Date 17/11/22

Revision of experiment

EXP-01

Object: To determine the viscosity of a given liquid (20% & 30% glycerol solution) at room temperature using ostwald viscometer.

Theory: A suitable volume of experimental solution is allowed to flow through the capillary tube under the influence of gravity and the time of flow (t_1) of the given solution is determined. The experiment is then repeated exactly with the same volume of the reference liquid (water) and the time of flow (t_2) is noted. Then the relative viscosities η_1 & η_2 and the time of flow t_1 & t_2 are related to each other as:

$$\frac{\eta_1}{\eta_2} = \frac{d_1 t_1}{d_2 t_2}$$

where d_1 & d_2 are the densities of the given liquid and water respectively.

Chemicals Required: Given liquid / solution, chromic acid & acetone (for washing & drying).

Apparatus required: Ostwald viscometer, Rubber tube, Screw pinch, Pipette, clamp stand, stop watch.

Procedure: Fill 25 ml of water (or a reference liquid) with the help of pipette, into the ostwald's viscometer through the other end. Adjust the quantity of solution in such a way that when sucked from Rubber tube, it stood above the upper mark. Fill the upper bulb and capillary tube and half of the lower bulb with the given solution. →

Suck the reference liquid or water through the rubber tube so that it is few cm above the upper mark. Now release the pressure and allow the liquid to flow back under the gravity through the capillary tube into the lower bulb. Start the stop clock when liquid meniscus just crosses the upper mark & stop the clock when liquid crosses the lower mark in viscometer. The difference give the time taken for liquid meniscus to pass from upper mark to lower mark. Again suck the water and repeat the experiment for about 3 times.

Repeat the experiment by taking same amount of liquid (20% & 30%) exactly in same way.

Observation Table:

at 20°C

$$\frac{\text{gm}}{\text{cm sec}} = \frac{\text{gm}}{\text{cm sec}} = \frac{d_{20\%}\, t_{20\%}}{d_w \times t_w} \times \eta_w$$

$$d_{20\%} = 1.04690 \times 10^3 \text{ kg/m}^3$$

$$d_{30\%} = 1.07270 \text{ g/cm}^3$$

$$\frac{d_{30\%}\, t_{30\%}}{d_w \times t_w} \times \eta_w$$

g/cc = poise

$\eta = 0.9982 \times 10^{-3}$ kg/m³

$V = \frac{\pi r^4 t}{8 l \eta} P$ ($P = \rho g h$)

or $\eta = \frac{\pi r^4 t}{8 l V} P$

t = ?