Performance of 3- Cylinder 4 Stroke SI Engine under the Influence of Permanent Magnetic Field

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Abstract- *In recent years due to excessive use of fossil fuel in a vehicular and industrial purpose its stock will almost come to end within few decades. Hence there are so many efforts towards the improving power output and reducing emissions from IC engine taking place. The experiments comprise the use of permanent magnets with different shapes like rectangular, cylindrical, square & the present study investigates the effect of magnetic field on the performance of three cylinder four stroke variable speed petrol engine. The study concentrates on the effect of magnetic field the engine performance parameters such as fuel consumption, air consumption, break thermal efficiency and exhaust emissions like CO, HC, NOx . The magnetic field with strong permanent magnets(3000 Gauss) is applied along the fuel line immediately before carburettor. The experiments were conducted at different engine loading conditions & it is found that there is appreciable changes in engine performance and emissions. The fuel consumption rate gets reduced as effect of that efficiency of engine is increased in some extent and emissions gets reduced as combustion of fuel is maximum.*

Keywords- Variable speed petrol engine, Strong permanent magnets, Exhaust gas analyser, etc.,

I. INTRODUCTION

The effect magnetic field on the biological and mechanical systems is the subject of study of interest from last fifty years. Many studies suggest that magnetic field has positive effect on the performance of the system. The study related to the effect of magnetic field on the fuel of I.C. engine is gaining importance in order to reduce the fuel consumption and the engine emissions [8].Since fuel of I.C. engine is a complex molecular arrangement of hydrocarbon as Fuel mainly consists of hydrocarbons .The simplest of hydrocarbon is methane. The chemical composition of methane is CH4.It has the major (90%) constituent of natural gas (fuel) and an important source of hydrogen [5]. The greatest amount of releasable energy lies in the hydrogen atom. As an example, in octane (C8H18) the carbon content of the molecule is 84.2%. When combusted, the carbon portion of the molecule will generate 28,515 KJ/Kg of carbon. On the other hand, the hydrogen, which comprises only 15.8% of the molecular weight, will generate an amazing energy- 22,825 KJ /Kg of H2. In the present work, it is proposed to study the effect of magnetic field on the internal combustion (SI) engine.

EFFECT OF MAGNETIC FIELD ON FUEL MOLECULE

Hydrogen occurs in two distinct isomeric forms Para and ortho. It is characterized by the different opposite nucleus spins. The ortho state of hydrogen has more effective than para state for maximum complete combustion. The ortho state can be achieved by introducing strong magnetic field along the fuel line [5]. Hydrocarbon molecules form clusters, It has been technically possible to enhance van der Waals' discovery due to the application of the Magnetic field, a high power, permanent magnetic device strong enough to break down, i.e. de-cluster these HC associations, so maximum space acquisition for oxygen to combine with hydrocarbon [8]. Thus when the fuel flows through a magnetic field, created by the strong permanent magnets, the hydrocarbon change their orientation (para to ortho) and molecules of hydrocarbon change their configuration, at the same time inter molecular force is considerably reduced. This mechanism helps to

disperse oil particles and to become finely divided. This has the effect of ensuring that the fuel actively interlocks with oxygen and producing a more complete burn in the combustion chamber. Figure.1 shows the clusters of hydrocarbons changed with the influence of magnetic field and they are more dispersed.

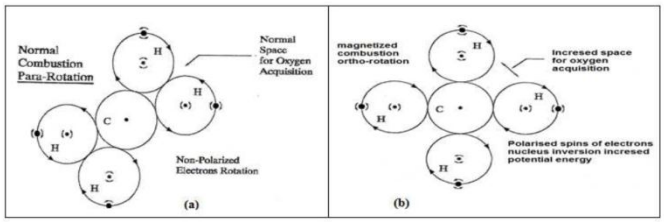

Fig 1 Conversion of para to ortho form of hydrogen.[5]

II. EXPERIMENTAL SETUP

Three cylinder four stroke petrol engine is connected to hydraulic dynamometer with the help of coupling. On the inlet passage of fuel supply to the engine, a burette is located which is useful for carrying out fuel consumption

measurement. There is an arrangement of direct supply of fuel to the engine from fuel tank or fuel can be supplied to the engine from the burette.This is possible with the 3 way cock arrangement.there is an arrangement of airbox with orifice locating on it for supplying the Air to the engine.U tube manometer filled with water as man metric fuel is fitted on panel.On end of manometer is connected to the airbox and other end open to atmosphere with the airbox arrangement it is possible to carry out air flow measurement. before starting the engine,the lubricating oil of required grade is to be fill in the crank case from top. The level of it can be checked with help of dip stick. The accelerator cable of carburettor is attached to the lever fitted on front panel. The electric supply to the ignition system of the engine is given by battery.

The engine exhaust manifold is connected to exhaust gas calorimeter which is simply a heat exchanger. It consist of number of tubes through which cooling water flows which is absorbs heat from exhaust gases coming from engine. Thermocouples exhaust gas inlet, outlet and water outlet are inserted at suitable location. This arrangement is useful for measuring the heat carried away by exhaust gases.

The cooling water supply is given to engine jacket which absorb heat from cylinder and cylinder head with the thermocouple inserted, The outlet temperature of cooling water can be measured. The flowrate of water coming from water jacket and from calorimeter is measured by collecting a water in a jar from certain period of time. All thermocouples are connected to digital temperature indicator which gives the direct temperature reading on panel board. The speed measurement can be carried out by inserting the tachometer point in the hole made at the end of dynamometer shaft.

Fig 2. Photographic view of 3 cylinder 4 stroke SI engine

Sr.No.	Description	Specification
1	Model	Maruti 800(4S-vertical)
2	Maximum output	27.6kW @ 500rpm
3	Maximum Torque	59 N-m @ 2500rpm
4	No. of cylinder	3
5	Bore x Stroke	66.5*72mm
6	Compression Ratio	9.2:1
7	Cubic Capacity	796cc
8	Lubrication System	Pressure feed system
9	Cooling System	Water cooling
10	Fuel Supply system	MPFI
11	Dynamometer	Hydraulic dynamometer
12	Calorific value	42500kJ/kg
13	Specific Gravity of Petrol	0.76
14	Dynamometer Radius	200mm
15	Coefficient of discharge for orifice	0.62
16	Orifice Diameter	35mm

ENGINE SPECIFICATIONS

Magnetic field effect on fuel consumption

The experimental results show that the fuel consumption of engine was less when the engine with fuel magnet than that without fuel magnet. Always less amount of fuel was consumed with the fuel with magnetic field. The brake power vs fuel consumption graph is as shown in fig.4

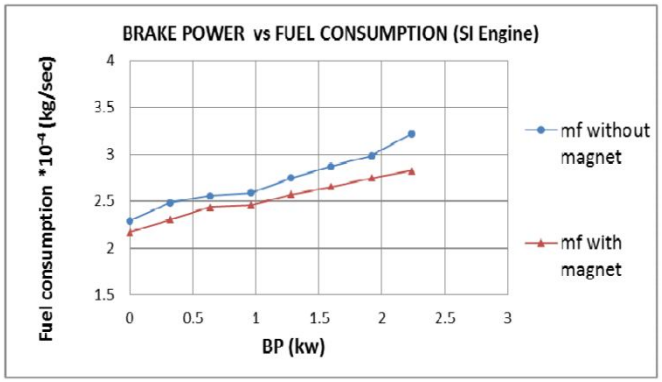

Fig 3.Variation of fuel consumption with brake power

It is clear that the fuel consumption is reduced maximum about 12% at maximum break power that is at 2.2 kw. As the fuel consumption rate reduces with the application of magnetic field the brake thermal efficiency goes on increasing.The result is better fuel economy.

Magnetic field effect on brake thermal efficiency

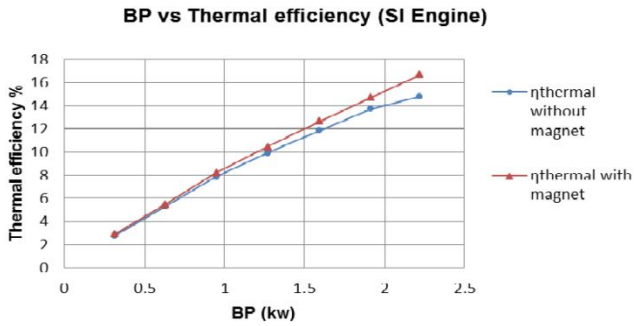

Fig.4 Variation of Thermal efficiency with brake power

It is clear that the brake thermal efficiency goes on increasing with the application of magnetic field. The percentage increase of brake thermal efficiency is about up to 11 %.

Magnetic field effect on exhaust emissions

The emission readings were carried out with the help of five gas analyzer. The exhaust emissions like CO, CO2, HC, NOX were measured at different load conditions. The emission graphs shows the variation of curve with respect to Brake power.

Magnetic field effect on HC emissions

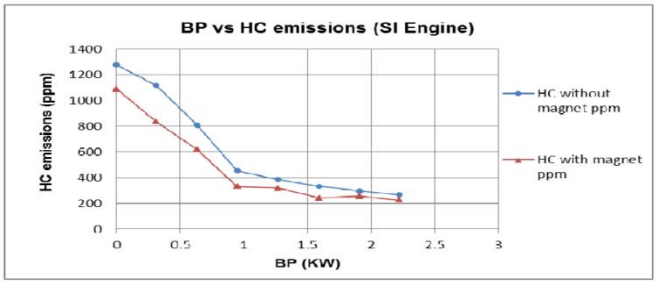

Fig 5 Variation of HC emissions with BP

Fig 5 Clearly shows the effect of magnetic field on HC emissions, and the percentage reduction of HC. The HC emission reduction in the application of magnetic field maximum about 26 % at 0.96kw

Magnetic field effect on CO emissions.

CO emissions with the application of magnetic field gets reduced as compared to the CO emissions without magnetic field . In both the cases the CO emissions gets increased up to 3 kg load and after that it gets reduced. The CO reduction in the application of magnetic field is maximum of 11.5 % at 0.64 kW and at load of 2 kg

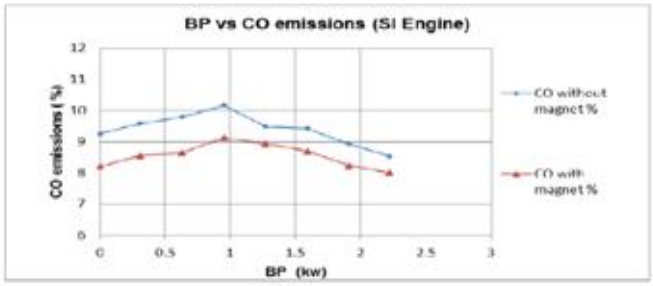

Fig 6 Variation of CO_2 emissions with BP

Magnetic field effect on CO_2 emissions.

The effect of magnetic field in the reduction of CO2 emissions is shown in fig 7. The percentage increase of CO2 as compared with the percentage of CO2 without magnet is about 11.2 %.

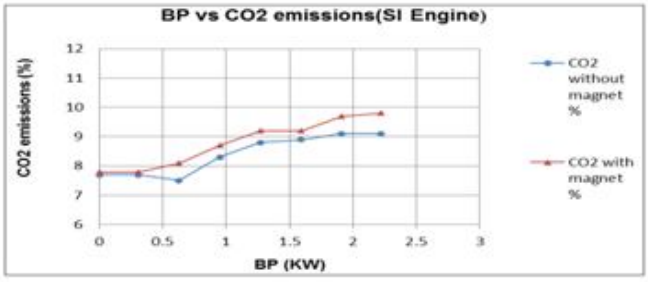

Fig 7 Variation of CO_2 emissions with BP

Magnetic field effect on NO_x emissions

The NO_x emission gets increased with the application of magnetic field as compared to the NOx without magnetic field. Here the magnetic field shows adverse effect.The maximum increase of NOx emissions are 19% at 1.60 kw.

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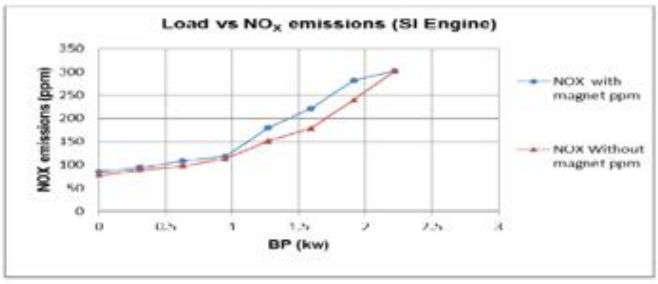

Fig 8. Variation of NO_x emissions with BP

III. CONCLUSION

There is significant increase in brake thermal efficiency due to the reduction of fuel consumption and also thereduction in the exhaust emissions. The experiments show the magnetic effect on fuel consumption reduction was upto

12%. CO reduction was range up to 11%. The effect on NO emissions increases range up to 19%. The reductionof HC emissions was range up to 27%.

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