.

III. RESULTS AND DISCUSSION

i. Brake Thermal Efficiency Vs Speed

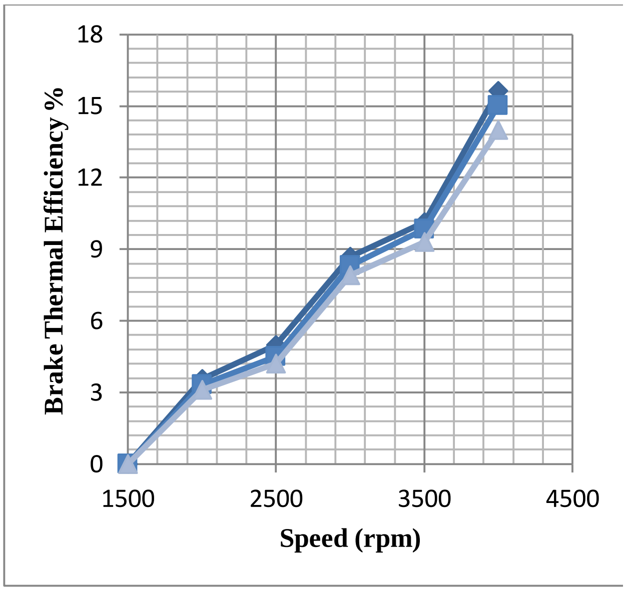

Fig 1. Brake Thermal Efficiency Vs Speed

It explains why brake thermal efficiency varies depending on engine speed. When the amount of ethanol in the gasoline-ethanol blend is increased, the brake thermal efficiency reduces significantly. At full load, the maximum reduction efficiency for neat gasoline and E4 blend is 1.63 percent. This decrease is due to the increased mass of fuel burned inside the combustion chamber as well as the increased calorific value of the fuel.

ii. Total Fuel Consumption Vs Speed

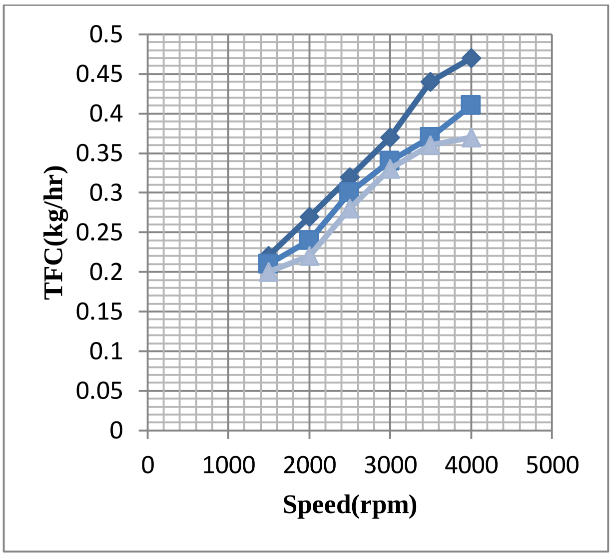

Fig. 2 Total Fuel Consumption Vs Speed

The graph above depicts the variation in overall fuel usage as a function of engine speed. As can be seen in the graph above, total fuel usage rises as engine speed rises. Gasoline has the highest total fuel consumption compared to E4 and E2. Improvement if vaporisation leads to improved combustion and lower TFC.

iii. Hydrocarbon Emission Vs Speed

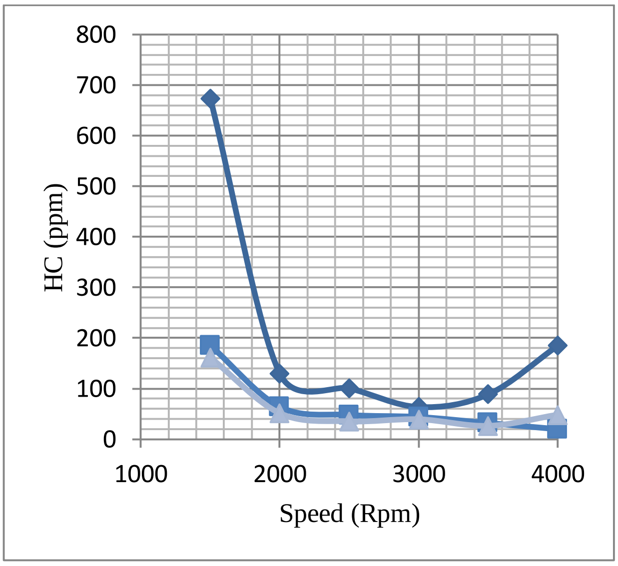

Fig. 3 HC Emission Vs Speed

The graph above depicts the variance in hydrocarbon emissions as a function of engine speed. The preceding graph shows that as the ethanol level in the gasoline-ethanol blend increases, the hydrocarbon emissions decrease. For neat gasoline and E4 blends, the highest reduction in was determined to be 600 ppm at idle and 60 ppm at full load. Because of the accumulation of air-fuel mixture

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in the crevice volume and flame quenching, hydrocarbon is generated in SI engines. During the expansion stroke, the oxidation of the premixed charge has a substantial impact on the exhaust hydrocarbon emissions. ethanol contains 49% of oxygen it helps to reduce HC emissions.

iv. Carbon-Monoxide Emission Vs Speed

The graph below depicts the variance in CO emission as a function of speed. CO emission decreases as the ethanol level in this blend increases. CO emission is caused by engine speeds. When compared to gasoline, E4 emits 56 percent less carbon monoxide at 4000 rpm, and E2 emits a similar amount at the same speed. CO is produced as a result of incorrect combustion caused by the use of a lot of fuel. The inclusion of oxygen in the fuel blend aids in the reduction of fuel-rich zones, resulting in a reduction CO.

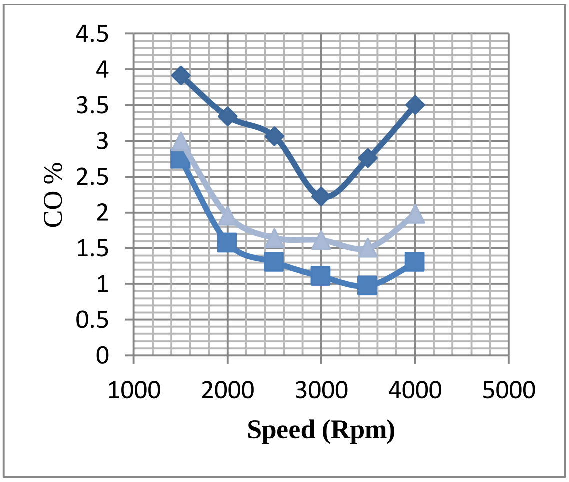

Fig.4 CO Emission Vs Rpm

v. Nitrous-Oxide Emission Vs Speed

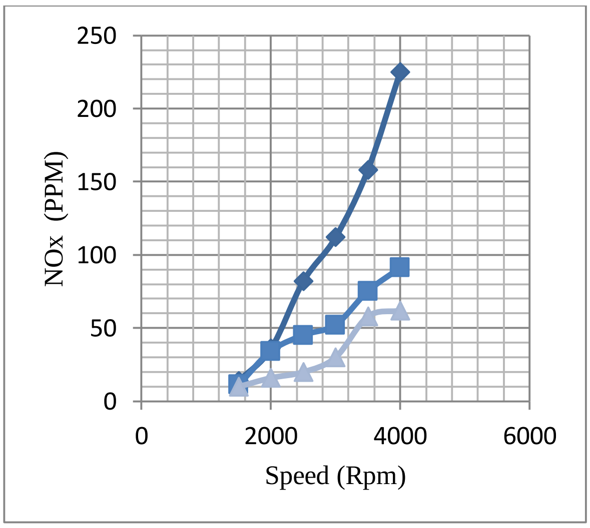

Fig.5 Nox Emission Vs Speed

The graph explains the variance in nitrous-oxide emission as a function of engine speed. The oxides of nitrogen emissions decrease as the ethanol percentage in the gasoline-ethanol blend increases for a wide range of engine speeds, as seen in the graph above. When the engine is driven with E4 fuel at 4000 rpm, there is a 150 ppm reduction in NOx emissions when compared to gasoline, and a similar trend is also found for E2. NOx is produced by the oxidation of monoatomic nitrogen in the burning gases behind the flame front at high temperatures. The high latent heat of vaporisation of ethanol tends to lower the temperature reached at the conclusion of compression, which has an effect on the temperature at the beginning or end of the combustion process. Furthermore, when the octane number of the gasoline increases, the peak cycle temperature is somewhat shifted away from the TDC, reducing NOx generation.

IV. CONCLUSION

Yamaha Rl5 assists us in optimising the use of various fuels. The study concludes that when the ethanol level in the gasoline-ethanol blend increases, the brake thermal efficiency decreases due to the lower calorific value of the fuel. Because of the acrumulaaon of air-fuel mixture within the crevice volume and flame quenching, hydrocarbon emissions decrease as the ethanol concentration of the gasoline-ethanol blend increases throughout a wide range of engine speeds. For a wide range of engine speeds, the carbon monoxide emission decreases as the ethanol percentage in the gasoline-ethanol blend increases. The inclusion of oxygen in the fuel blend helps to prevent the creation of fuel rich zones, which is one of the reasons for the reduction in CO emissions associated with the use of alcohol. For a wide range of engine speeds, increasing the ethanol percentage in the gasoline-ethanol blend reduces nitrogen oxide emissions. The high heat of vaporisation transformation lowers peak temperature and lowers NOx emissions. The attainment of peak cycle temperature is somewhat shifted far away from the TDC as the octane rating of the fuel increases, reducing NOx formation.

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