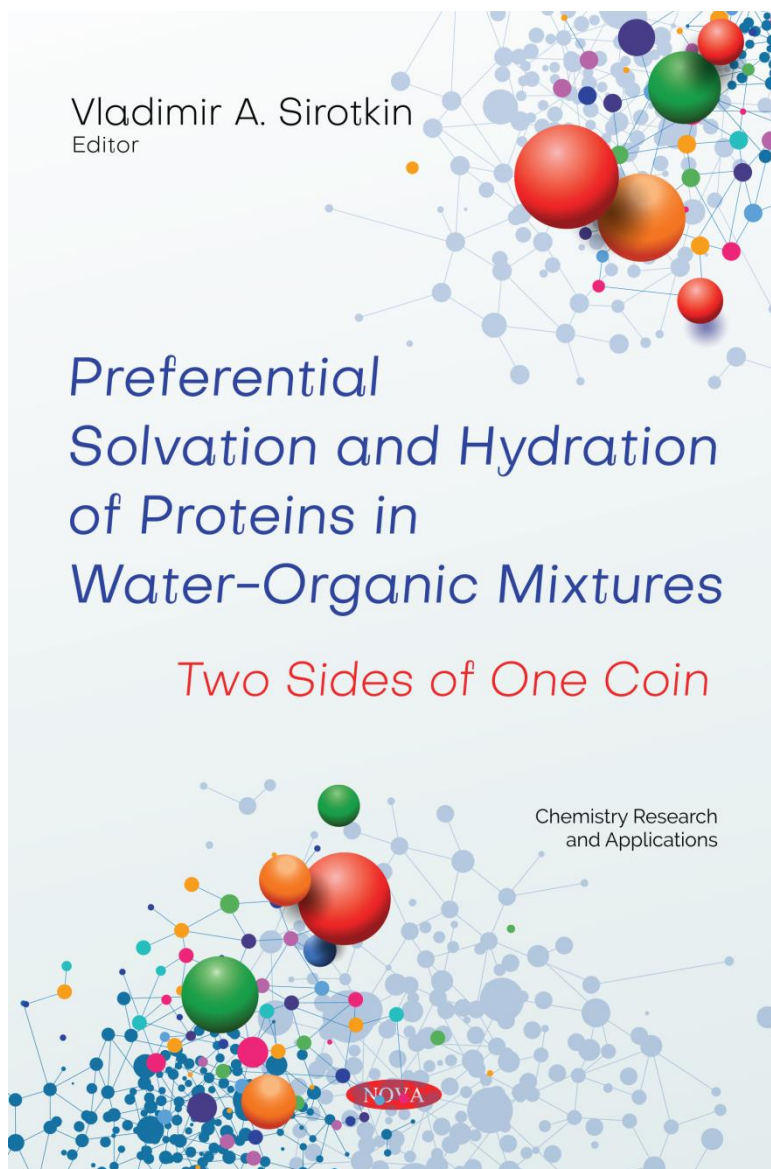


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*Chapter 5*

**Preferential Solvation and  
Hydration of Lysozyme  
IN ETHYLENE GLYCOL AND ETHANOL:  
EFFECT OF HYDROXYL GROUP**

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**ABSTRACT**

A thermodynamic description of the preferential solvation and preferential hydration of hen egg-white lysozyme in water-alcohol (ethanol and ethylene glycol) mixtures was performed. Residual enzyme activity and absolute values of the water/alcohol sorption were investigated at 25 °C. One of the most important advantages of our approach is the facilitation of individual evaluation of the Gibbs energies of water, alcohol, and protein at low water content. There are three concentration regimes for ethanol. Protein is preferentially hydrated at high water content. The residual enzyme activity values are close to 100%. The dried enzyme has a higher affinity for alcohol than for water at intermediate water content. Residual enzyme activity is minimal in this concentration range. The ethanol molecules are preferentially excluded from the protein surface at the lowest water content. This results in preferential hydration of lysozyme. The residual catalytic activity is ~60% in water-poor ethanol. Opposite to ethanol, the residual activity is close to zero in water-poor ethylene glycol. Our data clearly demonstrate that the replacement of the hydroxyl group by methyl group constitutes a critical factor in determining the stability of protein-water-alcohol systems.

**Keywords:** preferential solvation, preferential hydration, lysozyme, water, alcohol, ethanol; ethylene glycol

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