Advanced Biopharmaceutics

Introduced by:

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Solubility

- Introduction
- Solubility Expressions
- Factors affecting solubility
- Measurement of solubility
- Importance of solubility

- **SOLUBILITY** is an ability of a substance to dissolve.
- In the process of dissolving, the substance which is being dissolved is called a **solute** and the substance in which the solute is dissolved is called a **solvent.**
- A mixture of solute and solvent is called a **solution.**

- **SOLUBILITY** is understood as a maximum amount of solute that dissolves in a solvent at so called **equilibrium**.
- In chemistry an equilibrium is a state where reactants and products reach a balance - no more solute can be dissolved in the solvent in the set conditions (temperature, pressure). Such a solution is called a **saturated solution**.

- **Dissolution** is the transfer of molecules or ions from a solid state into solution.
- **Diffusion** is the transfer of molecules or ions (particles) from site to another depending on the concentration (or pressure, temperature) differences (high to low) till reach equilibrium.

- **Osmosis** is the spontaneous net movement of solvent molecules through a semi-permeable membrane into a region of higher solute concentration, in the direction that tends to equalize the solute concentrations on the two sides

- States of matter and binding forces?
- Sub-saturated solubility??
- Super-saturation solubility??
- Table of solubility terms??
- Importance of solubility??

(For formulation and dissolution)

- Factors affecting the solubility (rate and extent)???
- Miscibility??

- Dissolution mechanisms?? Interfacial reaction, Diffusion

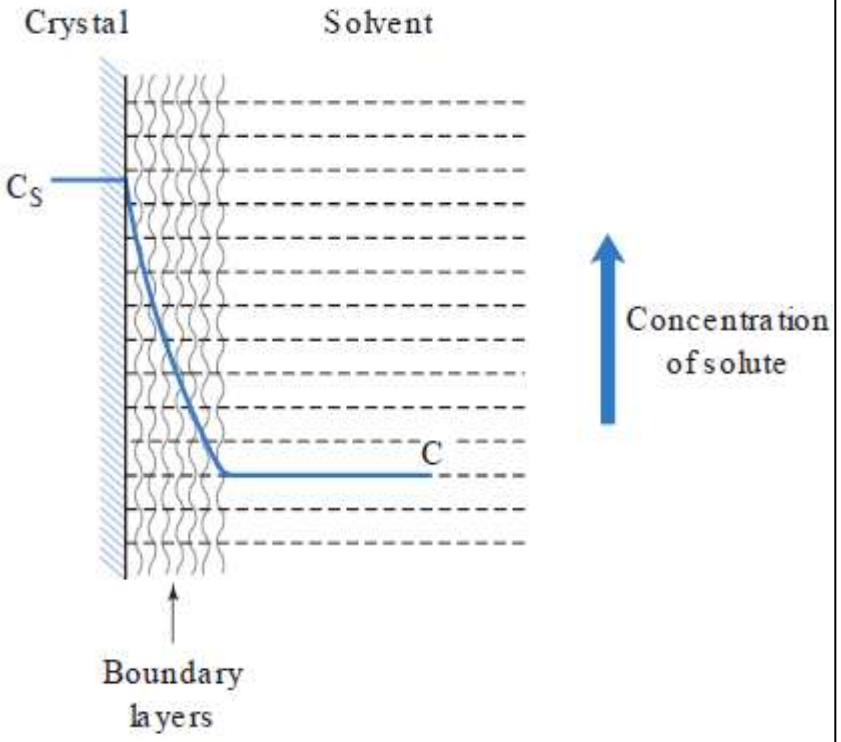

Fig. 2.1 • Diagram of boundary layers and concentration change surrounding a dissolving particle.

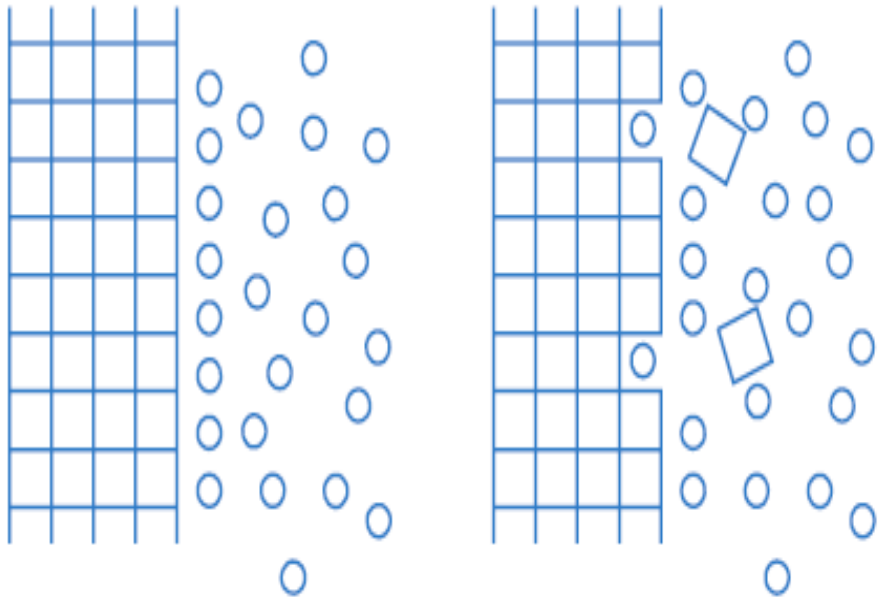

Fig. 2.2 • Schematic representation of the replacement of crystal molecules with solvent molecules during dissolution.

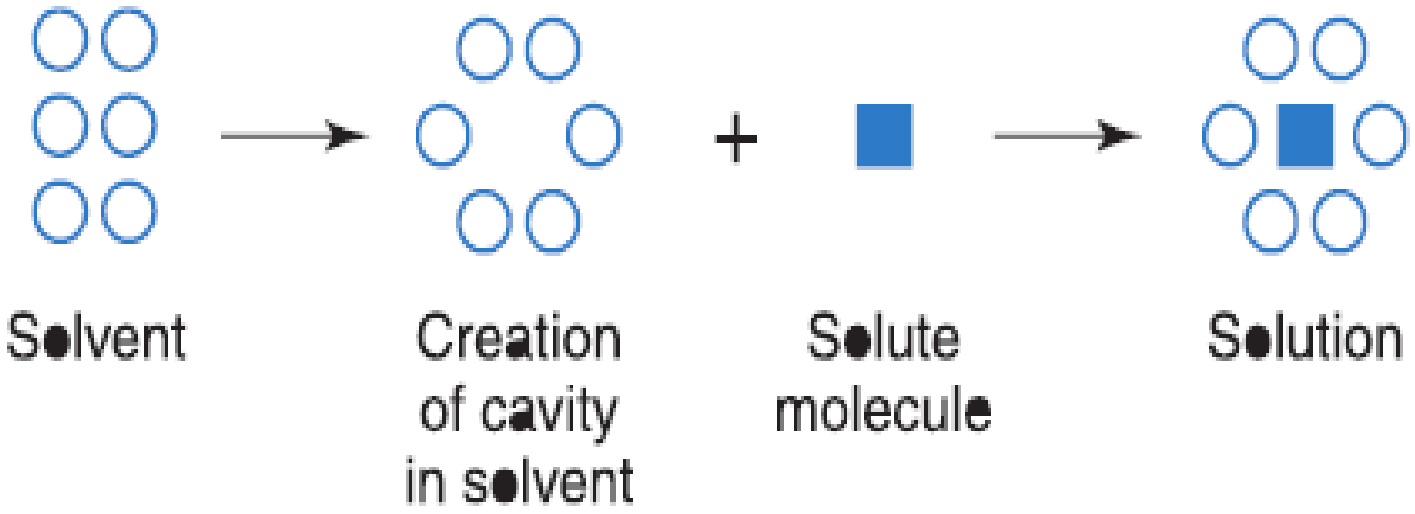

Fig. 2.3 • The theory of cavity creation in the mechanism of dissolution.

Solubility Expressions:

- Quantity per quantity (micro, milli or grams per ml or L)
- Percentage (w/v, v/v)
- Parts (1:100) gm:ml
- Molarity (moles no./ $1dm^3$ or L)
- Molality (moles no./1kg)
- Mole fraction , for $x_1 = (n_1/n_1+n_2)$
- Milliequivalents and normal solutions

  1mEq= ionic wt. in mg/ valency
- Qualitative descriptions

Table 13-1. Descriptive Terms for Solubility

Descriptive Terms	Parts of Solvent for 1 Part of Solute
Very soluble	Less than 1
Freely soluble	From 1 to 10
Soluble	From 10 to 30
Sparingly soluble	From 30 to 100
Slightly soluble	From 100 to 1000
Very slightly soluble	From 1000 to 10000
Practically insoluble, or insoluble	More than 10000

Factors affecting solubility of solids in liquids

- Temperature
- Molecular structure of solute (salt form, hydro -philic gp.)
- Nature of solvent.
- Crystal properties (polymorphism and solvation)

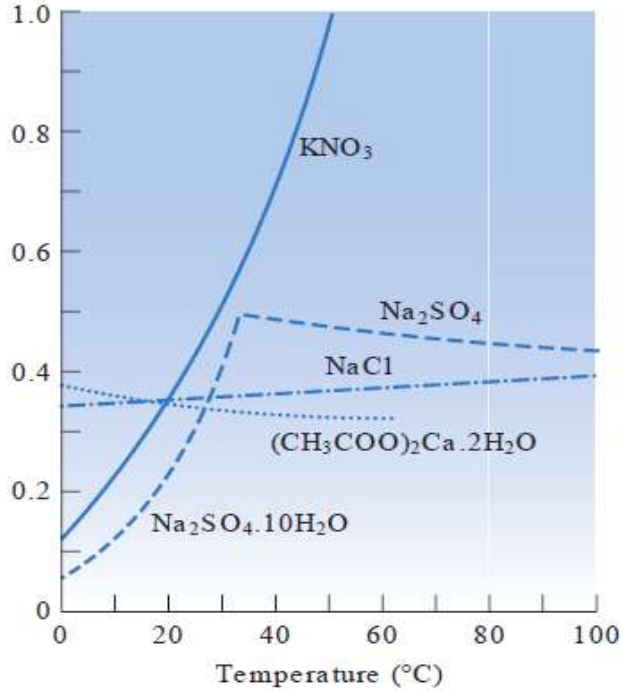

Fig. 2.6 • Solubility curves for various substances in water.

- Particle size
- pH and pKa
- Common ion effect
- Effect of non-electrolytes on the solubility of electrolytes
- Effect of electrolytes on the solubility of non electrolytes
- Complex formation
- Addition of SAA.

Answer the following?

- What are the factors affecting the solubility of gases in liquids?
- What are the factors affecting the solubility of liquids in liquids?
- What is meaning of the phase rule, binary system, ternary system, CST, Partition coeff.?
- What is meaning of Intrinsic dissolution rate IDR?? And Techniques used for measuring IDR??
- How can you measure the solubility of solids in liquids?