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Heat effects of dehydration of human serum albuminin hydrophilic organic solvents

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Abstract

A thermochemical model for describing the transfer of water from the protein phase to the organic solvent liquid phase and for determining how the solvation ability of organic solvents affects this process was developed. Enthalpy changes on the interaction of dried and hydrated human serum albumin (HSA) with hydrophilic organic solvents (dimethyl sulfoxide, formamide, ethanol, methanol and acetic acid) and water were measured by isothermal calorimetry at 25°C. The initial hydration level of human serum albumin was varied in the entire water content range from 0-30% g water/g HSA. The dependence of the interaction enthalpies on the initial water content is complex. The interaction enthalpies of the dried HSA with organic solvents are exothermic. At low water contents (less than 0.1 g/g), there is a sharp increase in the interaction enthalpy values. At the highest water contents (more than 0.2 g/g), the interaction enthalpies are endothermic for acetic acid and formamide and exothermic for DMSO, methanol, and ethanol. These thermochemical data were analyzed in conjunction with the results for the water adsorption in organic solvents to calculate the molar enthalpies of dehydration of HSA in organic liquids. It was found that the dehydration enthalpy changes may be endothermic or exothermic depending on the initial water content and the water solvation enthalpy value. From the results obtained, it can be concluded that: (i) only the solvation of water by hydrophilic organic solvent determines the changes in the dehydration enthalpy values, and (ii) the data for the enthalpies of solvation of water by the solvent at infinite dilution reflect this effect. © Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim.

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Keywords

Heat effect of dehydration, Isothermal calorimetry, Water solvation