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It's Important to Know!

BP302T — Physical Pharmaceutics I

B.Pharm Semester 3 · Unit 3 — Surface and interfacial phenomena

Unit III: Surface and interfacial phenomena

Surface tension and interfacial tension

Surface tension is the force or free-energy effect associated with a liquid surface. Interfacial tension occurs at the boundary between immiscible phases. Both arise from unbalanced molecular forces at an interface. Methods include capillary rise, drop weight, drop volume, ring and plate methods. Method selection and correction factors are set out in the prescribed text.

The spreading coefficient helps predict whether one liquid spreads over another surface. Lowering interfacial tension can improve wetting, dispersion and emulsification, but does not alone guarantee physical stability.

Surface-active agents and HLB

Surfactants contain a portion compatible with the continuous phase and a portion attracted to another phase or interface. They adsorb at interfaces and can lower surface or interfacial tension. The hydrophile-lipophile balance system provides a practical way to compare surfactant tendencies. Exact HLB ranges for a specific application should be checked against the prescribed text.

Surfactants support wetting, detergency, solubilisation, emulsification and micelle formation. Concentration above the critical micelle concentration can produce aggregates. The effect depends on temperature, electrolyte, pH, surfactant structure and drug interactions.

Adsorption at solid interfaces

Adsorption is accumulation at an interface, unlike absorption into the bulk. Physical adsorption is usually weaker and more reversible than chemisorption. Isotherms relate the amount adsorbed to equilibrium concentration or pressure. Adsorbents can remove impurities, alter drug availability or stabilise a dispersion.

Unit III: Frequently asked questions

Q: What is the difference between surface and interfacial tension?

A: Surface tension describes a liquid-gas boundary, while interfacial tension describes a boundary between two immiscible phases.

Q: What is the critical micelle concentration?

A: It is the approximate concentration above which added surfactant increasingly forms micelles rather than only increasing monomer concentration.

Q: How is adsorption different from absorption?

A: Adsorption occurs mainly at a surface, while absorption involves entry into the bulk of a material.

Unit III: Key takeaways

- Interfacial energy affects wetting, dispersion and emulsification.
- Surfactants can lower tension and form micelles.
- HLB is a practical guide, not a complete formulation rule.
- Adsorption can be physical or chemical and changes with surface and solute properties.
- Measurement method and conditions must be reported.

Unit III: Practical correlation

Practical correlation: suspension wetting. A poorly wetted powder may float or form lumps; a suitable wetting agent and mixing sequence can improve dispersion. The surfactant concentration and compatibility for a specific formula are set out in its approved specification.