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Analysis of hydration of human serum albumin by isothermal calorimetry

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Abstract

This work describes the basic principles of a novel experimental approach for studying the hydration of proteins. This method, based on the calorimetric measurements, allows for the simultaneous monitoring of the excess partial enthalpies of water and the protein obtained in the entire range of water contents. Human serum albumin (HSA) was used as a model protein. The excess partial quantities of water and HSA are very sensitive to the hydration level. At the lowest water contents, HSA is in a rigid (glassy) state. Changes of the excess thermochemical function can mainly be attributed to water addition. A transition from the glassy to the flexible state of HSA is accompanied by significant changes in the excess partial quantities of water and HSA. This transition appears at water weight fraction (w1) of 0.06 when charged and polar groups of HSA are covered. Excess partial quantities reach their fully hydrated values at w1 > 0.4 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 thermochemical function. At w1 > 0.4, the observed changes in the excess function can solely be attributed to changes in the protein structure.