Experimental Investigations on Fuel Properties Under the Influence of Magnetic Field

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***Abstract* – The aim of this study is to investigate the effect of a magnetic field on fuels property viscosity and density. These properties were measured by using calibrated Brook field Viscometer for viscosity measurement & density meter for density measurement. In this experiment three fuels were taken namely Petrol, Diesel & Kerosene that is subjected to magnetic field which is placed on the pipe line carrying these fuels. The experiments in current research comprise the using of permanent magnets with different field intensity (2500, 3500, 4500 Gauss).It has been reported that the viscosity & density of the flowing hydrocarbon fluids decreases on application of magnetic field and The decrease rate of viscosity and density increases more & more slowly accompanying the increase of the magnetic field strength.**

Keywords – Magnetic field, Viscosity, Density, I.C.Engine fuels

I. INTRODUCTION

There have occurred a great number of experimental studies which present evidences of the benefits of magnetic treatment on many occasions. Some eye-catching proto-industrial examples ever reported include: the enhancement of oil recovery and prevention of wax deposition. In petroleum production, transportation and refining; the improvement of fluidity of crude oils and the demulsification of oil-water mixtures**.** Even for motor vehicles and industrial boilers, much fuel economy and noticeable soot suppressions could be approached when the magnetic treatment was introduced. Over the last decade or so, the magnetic treatment, as a novel technique with great economic potentiality, has been strenuously exploited and widely adopted in the domain of petroleum chemical engineering.

However, there remain some blurring issues waiting eagerly for early answers, with the core of the uncertainties being the unfolding of the molecular interaction mechanism governing the macro-behaviours of the magnetically treated hydrocarbons and fuels. In our study, focus has been laid on the understanding of magnetic action modes which have led to the fuel economy and soot abatement in engine applications. In the present research, measurement will made about the properties of some typical hydrocarbons (Petrol, Diesel & Kerosene) such as viscosity, density after they have been treated in the magnetic field of different intensities.

II. LITERATURE SURVEY

Many of experimental studies presented evidence of the benefits of magnetic treatment which will enhance the fuel economy and reducing exhaust emission. Ali S. Faris et al have used the energy of permanent magnets in this research for the treatment of vehicle fuel. The experiments in current research comprise the using of permanent magnets with different intensity (2000, 4000, 6000, 9000) Gauss, which installed on the fuel line of the two-stroke engine. The overall performance and exhaust emission tests showed the rate of reduction in gasoline consumption ranges between (9-14%) and the higher value of a reduction in the rate of 14% 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. Farrag A. El Fatih et al in their research investigated the effect of magnetic field on internal combustion engines. The fuel is subjected to a permanent magnet mounted on fuel inlet lines. The experiments were conducted at different idling engine speeds. 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. Shweta Jain et al have applied the permanent magnet having strength 1000-1800 gauss are mounted on the fuel lines of single cylinder 4 stroke diesel engine. The experimental results found increase in the mileage by 10-14%, the clogging problems in diesel engine can be avoided, and the life of catalytic converter increases by 30%. Y. Al Ali et al has conducted two experiments, each using a different type of magnetic device. The first type of magnetic device is installed within the fuel tank and the second is installed onto the fuel line. Each experiment was performed on ten separate vehicles from the Dubai Taxi Corporation fleet. When compared to the baseline data, reductions of 70 % for both hydrocarbon and carbon monoxide emissions, and 68 % for oxides of nitrogen were recorded. Results also demonstrated an average fuel consumption reduction of 18 %.apart from all these study result which were get after applying the magnetic field are not consistent and does not have correlation with the applied magnetic field strength hence in order to do that much more study is required in the field of hydrocarbon behaviour under the influence of magnetic field. By considering this present study is focus on effect of magnetic field on two physical properties of fuels namely viscosity and density.

III. METHODOLOGY

Fuels molecules consist of a nucleus and orbiting electrons. The charismatic movement already exists in these molecules. Therefore, they have active and negative charges. This situation tends to increase combustion fuel resistance. When fuel is passed through a magnetic field, its molecules are got realign, and the intermolecular forces are considerably reduced, and that will make them easier to interlock with oxygen; produc-ing a complete burn in the combustion chamber. This procedure results in a better fuel consumption and reduction of hydrocarbon compounds, carbon monoxide and increases carbon dioxide emissions. The ionization of fuel also helps to dissolve the carbon build up in the fuel injectors, and combustion chambers were thereby keeping the engine in clean condition.

IV. EXPERIMENTAL SETUP

A. For Viscosity Measurement

To measure the viscosity of fuels we use a saline bottle with saline carrying tube. We take appropriate quantity of fuels in the saline bottle which is kept at a height of 60 cm from platform of viscometer with the help of iron stand. From saline bottle fuel is carried to the flask which is kept under viscosity measuring spindle of calibrated Brook field viscometer with the help narrow hollow tube. This tube attached to the bottle. It having inner dia. of 2mm & outer dia.4mm, hence thickness of 2mm as flowing fluids are low viscous fuels such as petrol, diesel & kerosene .The total length both of this tube is 110 cm. Initially we measure the viscosity of fuels without applying any magnetic field on fuel supply tube which gives the reading of viscosity of test fuel without magnetisation. After that the pair of magnets with opposite polarity separated by wooden block having intensities 2500, 3500 & 4500 gauss was taken. For taking a reading of viscosity of fuel with magnetisation, the fuel carrying tube is passing through centre of the pair of magnet. We take three readings for viscosity of fuel with magnetisation for each fuel as per follows.

1. Only 4500 gauss pair of magnets used.
2. 4500 & 3500 gauss pair of magnets kept in series with 15 cm distance between them.
3.4500,3500 & 2500 gauss magnet kept in series with 15 cm distance between them.

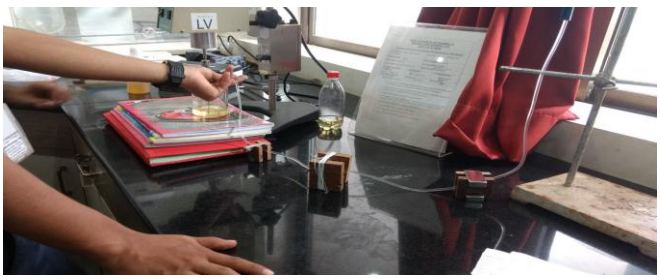


Fig.No.1.Set Up For Viscosity Measurement of Fuel with Magnetization.

a.

B. For Density Measurement

Density as a function of pressure and temperature is probably the most important property of petroleum fluids, whether liquid or gaseous, affecting production, processing as well as transport, and storage. To measure the density of fuel we go for the same setup as that of viscosity measurement only the difference here we use density meter .For taking a reading of density of fuel with magnetisation, the fuel carrying tube is passing through centre of the pair of magnet. This magnetise fuel taken into a flask having capacity of 10ml which is then kept on weighing machine to measure the density. Fig. shows the instrument use for measurement of density.

Fig.No.2.Set Up For Density Measurement of Fuel with Magnetization

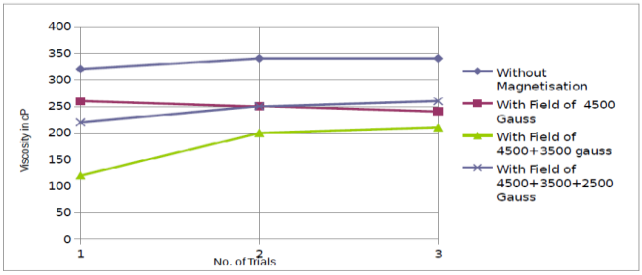
V. RESULTS & DICUSSION

Table No.1 gives the reading of viscosity of diesel with and without magnetisation under the influence of varying magnetic field. After comparing the reading of viscosity of diesel between without and with a 4500 gauss field it shows that there is a large decrease (25% average for three trial) in the viscosity. This decrease rate is further increases more & more slowly accompanying the placing the two magnets in series (4500+3500 Gauss) on fuel supply line. But this value of viscosity is increases somewhat when applying magnetic field of three magnet in series combination on fuel supply line.

Table No.1. Viscosity reading of Diesel Fuel with & without Magnetisation

Trial No.	W/o Magnetisation	With Field 4500 Gauss	With Field 4500+3500 Gauss	With Field 4500+3500+ 2500Gauss
1	320	260	120	220
2	340	250	200	250
3	340	240	210	260

Graph No.1.Shows the variation of viscosity of diesel fuel with and without magnetisation for a three trials. Form graph it is clear that there is large (45%) decrease in the viscosity of fuel when fuel line is subject to a magnetic field of (4500+3500)gauss series combination. for other field it is less than (25% decrease)that of without magnetic field.



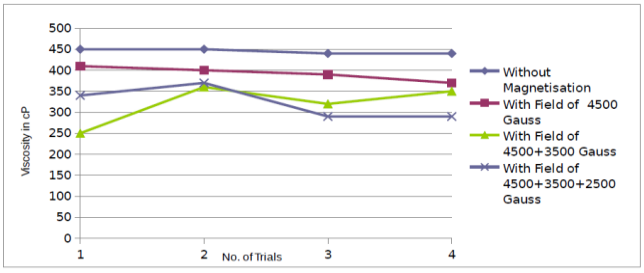
Graph No.1:Varition of viscosity of diesel fuel after Magnetisation

Table No.2 gives the reading of viscosity of Petrol with and without magnetisation under the influence of varying magnetic field. After comparing the reading of viscosity of Petrol fuel between without and with a 4500 gauss field it shows that there is a decrease (12% average for three trial) in the viscosity. This decrease rate is further increases more & more slowly accompanying the placing the two magnets in series (4500+3500 Gauss) on fuel supply line. This value of decrease viscosity is remain same somewhat when applying magnetic field of three magnet in series combination on fuel supply line.

Table No.2 .Viscosity reading of Petrol Fuel with & without Magnetisation

Trial No.	W/o Magnetisation	With Field 4500 Gauss	With Field 4500+3500 Gauss	With Field 4500+3500+ 2500Gauss
1	450	410	250	340
2	450	400	360	370
3	440	390	320	290
4	440	370	350	290

Graph No.2.Shows the variation of viscosity of Petrol fuel with and without magnetisation for a three trials. Form graph it is clear that there is large (27%) decrease in the viscosity of fuel when fuel line is subject to a magnetic field of (4500+3500+2500) gauss and (4500+3500) gauss in series combination.



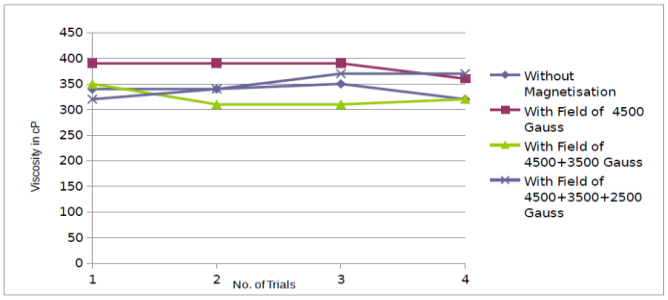
Graph No.2:Varition of viscosity of petrol fuel after Magnetisation

Table No.3 gives the reading of viscosity of Kerosene with and without magnetisation under the influence of varying magnetic field. After comparing the reading of viscosity of Kerosene fuel between without and with a 4500 gauss field it shows that there is an increase (13% average for three trial) in the viscosity. The value of viscosity is decreases by (8%) when placing the two magnets in series (4500+3500 Gauss) on fuel supply line. But this value of viscosity is again increases somewhat when applying magnetic field of three magnet in series combination on fuel supply line when compared with value of viscosity without magnetisation.

Table No.3 .Viscosity reading of Kerosene Fuel with & without Magnetisation

Trial No.	W/o Magnetisation	With Field 4500 Gauss	With Field 4500+3500 Gauss	With Field 4500+3500+2500Gauss
1	340	390	350	320
2	340	390	310	340
3	350	390	310	370
4	320	360	320	370

Graph No.3.Shows the variation of viscosity of Kerosene fuel with and without magnetisation for a three trials. Form graph it is clear that there is decrease in the viscosity of fuel when fuel line is subject to a magnetic field of (4500+3500) gauss in series combination. For other field it is more than that of without magnetic field.



Graph No.3:Varition of viscosity of Kerosene fuel after Magnetisation

Below graph shows the variation of viscosity of Petrol, Diesel and Kerosene fuel with and without magnetisation. Form graph it is clear that there is a very large variation in the density value of fuels when they are subject to a magnetic field. The rate of decrease is more for diesel fuel compared with petrol fuel at all applied magnetic field while viscosity variation behave in zigzag manner for kerosene fuel.

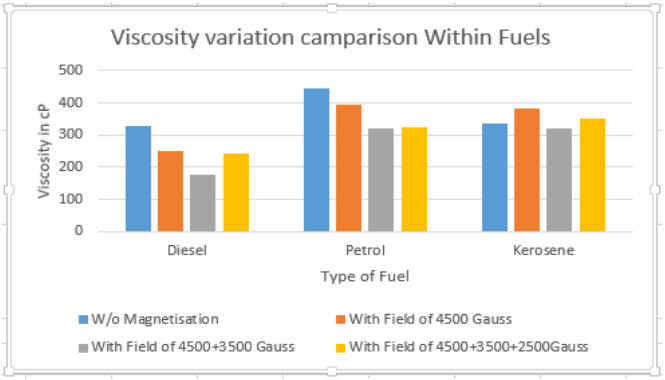
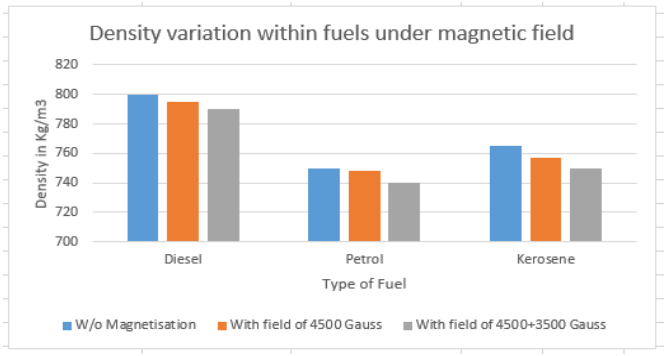


Table No.4 gives the reading of density for Diesel, Petrol and Kerosene with and without magnetisation under the influence of varying magnetic field. After comparing the reading of density of these fuels between without and with a magnetic field of 4500 gauss, it shows that there is a small decrease (0.6 %) in the density value. This decrease rate is remain same when placing the two magnets in series (4500+3500 Gauss) on fuel supply line. But these density values does not get change when applying magnetic field of 2500 gauss on fuel supply line.

Table No.4 .Density reading of Fuels with & without Magnetisation

	W/o Magnetisation	With field 4500 Gauss	With field of 4500+3500 Gauss
Diesel	800	795	790
Petrol	750	748	740
Kerosene	765	757	750

Below graph shows the variation of density of Petrol, Diesel and Kerosene fuel with and without magnetisation. Form graph it is clear that there is a very small decrease in the density value of fuels when theses fuels are flowing through a magnetic field and the rate of decrease is same for all three fuel at all applied magnetic field.



V. CONCLUSION

The study on fuel properties for Petrol, Diesel & Kerosene under the influence of magnetic field when being compared with that with without magnetic field have been concluded into points as followed:

- After applying a magnetic field on fuel line, fuel is get magnetized and viscosity of fuel is deceases. The decrease rate of viscosity increases more & more slowly For diesel & petrol accompanying the increase of the magnetic field strength. But for kerosene fuel viscosity behavior under magnetic field is remain uncertain.
- After applying a magnetic field on fuel line, fuel is get magnetized and density of all fuels is deceases. The decrease rate of density increases more & more slowly accompanying the increase of the magnetic field strength.

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