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A Comparative Study of Effect of Magnetic Field on Exhaust Emission in Internal Combustion Engine

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Abstract: *Complete combustion of fuel does not take place due to lack of sufficient air-fuel mixing in the combustion chamber of vehicles. This happens due to stable structure of fuel. Incomplete combustion of fuel results in discharge of carbon monoxide, hydrocarbons, nitrogen oxides and fine particles through exhaust emissions causing environmental pollution. Magnetic field changes the structure of fuel which increases air-fuel mixing giving rise to increased combustion of fuel.Number of experiments to reduce pollutants in exhaust emission by applying magnetic field are performed and are available in literature. Present work is a comparative study of some of such experiments.It includes the study of both petrol and diesel engines.*
Keywords: *Air-fuel mixing,Combustion,Hydrocarbons,Magnetic field,Stable structure.*

I. Introduction

Liquid fuels such as petrol and diesel used for internal combustion engine do combust when they are vaporized and mixed with air [1].But due to the stable structure of fuel sufficient air cant mix with it. Hence incomplete combustion of fuel takes place. As a result fuel consumption of engine increases so also hydrocarbons present in the fuel are not burnt properly and come out through exhaust gases and hence many polluting gases and particles are discharged in the environment. This increases the pollution of environment. Theoretically the exhaust of engine should contain carbon dioxide, water vapor and nitrogen from air. But practically the exhaust of engine contains carbon monoxide, hydrocarbons, oxides of nitrogen and carbon dioxide. These components in exhaust emission can penetrate into the human respiratory tract and cause respiratory infections and diseases like lung cancer and some cardiovascular diseases. Hydrocarbon fuel molecules treated with magnetic field tend to de-cluster, creating smaller particles leading to better combustion [1]. Magnetic fuel treatment works on the principle of interaction of magnetic field with fuel molecules to increase mixing of oxygen with fuel [1]. Liquid fuel consists of mixture of chemical compounds of carbon and hydrogen atoms in the form of a definite structure. Highly stable structure of fuel does not allow oxygen atoms to penetrate into the interior during air-fuel mixing process. Therefore incomplete combustion of fuel takes place. [2]. Hydrogen occurs in two isomeric forms Para and Ortho. In the Para form spin state of one atom relative to other is in opposite direction, while in the Ortho form spin state of one atom relative to other is in the same direction. Normally the fuel occurs in Para form but magnetic treatment of fuel changes it into ortho form**.** [3].When a strong magnetic is applied to fuel, hydrocarbon change their orientation and it changes from Para form to Ortho form [1]. In Ortho form considerable reduction in inter-molecular forces takes place causing increase in space between hydrogen. Due to the magnetic treatment of fuel interaction of fuel with oxygen increases and there is complete combustion of fuel in the chamber [4].

Although technology improvements have reduced vehicle emissions there is still cause for concern because the number of vehicles on road continues to increase, urban development has increased the demand for vehicles and vehicles are main contributor to greenhouse gases. Magnetic treatment of fuel tends hydrocarbon molecules to de-cluster giving increased surface for fuel-oxygen reaction leading to improved combustion. Thus when fuel is magnetized bonding between hydrocarbon and oxygen becomes stronger which gives rise to proper burning of fuel-air mixture in the combustion chamber. Therefore fuel consumption of engine gets reduced and emission of carbon particles, carbon monoxide and hydrocarbons and other pollutants also get reduced**.** [1].

II. Effect Of Magnetic Field On Exhaust Emission:

The fact that there is significant reduction in various exhaust emissions due to the application of magnetic field has been proved. Govindasamy and Dhandapani [9] observed 13.3 % reduction in CO and 22.1 % reduction in HC for single cylinder two stroke S. I. Engine using a magnetic field of 9000 G. A. R. A. Habbo et al [5] observed a maximum 90 % of reduction in CO and 58 % of reduction in HC for single cylinder four stroke S. I. engine using 2000 G. A. S. Faris et al [1] observed a maximum 40 % of reduction in CO and 30 % of reduction in HC for two stroke S. I. engine under the influence of 2000 to 9000 G magnetic field. V. Ugare et al [6] observed 11.5 % reduction in CO and 26 % reduction in HC for single cylinder four stroke S. I. engine with 5000 G magnetic field. They observed 7 % reduction in CO and 22 % reduction in HC for single cylinder

four stroke C. I. engine with 5000 G magnetic field. P. Patel et al [4] observed 30 % reduction in HC emission for single cylinder four stroke C. I. engine.

Table: 1: Reduction in exhaust emissions of C.I. and S.I. engines due to different MF intensities. [1, 4, 5, 6, 9]

Sr. No	Engine Type	Fuel	Strength of MF Gauss	% Reduction in CO	% Reduction in HC	Reference
1	Single cylinder two srtoke S.I. Engine	Petrol	9000	13.3	22	Govindasamy et al [9]
2	Single cylinder four srtoke S.I. Engine	Petrol	1000 2000	80 90	45 58	Habbo et al [5]
3	Two srtoke S.I. Engine	Petrol	2000 to 9000	40	30	Faris et al [1]
4	Single cylinder four srtoke S.I. Engine	Petrol	5000	11.5	26	Ugare et al [6]
5	Single cylinder four srtoke C. I. Engine	Diesel	2000	-	30	Patel et al [4]
6	Single cylinder four srtoke S.I. Engine	Diesel	5000	7	22	Ugare et al

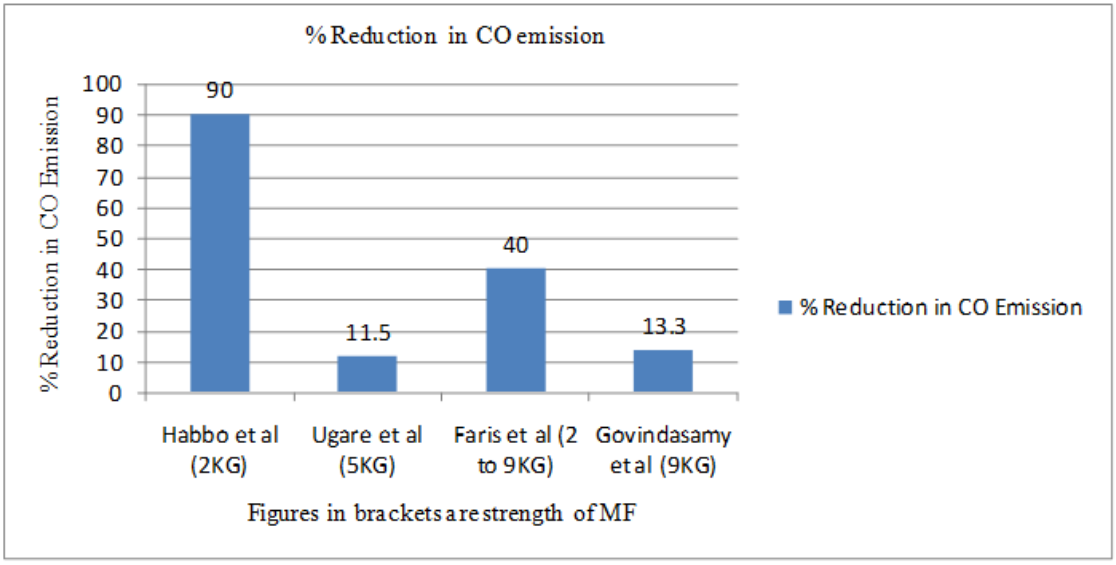

Fig. 1: variation in % reduction in CO with different strengths of mf [1, 5, 6, 9, 13, 14]

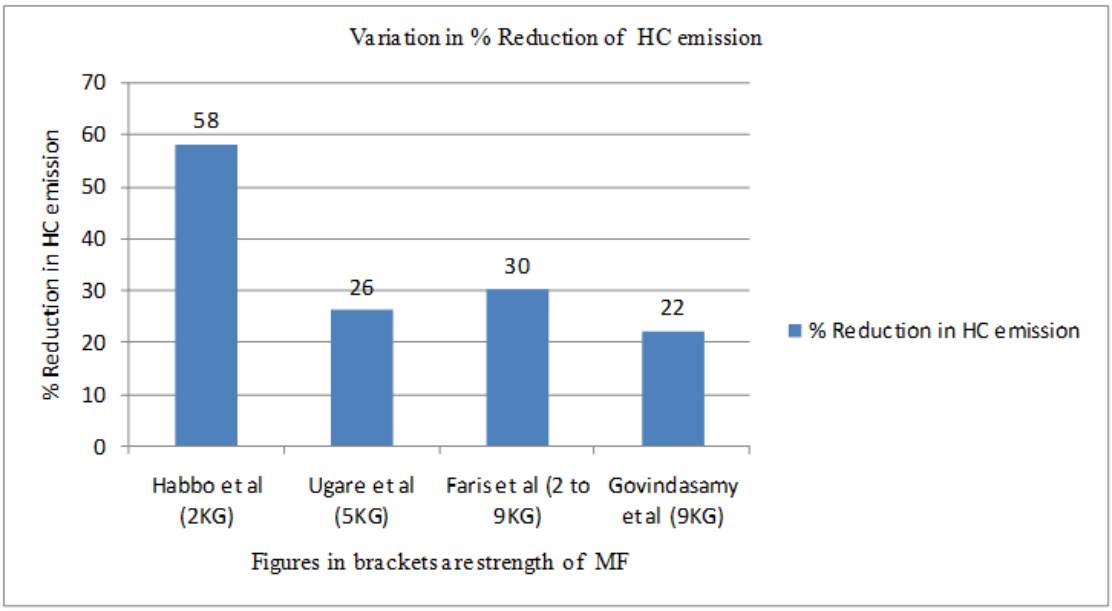

Fig. 2: variation in % reduction in HC with different strengths of mf [1, 5, 6, 9, 13, 14]

III. Results And Discussion:

Results obtained in various experiments show that maximum reduction in CO emission for petrol engine was 90% for applied magnetic field of strength 2000 G and maximum reduction in HC emission for petrol engine was 58% for the same applied magnetic field . This excellent result was obtained for single cylinder four stroke engine. For a two stroke petrol engine the results are not satisfactory. For this engine reduction of 13.3% for CO and 22% for HC emission was observed by applying a magnetic field of strength from 2000 G to 9000 G. For diesel engine the reduction of 7% in CO emission and a maximum of 30% reduction in HC emission was observed.

Magnetic treatment of fuel has come forward as an excellent tool for reduction in various pollutants from exhaust of various engines. A maximum reduction of 90% in CO emission and 58% of reduction in HC was observed for a single cylinder four stroke spark ignition engine under the influence of 2000 G magnetic field. However observation of Table: 1, Fig.1and Fig.2 show that the changes observed due to fuel magnetization are not consistent. Hence more research in this field is needed to increase reliability and consistency.

IV. Conclusion:

Magnetic treatment of fuel has proved its excellent performance through large number of experiments to reduce the consumption of fuel and to reduce the components in exhaust of engine, polluting the environment. Hence magnetic treatment of fuel on very large scale will help to save the fuel and to reduce the environmental pollution.

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