Stability of Proteins in Solutions: A Microscopic Investigation on the Role of Surrounding Water/Cosolvent

Madhurima Jana

Department of Chemistry, National Institute of Technology Rourkela, India, Odisha 769008

Email: janam@nitrkl.ac.in

Preservation of protein's native folded form is important to conserve its biological activities. The folded native structure of a protein is highly sensitive towards the nature of solvent under specific environmental conditions. With the change of solvent's physicochemical properties protein's native structure can be disrupted.[1-2] Although water is a common solvent in biological systems that maintains the structure and function of proteins, the use of cosolvent in experiments has become popular due to their ability to solvate proteins quite efficiently. Further, in presence of cosolvent the stability of proteins can alter. Generally, cosolvents like some amino acids, polyhydric alcohols, sugars, trimethyl amine N-oxide etc., are used to conserve protein's native folded state and are known as osmolytes whereas urea, guanidinium hydrochloride, strong ionic detergents etc., are known as denaturant and are popularly used to denature protein's native folded state.

Studies have shown that the cosolvent effects on proteins are concentration dependent however there remains controversy. Moreover, despite significant efforts, the molecular mechanism of the action of cosolvents on proteins has been strongly debated in the literature. Therefore, the molecular-level understanding of the concentration dependent effects of cosolvent on proteins is of fundamental importance. In this presentation I shall discuss the behavior of a small protein in various monohydric alcohol-water binary mixtures at several alcohol concentrations under thermal stress.[3-6] This is essentially the study of cosolvent governed unfolding of a protein. Further, I shall discuss about the concentration dependent protein stabilizing efficiency of amino acids.[7] In all such work emphasis has been be given to identify the interaction that play major role to alter or preserve protein's structure. Our detailed discussion would shed light on competitive protein-water and protein-cosolvent interactions that would further help us to know whether the cosolvent governed phenomenon follows the direct mechanism or it an indirect interaction in which the presence of cosolvent alters the water properties and hence promotes the respective process.

References:

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