Al-Mustaqbal University
College of Engineering and Engineering Technologies
Department of Chemical Engineering and Petroleum Industries

EXPERIMENTS(4)

SECOND CLASS

1 ND SEMESTER

PHYSICAL CHEMISTRY LABORATORY

By

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Experiment No. (4): *(viscosity)*

Object of Experiment:

Determination of viscosity and the effect of the temperature on viscosity.

Theory:

Viscosity of a fluid is a measure of its resistance to gradual deformation by shear stress or tensile stress. For liquids, it corresponds to the informal notion of "thickness". For example, honey has a higher viscosity than water.

Viscosity is due to the friction between neighboring particles in a fluid that are moving at different velocities. When the fluid is forced through a tube, the fluid generally moves faster near the axis and very slowly near the walls; therefore, some stress (such as a pressure difference between the two ends of the tube) is needed to overcome the friction between layers and keep the fluid moving. For the same velocity pattern, the stress required is proportional to the fluid's viscosity. A liquid's viscosity depends on the size and shape of its particles and the attractions between the particles.

A fluid that has no resistance to shear stress is known as an ideal fluid or inviscid fluid. Zero viscosity is observed only at very low temperatures, in super fluids. Otherwise all fluids have positive viscosity. If the viscosity is very high, for instance in pitch, the fluid will appear to be a solid in the short term. A liquid whose viscosity is less than that of water is sometimes known as a mobile liquid, while a substance with a viscosity substantially greater than water is called a viscous liquid.

Procedure:

1. Measure the radius of the ball and it's weight .
2. Put the liquid (Glycerin) in cylinder and measure the liquid height.
3. Measure the temperature of the liquid.
4. Measure the Density of the liquid by Pyknometer .
5. Fall the ball in the cylinder and measure the time of the ball fall.
6. Repeat (3-5) steps at different temperatures (25, 30, 35, 40)^{o}C.

Viscosity is influenced by several key factors, including:

1. Temperature: Viscosity typically decreases with an increase in temperature,

2. Pressure: In some liquids, an increase in pressure may lead to an increase in viscosity.

3. Liquid Composition: The viscosity of liquids varies based on their components. For instance, oils have a higher viscosity than water.

4. Velocity: Viscosity can change with varying fluid velocities; some fluids are known as non-Newtonian, meaning their viscosity depends on the shear rate.

5. Presence of Additives: Certain materials such as thickeners or other additives can increase the viscosity of the liquid.

6. Chemical Nature: The chemical properties of the molecules affect their cohesion and, consequently, their viscosity.

Discussion:

1- Discuss the results you obtained and explain how temperature affects the viscosity of liquids.

2- In the Say bolt viscosity device, how is the viscosity calculated based on what factors?

3- Plot and find the slope for :-

t (time)

T(Temperature)

4- What are the advantage and disadvantage of viscosity?