Unit - I

Solubility of drugs

Ideal solubility parameter:

Hildebrand solubility parameter (HSP) (σ):

The Hildebrand solubility parameter (σ) provides a numerical estimate of the degree of interaction between materials and can be a good indication of solubility, particularly for non polar materials such as many polymers.

Materials with similar values of (σ) are likely to be miscible.

Definition:

The Hildebrand solubility parameter is the square root of cohesive energy density.

Heat of vaporisations (ΔH):

The energy required to vapourised the liquid is called heat of vapourisation. (Regardless of temperature at which boiling begins the liquid that vapourises readily has less inter molecular stickness then the liquid that required considerable addition of heat to vapourise.

It is denoted by ΔH.

Cohesive energy density:

It is a numerical value which indicates the energy of vapourisation in calories per cubic cm and is a direct reflection of the degree of Vanderwall's forces holding the liquid molecules together.

The cohesive energy density is explained by the following expression.

$$C = \Delta H - RT / Vm$$

Where,

C = Cohesive energy density

ΔH = Heat of vapourisation

R = Gas constant

T = Absolute temperature

Vm = Molar volume

Aspects of solubility parameter:

- It is describe by scientist Hildebrand. It is applicable to non- polar solvent.
- It is a numerical value that indicates the solvency behaviour of a specific solvent.
- It is derived from the cohesive energy density. (The state of being solvent is called as solvency).
- It is denoted by the symbol σ.
- Mathematically solubility parameter was following expression.

$$\mathbf{HSP} = \sqrt{c}$$

$$\sigma = \sqrt{c} = \sqrt{\mathbf{\Delta H - RT / Vm}}$$

- Materials with similar solubility parameters will be able to interact with each other resulting in salvation, miscibility and swelling.
- Unit: Conventional unit: $(Cal/Cm^3)^{1/2}$ or $cal^{1/2}.cm^{-3/2}$
- In SI: $J^{1/2}. M^{-3/2}$

Applications of solubility parameter:

- It indicates the different polymer of different Solvent.
- It provides simple predication of phase equilibrium based on a single parameter i.e readly obtain for waste material.

- It is used in predicting the solubility and swelling of polymers by solvent.
- It is used in industry to aid the selection of solvent.
- Determination of drug transport through model membranes.
- Determination of mechanism involved in drug action.
- Determination of structure activity relationship.

Limitation:

- The main limitation of solubility parameter approach is that it applies only to associated solutions i.e solution having +ve deviation from Raoult's Law.
- It cannot account for –ve deviation from Raoult's law that results from effect such as salvation or the formation of electron donor acceptor complexes.

Hansen Solubility parameter:

- It is proposed for polar molecule.
- The basis of Hansen solubility parameter is that the total energy of vapourisation of a liquid consists of several individual parts.