Ministry of Higher Education and Scientific Research
AL Mustaqbal university college
Chemical Engineering Department

Petroleum Properties Laboratory

2nd. Stage.

Exp. No. 6
Petroleum Products Kinematic Viscosity Test

Prepared by

Asst.lect. Ban Ali Hassan

2021-2022

Purpose of this test:

This test method covers the determination of kinematic viscosity of petroleum product .

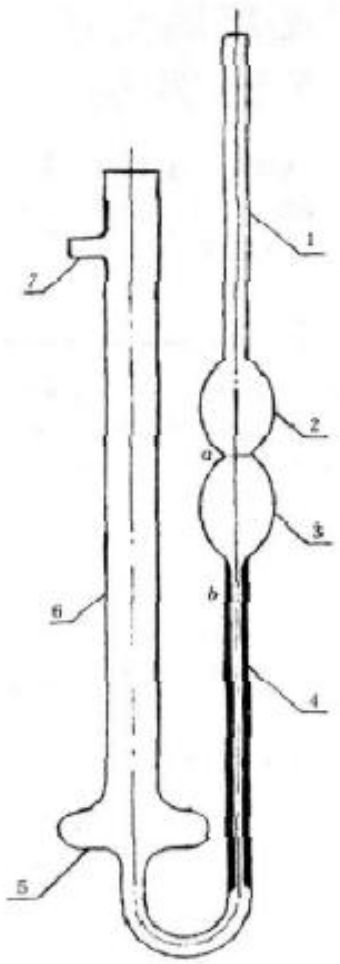
Introduction and theory :

Kinematic viscosity is used to evaluate the flow performance of crude oil and petroleum products and is an important physical constant in the process of processing, transportation, management, sales and use of crude oil and petroleum products. At the macro level، kinematic viscosity is a measure of the viscosity of organic heat carriers. At the micro level, it reflects the composition and structure of molecules. Therefore, the measurement of kinematic viscosity is very important in theory and engineering. There are many methods for the determination of kinematic viscosity, and the capillary viscometer method is commonly used in China. For example, the Flat capillary viscometer is used for the determination of kinematic viscosity of colorless or light-colored liquid petroleum products, and the countercurrent viscometer is used for the determination of kinematic viscosity of dark-colored petroleum products. However, the method is manual sample detection, and the capillary viscosity tube shall be cleaned manually with acetone or petroleum ether after detection. Among them, acetone is easy to make drugs، while petroleum ether is a dangerous chemical, which will cause human damage and environmental pollution if used in large quantities for a long time. With the development of The Times and the progress of science and technology, automatic viscosity meter arises at the right moment, Stabinger viscometer is one of them, it is the use of liquid viscosity force, by measuring the constant speed driving sample tube light suspension rotor speed, calculate the dynamic viscosity of the sample, and then through the U-shaped shock tube measurement of the density. The kinematic viscosity of the sample is obtained after conversion. This method has the advantages of less sample demand, faster test، convenient cleaning and environmental protection. In order to make the Stabinger viscometer widely used, it is urgent to study the accuracy of the automatic viscometer in the detection of kinematic viscosity.

Significance and Use

Kinematic Viscosity Test Instrument is designed as per ASTM D 445 to determine kinematic viscosity of liquid petroleum products including transparent and opaque liquid, by time measurement for a volume of liquid to flow under gravity through a calibrated glass capillary viscometer. Lab tech can provide both manual and automated type of Kinematic Viscosity Tester for customer choosing.

Petroleum products kinematic viscosity tester



Capillary viscometer test

①First, turn on the thermostatic bath and set the temperature at 40℃. After the temperature is stable‹ choose a clean and dry viscometer.
②Invert the viscometer and insert tube 1 into the sample. At the same time, plug the thick tube opening of tube 6 with the left thumb. Then use the ear-wash ball to suck the sample higher than the mark a at the glass fork .7Be careful not to create bubbles or cracks in the capillaries and in the dilated part 3.
③Straighten the viscometer, fix it in the constant temperature bath, insert a piece of rubber tube on pipe body 1, and start the test after 20min.
④During the test, the sample was first sucked higher than mark A with an ear-washing ball, and the flow of the sample in the tube was observed. The

stopwatch was started when the liquid level reached mark A. Stop the stopwatch when the liquid level reaches mark B.
⑤To check the number of seconds, it is necessary to make the flow time between 200s ~ 900s. If not, it is necessary to replace the viscosity coefficient with an appropriate capillary viscometer, and continue to repeat steps 2, 3, and 4 until a viscometer meeting the time requirement is found.
⑥After finding an appropriate viscometer, continue to repeat the test according to Step 4 for at least four times, in which the difference between each flow time and its arithmetic mean value should meet the specified requirements (the difference should not exceed ±0.5% of the arithmetic mean value), and then take the arithmetic mean value obtained from at least three flows as the average flow time of the sample.
⑦ The viscometer constants of the capillary viscometer used were obtained and the kinematic viscosity of the sample at 40℃ was calculated based on the time recorded. See Formula (1) for the calculation formula.

$$\mathbf{V_t = c * v_t} \quad \text{..... (1)}$$

Description:
V_t : The kinematic viscosity of the sample
C : Viscometer constant
v_t : Average flow time of the sample

or:
Calculate the viscosity by the relationships:

$$\frac{\eta_1}{\eta_2} = \frac{t_1\,\rho_1}{t_2\,\rho_2} \quad \text{.....(2)}$$

Where :
η_1 : is viscosity of diesel fuel @40 ℃ .
η_2 : is viscosity of water 0.891 poise.
t_1 : flow time of diesel fuel @ 40 ℃ . = 14.9 sec.
t_2 : flow time of water = 11.35 sec.
ρ_1 : density of Diesel fuel (gas oil) @ 40 ℃
ρ_2 : density of water 0.997 g/cm^3 .

Procedure :

1. Clean the viscometer by the water and ethanol and dry it.
2. Put a certain amount of liquid in the large bulge viscometer and pull it by pipette until the small bulge is full.
3. Put viscometer vertically in the water bath at the desired temperature.
4. Let the liquid to flow through the capillary tube with run time when the liquid reaches the mark shown on the viscometer and then stopped time when the liquid reaches the bottom mark.
5. Repeat the experiment and record the results (take average of results).
6. Repeat the experiment to other liquids.
7. Change the temperature and calculate the viscosity.

Discussion:

1. What is the effect of temperature on the viscosity ?
2. What is the importance of the experiment ?
3. What are the parts of the device used in the experiment?
4. What is the effect of stirrer on the viscosity ?
5. What is the other sample can be used in the experiment?