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Hydrophobic Interactions in Water: Effect of Ionic Strength Dependent on Solute Size and Shape

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Abstract

The phenomena of hydrophobicity is crucial to biology, chemistry, and biochemistry. It is described as the interaction of low solubility nonpolar molecules or groups with water. Numerous water-related processes, such as complexation, surfactant aggregation, and coagulation, are impacted by hydrophobic interactions. These interactions are crucial for the development and maintenance of proteins or biological membranes. Biology, chemistry, and biochemistry all place a high value on hydrophobicity. It is described as having a poor affinity for water or even as some molecules or compounds avoiding it. There are several processes in an aqueous solution that include hydrophobic contacts, including complexation, surfactant aggregation, and coagulation. Hydrophobic interactions are defined as water-mediated interactions of hydrophobic particles in an aqueous environment.

Keywords:* *Hydrocarbon separation, Metal-organic frameworks, Porous organic frameworks, Porous materials zeolites

Introduction

The development and stability of proteins, biological membranes, and micelles depend heavily on hydrophobic interactions. The development of gas clathrates, molecular recognition, and detergency are all significantly impacted by hydrophobic effects. Hydrophobic interactions are thought to be crucial for the beginning of the protein-folding process [1]. The protein fragment with the most nonpolar residues is thought to undergo one of the early stages of this process, and hydrophobic interactions result in protein folding [2].

Van der Waals interactions take happen between nonpolar molecules and some specific modifications in water structure when hydrophobic interactions take place [3]. There are fewer water particles in contact with the molecules as they get closer to one another. Additionally, these structural alterations considerably add to free energy. Solvent-induced interactions include hydrophobic interactions. In this context, the free energy of association or alternatively changes in the free energy as a function of the separation between two nonpolar molecules in an aqueous solution could be used to define hydrophobicity [4]. Hydrophobicity is significantly influenced by temperature, size, and shape of the interacting particles. For tiny molecules at normal temperature, the entropy contribution dominates hydrophobic effects; however, for larger molecules, the enthalpic term predominates [5]. Small nonpolar particles are more and less soluble in water as the temperature rises and as the temperature falls. At higher temperatures, the entropy term is also less important than the energetic one [6].

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