



Unit III

Surface and interfacial phenomenon

Adsorption at Liquid Interfaces:

Surface free energy was defined as the **work that must be done to increase the surface by unit area**. As a result of such an expansion, more molecules must be brought from the bulk to the interface. The more work that has to be expended to achieve this, the greater is the surface free energy.

Certain molecules and ions, when dispersed in the liquid, move of their own accord to the interface. Their concentration at the interface then exceeds their concentration in the bulk of the liquid. Obviously, the surface free energy and the surface tension of the system are automatically reduced. Such a phenomenon, where the added molecules are partitioned in favor of the interface, is termed adsorption, or, more correctly, **positive adsorption**.

For example: when inorganic electrolytes (sodium chloride) are added to water, they marginally enhance the surface tension (Figure). The electrolytes remain in the bulk and pull the solvent molecules on the surface through electrostatic interactions.

Other materials (e.g., inorganic electrolytes) are partitioned in favor of the bulk, leading to **negative adsorption** and a corresponding increase in surface free energy and surface tension.

Some substances like sugar, carbohydrate and cellulose derivatives do not affect the interfacial tension when they are added to water (Figure). Any marginal increase in the interfacial tension may be related to enhanced viscosity of sugar solutions.

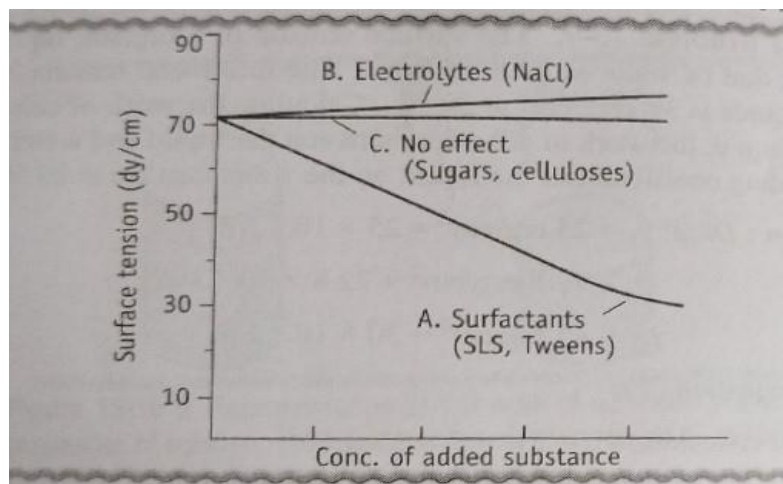


Figure: Influence of added substance on the surface tension of water

Adsorption, can also occur at solid interfaces. Adsorption should not be confused with absorption. The former is solely a surface effect, whereas in absorption, the liquid or gas being absorbed penetrates into the capillary spaces of the absorbing medium.

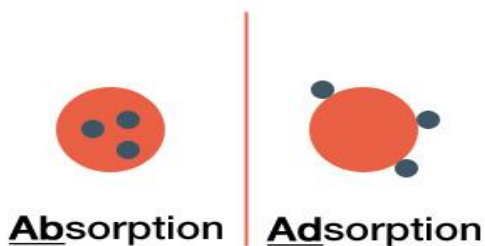


Figure: Differentiation between absorption and adsorption

The taking up of water by a sponge is absorption; the concentrating of alkaloid molecules on the surface of clay is adsorption.

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