DETERMINATION OF SURFACE TENSION OF A LIQUID

Experiment No. ....   Date:.....................

Aim: To determine the surface tension of a liquid using Stalagmometer.

Materials: Stalagmometer, volumetric flask, water sample

Description of Apparatus: Stalagmometer is especially used for relative methods of determination of surface tension for comparing surface tension of liquids. It consists of a capillary tube the end of which is flattened to provide a large dropping surface with a sharp boundary. The capillary tube extends upwards upward into bulb which terminates again into a capillary. On either ends of bulb are found marks X and Y the surface tension may be determined by counting of drops formed by liquid volume from X to Y. The number of drops is counted for a liquid provided with a scale the fraction of the drop may be estimated to an accuracy of 0.05 of a drop. To check the flow the capillary tube is attached to a rubber fuse filled with a pinch cock at one of the ends the rate of flows should not exceed 15 drops per minute if it is more than this it should be decreased with the help of rubber tube with pinch cock.

Theory: Surface tension is defined as the force in dynes acting on a surface at right angles to any line of unit length or per centimeter.

There are two methods of determining surface tension

1. Drop weight method and
2. Drop number method

Surface tension of a liquid is measured by using an apparatus called stalagmometer. The method is based on the principle that the weight of a liquid falling from a capillary tube held vertical is approximately proportional to the surface tension of the liquid. It is more convenient to count the number of drops of the liquid than finding the weight of a single drop. The weights of equal volumes of two liquids are proportional to their densities. If N_1 and N_2 are the number of drops of two liquids of the same volume, then:

$$\gamma_1 / \gamma_2 = N_2 d_1 / N_1 d_2$$

Where γ_1 and γ_2 are surface tensions of water (given in the table) and solution (to be calculated) respectively; d_1 and d_2 are the densities of water and solution (given in the table) respectively.

Procedure:

1   Take a clean and dry Stalagmometer.
2   Suck distilled water into the Stalagmometer till the level reaches to the top mark above the bulb (X).
3   Now allow the water to flow through the capillary and count the number of drops formed till the liquid level reaches the lowest mark below the bulb (Y).
4   Prepare 2% detergent solution by dissolving 2gms of detergent in 100 ml distilled water.
5   Repeat Steps 2 and 3 with 2% detergent solution
6   Dilute the 2% detergent solution to different concentrations as given in the table and repeat Steps 2 and 3 with each solution.
7. Use the formula to calculate the surface tension of each liquid. Record your data and the surface tension of each liquid in the table.

Observation Table:

No	Solution / Water	Concentration of detergent Solution (Density)	Number of drops Exp-1	Number of drops Exp-2	Number of drops Ave.	Surface Tension Dynes/cm
1	Pure Water	0% (1)				72
2	Pure ditergent solution	2%(1.04)				
3	50 ml water + 50 ml 2% ditergent solution	1%(1.03)				
4	50 ml water + 50 ml 1% ditergent solution	0.5%(1.02)				
5	50 ml water + 50 ml 0.5% ditergent solution	0.25%(1.01)				

Result:

Surface Tension of the given liquids is 2% solution =---------- dynes/cm

1% solution = --------- dynes/cm

0.5% solution = -------- dynes/cm