Research & Reviews: Journal of Pharmaceutical Analysis e-ISSN:2320-0812

Solubility: The Important Phenomenon in Pharmaceutical Analysis

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Commentary

Received: 21/01/2022
Accepted: 04/02/2022
Published: 11/02/2022

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DESCRIPTION

The amount of substance dissolved in a given quantity of solvent is known as solubility. This is the main basis for the development of the different branches of science such as chemistry, food science, physics, pharmaceutical and biological sciences are developed mainly on the basis of solubility. Especially the bioavailability of the drug in pharmaceutical science depends mainly on the solubility. Hence solubility phenomenon has much importance in the field of Pharmaceutical Analysis. This solubility phenomenon mainly helps in selecting the appropriate solvent, overcoming the problems arising during preformulation and providing intermolecular forces of the drug. Solute, solvent and solution are the terms which are generally used for the solubility phenomenon. A solute is the substance which is dissolved in the solvent. Solvent is the substance which is dissolving the solute and solution is a homogenous mixture of two or more components

Factors affecting solubility

Solubility is mainly affected by the following factors.

1. **Temperature**: Solubility is directly proportional to the temperature; this means that if the temperature increases, solubility also increases. But solubility decreases in some cases when the temperature increases. In the case of calcium oxide, the solubility decreases with increase in the temperature.
2. **Nature of the solvent**: Not only the polarity of the solute but also the polarity of the solvent affect the solubility. For example, polar solvents dissolve polar solutes. Non-polar solvents dissolve non-polar solutes.
3. **Effect of pressure**: The solubility of gases is mainly affected by this factor. Solubility of the gases increases when the pressure increases. For example, under pressure, carbon dioxide gas dissolves in liquids for effervescent preparations.

Solute—solvent interaction forces, solvent—solvent interaction forces, solute—solute interaction forces are the three intermolecular attraction forces which are considered throughout the dissolving process. If the solute-solvent forces are greater than that of the solute-solute interactions and solvent-solvent interactions, then the solute will be freely dissolved.

Solubility rules

- Compounds of Group I and ammonium ions are soluble.
- Nitrates, acetates and chlorates are soluble.
- Except for Ag, Hg (I), and Pb, binary compounds of halogens (other than F) with metals are soluble. Pb halides are soluble in hot water.
- Sulphates are soluble, except those of barium, strontium, calcium, lead, silver and mercury (I). The latter three are slightly soluble.
- Carbonates, hydroxides, oxides, silicates, and phosphates, with the exception of rule 1, are insoluble. Except for calcium, barium, strontium, magnesium, sodium, potassium, and ammonium, sulphides are insoluble.

The following solubility enhancement techniques are used to increase the solubility of the poorly soluble compounds.

pH adjustment: The pH adjustment of the sample solution by the addition of buffer solution increases the solubility of the poorly soluble compounds.

Co-solvency: The solubility of the poorly soluble compounds is enhanced co-solvents. Co-solvents are the mixture of water and water miscible solvents like PEG-300, Ethanol propylene glycol, Dimethyl sulfoxide and Dimethyl acetamide.

Particle size reduction: Particle size reduction decreases particle size while increasing surface area, improving solubility.

Hydrotrophy: A large amount of the second solute to the sample solution is added in this solubilization process.

Applications

- Used for the study of the bioavailability of the drug.
- Used for the development of different dosage forms based on the solubility of active pharmaceutical ingredient.
- Used for common salt purification.
- Salting out of the soap and used in the manufacture.