

Protein - Water Interactions: A Differential Approach, 2014, pages 71-86

A study of the heat capacity of ribonuclease a - water mixtures

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Abstract

© 2014 by Nova Science Publishers, Inc. All rights reserved. Excess heat capacities of the binary system of bovine pancreatic ribonuclease A (RNase A) with water were obtained as a function of composition at 25°C. Differential scanning calorimetry was applied to study hydration dependencies of the excess thermodynamic functions. A major focus of this study aims to show how these thermodynamic quantities correlate with coverage of the protein by the water molecules. The excess partial quantities are found to be sensitive to changes in the water and protein states. At the lowest water weight fractions (w_1), the changes of the excess functions can mainly be attributed to water addition. A transition from the glassy to the flexible state of the protein is accompanied by significant changes in the excess partial quantities of water and lysozyme. This transition appears at $w_1 >$ of 0.05 when charged groups of the protein are covered. Excess partial quantities reach their fully hydrated values at $w_1 > 0.5$ when coverage of both polar and weakly interacting surface elements is complete. At the highest water contents, water addition has no significant effect on the excess quantities. At $w_1 > 0.5$, changes in the excess functions can solely be attributed to changes in the state of the protein.

Keywords

Biocalorimetry, Excess partial quantities, Heat capacity, Hydration of proteins (biomacromolecules)