Effect of Fuel Magnetism on Engine Performance and Emissions

Article *in* Australian Journal of Basic and Applied Sciences · December 2010

CITATIONS
25

READS
5,509

2 authors, including:

Mohammed Saber Gad
Fayoum University
38 PUBLICATIONS **116** CITATIONS

SEE PROFILE

Australian Journal of Basic and Applied Sciences, 4(12): 6354-6358, 2010
ISSN 1991-8178

Effect of Fuel Magnetism on Engine Performance and Emissions

[1]Farrag A.El Fatih, [2]Gad M.saber

[1,2]Department of Mechanical Engineering, Engineering Research Division,
National Research Center, Dokki, Egypt

Abstract: The current research investigates the effect of magnetic field on internal combustion engines. The study concentrates on engine performance parameters such as fuel consumption and exhaust emissions. The magnetic field was applied to S.I.E. using gasoline fuel. Moreover, the fuel is subjected to a permanent magnet mounted on fuel inlet lines. The experiments were conducted at different idling engine speeds. The exhaust gas emissions of CO, NO, and CH_4 were measured by using an exhaust gas analyzer. The magnetic effect on fuel consumption reduction was up to 15%. CO reduction at all idling speed was range up to 7%. The effect on NO emission reduction at all idling speed was range up to 30%. The reduction of CH_4 at all idling speed was range up to 40%

Key words: Fuel Magnet-Fuel Consumption- Carbon Monoxide- Nitrogen Oxides- Hydrocarbons

INTRODUCTION

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. The same is true of home heating units where improper combustion wasted fuel and cost, money in poor efficiency and repairs due to build up.

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, Paul M (1993), Park K.S (1997) and Al Dossary *et al*, (2009) said.

The combustion engine vehicle efficiency is about 9%. This means that the engine consumes more energy that it converts in movement. In other words, you pay more energy that you use. Scientists search about a method to reduce engine emissions and fuel consumption. A fuel magnet is a device that is strapped to the fuel line in your engine or each injector line on a diesel engine and makes the fuel more receptive to oxygen, thus producing a leaner more efficient combustion with less exhaust waste, as mentioned by Paul (1993), Park K.S, (1997), Zhao H (1997) and Crous *et al*, (1970).

2. Effect of Magnetism on Fuel Molecules:

Fuel 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 inter-locked 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 **P**aul (1993), Park K *et al* (1997).

Fuel mainly consists of hydrocarbon and when fuel flows through a magnetic field, the hydrocarbon change their orientation and molecules of hydrocarbon change their configuration. At the same time inter molecular force is considerably reduced or depressed. These mechanisms are believed to help disperse oil particles and to become finely divided. This has the effect of ensuring that fuel actively interlocks with oxygen 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, there by keeping the engines clear condition.

Corresponding Author: Farrag A.El Fatih, Department of Mechanical Engineering, Engineering Research Division, National Research Center, Dokki, Egypt

Fuel Magnet is installed on cars, trucks immediately before carburetor or injector on fuel line. 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, Zhao H (1997) *et al* mentioned.

Experimental Set up:

The experimental work has been performed on a four cylinder four stroke S.I.E fueled with gasoline. The experimental set up used in the present work is designed to study engine performance and exhaust emissions concentrations using fuel magnet. Instrumentation for measuring fuel consumption, engine speed and emission analysis are included in the test rig. The specifications of the engine are listed in Table 1. The photographic view of the experimental test rig is illustrated in Fig.1.

Table 1: Test Engine Specifications

Engine parameters	Specifications
Company	Waukesha
Engine Model	VRG 155U
Number of cylinders	Four
Cycle	Four stroke
Cooling	Water
Cylinder diameter (mm)	92.075
Piston stroke (mm)	95.25
Connecting rod length (mm)	171.5
Compression ratio	8:1
Governing speed	1800 rpm
Rated power (HP)	20

Experimental procedure:

The engine was prepared to run as a petrol engine during all tests. An induction to the engine was designed and installed. The fuel system is designed to facilitate safe and accurate metering of the fuel flow rate.

The gasoline fuel consumption is measured by Burette method. In this method, gasoline fuel system design consists of main gasoline fuel tank, gasoline fuel metering system (graduated one liter glass jar) and three control valves to deliver the fuel from the tank to the engine. The gasoline fuel system utilizes the gravity effect to feed the carburetor with gasoline.

The gasoline fuel consumption flow rate is measured directly by using the graduated glass jar (1000 ml capacity and 10 ml division). A digital stopwatch of 0.1 second accuracy is used to measure the time required by the engine to consume a specific volume of gasoline from the graduated glass jar.

A digital photo tachometer model (BRI 5045) is used for engine speed measurement. The tachometer has been fixed on the engine test rig close to the flywheel. A strip of reflective tape is applied to the engine flywheel. This digital photo tachometer has a measurement range up to 100000 rpm with a resolution of 0.1 rpm (0.5 to 999.9 rpm) and one rpm (over 1000 rpm).

The exhaust gas analyzer is used to measure exhaust emissions from the engine during experimental tests was made of brand Madur type GA-21plus-flue gas analyzer. The main advantage of this analyzer is that the fuel type is programmable to automatically calculate the air to fuel ratio from the exhaust gases analysis. Fuel type can be chosen to be gasoline or CNG. The exhaust gas analyzer measures some gases such as some gases such as CO, NO and CO_2 concentrations at every idling engine speed and equivalence ratio.

RESULTS AND DISCUSSION

The main purpose of this work was to evaluate the following:

1. Fuel Consumption for S.I.E fueled with gasoline at different idling engine speeds with and without Fuel Magnet.
2. Effect of Fuel Magnet on CO Emission Levels at different idling engine speeds.
3. Effect of Fuel Magnet on CH4 Emission Levels at different idling engine speeds.
4. Effect of Fuel Magnet on NO Emission at different idling engine speeds.

4.1 Effect of Fuel Magnet on Engine Fuel Consumption:

In Fig.2, the experimental results show that the fuel consumption of engine was less when the engine with fuel magnet than that without fuel magnet. Fuel consumption increases for the two fuels at all the idling speed range due to the increase in heat release rate.

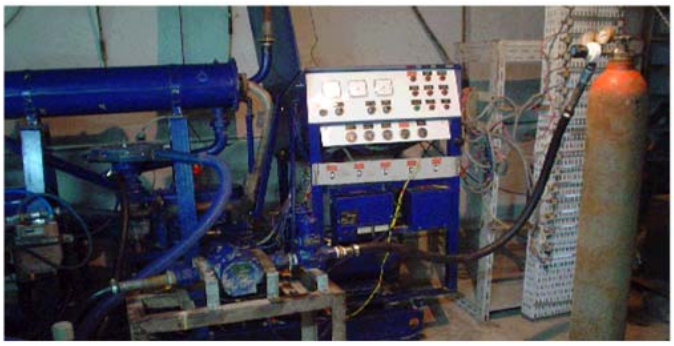

Fig. 1: Photographic view of The Experimental Test Rig

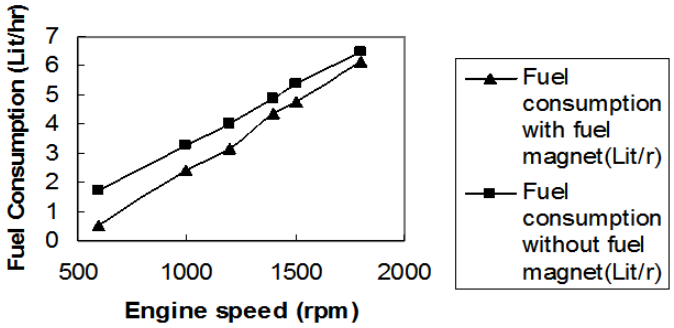

Fig. 2: Variation of Fuel Consumption at idling engine speeds of S.I.E with and without Fuel Magnet

Inter molecular force is considerably reduced or depressed. These mechanisms are help disperse oil particles and to become finely divided. This has the effect of ensuring that fuel actively interlocks with oxygen producing a more complete burn in the combustion chamber. It is clear that the fuel consumption is reduced to about 15%. The result is better fuel economy.

In Fig.3, the experimental work depicts the emissions concentrations of CO with speed. CO concentrations decrease when the engine fuelled with fuel magnet than that without fuel magnet. CO concentration increases for the two fuels at all the range of idling speed due to the incomplete combustion and the increase of heat release rate. The fuel actively interlocks with oxygen producing a more complete burn in the combustion chamber. The experiment revealed that CO concentration is reduced up to 7%.

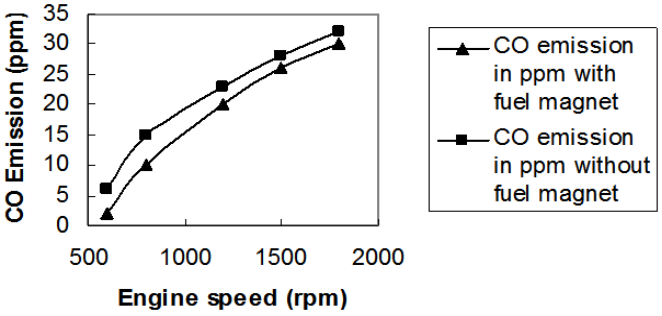

Fig. 3: Variation of CO Concentration with idling engine speeds of S.I.E with and without fuel magnet

In Fig.4, the experimental work depicts the emissions concentrations of CH_4 with speed. CH_4 concentrations decrease when the engine fuelled with fuel magnet than that without fuel magnet.

CH_4 concentration decreases for the fuel at all the range of idling speed due to the incomplete combustion and the increase of heat release rate.

Inter molecular force makes the fuel particles finely divided. This has the effect of ensuring that fuel actively interlocks with oxygen producing a more complete burn in the combustion chamber. It is found that the CH_4 concentration is reduced by about 40%. The result is less hydrocarbons.

In Fig.5, the concentration of NO in the exhaust gases was found to decrease when using fuel magnet as than without fuel magnet case. The fuel magnet makes the fuel is more receptive to oxygen, thus producing a leaner more efficient combustion. The heat is liberated inside the cylinder per unit time and cooling becomes less efficient. When the idling engine speed increases, dissociation of N_2 concentration increases due to the increase in the exhaust gas temperature. It was clear that the concentration of NO in the exhaust gases is reduced to about 30%.

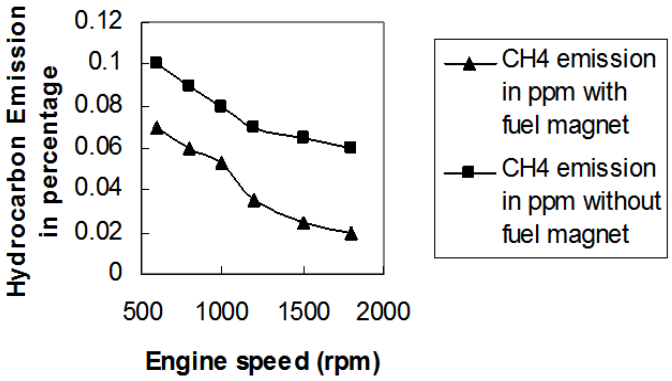

Fig. 4: Variation of CH4 Concentration with idling engine speeds of S.I.E fueled with and without fuel magnet

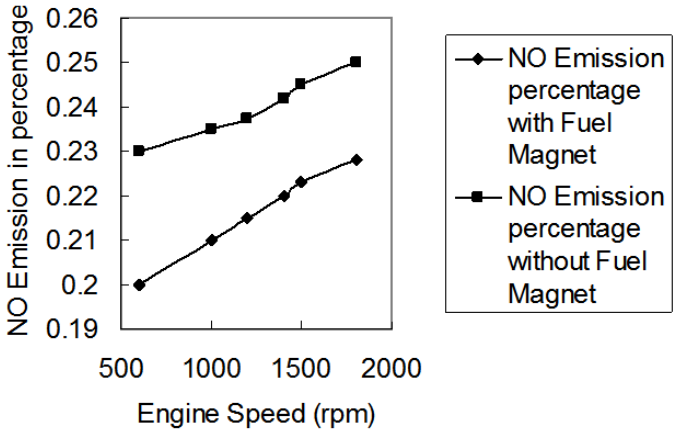

Fig. 5: Variation of NO Concentration with idling engine speeds of S.I.E fueled with and without fuel magnet

Conclusion and Recommendations:

From the above experimental work, it is clear that it is worthy to use a permanent magnet on the fuel inlet line of the petrol engine. The experiments reveal that the magnetic effect on fuel consumption reduction was up to 15%. CO reduction at all idling speed was range up to 7%. The effect on NO emission reduction at all idling speed was range up to 30%. The reduction of CH_4 at all idling speed was range up to 40%

By using permanent magnet on gasoline fuel feeding system attached to internal combustion engine, it is recommended to conduct this method similarly to internal combustion engines fuelled by diesel fuel and CNG as well. Then the effect on engine performance and emissions reductions can be studied.

It is very interesting to study the effect of variable magnet on the engine performance and emissions as.

REFERENCES

Paul, M. Fishbane *et al*, 1993. "Physics for Scientists and Engineers", ISBN 0-13-663238-6, by Prentice-Hall, Inc.

Park K.S. *et al* 1997. "Modulated Fuel Feedback control of a fuel injection engine using a switch type oxygen sensor", Proc Instn Mech Engrs vol 211 partD, IMechE,

Al Dossary, Rashid. M.A., 2009. "The Effect of Magnetic Field on Combustion and Emissions", Master's thesis, King Fahd University of Petroleum and Minerals.

Zhao, H., N. **L**adommatos, 1997. “Engine performance monitoring using spark plug voltage analysis”, Proc Instn Mech Engrs vol 211 partD, IMechE,

Crouse, W.H., 1970. “Automotive Engine Design”, Mc Graw-Hill.

http://fuelsaving.info/magnets,htm.

www.techalone.com

http://fuelmagnet.ne.

http://www.ecomagnets.com/thermoflow.htm.