EFFECT OF APPLICATION OF MAGNETIC FIELD ON EMISSION OF PETROL ENGINE

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ABSTRACT

In normal circumstances, due to incomplete combustion, 30% of the fuel remains unburnt and is emitted in the form of black smoke, causing air pollution. Moreover, the carbon originating from incomplete fuel combustions, settles on the spark plug and on the engine piston, thus diminishing the compression capac ity of the piston and increasing the friction factor. This rate of carbon deposition increases especially in city driving, as the engine works much of the time at part throttle. Excess carbon decreases the compression ratio of the engine which ultimately robs the engine of its power, due to acute knocking or detonation. The above problem can be reduced to some extent by making use of paramagnetic property of oxygen present in the incoming air i.e. by passing the air through external magnetic field.

The experiment results inreduction in exhaust gas emissions in I.C. engine using magnetic field. Permanent magnets with different intensity installed on the fuel line show eye catching results. The exhaust gas emissions such as CO and HC are measured by using exhaust gas analyzer. The magnets help to disperse the hydrocarbon cluster into smaller particles which will improve the efficiency of combustion. This will maximize the combustion and thus reduce the unburned hydrocarbon in the emission.

1. Introduction

Internal combustion engines represent the main sector of hydrocarbon fuel consumption. On the other hand, as the fuel prices have increased sharply in the past few years due to high demand therefore, engineers and researchers are now interested in improving engines performance (increasing power output and reducing fuel consumption). Many studies suggest that magnetic field has positive effect on the performance of the system. Generally a fuel for internal combustion engine is compound of molecules. Each molecule consists of a number of atoms made up of number of nucleus and electrons, which orbit their nucleus. These molecules have not been realigned, the fuel is not actively interlocked with oxygen during combustion, the fuel molecule or hydrocarbon chains must be ionized and realigned. The ionization and realignment is achieved through the application of magnetic field. Applying a magnetic field to ionizing fuel to be fed to combustion devices we can ensure more complete combustion, obtaining a maximization of the fuel economy, improving the fuel efficiency.

The fuel is subject to the lines of forces from permanent magnets mounted on fuel inlet lines. The magnet for producing the magnetic field is oriented so that its South pole (red) is located adjacent the fuel line and its North pole (blue) is located spaced apart from the fuel line. It is now well accepted that a hydrocarbon fuel can be polarized by exposure to external force such as magnetism. The effect of such magnetism is the production of a moment created by the movement of the outer electrons of a hydrocarbon chain moving the electrons into states of higher principal quantum number. This state effectively breaks down the fixed valance electrons that partake in the bonding process of the fuel compounds. These states create the condition for free association of fuel particulars. The consequence of treating fuel with a high magnetic field is improved combustion of fuel and consequently increased engine power as well as reduced fuel consumption. Also the engine performance is very important for the better efficiency of vehicle, it is solve by increasing the fuel property. Increases the percentage in the complete combustion of the fuel in combustion chamber, Here we introduce the magnet and there magnetic field in the inlet line of the fuel supply.

2. LITERATURE SURVEY

The purpose of this chapter is to review the critical points of the project from the referred works. A magnetic

field is set up when a body, for example an iron bar magnet or the Earth's core, has a lot of unpaired electrons, we say, spinning in the same direction. The energy influence of these unpaired electrons is transmitted through space to affect other electrons in other bodies. A magnetic field is created by the magnetized iron bar magnet [1] 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 o0f 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. 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 [2]. This chapter explores the undesirable emissions generated in the combustion process of automobile and other IC engines. These emissions pollute the environment and contribute to global warming, acid rain, odors, and respiratory and other health problems. The major causes of these emissions are non-stoichiometric combustion, dissociation of nitrogen, and impurities in the fuel and air. The emissions of concern are hydrocarbons (He), carbon monoxide (CO), oxides of nitrogen (NOx), sulfur, and solid carbon particulates. Ideally, engines and fuels could be developed such that very few harmful emissions are generated, and these could be exhausted to the surroundings without a major impact on the environment. With present technology this is not possible, and after treatment of the exhaust gases to reduce emissions is very important. This consists mainly of the use of thermal or catalytic converters and particulate traps[3]. A hydrocarbon fuel consists of molecules made from atoms of carbon and hydrogen, which are collected by what are called covalent bonds. In such bonds an individual atom will share a pair of electrons with a neighboring atom. Two carbon atoms might share two electrons and by doing so they are held together. Each carbon atom can be connected in four different directions. For example, a given carbon atom might form a sharing partnership with two other carbon atoms in order to be a link in a chain. At the same time this same carbon atom will form a sharing partnership with two hydrogen atoms. Each of the bonds, the C-C bonds or the C-H bonds consists of shared and paired electrons. Normally the two electrons in each covalent bond have balanced opposite spins. "Normal" properties of non-polar molecules such as the hydrocarbons in gasoline, diesel fuel and related materials presuppose such electron spin-balanced chemical bonds [4].Today's hydrocarbon fuels leave a natural deposit of carbon residue that clogs carburetor, fuel injector, leading to reduced efficiency and wasted fuel. Pinging, stalling, loss of horsepower and greatly decreased mileage on cars are very noticeable. Most fuels for internal combustion engine are liquid, fuels do not combust until they are vaporized and mixed with air. Most emission motor vehicle consists of unburned hydrocarbons, carbon monoxide and oxides of nitrogen. Unburned hydrocarbon and oxides of nitrogen react in the atmosphere and create smog. Generally a fuel for internal combustion engine is compound of molecules. Each molecule consists of a number of atoms made up of number of nucleus and electrons, which orbit their nucleus. Magnetic movements already exist in their molecules and they therefore already have positive and negative electrical charges. However these molecules have not been realigned, the fuel is not actively interlocked with oxygen during combustion, the fuel molecule or hydrocarbon chains must be ionized and realigned. The ionization and realignment is achieved through the application of magnetic field [5].

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. 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 [6]. 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. It has been reported that declustering of the Hydrocarbon fuel molecules takes place due to application of magnetic field resulting in better atomization of the fuel better mixing of the fuel-air mixture [7]. 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, This helps in lowering the amount of un-burnt fuel. It reduces the Carbon Monoxide and Hydrocarbon percentages in the exhaust gases, thus enhancing the thermal efficiency of the I. C. Engine Many experimental tests have been carried out in the world for explaining the magnetic power for treating fuel lines for more efficient combustion and less pollution. Their invention relates to the control of combustion and pollution by means of magnetic field processing of fuel lines under a controlled magnetic field [7]. In terms of emission, for every 1kg of fuel burnt, there is about 1.1kg of water vapor and 3.2kg of carbon dioxide produced (BP Australia Limited, 2000). Unfortunately, there is no automobile engines have 100% combustion and so there is also a small amount of products of incomplete

combustion and these are carbon monoxide (denoted CO), unburned hydrocarbons, oxides of nitrogen, commonly called NOx and sulphur dioxide. This gaseous lead to hotter exhaust gas emission

Emission norms are prescribed for CO (Carbon Monoxide), HC (Hydrocarbons) and NOx (Nitrous oxide) levels set by the government which a vehicle would emit when running on roads. All the manufacturers need to implement the same for vehicles being manufactured from the date of implementation [8]

The results obtained from this study agreed with those of Washburn et al. (2001) indicating that vehicles manufactured by different manufacturers produce different percentages of vehicle emissions. This reflects the engine technology and emission control system used by these manufacturers. Accordingly, there is a significant relationship between car manufacturer and emission rates. Vehicle it should have an injection fuel supply system, no matter what the manufacturing country is. More attention should be given with a Japanese vehicle to engine size and maintenance period. Small engine "less than 1500 cc", with a periodic maintenance of once "at least every three months" is a rule with Japanese vehicles in order to reduce pollutants from emissions. However, the most aspect which should be considered with a German vehicle is the fuel type (super or unleaded). The results support that only new vehicles should be used by Jordanian citizens and that the vehicles with carburetor fuel supply system should not be imported to Jordan in order to reduce and control vehicle emissions [8]. The energy of permanent magnets was used in this research for the treatment of vehicle fuel (Iraqi gasoline), to reducing consumption, as well as reducing the emission of certain pollutants rates. The experiments in current research comprise the using of permanent magnets with different intensity (2000, 4000, 6000, 8000) Gauss, which installed on the fuel line of the two-stroke engine, and study its impact on gasoline consumption, as well as exhaust gases. For the purpose of comparing the results necessitated the search for experiments without the use of magnets. The overall performance and exhaust emission tests showed a good result, where the rate of reduction in gasoline consumption ranges between (-1) %, and the higher the value of a reduction in the rate of 1 % was obtained using field intensity 6000 Gauss as well as the intensity 9000 Gauss. It was found that the percentages of exhaust gas components (CO, HC) were decreased by 30%, 40% respectively, but CO2 percentage increased up to 10%. Absorption Spectrum of infrared and ultraviolet radiation showed a change in physical and chemical properties in the structure of gasoline molecules under the influence of the magnetic field. Surface tension of gasoline exposed to different intensities of magnetic field was measured and compared with these without magnetization[8]. Most fuels for internal combustion engine are liquid, fuels do not combust until they are vaporized and mixed with air. Most emission motor vehicle consists of unburned hydrocarbons, carbon monoxide and oxides of nitrogen. Unburned hydrocarbon and oxides of nitrogen react in the atmosphere and create smog. Smog is prime cause of eye and throat irritation, noxious smell, plat damage and decreased visibility. Oxides of nitrogen are also toxic. Even when fuel is still clear and bright, microscopic fuel components agglomerate forming larger clusters and organic compounds. (i.e. chaotic form) This continuous process affects combustion and engine performance which causing loss of power, excessive fuel consumption, smoking engines, damage to injection systems and carbon soot build up in lube oil, emission filters and catalytic converters. There are different methods (MPFI, EGR, PCV, catalytic) used which not only gives proper combustion of fuel in engine but also minimize the rate of emission through I.C. engine. One new modern technique to reduce the emission & gives proper combustion is use of magnetic fuel conditioner.[9]

In recent years, there are so many efforts towords the improving power output and emission of internal combustion engines per fuel, so that the products of combustion exhausted from internal combustion (IC) engines environmental friendly, and also beneficial for cost. The use of diesel engines have been increase day by day, due to their high thermal efficiency and low pollutant formation characteristics but it has a serious drawback of having a comparative larger amount of emission which is larger than that of a gasoline engine. Magnetic field that ionized the fuel based on the principle of magnetic field mutual action with hydrocarbon molecules of fuel and oxygen molecules. There are various physical attraction forces between hydrocarbons and they form densely packed structures called pseudo compounds which can further organize into clusters . Due to the physical attraction forces between hydrocarbons, oxygen atoms cannot penetrate into their interior during air/fuel mixing process, these structures become stable. The external force by means of magnetic field helps to polarized the hydrocarbon fuel. Due to that hydrocarbon fuel change their orientation and increase space between hydrogen. This hydrogen of fuel actively interlocks with oxygen and producing a more complete burn in the combustion chamber. It has been noted that When the fuel passes through a magnetic field, it helps increasing the atomization process by improved mixture formation. Due to increasing the rate of disintegration of the droplets as a result of reduction in the surface tension and viscosity of the fuel[10].

3. INSTALLATION OF MAGNET AND WORKING

3.1 Installation Position

The magnetizing apparatus is located on the pipe between pumping means and the burner, carburetor or fuel

injectors, because it is unnecessary for any other parts to be magnetized. A portion of the fuel feeding system extending from a point downstream of the magnetizing apparatus to the burner must be made of non-magnetic material. In this case, magnetized fuel is directly fed to burners or atomizing nozzles with a minimum reduction of magnetism. The magnets are embedded in a body of non-magnetic material, such as plastic, copper or aluminum, to secure them to the fuel line. No cutting of the fuel line and any hose and clamps are necessary to install this device, outside a fuel line without disconnection or modification of the fuel or ignition system for producing magnetic flux in the flow path of combustible fuel within the pipe. In a preferred embodiment, one or more magnets are strapped to the fuel line as close as possible to the carburetor or fuel injectors with only one pole of the magnet or magnets adjacent to or in contact with the fuel line. One or more magnets are strapped to the air intake in such a way as to magnetically expose the oxygen to the magnetic field emanating from the pole opposite that of the pole used to expose the fuel.

The magnets should have a Curie temperature sufficiently high that they retain their magnetic characteristics at the operating temperatures to which they are exposed. For example, in an automobile engine, the fuel line magnets will lie above the engine block where relative heating will greatly increase their temperature. Some magnets lose much of their magnetic field strength as their temperature rise. The Curie temperature on Alnico magnet are 760\BAC to 890\BAC, on Ceramic magnets (ferrite magnets) 450\BAC, on Neodymium 310\BAC to 360\BAC and on Samarium 720\BAC and 825\BAC. It is just before the injector on inlet pipe or housing for maximum alignment & maximum effect.

The effect of the magnetic field on fuel used in the engines and its impact on the amount of consumption, as well as emission of exhaust gases, the appropriate method was examined. We include below the description of the materials and equipment used.
Two types of magnetic coils were used to magnetize the fuel before entering the engine cylinder. This was done with aid of electric magnetic coil which is placed on the pathway of fuel, approximately at one meter before the carburetor system, to ensure that magnetizing takes place. One of the coil with intensity of 1000 Gauss and the second with 2000 Gauss as shown by the schematic diagram of engine given in fig.4.1.

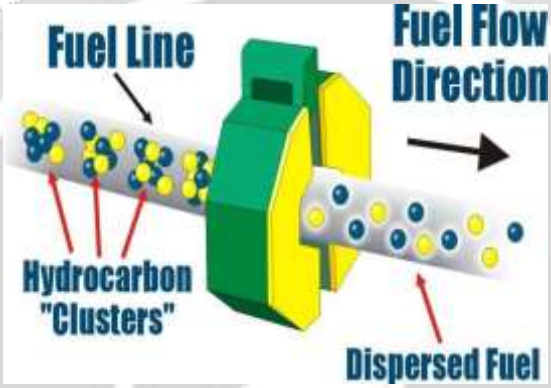
Fig.3.1 Schematic Diagram For Magnetic Coil Installation

3.2 WORKING

Most fuels for internal combustion engines are liquid. But liquid fuels don't combust till they are vaporized and mixed with air. Fuel mainly consists of hydrocarbons. Groupings of hydrocarbons, when flowing through a magnetic field, change their orientations of magnetization in a direction opposite to that of the magnetic field. The molecules of hydrocarbon change their configuration. At the same time intermolecular force is considerably reduced or depressed. These mechanisms are believed to help to disperse oil particles and to

become finely divided. In addition, hydrogen ions in fuel and oxygen ions in air or steam are magnetized to form magnetic domains which are believed to assist in atomizing fuel into finer particles.

Generally a liquid or gas fuel used for an internal combustion engine is composed of a set of molecules. Each molecule includes a number of atoms, which is composed of a nucleus and electrons orbiting around their nucleus. The molecules have magnetic moments in themselves, and the rotating electrons cause magnetic phenomena. Thus, positive (+) and negative (-) electric charges exists in the fuel's molecules. For this reason, the fuel particles of the negative and positive electric charges are not split into more minute particles. Accordingly, the fuels are not actively interlocked with oxygen during combustion, thereby causing incomplete combustion. To improve the above, the fuels have been required to be decomposed and ionized. The ionization of the fuel particles is accomplished by the supply of magnetic force from a magnet. The resultant conditioned fuel / air mixture magnetized burns more completely, producing higher engine output, better fuel economy, more power and most importantly reduces the amount of hydrocarbons, carbon monoxide and oxides of nitrogen in the exhaust. Another benefits if these devices is that magnetically charged fuel molecules with opposite polarities dissolve carbon build-up in carburetor jets, fuel injectors, and combustion chambers help to clean up the engine and maintain the clean condition. Magnets help to ionize the fuel. Fuel is basically from the groupings of hydrocarbons.



.3.2 Changes in Fuel after Passing through Magnetic Field

When the molecules of hydrocarbon flowing through a magnetic field, it changes their orientation in the direction opposite to the magnetic field. In other words, magnetic field actually disperses the molecules into more tiny particles and making the fuel less viscous. Fig.4.2 shows how magnets help to disperse the molecules. Emission is another hot topic of diesel engine. Thus, automatically the amount of dangerous gaseous can be reduced. The amount of unburned hydrocarbon also can be reduced as the combustion rate improved.

3.3 Experimental set up and procedure

1.start the engine and warm it .
2.switch on the PUC machine analyzer.
3.allow machine to warm up period 15 min .response time 5 min.
4.PUC machine consists of plastic pipe ,nozzle, printer unit ,monitor with digital number disply ,knob for manual adjustment ,power ON-OFF switches and gas selector knob.
5.plastic pipe is connected to the pump of PUC machine through which smoke enters into the machine for analysis.
6.put in the nozzle of the plastic pipe in the silencer tail pipe .wait for 5 min.
7.set CO & HC value o zero by using the knob 8.switch on the pump.
9.operate the gas selection switch and put it to HC & CO.
10.after 5 min operate the air –screw in carburetor for adjustment the value. 11.note the recording of CO&HC.
12.Switch OFF the pump & machine & remove the pipe from the silencer of the car 13.take print out for certification.

Note down all the readings and observe the changes in readings with and without magnetic effect

3.4 Technical Specifications of Engine:

The performance tests were carried out on a single cylinder, four stroke,variable speed water cooled Petrol engine. The setup consists of an engine, an eddy current dynamometer, and an exhaust gas analyzer.

Model	ED 1
Make	Kirloskar
Type	Four stroke variable speed water cooled petrol engine
No of cylinder	One
Bore	87.5mm
Stroke	110mm
Compression ratio	10:1
Cubic capacity	661.45cc

Table 3.4 Technical Specifications of Engine

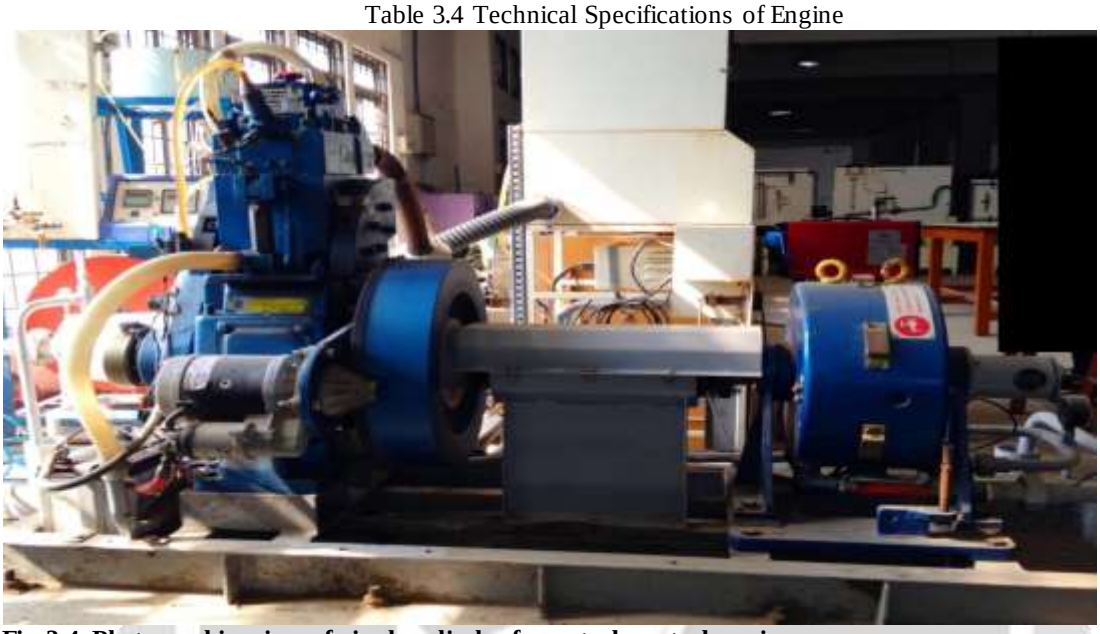


Fig 3.4 Photographic view of single cylinder four stroke petrol engine

The engine was prepared to run on petrol as a fuel during all tests. The fuel system is designed to facilitate for accurate measurement of the fuel flow rate. The fuel consumption is measured directly by using the burette method. The fuel consumption was measured at different engine loading conditions and exhaust gas measured by Exhaust gas analyzer.

3.5 Exhaust Gas Analyser

Fig 3.5 Exhaust Gas Analyzer

The exhaust gas analyzer is used to measure exhaust emissions from the engine during experimental tests. It is measures gases such as HC, CO, O2 and CO2 concentrations at each and every load. This procedure was done twice one for without magnet situation and other for with magnet situation, and results were compared.

4.READING AND OBSERVATION

1) At 0 load condition:

	CO	HC	CO_2	O_2
Without magnet	0.03	50	1.2	22.41
2000 gauss	0.02	45	1.12	21.35
4000 Gauss	0.01	43	1.14	21.15
6000 gauss	0.02	46	1.15	22.22
8000 gauss	0.02	44	1.16	22.25

Table No.4.3.1 Reading of CO,HC,CO_2,O_2 at 0 load condition without & with 2000,4000,6000,8000 gauss magnet

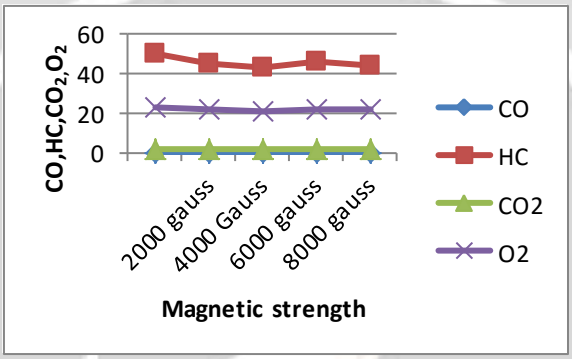


Fig .4.3.1 Graph of variation of CO,HC,CO_2,O_2 Vs magnetic strength at 0 load

2) At 1 Kg load condition.

	CO	HC	CO_2	O_2
Without magnet	0.06	30	1.4	23.3
2000 gauss	0.02	27	1.35	21.24
4000 Gauss	0.01	25	1.32	21.19
6000 gauss	0.04	28	1.33	22.12
8000 gauss	0.05	26	1.36	22.23

Table No.4.3.2 Reading of CO,HC,CO_2,O_2 at 1 load condition without &with 2000,4000,6000,8000 gauss magnet

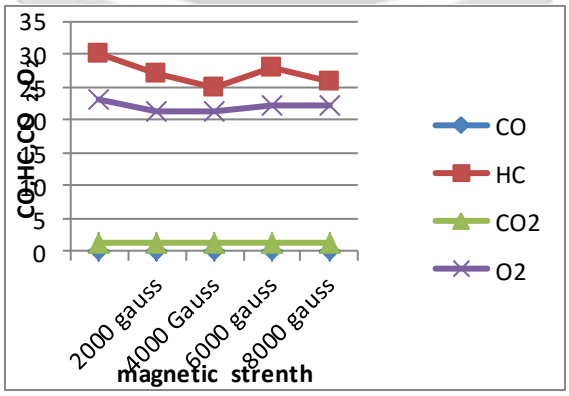


Fig .4.3.2 Graph of variation of CO,HC,CO_2,O_2 Vs magnetic strength at 1 load

3) At 2 kg load condition

	CO	HC	CO_2	O_2
Without magnet	0.13	11	1.5	22.49
2000 gauss	0.11	9.4	1.43	20.45
4000 Gauss	0.10	9	1.41	20.35
6000 gauss	0.13	10	1.45	22.06
8000 gauss	0.12	10.20	1.48	20.60

Table No.4.3.3. Reading of CO,HC,CO_2,O_2 at 2 load condition without &with 2000,4000,6000,8000 gauss magnet

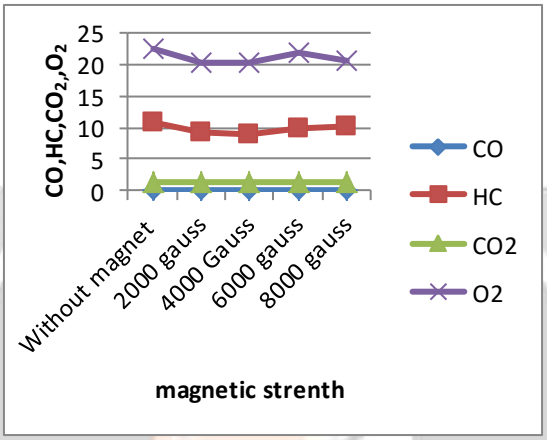


Fig .4.3.3 Graph of variation of CO,HC,CO_2,O_2 Vs magnetic strength 2 load

4) At 3kg load condition.

	CO	HC	CO_2	O_2
Without magnet	0.28	26	1.6	22.26
2000 gauss	0.25	22	1.53	20.43
4000 Gauss	0.26	23	1.49	21.13
6000 gauss	0.30	30	1.45	22.17
8000 gauss	0.29	27	1.56	22.21

Table No.4.3.4 Reading of CO,HC,CO_2,O_2 at 3 load conditionwithout&witT2000,4000,6000,8000 gauss

5) At 4 kg load condition

	CO	HC	CO_2	O_2
Without magnet	0.43	30	1.8	20.64
2000 gauss	0.39	26	1.74	19.13
4000 Gauss	0.37	28	1.63	18.24
6000 gauss	0.40	26.14	1.71	18.37
8000 gauss	0.42	27	1.77	20.24

Table No.4.3.5.Reading of CO,HC,CO_2,O_2 at 4 load condition with 2000,4000,6000,8000 gauss

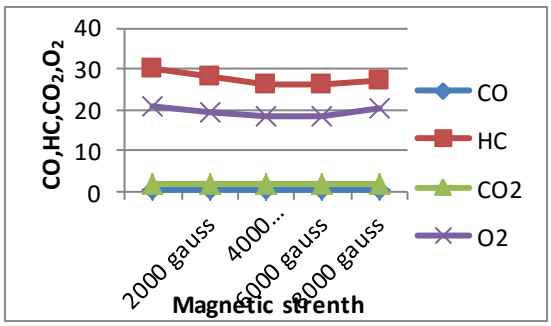


Fig .4.3.5 Graph of variation of CO,HC,CO_2,O_2 Vs magnetic strength at 4 load

4.4 Discussion

1) Magnetic field effect on CO emissions

With the application of magnetic field CO emissions gets reduced as compared to the CO emissions without magnetic. The better results are obtained at 2000,4000 gauss magnet than 6000,8000 gauss magnet. The variation of CO emissions with load as shown in above graphs.

2) Magnetic field effect on CO_2 emissions

The CO_2 emission gets decrease with the application of magnetic field as compared to the CO_2 without magnetic field. The variation of CO_2 emissions with load as shown in above graphs. The better results are obtained at 2000,4000 gauss magnet than 6000,8000 gauss magnet

3) Magnetic field effect on HC emissions

The HC emission gets decrease with the application of magnetic field as compared to the HC without magnetic field. The variation of HC emissions with load as shown in above graphs. The better results are obtained at 2000,4000 gauss magnet than 6000,8000 gauss magnet

3) Magnetic field effect on O_2 emissions

With the application of magnetic field O_2 emissions gets reduced as compared to the O_2 emissions without magnetic. The better results are obtained at 2000,4000 gauss magnet than 6000,8000 gauss magnet. The variation of O_2 emissions with load as shown in above graphs

5.CONCLUSIONS

1. When fuel is exposed to a magnetic field, we find that its properties are changed.
2. Change in properties of the fuel by using the magnetic field, and takes advantage from that to the Increase the efficiency of engine and reduce fuel consumption .
3. The brake power increased due to placing magnetic coil before the engine carburetor to magnetize the fuel before entering the engine cylinder. The power increases as the intensity of magnetic field increases too.
4. With regard to the specific fuel consumption, it be seen that the magnetic field has positive effect on it. This means that specific fuel consumption decreases as the magnetic field intensity increases.
5. The Brake thermal efficiency was improved relatively with the magnetic field intensity.
6. Reduce the amount of environmental pollutants in the exhaust gases.
7. Finally, it can be concluded that using magnetic field with high intensity has a positive effect on spark ignition engine performance and emission.

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