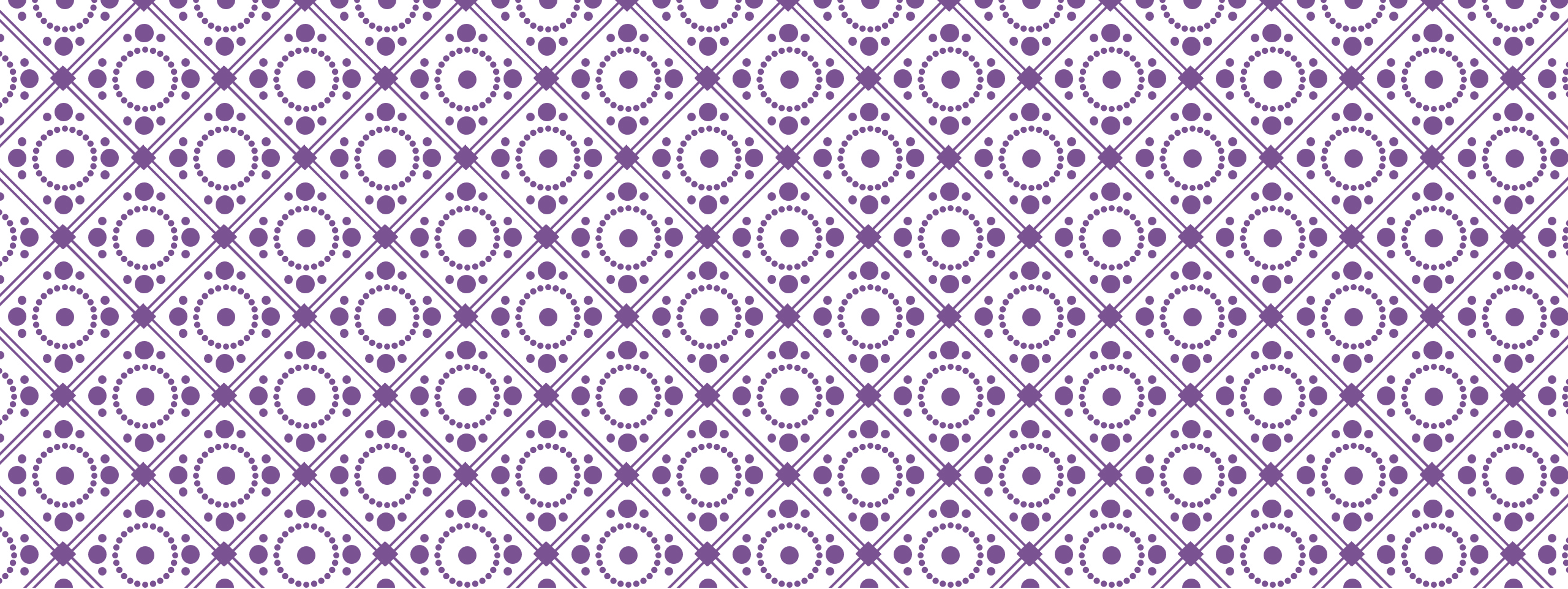




STABILITY OF PHARMACEUTICALS

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STABILITY OF PHARMACEUTICALS

Decomposition and Stabilization of Medicinal Agents

Pharmaceutical decomposition can be classified as:

- Hydrolysis.
 - Oxidation.
 - Isomerization and epimerization.
 - Photolysis.
- These processes may affect the stability of drugs in liquid, solid, and semisolid products.

INTERFACIAL PHENOMENA

- When phases exist together, the boundary between two of them is known as an interface.
- The properties of the molecules forming the interface are often sufficiently different from those in the bulk of each phase that they are referred to as forming an interfacial phase.
- Several types of interface can exist, depending on whether the two adjacent phases are in the solid, liquid, or gaseous state.

INTERFACIAL PHENOMENA

- Liquid interfaces involve the association of a liquid phase with a gaseous or another liquid phase.
- Solid interfaces will deal with systems containing solid–gas and solid–liquid interfaces.

LIQUID INTERFACES

SURFACE AND INTERFACIAL TENSIONS

➤ Surface tension :-

It is a property of the surface of the liquid that causes it to behave as an elastic sheet. It is caused by the attraction between molecules of the liquid by various intermolecular forces.

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- In the liquid state, the cohesive forces between adjacent molecules are well developed. Molecules in the bulk liquid are surrounded in all directions by other molecules for which they have an equal attraction.
 - molecules at the surface (i.e., at the liquid–air interface) can only develop attractive cohesive forces with other liquid molecules that are situated below and adjacent to them.

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- They can develop adhesive forces of attraction with the molecules constituting the other phase involved in the interface, although, in the case of the liquid–gas interface, this adhesive force of attraction is small.
 - The net effect is that the molecules at the surface of the liquid experience an inward force toward the bulk.
 - Such a force pulls the molecules of the interface together and, as a result, contracts the surface, resulting in a surface tension.

- The values for surface tension reflect the nature of intermolecular forces present. Large values for mercury (metallic bonds) and water (H-bond) ,

the lower values for benzene and chloroform (London forces) Values of interfacial tensions reflects the differences in chemical structure of the two phases involved, the greater the tendency to interact, the less interfacial tension. In each case the presence of chemical groups capable of hydrogen bonding with water markedly decrease interfacial tension.

SURFACE ACTIVE AGENT

- Interfacial tension causes immiscible liquids to resist mixing. Oil and water do not mix because of interfacial tension.
- To dispense one in the other, it is necessary to introduce another kind of molecule that has affinity for both oil and water like an amphiphile molecule.
- This type of molecule is called **surface active agent (S.A.A)**.
- These molecules when place them at the interface of oil and water will decrease the interfacial tension, allowing oil and water to mix
- Both Surface and interfacial tensions decrease by increasing the temperature, due to increase in the kinetic energy of the molecules.
- They are also decrease by addition of S.A.A

ADSORPTION AT LIQUID INTERFACES

- Adsorption is a spontaneous phenomenon, adsorption can occur at the surface or interfaces of liquid with other liquids (positive adsorption).
- It is the amphiphilic nature of surface-active agents that causes them to be adsorbed at interfaces, whether these are liquid–gas or liquid–liquid interfaces

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- For the amphiphile to be concentrated at the interface, it must be balanced with the proper amount of polar and nonpolar groups. If the molecule is too hydrophilic, it remains within the body of the aqueous phase and exerts no effect at the interface.
 - Likewise, if it is too lipophilic, it dissolves completely in the oil phase and little appears at the interface. On the other hand, negative adsorption is related to materials that are found in the bulk of liquid.

EFFECT OF SURFACE ACTIVE AGENTS ON SURFACE AND INTERFACIAL TENSION OF WATER

- The surface active agents reduce surface tension because when surfactant molecules adsorb at the water surface, the surfactant molecules replace some of the water molecules in the surface and the forces of attraction between surfactant and water molecules are less than those between two water molecules (interfere with hydrogen of water), hence the contraction force is reduced.

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- The surface tension decreases with increasing concentrations of the surface active agent; however, after a certain concentration of the surface active agent, the surface tension stops decreasing and reaches a plateau.

This concentration is called critical micelle concentration (CMC).

HYDROPHILE-LIPOPHILE BALANCE

- The hydrophile–lipophile balance (HLB) number is a measure of the balance between hydrophobic and hydrophilic portions of a surfactant.
- The HLB of a surfactant is expressed using an arbitrary scale which ranges from 0 to 20
- At the higher end of the scale, the surfactants are hydrophilic and act as solubilizing agents, detergents and oil-in-water emulsifiers.
- Oil-soluble surfactants have low HLB and act as water-in-oil emulsifiers.