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DETERMINING OF THE VISCOSITY FACTOR IN BANI WALEED GASOLINE STATIONS

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ABSTRACT
This paper aims to estimating the ratio of viscosity factor in benzene to some stations. Gasoline samples were taken at several petrol stations in one of the Libyan cities called Bani Waleed, the selected stations are station No. 288 (Hussein Amer Airport Road), Station No. 388 (Abu-Qureen Station), Station 105 (Sons of Ghattas), and station No. 541 (Sons of Heba Almardoum). The viscosity factor in benzene in these samples was measured and estimated at varying degrees using Viscometer for each fixed sample. The results indicate that, the highest viscosity of benzene was found at Station No. 388, which was 0.6424 *while the lowest viscosity was in Station No. 288 which was* 0.6067.
KEY WORDS: *Viscosity, Viscosity factor, Viscometer*

1. INTRODUCTION

The demand for transportation, together with the increasing of resources of world fuel has been responsible for many of the advances in the crude oil recovery, the internal combustion engine, and fuel development,. Depleted oil reservoirs are being revisited increasingly with more sophisticated ways of recovering remaining oil deep below the ground level. Above land, the developments over the past century have led to modern automobiles and the heavy goods vehicle units bearing little resemblance to the noisy, polluting, efficiency engines of the early pioneering models, and low power. The diesel engine, in particular, originally developed by Dr Rudolph Diesel at the end of the nineteenth century, has been completely revolutionized in recent years. The development of diesel engine and gasoline technology has, to a large extent, been driven by legislation and the public demand for lower gas emissions of noise, particulates, and gas emissions which including carbon monoxide, the oxides of Sulphur, carbon dioxide, and nitrogen.

Viscosity is defined as a measure of the resistance of the fluid which is being deformed by either tensile stress or shear stress. In everyday terms (and for fluids only), viscosity is " internal friction" or " thickness ". Thus, water is "thin", having lower viscosity, while honey is "thick", which means having higher viscosity. Put simply, the less viscous the fluid is, the greater its ease of movements (fluidity).

Viscosity describes the fluid's internal resistance to flow and may be thought of as a measure of fluid friction. For example, high viscosity felsic magma will create a tall, steep stratovolcano, because it can not flow far before it cools, while low viscosity mafic lava will create a wide, shallow-sloped shield volcano. All real fluids (except the superfluid) have some resistance to stresses and therefore are viscous, but a fluid which has no any resistance to shear stress is known as an inviscid fluid ideal fluid.

Viscosity is an important characteristic property that is required for process engineering calculations such as prediction of pressure drops in tubes or pipes. Viscosity describes the resistance of the fluid to shear stress. Viscosity is a function of pressure and temperature, but the change in the

pressure or the temperature has different effects on liquids and gases. Viscosities can be expressed in two different forms: kinematic viscosity or dynamic viscosity. Kinematic viscosity is the ratio of the dynamic viscosity to the fluid density. Dynamic viscosity is the tangential force per unit area required to move one a horizontal plane with respect to the other at unit speed when maintained a unit distance apart by the fluid.

This paper aims to estimating the viscosity factor in benzene to some stations, and the gasoline samples were taken at several petrol stations in one of the Libyan cities called Bani Waleed.

2. WAYS TO MEASURE VISCOSITY

The viscous properties of a fluid or amorphous solid are primarily determined by inter-particle forces within the solution, including friction and attraction between the molecules in the macrostructures. These Van der Waals forces are critical facets of a sample's resistance to deformation, or flow, which defines the material's viscosity.

Shear viscosity is expressed due to two distinct forms:

- Dynamic viscosity; which is a measure of the shear stresses per a unit area required before a sample begins to deform. This characteristic is expressed in mill-pascal seconds (mPa-s).
- Kinematic viscosity; which refers to the resistive flow of a fluid under influence of the gravity. This property is density-dependent and is measured in square meters per second (m^2/s).

This part of paper obtains five of the fundamental measuring techniques for obtaining the dynamic viscosity and the kinematic viscosity of fluidic samples.

Capillary Viscometers

Measuring viscosity due to a capillary tube is one of the oldest methods of determination the kinematic viscosity of the sample, requiring prior knowledge of the density and volume of the sample of interest. This fluid is passed through a vertical U-tube of known dimensions and very small diameter. The time taken for the sample to travel through the capillary correlates to its kinematic viscosity.

Fig. 1. Capillary Viscometer.

Rotational Rheometry

A rotational viscometer applies relatively weak levels of torque to a liquid sample to encourage mechanical deformation. The amount of torque required to cause rotation across a horizontal plane in the sample is measured and is relative to sample viscosity. Using a rotational rheometer allows analysts to plot a full flow curve of the material's flow characteristics in response to varying levels of shear force and determine more advanced material parameters. Alternative viscometers only allow for single point measurement and provide only shear viscosity measures.

Fig. 2. Rotational Rheometry.

Vibrating Viscometers

Viscosity can also be measured by applying oscillating vibrations to the sample and monitoring the damping effects of the fluid. These can be assessed by monitoring power input, the decay time of oscillations, or changes in the resonated frequency.

Fig. 3. Vibrating Viscometer.

Microfluidic Rheometers

Microfluidic rheometry is an innovative method for determining the dynamic viscosity of fluids in small sample volumes by forcing a liquid sample through a microfluidic channel in a laminar flow. At Formulaction, Fluidicam Rheo uses this principle to flow the fluid side by side with a reference material. Dynamic viscosity is measured by comparing the differential flow rates, the viscosity of the reference material, and the position of the interface between the two fluids within the microfluidic channel.

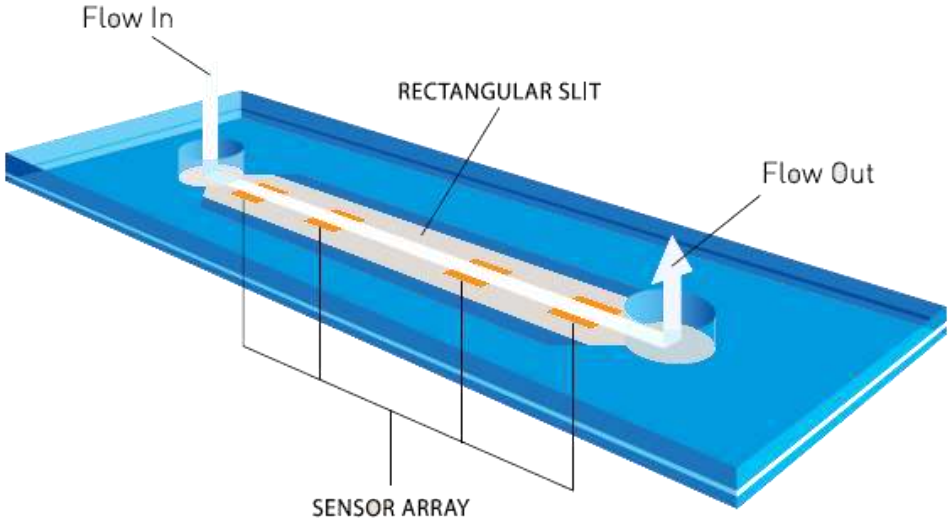

Fig. 4. Microfluidic device.

Non-Contact Rheology

Passive micro-rheology is a more complex measurement of a sample's rheological characteristics. It measures similar properties to rotational Rheometry but is adapted to more complicated and fragile structures such as gels, weak pastes, and viscoelastic materials that could break under extremely low shear. Unlike traditional rotational rheometers, non-contact rheology enables a quantitative assessment of the rheological properties of a sample at rest without mechanical stress.

3. MATERIALS AND METHODS

In this part of the paper, the measurement of the viscosity is completed using some groups of different samples of benzene C_6H_6 from different gasoline stations at different temperatures were shown in the sample. The device used in this work is Rotational Rheometry which obtained in figure 2.

Table 1: Station No. 288.

Temperature C⁰	Viscosity Y/pa*s	Percentage	Viscosity factor
27	5.2	1.0	$d = \frac{15.3}{25.215} = 0.6067$
30	5.0	1.0	
34	5.1	1.0	

Table 2: Station No. 541.

Temperature C⁰	Viscosity Y/pa*s	Percentage	Viscosity factor
27	5.4	1.2	$d = \frac{15.6}{25.215} = 0.6186$
30	5.1	1.0	
34	5.1	1.0	

Table 3: Station No. 388.

Temperature C⁰	Viscosity Y/pa*s	Percentage	Viscosity factor
27	5.5	1.3	$d = \frac{16.2}{25.215} = 0.6424$
30	5.4	1.1	
34	5.3	1.1	

Table 4: Station No. 105.

Temperature C⁰	Viscosity Y/pa*s	Percentage	Viscosity factor
27	5.4	1.3	$d = \frac{15.7}{25.215} = 0.6226$
30	5.1	1.3	
34	5.2	1.3	

To compare the viscosity factor values in all stations, the diagram in Figure 5 is prepared. It can be seen that station 288 has a lower value of the viscosity factor while the value of viscosity factor in station No. 388 is larger than the other stations. This difference is due to changing of temperature from one place to another.

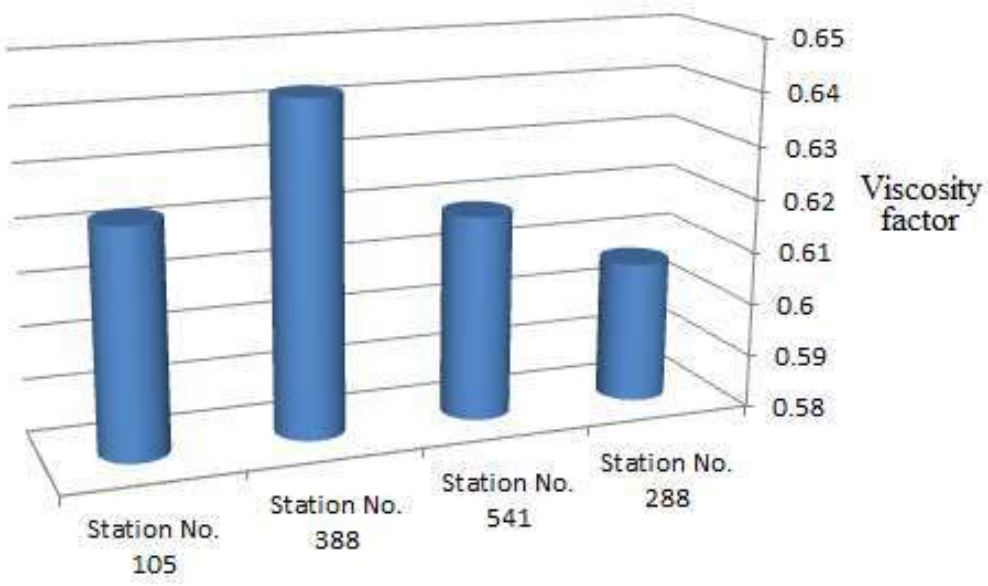

Fig. 5. Viscosity factor for all stations.

4. CONCLUSION

The results and analysis of the samples obtained a clear variation in the viscosity factor, density, and boiling point. Although this apparent disparity is very small and maybe negligible, the reason for this variation is due to the use of a variety of benzene sources and the samples used to determine the viscosity factor from one station to another. Even though this difference is small, it is sometimes occurred due to the efficiency of the equipment and machines used in the refinery or the transport, and storage equipments of the stations. The reason for the discrepancy is sometimes due to the difference in the quality of crude oil used.

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