

Experimental Study the Effect of Electromagnetic Field on Performance & Emission of IC Engine

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Abstract: The present work deals with fuel ionization by using magnetic field which will ensure complete combustion of air-fuel mixture. Incomplete combustion in engine is due to improper mixing of hydrocarbon and oxygen molecule. In I.C. engine incomplete combustion produced large amount of emission gasses like CO, HC & NO_x etc. & incomplete combustion fuel gives lower efficiency. These attempt is made in this work to improve the combustion efficiency of internal combustion engines by adopting a magnetic fuel ionization method in which the fuel is ionized due to the magnetic field. To overcome these issues electromagnets are developed called as electro-magnetic fuel conditioner. This help to aligns & orientation of hydrocarbon molecules, better atomization of fuel. Use of such electromagnet mounted in path of fuel lines improves mileage & reduces emission of vehicle. These experiments are conducted at different engine loading conditions. The work in particular is very significant on account of its impact on the global automobile market.

Keywords: aligns& orientation, efficiency, electromagnetic fuel conditioner, HC

I. INTRODUCTION

Over the last decade there so many efforts towards the improving power output and emission of internal combustion engines per fuel, but success up to 31%. It is very difficult to improve the more than that efficiency but magnetic fuel conditioner help to improve 3-4% in present value. We have, combustion of fossil fuel has release of pollutants such as CO, HC and NO_x like many component in environment. When these pollutants are in place, an atmospheric phenomenon called smog is created by the action of sunlight on hydrocarbon (HC) in the atmosphere, and the main source of HC is the exhaust gases of vehicles, the rapid increase in traffic causes the increase in the percentage of smog.

That effect the deterioration of air & harmful for health is irritate the eyes & throats, noxious smell, decrease visibility. Wide range of pollutants are believed to penetrate deeply into human lungs including aerosols of many small particles. Due to the reduction the emission from mobile sources increase the demand. Hydrocarbon leaves the natural deformation of carbon clog stalling, loss of horsepower & reducing mileage. There are many method MPFI, EGR, PCV, CATALYTIC use to complete combustion as well as minimize the emission. This is new technology working the similar to other technology but in better way. Electro-Magnetic field that ionized the fuel 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 is called pseudo compounds which can later organize into clusters.

The external force of magnetic field helps to polarize the hydrocarbon fuel. Due to that hydrocarbon fuel change their orientation and increase space between hydrogen This hydrogen of fuel interlocks with oxygen and producing a more complete combustion 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 air fuel mixing

a. Background Of An Electromagnet

In 1819, Hans Christian Oersted, the Danish physicist and chemist (1777-1851), noticed that a current in a wire caused a compass needle to deflect. He had discovered that moving electric charges create a magnetic field. A dedicated teacher, he made this discovery while teaching his students at the University of Copenhagen. He Suspected there might be an effect and did the experiment for the very first time in front of his class. With his discovery, Oersted was the first to identify the principle of an electromagnet.

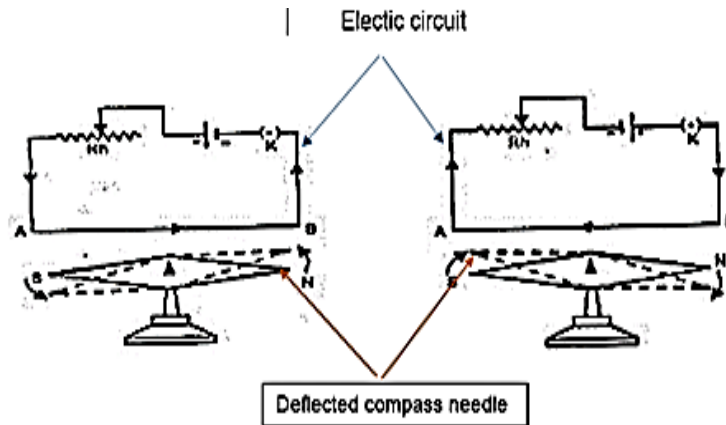


Fig.1.1.1 Oersted law

II. MAGNETIC FUEL CONDITIONER

An electromagnetic fuel conditioner is device which arrange the fuel molecules & alter the atomic structure so that proper combustion take place in engine. Magnetic field applied at fuel line atomize the fuel & which get adhere to oxygen enhance fuel air mixing ratio. Basic concept of magnetize fluid is that: In 1989, Hans Dehmel of university of Washington awarded Noble prize in physics for his great contribution in fundamental property of electron [1]. According that electron have ability to store the energy within itself called spine. When provide small of magnetic field, it absorb the energy and changing property. Particle made up of number of atom which have same number proto & neutron charge, if greater number of electron then '– ve' charge obtain & vice versa.

Two distinct type hydrogen

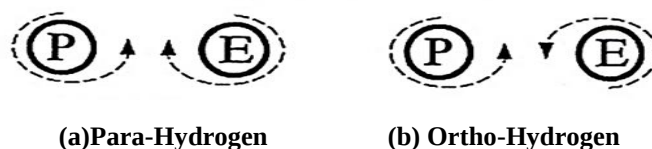


Fig.2.1 Rotational view of para & ortho hydrogen

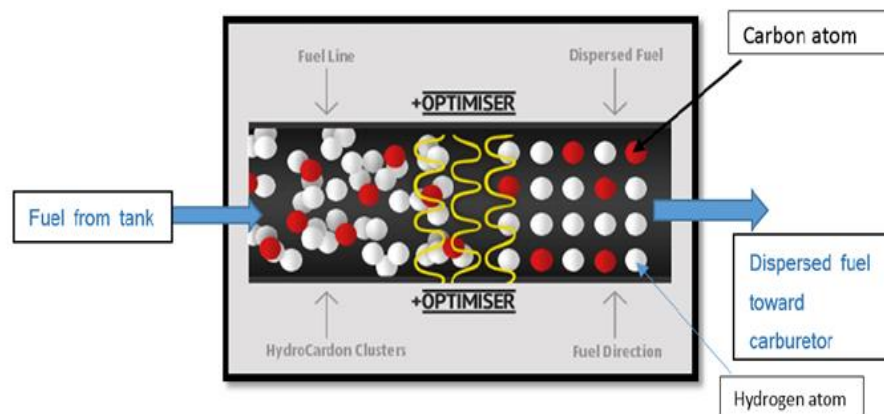
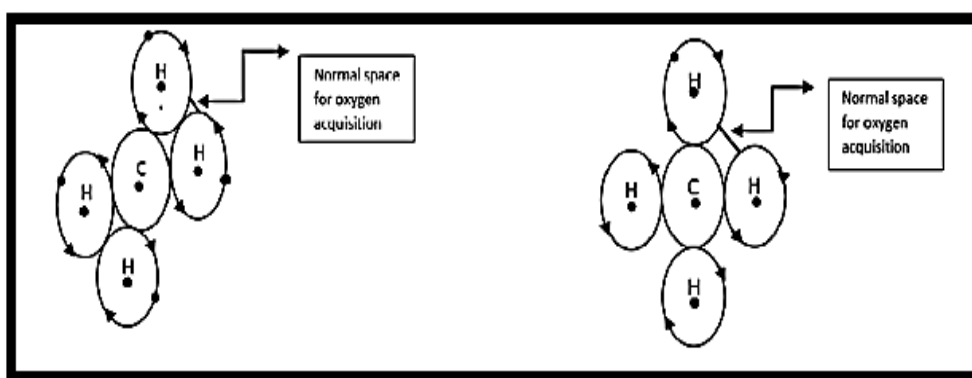


Fig.2.2 process of the fuel ionization

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, as said by Paul (1993), Park K et al (1997). Hydrogen occurs in two different part isomeric forms one is Para which is normally occurs in fuels, second is ortho which is achieved by applying magnetic field. These two forms are the different opposite nucleus spins. The ortho state can be achieved by applying strong magnetic field along the fuel line. In the para Hydrogen molecule, which occupies the anti-parallel rotation, the spin state of one atom relative to another is in the opposite direction, therefore it is diamagnetic. In the ortho molecule, which occupies the parallel rotational levels, the spin state of one atom relative to another is in the same direction. When the fuel passes through a magnetic field, created by the strong electro-magnets, due to that magnetic field hydrocarbon change their orientation and convert from para state to ortho state.

In ortho state inter molecular force is considerably reduced and increase space between hydrogen. This hydrogen of fuel actively interlocks with oxygen and producing a more complete burn in the combustion chamber. The result is better fuel economy and reduction in hydrocarbons, carbon monoxide and oxides of nitrogen that are emitted though exhaust. The ionization fuel also helps to dissolve the carbon build-up in carburetor, jets, fuel injector and combustion chamber, thereby keeping the engines clear condition. Electro-Magnetic kit is installed on cars, trucks, auto rickshaw, and heavy trucks immediately before carburetor or injector on fuel line.



(a) Para state

(b) ortho state

Fig.2.3. Conversion of para to ortho state

III. OBJECTIVES

By this technique of electromagnetic field used to reduce exhaust emission following objectives are obtained:

1. To study electromagnetic field used to decrease intermolecular force of attraction of hydrocarbon atoms.
2. To study reduction in exhaust emission.
3. To prepare Electromagnetic kit or model.
4. To test fuel emission on various engines.
5. To improve in engine performance.
6. To study increase in mileage of vehicle.
7. To study increase in engine life

IV. CONSTRUCTION OF ELECTROMAGNETIC FIELD

Electromagnets are magnets that are created when there is electric current flowing in a wire. The simplest electromagnet uses a coil of wire, often wrapped around some iron. Because iron is magnetic, it concentrates the magnetic field created by the current in the coil.

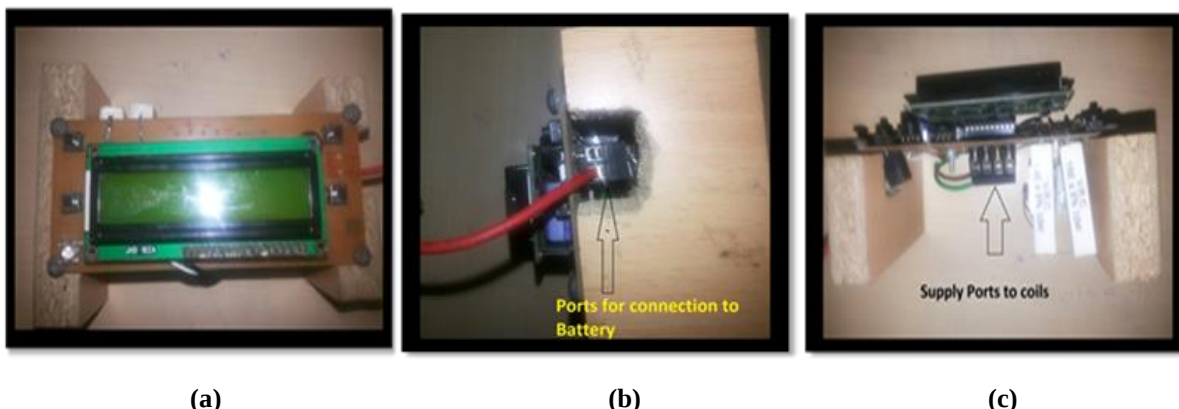


Fig.5 Structure of electromagnetic circuit

An electric current flowing in a wire creates a magnetic field around the wire, due to Ampere's law. To concentrate the magnetic field, in an electromagnet the wire is wound into a coil with many turns of wire lying side by side. The magnetic field of all the turns of wire passes through the center of the coil, creating a strong magnetic field there. A coil forming the shape of a straight tube (a helix) is called a solenoid. Much stronger magnetic fields can be produced if a "core" of ferromagnetic material, such as soft iron, is placed inside the coil. The ferromagnetic core increases the magnetic field to thousands of times the strength of the field of the coil alone, due to the high magnetic permeability μ of the ferromagnetic material. This is called ferromagnetic-core or iron-core electromagnet.

The direction of the magnetic field through a coil of wire can be found from a form of the right-hand rule. If the fingers of the right hand are curled around the coil in the direction of current flow (conventional current, flow of positive charge) through the windings, the thumb points in the direction of the field inside the coil. The side of the magnet that the field lines emerge from is defined to be the North Pole.

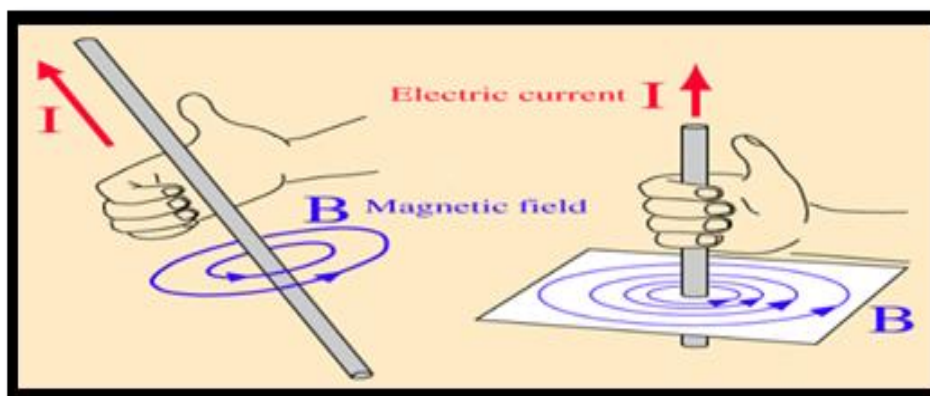


Fig.6 The right hand rule

When your fingers curl in the direction of current, your thumb points toward the magnet's North Pole. For generating electromagnetic field source of energy of electric energy is used as the automobile battery. The microprocessor chip is used to vary the frequency of the electromagnetic field. The range of frequency is set from 1.5 kHz to 38 kHz. This frequency is set so that to break the bonding of hydro-carbon molecules bonds. This frequency matches with respective hydro-carbon molecules natural frequency and resonance is created and strong bonding is broken. This frequency varies from highest limit to lowest limit in micro seconds.

The electrical supply from the battery is given to the input of the circuit. Where frequency is varied in micro-seconds. There are two output connections. The simply wire is wound around the fuel line to generate electromagnetic field. At the center of wire resistor is used as consumer. In same way other set of wire is used to generate the electromagnetic field

a. SPECIFICATION OF ELECTROMAGNETIC CIRCUIT

- Frequency band : 1kHz to 38kHz
- Per coil voltage : 12 V
- Per coil current : 350mA
- Per coil power : 4.2 watt.
- Resister : 47 Ω

V. DETAILS OF ENGINE SETUP

The setup consists of three cylinder, four stroke, and petrol (MPFI) engine connected to hydraulic dynamometer for engine loading. The setup has stand-alone type independent panel box consisting of air box, fuel tank, and manometer, fuel measuring unit, digital speed indicator and digital temperature indicator. Engine jacket cooling water inlet, outlet and calorimeter temperature is displayed on temperature indicator. Rotameter are provided for cooling water and calorimeter flow measurement. The setup enables study of engine for brake power, BMEP, brake thermal efficiency, volumetric efficiency, specific fuel consumption, and air fuel ratio and heat balance. Provision is also made for conducting Morse test.



Fig.5.1 Experimental setup of electromagnetic kit

a. ENGINE SPECIFICATIONS

Product	: Engine test setup 3 cylinder, 4 strokes, Petrol
Engine	: Make Maruti, Model Maruti 800, Type 3 Cylinder, 4 Stroke, Petrol (MPFI), water cooled, Power 27.6Kw at 5000 rpm, Torque 59 NM at 2500rpm, stroke 72 mm, bore 66.5mm, 796 cc, CR 9.2
Dynamometer	: Type Hydraulic
Propeller shaft	: With universal joints
Air box	: M S fabricated with orifice meter and manometer
Fuel tank	: Capacity 15 lit with glass fuel metering column
Calorimeter	: Type Pipe in pipe
Temperature sensor	: Thermocouple, Type K
Temperature indicator	: Digital, multi channel with selector switch
Speed indicator	: Digital with non contact type speed sensor
Load sensor	: Load cell, type strain gauge, range 0-50 Kg
Load indicator	: Digital, Range 0-50 Kg, and Supply 230VAC
Rotameter	: Engine cooling 100-1000 LPH; Calorimeter 25-250 LPH
Pump	: Type Monoblock
Overall dimensions	: W 2000 x D 2750 x H 1750 mm

VI. RESULT AND DISCUSSION

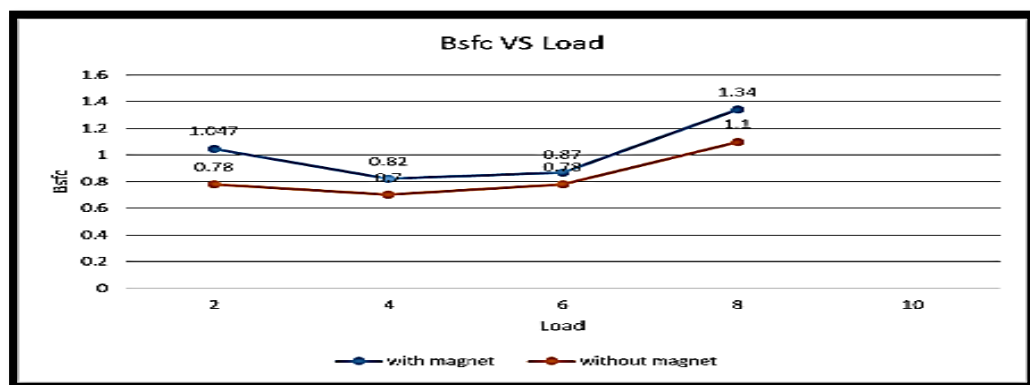
From below experimental result table it is conclude that the efficiencies of engine increases by adding the magnetic field in the path of fuel line. This experimental test have been carried out fixed load condition. Above value of thermal efficiency & volumetric efficiency increasing that is indicate that the maximum air-fuel bonding achieved by magnet. So that the better burning is carried out & obviously emission levels will less from the engine

Table no.1

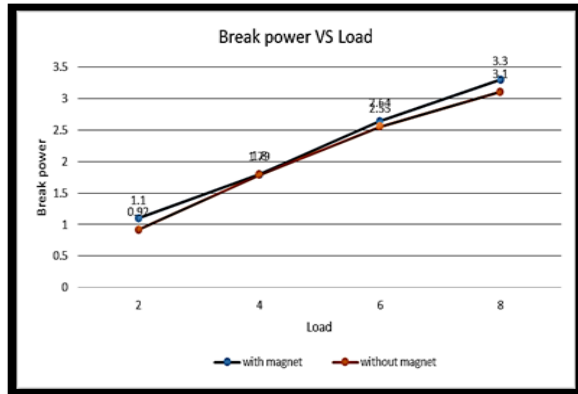
	2kg		4kg		6kg		8kg	
Parameters	Before	After	Before	After	Before	After	Before	After
BP (kW)	0.92	1.1	1.79	1.8	2.55	2.64	3.1	3.3
Mass of fuel(kg/s)	2.6e-4	2.38e-4	4.1e-4	3.7e-4	5.79e-4	5.78e-4	1.1e-3	1.02e-3
Bsfc (kg/kWhr.)	1.047	0.78	0.82	0.70	0.87	0.78	1.34	1.1
Heat I/p (kW)	11.83	0.78	18.21	16.28	27.13	25.48	52.09	45015
Thermal eff.	7.81	10.47	9.86	11.6	9.39	10.38	6.1	7.33
Volumetric eff.	40.38	67.38	42.07	79.08	44.47	84.65	47.57	90.27

a. PERFORMANCES GRAPHS:-

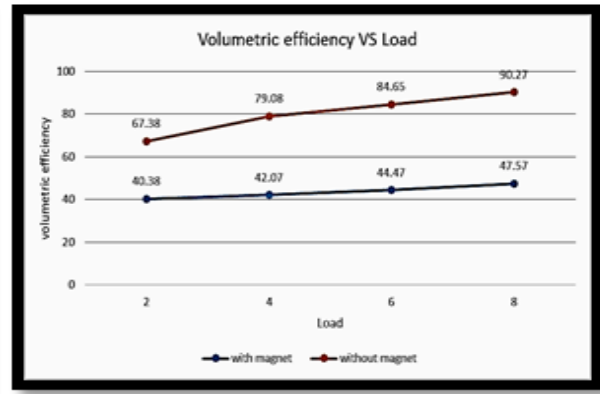
Engine Performances has been analyzed with following graph are plotted between load and other parameter from the experimental result.



Graph.1 Bsfc VS Load



Graph.2 Break power VS load



Graph.3 Volumetric efficiency VS Load

It is observed from the graph 1. That the Bscf is in magnet case always above the curve that without magnet & the after certain load continuous increase by large difference. Graph 2 is plotted break power VS Load, from the graph with magnet result varies 1 to 2% without magnet. There is large changes in volumetric efficiency 25% or more than that value when adding the electromagnet due to increases by well interlocking of hydrocarbon or oxygen showing in graph 3.

VII. RESULT AND DISCUSSION

Emission testing is done by using the gas analyzer in setup of experiment & direct printed result is obtained Fig. 8. Shows that result of before using magnetic field & Fig.9. After using the magnetic field but this test is conducted the different constant load, below showing printed result is 4kg load applied on the engine.

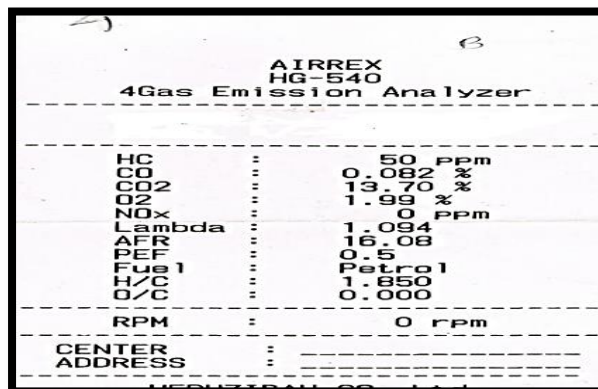


Fig.8 before Using Magnetic Field

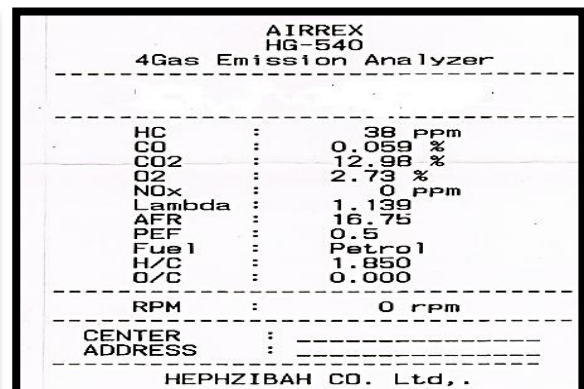
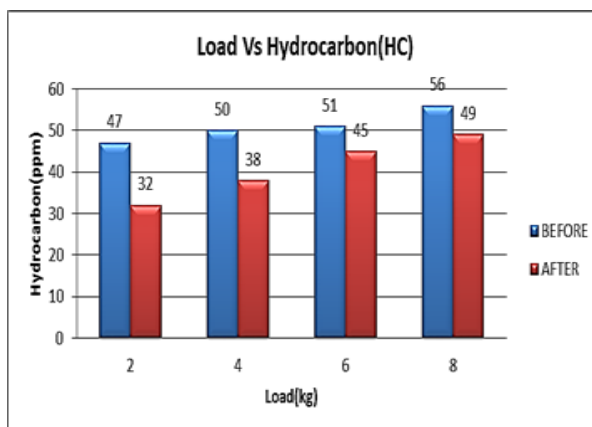
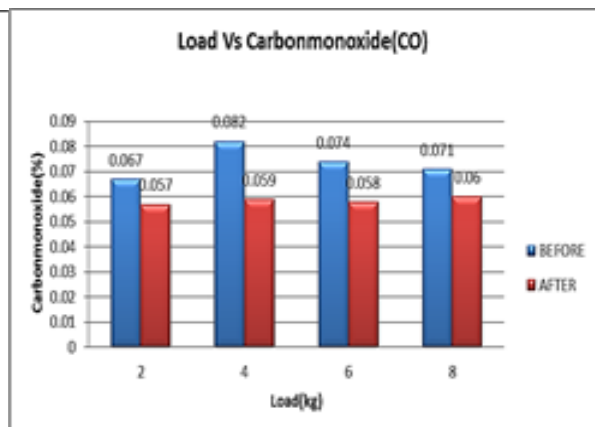


Fig.9 after Using Magnetic Field

a. COMPARISON OF EMISSION PARAMETER:



Graph.4 Load VS hydrocarbon



Graph.5 Load VS carbon monoxide

Graph. 4. Drown the load VS Hydrocarbon there is significant changes in before & after value of hydrocarbon. Here is gradually increase load & similarly reduction in between the difference before & after value of hydrocarbon, is showing in the graph. Averagely 7 to 8% hydrocarbon value are decreased after using electromagnetic kit. Hydrocarbon emission is less, which relies the burning of fuel completely. In the graph 5. Which is drown the load VS carbon monoxide fluctuating difference is obtained at the variable load at 4kg load maximum difference is obtained clearly shows the changes in value due to variation of load.

VIII. CONCLUSION

Internal combustion engine is getting maximum energy per liter as well as environment with lowest possible level toxic emission. The resultant fuel burn more completely, producing higher engine output, better fuel economy, more power & most importantly reduces the amount of HC, CO, NO_x in the exhaust.& therefore control the emission at low cost. Avoid clogging problems in Diesel Engine, Cost saving, Eco friendly, provides extra life for expensive catalytic converter & Reduce maintenance of engine. That increase the 10-30% mileage of vehicle. Complete combustion improve the life of engine cost of maintenance reduced

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