

EXPERIMENT #1

MEASUREMENT OF SURFACE TENSION IN AQUEOUS SOLUTIONS

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.

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.

Equipment, accessories and materials:

Krüss Ring Tensiometer
Platinum Ring
Distilled water

Preparation of the ring

Quickly dip the platinum ring into nitric acid followed by fast rinsing.
Dip it into acetone and rinse it several times.
Flame the ring.

Experimental Procedure:

Measure surface tension of distilled water using “Du Noüy Ring” method”. 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 °C is achieved. Add 10^{-3} M and 10^{-4} M of Sodium Dodecyl Sulfate (SDS) and measure the surface tension of the solution.

Report:

Compare your results on “Du Noüy Ring” with the literature. Discuss the source of differences in surface tension values of pure water and water with SDS.