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EXPERIMENTAL ANALYSIS ON SINGLE CYLINDER FOUR STROKE DIESEL ENGINE USING HONZE OIL WITH AIR GAP INSULATED PISTON

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Abstract*: Today, in developing countries like India, most of the transport vehicles are run on diesel fuel. Diesel fuelled vehicles discharge significant amount of pollutants like CO, HC, NOx, lead, soot, which are harmful to the environment. Also the world's fossil fuel reserves are depleting rapidly due to exponential growth of population and increased usage of Technology. To overcome this, bio fuels are used as alternate fuels for IC engines. In this project, honze oil is used as an alternate fuel with air gap insulated piston. Some gap of (2mm) is provided between piston crown (i.e. of brass) and piston body (i.e. of aluminium). This is done in order to retain more amount of heat inside the combustion chamber which promotes the complete combustion of the fuel. Brass is of low thermal conductivity material is attached to aluminium, high thermal conductivity material with help of some rivets or welded joints. The heat whatever concentrated inside the combustion chamber cannot be escaped due to this type of arrangement where brass piston crown acts as thermal insulation. This project shows the better brake thermal efficiency results compared to conventional piston arrangements.

Keywords:single cylinder four stroke engine, air gap insulated piston, honze oil.

I.INTRODUCTION

The most commonly used fuel for many automobiles is diesel. Though it has high compression ratio, it produce for reasonable efficiency, it emits large amount of harmful exhaust gases to the atmosphere.In order to overcome the emission problems, alternate fuels are used widely for automobiles. In this project, honze oil has been used in the place of conventional fuel. Also many of the changes have been taken in the arrangement of an internal combustion engine to increase the efficiency of the engine. Likewise, in this project, the conventional piston is replaced with air gap insulated piston. The term air gap insulation has the construction of piston crown with low thermal conductivity material like brass and piston body with high thermal conductivity material like aluminium. Some gap of 2mm is provided for insulation purpose at the combustion chamber at the top of the piston. Also the low thermal conductivity material acts as thermal insulators inside the engine cylinder. Also fuel economy of engines is greatly improved over decades as there is a enormous usage of automobiles. The overall research of the internal combustion engines meets the problems of fuel economy, efficiency etc.The air gap insulated piston concept is introduced to avoid thermal losses and to attain highest combustion efficiency resulting the increased efficiency of the engine. In this project, the honze oil diesel blends are used along with air gap insulated piston.

II.LITERATURE SURVEY

Cole. R.M. et al (1985) he made an air gap insulated piston designed for reduced heat loss was evaluated by examining its influence on the coolant heat rejection, engine performance and exhaust emissions of a single cylinder divided chamber diesel engine. At 1000rpm and 1500rpm engine speed, use of the low heat rejection engine (LHR) piston resulted in a reduction in total coolant heat rejection ranging 3% at light load to 5-7% at full load, in general reduction in hydrocarbon, carbon monoxide and smoke emissions, in an increase in oxides of nitrogen, and insignificant improvement in brake specific fuel consumption only at light loads.

You Zhang Shanghai et al (1998) for a vehicle engine, the piston is the essential part that bears heavy mechanical and thermal loads; therefore it has very nearly influences on the reliability and durability of an engine. So the piston greatly hire less the increase of power gas engine.

K. Kumarasekaran et al (1994) made a novel design of an air gap insulated piston has been proposed which is expected to give a larger life compared to the existing designs. The new composite piston is made of a crown piece which is fitted to the base of piston through a gasket by an interference fitting and locked by oral shaped riveted radially a steady state two dimensional thermal analysis is performed on the piston to predict the temperature distribution, and then a thermo elastic analysis is performed on the piston. Melvin Woods et al (1990) made an highly effective thermal insulating piston concept with high projected durability characteristicshas been developed by means of computer aided modelling, thermal rig bench screening, and small-bore engine testing. The piston concept is composed of a relatively low thermal

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conductivity titanium alloy type 6242 structural material and 1.25mm thick slurry densified thermal barrier carrying.

III. EXPERIMENTATION

a) Air gap insulated piston:

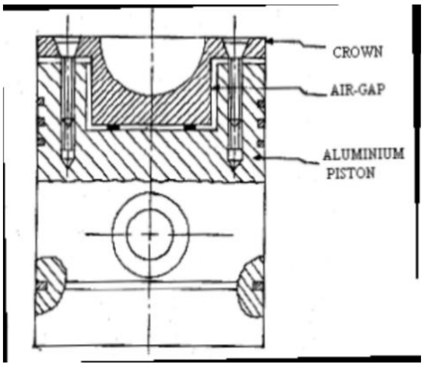

Fig.1 cut section air gap insulated piston

In the present experiment, an air gap of 2mm is provided between the piston crown and piston body. The air gap between the two components acts as an insulator for the heat transfer through the piston and provides more heat inside the chamber.

b) Experimental setup:

Fig.2 Diesel Engine test rig

Fig.3 loading arrangement of the engine t

Fig.4 Honze oil Diesel blends B10, B20, B30, and B40.

Before starting the engine, the blends of honze oil and diesel i.e. B10, B20, B30, B40 are prepared. The experimental setup has electrical loading equipment, single cylinder four stroke diesel engine test rig. The blends are to be heated as to attain viscosity in a heating pan [7]. The fuel is supplied through house pipe lines from the fuel tank. The engine is started by cranking the flywheel, through the electrical loading system, four loads at 0 W, 500 W, 1000W, 1500W, 2000W are applied on the engine correspondingly [8]. When the load is applied, the engine has to attain some consistency for the further procedure, nothing but it has to attain stability. Then the time taken for 10 C.C of fuel is taken down in sec[9]. Also while attaining stability of the engine to the corresponding load, the voltmeter and ammeter readings have to be taken. The same procedure is carried out for all the remaining loads taking down the important readings [10].

IV.GRAPHS

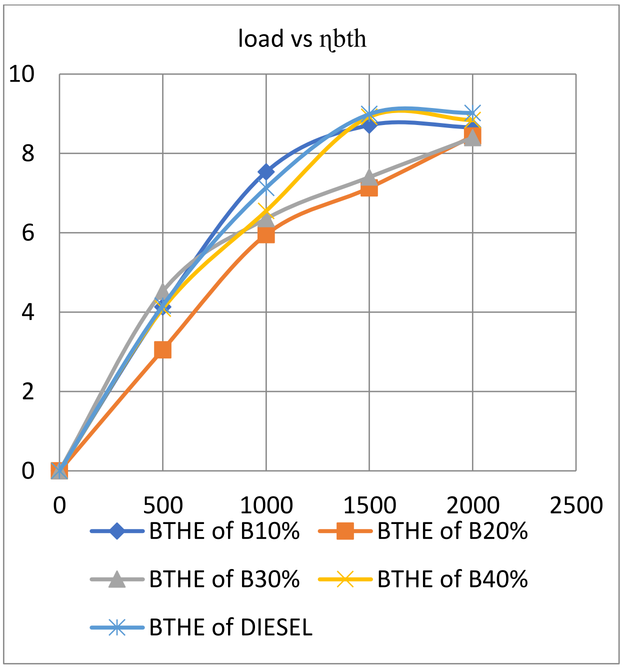

Fig 5. Variation of brake thermal efficiency at various loads withdifferent blends

From the above graph, B10 blend has higher brake thermal efficiency compared to B20, B30, B40 blends while working with the air gap insulated piston. The air gap insulated piston reduces heat losses providing as an insulator. So that the combustion efficiency is increasedresulting complete combustion of fuel i.e. increased efficiency.

V.RESULTS AND DISCUSSION

The maximum effective results are seen at 1500W load on the engine.

TABLE1

RESULTS OF EMISSIONS AND BRAKE THERMAL EFFICIENCY OF DIFFERENT BLENDS.

Type of fuel	η_{bth}	CO	CO2	HC	O2	NOx
B10	8.99	2.656	8.11	403	21.03	244
B20	8.921	2.53	8	351	21.25	277
B30	7.4028	2.362	6.9	207	21.6	296
B40	7.1342	2.1	6.6	337	21.58	278
DIESEL	8.712	1.627	6.1	230	21.42	261

From the above observations, the blend B10 has the highest value of the brake thermal efficiency, and has less NO x emissions under the load condition of 1500W.Whereas in case of conventional diesel fuel when working with air gap insulated piston, the value of brake thermal efficiency is lesser when compared to blend B10.

The concept of air gap insulated piston is introduced mainly to reduce heat losses from the piston in the combustion chamber and it allows more heat to retain inside the combustion chamber which further promotes complete combustion of the fuel resulting in the increased efficiency of the engine.

VI. CONCLUSION

1. The piston crown material brass acts as an insulator as it comprises of low thermal conductivity. With this, heat cannot be transferred or escapes from the piston and is supplied to the entering fresh charge. This retains more heat inside the combustion chamber and helps in complete combustion process and increases the exhaust gas temperatures and brake thermal efficiency.

2. The high temperature of the exhaust indicates the availability of considerable energy in the exhaust gases which can be used for operating a low pressure turbine.

3. Due to these high temperatures concentrated inside the combustion chamber the volumetric efficiency of the engine will be dropped. This further reduces the amount of air inside the chamber. This can be compensated by using a turbo charging system.

4. The high temperature in the chamber enables the use of low cetane fuels and supports the multi-fuel handling capability.

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