Experimental Investigation of The Effect of Magnetic Energization of Fuel in The Performance of a Four Stroke Petrol Engine

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Abstract- Now-a-days the world of automotive industry and transportation field is facing a harmful situation in the context of air pollution. Combustion of petroleum fuels in automobile vehicles stand a serious reason for the widespread release of pollutants such as CO, HC, NOx and many other dangerous compounds in the atmosphere, which results in the deterioration of air quality and consequent health hazards, in rural as well as urban areas. The two major issues which face our present-day automobile related field are air pollution and energy economy. To enhance the fuel efficiency of SI engines and thereby reducing harmful emissions, experimental investigations are conducted by powering the fuel by applying an external force of a magnetic field. Accordingly, the aim of the present experiment is a magnetic device for processing the fuel supplied to the engine, which is easy to provide, and which uses a magnetic field configuration to maximizes fuel economy and reduces the exhaust emissions from the automobiles. The experiments prove that the magnetic effect on fuel consumption has reduced up to 14.2% and 21.42% for ring and bar magnet respectively when compared to normal running conditions. Also, a considerable increase in brake thermal efficiency of 20.3% and 26.2% for ring and bar magnets respectively when compared to normal operating conditions. The pollutants such as CO, HC and NOx are decreased with the use of magnetic energization of fuel in both cases of ring and bar magnets. The reduction in CO emission is 16% and 32% for ring and bar magnets respectively. Similarly, the rate of reduction in HC emission is 7.5% and 8% in cases of ring and bar magnets respectively.

Keywords: magnetism, fuel consumption, exhaust emission, brake thermal efficiency.

1.INTRODUCTION

It is a well-known accepted fact that a hydrocarbon fuel can be polarized by exposure to an external force such as magnetic force. Any type of a fuel molecule comprises of a few atoms, which is made up of protons and electrons surrounding the nucleus. Magnetic forces already exist with them and hence they already have positive and negative electrical charges. However, due to the absence of realignment of these molecules, the fuel is not actively associated with oxygen during combustion. Therefore, the molecules of fuel or hydrocarbon chain must be ionized and realigned. This can be achieved through the application of a strong magnetic field in the of fuel line.

As the fuel mainly consist of hydrocarbons and when it flows through a magnetic field, the hydrocarbon changes their orientation and the molecules of hydrocarbon change their configuration, Meanwhile, the intermolecular force is considerably depressed or decreased. These mechanisms are supposed to help disperse oil particles and to become finely divided. As a result of this phenomenon, the fuel particles will have an active interlocking with oxygen and consequently it leads to a better combustion. The output is better fuel economy and reduction in the emission of hydrocarbons, CO and NOx.

2. METHODOLOGY

With the aid of certain arrangements, a magnetic field is introduced in the path of the fuel to the engine and its effect on the various parameters such as SFC, brake thermal efficiency and various emission characteristics are examined and measured. Compared these results with normal running case. The materials and equipment used are described below.

2.1 MAGNETIC DEVICES

It consists of small magnets which can be kept in a shell, which is clipped at the appropriate place in the fuel line. N42 20x10x40 mm thick Neodymium bar magnet and N42 10mm diax5mmthick Neodymium stepped ring magnet are used for this experiment. The photographic view of the magnetic devices is shown in fig.2.1.

2.2 ENGINE

The engine used for this test is a single cylinder four stroke air cooled variable speed petrol engine with the following specifications.

2.2.1 TEST ENGINE SPECIFICATIONS

Engine Parameter	Specifications
Make	Honda
Model	GK200
Engine Net Power	2.6kW at 3600 rpm
Engine Max.Net Torque	7.9 Nm@2500 rpm
Bore	87.5mm
Stroke	110mm
Compression ratio	11.5
Brake drum diameter	0.2116m
Rope Thickness	6 mm

2.3 INSTALLATION

1. Installation Position: It is just before the carburetor injector at inlet pipe for maximum alignment and maximum effect.
2. Polarity of Magnet: The fuel line is magnetized between polarity, which helps to burn fully, which produces more output, better fuel economy and increased power. Also decreases the emitting pollutants.
3. Diameter of Magnetic Device: If the diameter is close to the fuel line, then maximum result will be obtained.
4. Length of Magnetic Device: It will depend upon the quantity of fuel to be processed and intensity of the process.
5. Selection of Permanent Magnet: The magnet should have a suitable temperature to keep their magnetic characteristics at the operation temperature to which they are exposed.
6. Magnetic Insulation: To protect the magnet from the heat produced by the engine, he magnet is insulated with aluminum, coper or plastic to prevent heating and radiation.

3.EXPERIMENTAL SETUP AND PROCEDUE

The setup containing the engine, an electrolysis unit, permanent magnets and the exhaust gas analyzer brake power of the engine is measured by using a rope brake dynamo meter. The schematic layout is shown in fig.3.1.

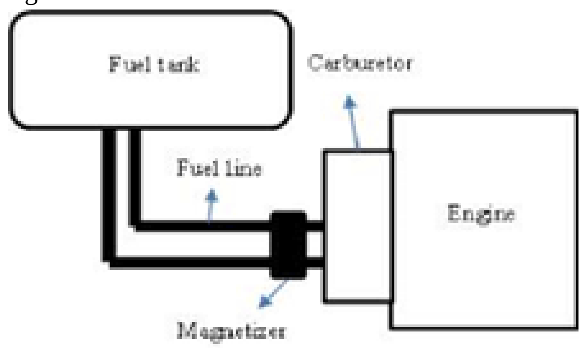

Figure 3.1 Experimental Layout and Setup

The engine was set ready to run on petrol. The fuel system I arranged in such a way that the fuel consumption is measure accurately. The fuel consumed by the engine is found by using the burette apparatus. A stopwatch is employed to observe the time taken to consume a certain quantity of fuel. The exhaust gas analyzer measures the rate of pollutants such as CO, HC, NOx and CO_2 concentrations. The speed of the engine is checked and maintained at a constant speed of 3000 rpm. The time taken for fuel consumption and exhaust emissions are observed for various load conditions.

The present experiment comprises he use of permanent magnets, which is provided on the fuel line just before the carburetor. Studied and observed the effect of magnets on engine performance and fuel consumption. Also noted the emitted pollutants from the exhaust gas analyzer.

4. RESULTS & DISCUSSIONS

Experiments were conducted to get the variations of brake thermal efficiency and SFC at varying load conditions (or brake power). The values of different emissions such as HC, CO, NOx and CO_2 were also noted. The impact of magnetization on these characteristics were analyzed. These results were compared with the normal engine performance parameters and the variations were given.
Keeping the engine speed at 3000rpm with varying load, the percentage change in performance parameters are compared and shown below in table 4.1.

Table 4.1 Comparison of Performance Parameters

Performance parameters	With ring magnet	With bar Magnet
Increase in efficiency (%)	20.3	26.2
Decrease in SFC (%)	14.2	21.42

4.1Effect of Magnetic field on Brake Thermal Efficiency

The variation of brake thermal efficiency with various values of brake power at a constant speed of 3000 rpm is plotted, which is shown fig.4.1. Brake thermal efficiency without magnets and with magnets were plotted. The efficiency is increased by 20.3% and 26.25 with the use of ring and bar magnets when compared to normal conditions.

Table 4.2 Effect of Magnetization on Efficiency

Trial No.	BP kW	Brake Thermal Efficiency %		
		Normal	Ring Magnet	Bar Magnet
1	0	0	0	0
2	0.2	6.3	7.3	8.4
3	0.4	7.2	8.2	9.2
4	0.6	9.1	10.1	11.2
5	0.8	12	14	15
6	1	11.8	14.2	14.9

4.2 Effect of Magnetic field on SFC

The results of SFC with different values of brake power at the rated speed of 3000rpm with and without magnets were plotted as shown in fig.4.2. From this plot with magnets the SFC is less than the corresponding values without magnets. This is because due to complete combustion, the fuel is utilized in a better and efficient manner so that no fuel is wasted. Bar magnets give much more better results than ring magnet. SFC is reduced by 14.2% and 21.42% in ring and bar magnets, comparing with normal conditions.

Table 4.3 Effect of Magnetization on SFC

Trial No.	BP kW	Specific Fuel Consumption (Kg/kW.hr)		
		Normal	Ring Magnet	Bar Magnet
1	0.2	1.4	1.3	1.28
2	0.4	1.8	1.5	1.5
3	0.6	0.8	0.75	0.7
4	0.8	0.7	0.6	0.58
5	1	0.7	0.6	0.55

4.3 Effect of magnets on CO emission

The effect of magnetic field processing of fuel on the emission CO at various conditions of BP were plotted, which is shown in fig.4.3. From this result with magnetic field application, the rate of emission of CO is reduced by 16% and 32% compared with normal running condition in cases of ring and bar magnets respectively.

Table 4.4 Effect on CO Emission

Trial No.	BP kW	CO Emission (ppm)		
		Normal	Ring Magnet	Bar Magnet
1	0	4000	3300	2800
2	0.2	4900	4000	3000
3	0.4	5900	4300	3600
4	0.6	6400	5000	4500
5	0.8	7300	6200	5200
6	1	8500	7100	5800

4.4 Effect of fuel magnetization on HC emission

The variations in the emission of HC with and without magnets were plotted at the speed of 3000rpm as shown fig.4.4. From this plot, the HC emissions were reduced by 7.55 and 8% in ring and bar magnets respectively when comparing with normal conditions.
Table 4.5 Effect on HC Emission

Trial No.	BP kW	HC Emission (percentage)		
		Normal	Ring Magnet	Bar Magnet
1	0	1.3	1.25	1.2
2	0.2	1.4	1.3	1.3
3	0.4	1.6	1.32	1.45
4	0.6	1.7	1.2	1.55
5	0.8	1.8	1.63	1.64
6	1	1.8	1.64	1.63

4.5 Effect of fuel magnetization on CO2 emission

Rate of carbon dioxide emission with and without magnets at various values of brake power at constant speed of 3000rpm were plotted. Because of the magnetic effect, an active and complete combustion takes place which results in the formation of CO2 and water vapour. This result is clearly shown in the fig.4.5.

Table 4.6 Effect on CO_2 Emission

Trial No.	BP kW	CO_2 Emission (percentage)		
		Normal	Ring Magnet	Bar Magnet
1	0	2.5	3.25	4.2
2	0.2	3.2	4.16	5.4
3	0.4	4	5.2	6.5
4	0.6	4.8	6.2	8.2
5	0.8	5.3	6.8	9.0
6	1	6.5	8.5	11

Table 4.7 Comparison of Emission Parameters

Emission parameters	With ring magnet	With bar Magnet
% reduction in CO	16	32
% reduction in HC	7.5	8
% reduction in CO_2	1.3	1.7

5. CONCLUSION

This investigation shows that with the application of fuel magnetization in a petrol engine, the thermal efficiency can be increased and SFC & emission parameters such as CO, HC, NOx are reduced considerably when compared with the engine running at normal conditions without any magnets.

The experiment reveals that application of magnetic effect for fuel energization has reduced the fuel consumption by 14.25 and 21.42% for ring and bar magnets respectively in comparison with normal condition. Also, an increase in brake thermal efficiency of 20.3% and 26.2% for ring and bar magnets than normal conditions.

The rate of pollutants is reduced with the application of fuel magnetization.

Emission of CO is reduced by 16% and 32% for ring and bar magnets.

Emission of HC is reduced by 7.5% and 8% for ring and bar magnets.

On the other hand, the CO_2 emission is increased by 1.3 to 1.7 times than the normal conditions.

This study clearly shows that by the application of a magnetization to energize the fuel in an IC engine will improve its performance.

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