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Experimental Investigation of Two Stroke Petrol Engine operating on blends of Methanol, Ethanol and Gasoline

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Abstract: India is a developing country with an increasing workforce. A large part of transportation, movement etc depends on SI engines. Even agriculture today is largely dependent on SI engines. However in recent past we have witnessed a rapid increase in petrol prices. This price rise has not only affected commuters but also farmers and industries. Today's fuel research is completely based on finding alternative fuel, however more availability of heat from fuel is not acceptable. It is the ability to transform into mechanical work that matters the most. Meanwhile until some substitute is chalked out, researchers are Concentrating on petrol blends (generally alcohol blended). Although a variety of alcohols can be chosen, it has been found that heat from ethanol can be transformed to mechanical work more efficiently. In this paper, facts supporting use of ethanol and petrol blends have been discussed. Results obtained from experimental tests have been discussed too. Internal combustion engine are the most preferred prime mover across the world. Spark ignition engine is preferred locomotive prime mover due to its smooth operation and low maintains. The gasoline is fossil fuel which is limited in reservoirs causes varieties of study in search of alternative fuel for SI engine, where alcohol promises best alternative fuel. In this paper study of 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. The result shows 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 you 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

Keywords: sfc, bsfc,

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I. INTRODUCTION

Increased consumption and unstable rates of end prices of fuel made us in various troubles resulting in more attraction of alternative and low cost biofule. Also lavish consumption of fossil fuels has led us to reduction in underground-based carbon resources. The search for alternative fuels, which promise a harmonious correlation with sustainable development, energy conservation, efficiency and environmental preservation, has become highly pronounced in the present days. The fuels of bio-origin can provide a feasible solution to this worldwide petroleum crisis. Also, gasoline and diesel-driven automobiles are the major sources of greenhouse gases emission. Scientists around the world have explored several alternative energy resources, which have the potential to quench the ever-increasing energy thirst of today's population and to minimize the emission with higher consumption.

Christoph Bauret al [1] analyzed the performance of SI engine with ethyl tertiary butyl ether (ETBE) as a blending component in motor gasoline and compared with ethanol blend. Presence of oxygen within fuel make fuel to burn clearly with better performance and lower emission and also provide higher octane rating of fuel which allows us to use higher compression ratio, CO and UHC emission levels with ETBE was much lower compared to those with the base gasoline and the NOx emission levels were increased slightly with the oxygenated fuels and was increasing with the increase of the oxygen content in the blended fuels which is related to the greater availability of oxygen and the leaning effect of those oxygenated fuels provides complete combustion of fuel. Evaporation values of alcohols such as ethanol, methanol and butanol make them appropriate fuels for high CR engines with high powers. High octane values can permit significant increases in CR. High heats of evaporation cool down the incoming fuel–air charge and make it denser to promote the power output. The fuels Which have high the auto-ignition temperature are ignited at higher temperatures. The auto-ignition temperatures of alcohols are higher than those of gasoline, which make it safer for transportation and storage. The heat of evaporation of alcohol is 3–5 times higher than that of gasoline, which makes the temperature of the intake manifold lower, and increases the volumetric efficiency. The laminar flame speed of methanol is significantly higher than those of most of the hydrocarbon fuels. High laminar flame speed increases thermal efficiency by completing the combustion earlier which decreases heat losses from the cylinder. Methanol exhaust contains lower concentrations of particulate matters and nitrogen oxides than gasoline exhaust. The molecule of methanol has an oxygen atom that makes the gasoline-methanol blends more oxygenated. This leads to better combustion of the fuel and decreases carbon monoxide and hydrocarbon emissions. Methanol is an alternative fuel and can be produced from natural gas, biomass, and coal and also municipal solid wastes and sewage. Several studies have been conducted on the use of methanol and methanol-gasoline blends as fuel in the SI (Spark Ignition) engines. These results showed that there was an increase in engine thermal efficiency and decrease in CO emissions (fig 1) when pure ethanol and pure methanol fuels were used and the effects of these fuels on engine performance and exhaust emissions. Rising fuel prices and increased oil consumption along with the lack of sustainability of oil-based fuels have generated an interest in alternative, renewable sources of fuel for internal combustion engines, namely alcohol-based fuels. Currently ethanol is the most widely used renewable fuel with up to 10% by volume blended in to gasoline for regular engines or up to 85% for use in Flex-Fuel vehicles designed to run with higher concentrations of ethanol. Ethanol can also be used as a neat fuel in spark-ignition (SI) engines or Blended up to 40% with Diesel fuel for use in compression-ignition (CI) engines [1-2]. Ethanol was introduced as a replacement for methyl tertiary butyl ether (MTBE) when it was realized that MTBE leaked onto the ground at filling stations resulting in the contamination of large quantities of groundwater. Ethanol is biodegradable, less detrimental to ground water, and has an octane number [4] much higher than gasoline as well as having a positive effect on vehicle emissions [3].

II. EXPRIMENTAL SETUP

This experiment is performed in I.C. engine Lab at R.G.P.V., Bhopal, m.p. College ground. Brake thermal efficiency calculated at different-2 loads like that 500 W, 1000W, 1500 W and 2000W at 10% methanol, 20% ethanol and 30% gasoline on the two stroke petrol engine At the different-2 quantity of fuel used with blends methanol, ethanol, and gasoline etc. in this setup various component attach like load control panel, exhaust cane, fuel supply by glass pipe.

As shown in figure 1, the test equipment is composed of a 150 CC 2-S Bajaj Chetek engine, a rope brake dynamometer (tongue buckle for loading and unloading purpose), two spring balances (for measuring loads on tight and slack side). Emission tester used is NETEL – EPID make, exhaust 2 gas analyzer, model - NPM-CH1. The experimental setup used in this studied schematically in fig. The experimental work is conducted on four strokes, single cylinder, water cooled, manifold injection ethanol engine and direct injection Ethanol engine coupled on an eddy current dynamometer. For measuring of exhaust temperature, NOX, CO, CO 2 and Unburned HC level are made in the exhaust pipe. The exhaust temperature of the engine measured using digital chrome - alumel thermocouple. The NOX level is measured using NOX analyzer. The carbon monoxide and unburned hydrocarbon is measured by using infrared analyzer. Fuel consumption is measured with the help of burette and digital stop watch. The experiments are conducted at various loads from no load to full load with uncoated piston and coated piston with different fuel (wet ethanol, diesel). Over head piston displacement allows changing compression ratio of engine from 2.5 to 8, further detail of engine and setup is described below. Primary goal of study is to find out the effect of oxygen percentage of alcohol on performance of IC engine. The engine is governed by mechanical governor which allow us to run engine at constant speed. Engine is coupled with DC dynamometer through constant load bank then load is varied by varying field voltage, generation efficiency for given loading which less than half is taken as 70 %. Various parts of engine are shown in Fig. 1 and Specification in Table. , contact type tachometer (Range 0-5000rpm, 0.05%±1) is used to measure the speed of engine mounted below Flywheel, engine is force air cooled but the VCR head is provided With water cooling. Load cell is to measure the fuel consumption rate, for verification manual burette Measurement is also provided.

III. Tables, Figures and Equations

A. Tables

To insert “Tables” or “Figures”, please paste the data as stated below. All tables and figures must be given sequential numbers (1, 2, 3, etc.) and have a caption placed below the figure (“Fig Caption”) or above the table(“Fig Table”) being described, using 8pt font and please make use of the specified style “caption” from the drop-down menu of style categories

Table 1: Engine specification

Engine make and	Bajaj Chetak
Engine type	Single cylinder
Displacement	150cc
Maximum power	7.5 BHP@5000
Gear	4
Ignition	CDI Electronic
Lubrication	Wet sump

B. Figures

Fig. 1 Experimental setup of two stroke engine

C. Performance Graph

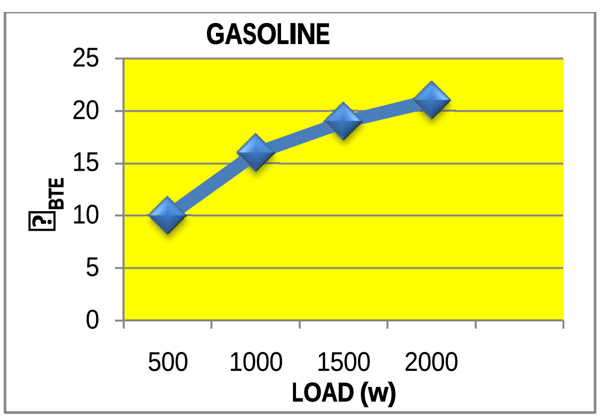

Fig 1.1 Loads between BTE

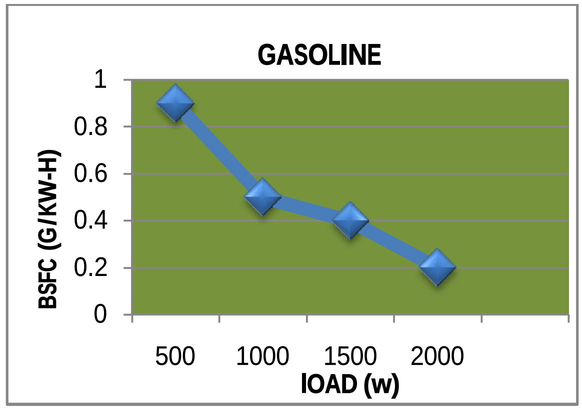

Fig 1.2 Loads between BSFC

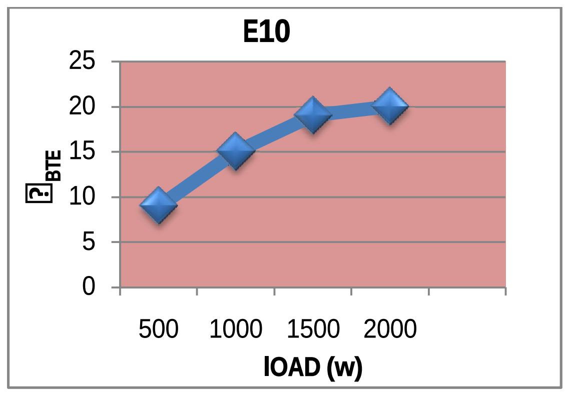

Fig 1.3 Loads between BTE

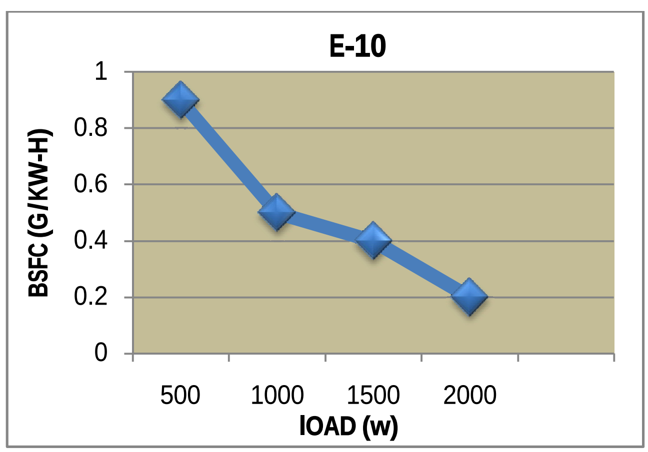

Fig 1.4 Loads between BSFC

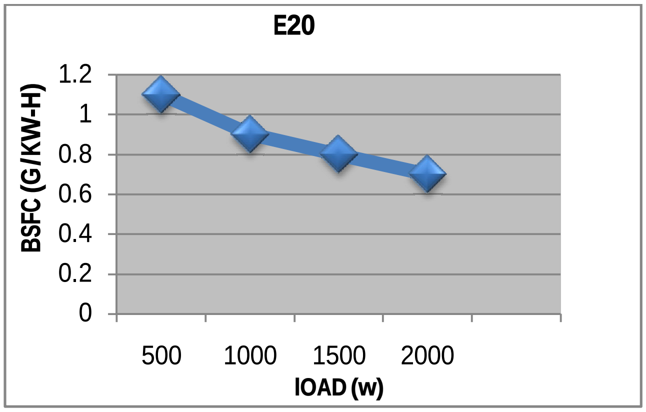

Fig 1.6 Loads between BSFC

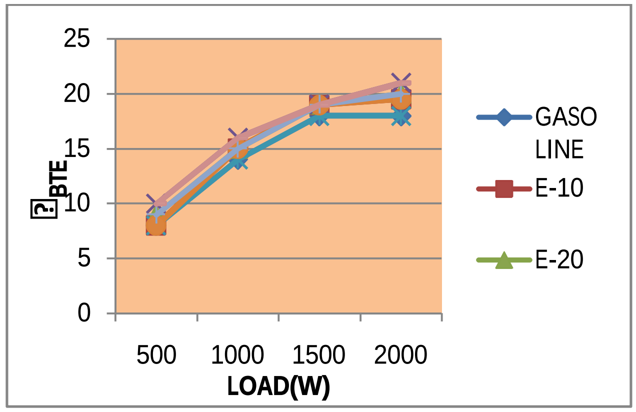

Fig 1.9 Loads between BTE

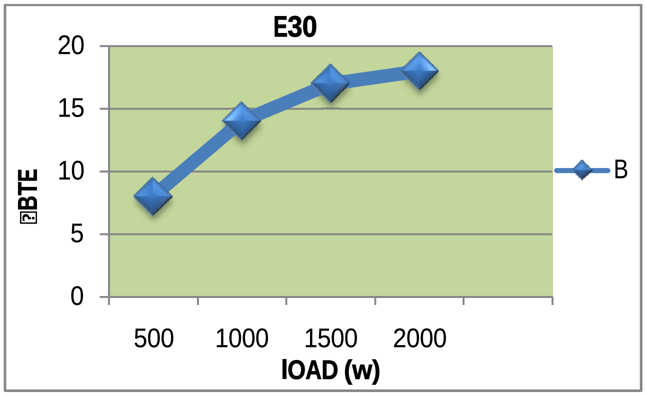

Fig 1.7 Loads between BTE

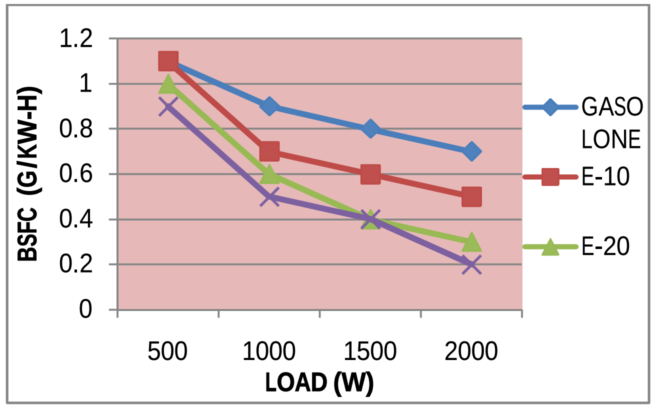

Fig 1.10 Loads between BSFC

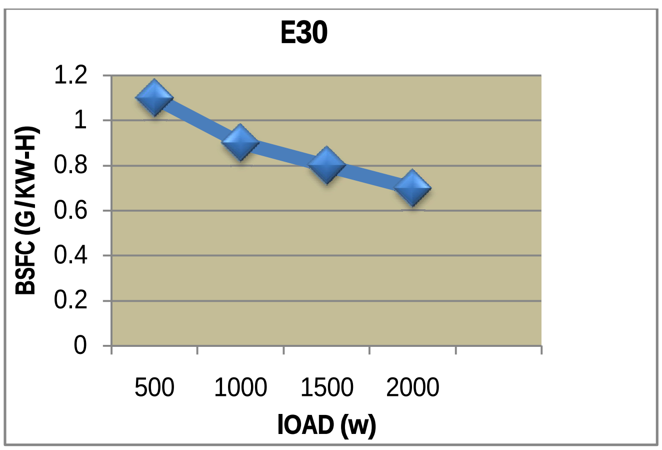

Fig 1.8 Loads between BSFC

IV. CONCLUSION

The following conclusion are listed below-

1. It is not only the price reduction by Ethanol blending that matters but also the millions of liters of petrol that we save for future.

2. Various properties of petrol and ethanol like density, ignition temperature are similar. Also the two liquids can be mixed easily without any external agent.

3. Ethanol helps in clean and complete combustion as it provides oxygen during combustion and gives water as product of combustion.

4. Ethanol blends help with higher octane rating and lower exhaust emissions.

5. Ethanol blends produce higher torque, compared with petrol at all speeds.

6. CO and HC emissions are lowered when ethanol percentage in petrol increases.

7. This chapter contains the conclusions of the present work besides scope for future work in the same area above results it is clear that Engine is running smoothly on pure petrol also. If we can agree for slight compromise with the engine performance parameters, we can use the different blend with diesel fuel. In blending fuel all the emission parameters found to be lower compared to petrol.

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