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Thermodynamics of water binding by human serum albumin suspended in acetonitrile

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Abstract

Heat effects resulting from the introduction of solid human serum albumin (HSA) into various water–acetonitrile mixtures were measured calorimetrically at 298 K. The amount of water bound to the suspended HSA as a function of the water content of the solvent was also determined. Introducing HSA into water–acetonitrile mixtures involves water binding according to the Langmuir isotherm with an adsorption constant $K_c = 1.0 \pm 0.1$ M^{-1}, enthalpy $\Delta h = -9.0 \pm 1.5$ kJ mol^{-1} and entropy $\Delta S = -30 \pm 6$ J mol^{-1} K^{-1}. Placing HSA in the solvent has an additional heat effect of 46 ± 19 J g^{-1}, which is attributed to an unknown transformation of the protein preparation.

Keywords: HSA; Human serum albumin; Organic solvent; Thermodynamics; Water sorption

1. Introduction

The layer of water bound to proteins is assumed to be essential for protein functioning in media of low water content [1]. The state of this layer depends on the ability of the solvent to strip water from the protein [2,3]. Quantitative information on the enthalpies and entropies of water binding by proteins in organic solvents is thus important. Such thermodynamic values are available for water vapour adsorption by proteins [4–6]. Isotherms for water sorption by proteins suspended in organic solvents are also known [7,8]. However, there are no experimental data on the enthalpies and entropies of water adsorption by proteins from organic liquids.

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