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Control of Exhaust Emissions by using Bimetallic (Brass+Al) Piston on Two Stroke Spark Ignition Engine

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Abstract*— As day by day there is technological development seen all around world, the research work is progressing but the resources involved in them are depleting rapidly. The demand of resources and fuels for the technological development is increasing day by day. In order to keep the pace of development high there is a need to think about some alternate fuel with better efficiency which would help overcome the demand keeping in mind the resources for the future generation. An alternate fuel needs to be developed and researched upon which could help us get greener and better tomorrow. Two stroke engine is one which completes all cycles of operations in one revolution of the crankshaft. Experiment has to be conducted on two-stroke spark ignition engine by using bimetallic piston runs with methanol blended gasoline and ethanol blended gasoline (20% of methanol blended and 20% of ethanol blended with 80% of gasoline by volume respectively) to control un-burnt hydrocarbons (UBHC) emissions, carbon mono oxide (CO) emissions. These pollutants are the roots for health problems to human beings and cause hazardous in nature but also encounter the environment. Hence control of these pollutants call for immediate attention .Aluminum and brass plates (1mm and 0.5mm) fixed on piston crown with help of rivet arrangement. A microprocessor-based analyzer was used for the measurement of un-burnt hydro carbon (UBHC) and carbon monoxide (CO) in the exhaust of the engine at various magnitudes of load. Brake thermal efficiency increased with ethanol blended gasoline with both variants of the engine. Bimetallic piston engine showed improved performance when compared to base piston engine with both different test fuels. In comparison with ethanol blended gasoline reduced pollutants less effectively than the methanol blended

Keywords— ***Two stroke engine, un-burnt hydro carbon (UBHC), Carbon Monoxide (CO).***

INTRODUCTION

Alcohol blended gasoline enhanced engine performance and declined pollution levels when compared to pure gasoline on basic engine (1-6). Carbon monoxide (CO) and un-burnt hydrocarbons (UHC), major exhaust pollutants founded due to incomplete combustion of fuel, cause abound human health disorders7-12. Such pollutants are motive for detrimental effects13 on animal and plant life, also harmful to environment producing some negative causes. The changes in the machine basic structure 14, 15 with copper coating on piston crown and inner side of cylinder head improves engine performance as copper and its alloys are good conductor of heat and combustion is improved with copper coating. The present paper evaluated the performance of bimetallic piston engine (BPE) with ethanol, methanol blended gasoline and compared with basic engine (BE) with pure gasoline operation document and are identified in italic type, within parentheses, following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

I. MATERIALS AND METHODS

Fig 1: Investigation Set-up

The machine which is nothing but the, SI engine (brake power 5.75 kW at the rated speed of 5000 rpm) is coupled to a electrical loaded dynamometer for measuring brake power. Compression ratio of engine is 6:2 fuel consumption of engine are measured with stop watch. In bimetallic piston engine, piston crown is cut to a size of 1.5mm.Placing 1mm thickness aluminum plate of 50mm diameter, 0.5mm thickness brass plate of 50mm diameter with help of riveted arrangement. These bimetallic plates have very high strength, very minute linear expansion and do not wear off even after 50 h of operation[15]. The process is evaluated at different magnitudes of electrical loads on the engine. CO and UHC emissions in engine exhaust are measured with five gas analyzer. Experiments are carried out on BE and BPE with different test fuels such as 20% by its composition under one operating conditions that is without catalytic converter.

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II. RESULTS AND DISCUSSIONS

Table.1 Data of performance parameters at a compression ratio of 6:2 and speed of 5000 rpm with different test fuels with different configuration of the engine

Parameters	Basic Engine BE		
	Gasoline	Ethanol	Methanol
Peak BTE (%)	18	21	20

Parameters	Bimetallic Piston Engine BPE		
	Gasoline	Ethanol	Methanol
Peak BTE (%)	20	25	23

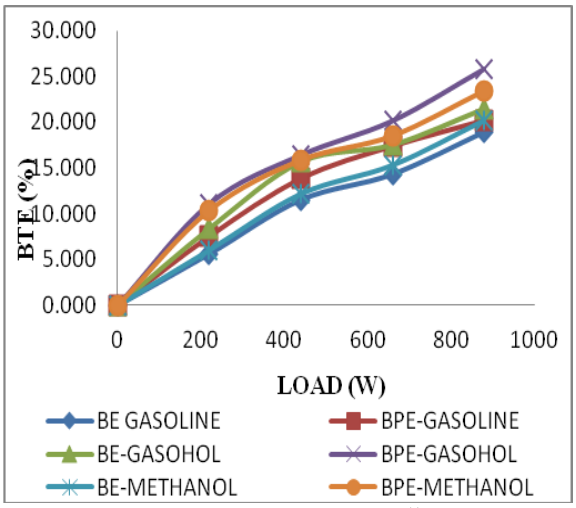

Figure II. Load Vs Brake Thermal Efficiency

Higher peak BTE is observed with ethanol blended gasoline operation over natural gasoline due to lower stoichiometric air requirement of ethanol blended gasoline over natural gasoline operation. Though theoretical air demand of the constituent parameter methanol is very less, the range of its calorific value is also less which leads to produce lower peak BTE. BPE showed higher thermal efficiency when compared to BE with

various varieties of fuels, Ethanol blended gasoline operation on BPE produced higher peak BTE in comparison with methanol blended gasoline as methanol absorbs more amount of heat from ambience due to its high latent heat, catalytic activity decreases with methanol operation leading to produce less peak BTE in comparison with gasohol operation.

Table.2 Data of performance parameters at a compression ratio of 6:2 and speed of 5000 rpm with different test fuels with different configuration of the engine

Parameters	Basic Engine BE		
	Gasoline	Ethanol	Methanol
BSFC (Kg/KW-hr)	0.429	0.406	0.445

Parameters	Bimetallic Piston Engine BPE		
	Gasoline	Ethanol	Methanol
BSFC (Kg/KW-hr)	0.403	0.336	0.384

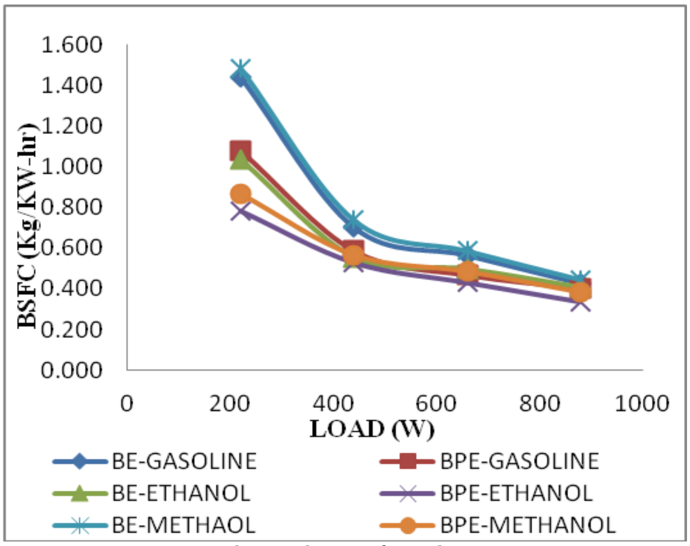

Figure III. Load Vs Brake Specific Fuel Consumption

For bimetallic piston engine specific fuel consumption reduced for both gasoline and gasoline blended ethanol and methanol. Slightly lower values of gasoline blended ethanol and methanol were due to lower calorific values and higher viscosity, density.

Table.2 Data of CO (%) emissions at a compression ratio of 6:2 and speed of 5000 rpm with different test fuels with different configurations of the engine

Parameters	Basic Engine BE		
	Gasoline	Ethanol	Methanol
CO (%)	3.6	1.7	1.5

Parameters	Bimetallic Piston Engine BPE		
	Gasoline	Ethanol	Methanol
CO (%)	2.6	0.8	0.79

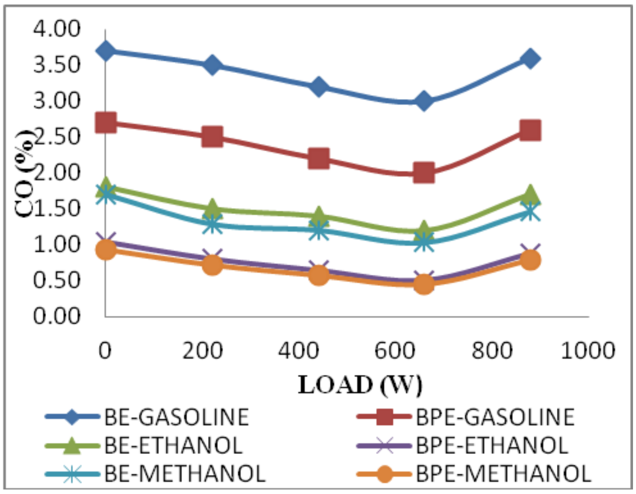

Figure IV. Load Vs Carbon monoxide

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Show the variation of pollution levels of CO and UBHC at a compression ratio of 6:2 and speed of 5000 rpm with different test fuels with different configurations of the engine. Ethanol, methanol blended gasoline decreased CO emissions at peak load operation when compared to pure gasoline operation on different configurations of the machine, are broken into smaller molecules as well it gets rejected with alcohol.

The process of burning certain components gives water vapour as output. So the blends in it have low air filled requirements when it is compared with gasoline. So oxygen content is more Thereby the component alcohol has its own structure

Therefore more oxygen that is available for combustion with the blends of alcohol and gasoline, leads to reduction of CO emissions. Ethanol, methanol dissociates in the combustion chamber of the engine and forms hydrogen , which helps the fuel-air mixture to burn quickly and thus increases combustion velocity, which brings about complete combustion of carbon present in the fuel to CO2 and also CO to CO2 thus makes leaner mixture more combustible, causing reduction of CO emissions. BPE reduces CO emissions in comparison with BE. Brass acts as catalyst in combustion chamber, whereby facilitates effective combustion of fuel leading to formation of CO2 instead of CO. UBHC emissions replace the same trend as CO emissions in BPE and BE .

Table.3 Data UHC (ppm) emissions at a compression ratio of 6:2 and speed of 5000 rpm with different test fuels with different configurations of the engine

Parameters	Basic Engine BE		
	Gasoline	Ethanol	Methanol
UBHC (%)	1950	1443	1408

Parameters	Bimetallic Piston Engine BPE		
	Gasoline	Ethanol	Methanol
UBHC (%)	1298	1154	986

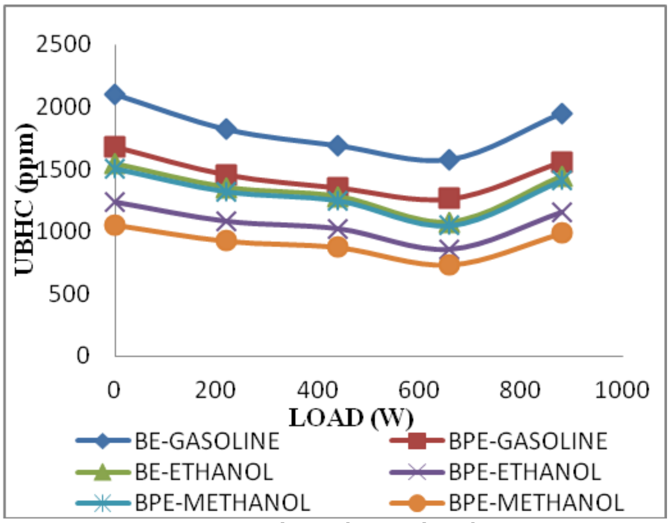

Figure V. Load Vs Unburn Hydrocarbons

III. CONCLUSION

- ❖ Brake thermal efficiency is 6.96% higher for E20 of bimetallic piston engine at all loads than pure gasoline in basic engine while at 880 W loads.
- ❖ Brake specific fuel consumption is 0.093Kg/KW-hr lower for E20 of bimetallic piston engine at all loads than pure gasoline in basic engine while at 880 W loads.
- ❖ Hydro carbon emission is 965 Ppm lower for M30 of bimetallic piston engine when compared to pure gasoline of basic engine at load 880W.
- ❖ Carbon monoxide emissions are 2.808% lower at M30 of bimetallic piston engine when compared to pure gasoline of basic engine at full load.

Performance parameters enhanced with ethanol blended gasoline operation when compared with methanol blended gasoline operation with both BE and BPE. However, pollution levels decreased with methanol blended gasoline operation in comparison with gasohol operation.

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