Relaxation of Water Protons in Highly Concentrated Aqueous Protein Systems Studied by ^{1}H NMR Spectroscopy

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Z. Naturforsch. **56 c**, 1075–1081 (2001); received June 1/August 28, 2001

Concentrated Aqueous Protein Systems, Proton Relaxation Times, Slow Chemical Exchange

In this paper we present proton spin-lattice (T_1) and spin-spin (T_2) relaxation times measured vs. concentration, temperature, pulse interval (τ_{CPMG}) as well as ^{1}H NMR spectral measurements in a wide range of concentrations of bovine serum albumin (*BSA*) solutions. The anomalous relaxation behaviour of the water protons, similar to that observed in mammalian lenses, was found in the two most concentrated solutions (44% and 46%). The functional dependence of the spin-spin relaxation time vs. τ_{CPMG} pulse interval and the values of the motional activation parameters obtained from the temperature dependencies of spin-lattice relaxation times suggest that the water molecule mobility is reduced in these systems. The slow exchange process on the T_2 time scale is proposed to explain the obtained data. The proton spectral measurements support the hypothesis of a slow exchange mechanism in the highest concentrated solutions. From the analysis of the shape of the proton spectra the mean exchange times between *bound* and *bulk* water proton groups (τ_{ex}) have been estimated for the range of the highest concentrations (30%–46%). The obtained values are of the order of milliseconds assuring that the slow exchange condition is fulfilled in the most concentrated samples.