CHZ 224 SURFACE AND COLLOID CHEMISTRY

EXPERIMENT #1: MEASUREMENT OF SURFACE TENSION IN AQUEOUS SOLUTIONS

1. Introduction

Surface tension is caused by the attraction between the liquid's molecules by various intermolecular forces. In the bulk of the liquid, each molecule is pulled equally in all directions by neighboring liquid molecules, resulting in a net force of zero. At the surface of the liquid, the molecules are pulled inwards by other molecules deeper inside the liquid and are not attracted as intensely by the molecules in the neighboring medium (be it vacuum, air or another liquid). Therefore, all of the molecules at the surface are subject to an inward force of molecular attraction which is balanced only by the liquid's resistance to compression, meaning there is no net inward force. However, there is a driving force to diminish the surface area, and in this respect a liquid surface resembles a stretched elastic membrane. Thus the liquid squeezes itself together until it has the locally lowest surface area possible. Three parameters that are affecting the surface tension are temperature, liquid type and impurity.

The mathematical model of surface tension is that the force per unit lenght.

Surface tension : F/L→ (N/m or dyne/cm)

2. Materials and Method

Du Noüy Ring method is the traditional one used to measure surface or interfacial tension. Wetting properties of the surface or interface have little influence on this measuring technique. Maximum pull exerted on the ring by the surface is measured. Surface or interfacial tension can be also determined by the profile of a drop of a liquid, which is suspended in another liquid or air, at mechanical equilibrium using an optical instrument. This profile is determined by the balance between gravity and surface forces.

In this experiment, the surface tension of solutions will be carried out by Krüss Ring Tensiometer for distilled water and sodium dodecyl sulfate (SDS) solutions at 10^{-3} and 10^{-4} M concentrations by platinium ring.

3. Experimental Procedure

1. Before surface tension measurements, quickly dip the platinum ring into nitric acid followed by fast rinsing. Dip it into acetone, rinse it several times and flame the ring.
2. Take extreme caution that the solution is free of any contamination. Try surface tension measurement until the theoretical value of 72.75 mN/m at 20 ^{o}C is achieved.
3. Follow the same procedure for 10^{-3} M and 10^{-4} M of Sodium Dodecyl Sulfate (SDS) solutions and measure the surface tension of the solution.

4. Experimental Procedure

1. Explain step by step how you performed the experiment
2. Compare your results on “Du Noüy Ring” with those available in literature.
3. Why is it that you get differences in surface tension values of pure water and and that with SDS.
4. Write about the importance of surface tension in mineral porcessing.
5. Explain why surface tension changes with temperature from the point of the interactions between molecules.