



Advance Research on Solubility and Solvation Thermodynamics on Pharmaceutically Important Molecules

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From birth to death, we all need medicines. At the end line of our life sometimes we consume more medicines than normal food. So, the importance of the pharmaceutical industry increases in our day-to-day life. Now, the production of our life-saving medicines is not an easy task. Their production processes are influenced by several factors like solubility and solvation thermodynamics. Thus, in the modern era, the study of this physical, as well as thermodynamics becomes an interesting area of research.

Several molecules are having their own pharmaceutical importance. But our main focus is on amino acids particularly. The importance of this category of pharma molecules is listed below.

- a) There are many therapeutic applications of amino acids such as treatment of imbalances of human brain metabolism and neurotransmission. Not only that but also amino acids are important in other treatments like gastrointestinal health, immune system, and cardiovascular health.
- b) In worldwide nowadays, research on pharmaceuticals and their production using cell culture methods have become much admired. Protein-building units are vital components of a cell culture medium. These molecules are considered to be essential to cell growth and the building of antibodies and protein molecules.
- c) There are problems that occur sometime during protein digestion and in that case, some amino acids like lysine, tryptophan etc., are very much useful for occurring digestion metabolism smoothly by the changing complex structure of protein molecule into a simple one. Side by side, amino acids have a great role in the food processing industries.

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- d) The taste of foods can be made tasty as well as delicious with the addition of some amino acids like alanine and glycine. Almost all over Asia monosodium glutamate can be used frequently as a food taste enhancer.
- e) Amino acids can be applied in the cosmetic industry basically in making hair conditioners and skin-protecting creams to prevent cell damage. They are applied basically to hold the age of human beings. Thus amino acids can be used as anti-ageing agents.

Now the investigation of the solubility phenomenon is the most important part of this area. This basically includes several kinds of interactions like dipole-dipole, ion-dipole; hydrogen bonding etc.² Cavity interaction and hydrophobic interaction are the other two. All type of interactions helps in explaining the solvation thermodynamics also. The ionic and covalent nature of electrolytes also influences solvation properties. The dielectric constant of the corresponding solvent is another factor of concern. The lattice energy of any electrolyte also affects the solvation process. So, our research also covers all parameters influencing solvation and this is not only helpful for pharma industries but also for all other production industries like cosmetics, food processing, reagent production etc.

The amino acids are polar and carry a considerable value of dipole moment,³ which leads to various forms of weak interactions in biological systems. They also differ wide-ranging due to divergent structural backbones. According to my knowledge now we can see various biological roles of amino acids like transportation and storage of important nutrients,⁴ in hormones and neurotransmitter production, overcoming fractures and many more, but, acquiring information on their stability and parameters connecting with thermodynamics in different medium systems remain under microscope which helps for understanding the previously mentioned biological phenomenon in a better way.

This solvation thermodynamics also helps in bringing out proteins in its pure form from different types of sources. The 3D framework of bio-molecules, aquaphobic, and aquaholic interactions are also considered under a microscope. The equilibrium solubilities of amino acids swap considerably based on the physical properties of electrolytes. Electrolytes present in experimental media have the capability of changing the conformation and direction of the amino acid molecule which in turn alter many thermodynamic properties like dipole-dipole interactions-, and hydrophilic-hydrophobic interactions. They all together influence the turn under and extending processes of the bodybuilding unit and biological environment. Therefore, the popularities go in increasing day by day on investigating the outcome of diversified salts on the bio-molecules like amino acids as a field of research. The investigation strives for the role of ionic $-NH_2$ and $-COOH$ groups and hydrophobic alkyl groups on the solvable capabilities of amino acids in strong electrolytes at equidistant temperatures. Consequently, the study would become an important topic in the field of similar as well as for industrial areas in near future. Extraction, as well as purification, becomes very much essential for pharmaceutical industries. So, the study of their solubility behaviour in pure aqueous and aqueous organic mixtures in the absence and presence of electrolytes is indispensable.

The pharmaceutically important biomolecules like amino acids-, and peptides have a significant role in biosynthesis, metabolism, nutrition,⁵ medicinal, etc., in human physiology. For quite a long time major attention has been introduced to developing a sophisticated and efficient process for the separation, concentration, crystallization and purification of these molecules. The most common and key property of such molecules is solubility. These molecules are therefore studied in different binary and ternary solvent systems and the thermodynamics of solvation in the presence of salts and organic solvents have been evaluated. A breakthrough has been reached in the case of solubility of amino acid solutes in the organic-water mixture, non-aqueous organic solvents and aqueous-electrolytic solutions. However, persistent evaluation in various industries stresses the way of finding new measurements and boosting the creation of more accurate experimental techniques for the separation and characterization of these molecules. Some modern areas in which advanced research going on are.

- 1) Solubility of the drug in human fluid during drug delivery.
- 2) Effect of branching on the solubility of drugs in the human body.
- 3) Justification of solubility data on the basis of thermodynamic parameters.
- 4) Influence of solvent medium on particular drug delivery.
- 5) Electrolytic influence on the solubility of amino acids.
- 6) Co-relation between experimental and theoretical modelling of solubility of several pharma molecules.

Conclusion

Solubility and solvation studies are still needed for precise determinations of some pharmaceutically important molecules. This type of research must be required for improvements in theoretical modelling for future developments in many industrial fields of research.

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