“How Multivalent Cations Tune the Phase Behaviour of Proteins: Insights from Scattering Experiments”

Protein phase behaviour is of importance for structural biology, rational drug design, protein condensation diseases and several processes in cell biology. Multivalent cations can induce a rich protein phase behaviour including liquid-liquid phase separation (LLPS) [1]. Under certain conditions, LLPS can promote the growth of protein crystals [2], with obvious implications for structural biology. Understanding the microscopic details of the phase behaviours described above is thus both crucial and a challenge for scattering experiments. Here, an attempt is made to shed light on this complex subject.

In the case of bovine serum albumin (BSA), LLPS induced by multivalent cations has a lower critical solution temperature (LCST). This unusual phenomenon is shown to be of entropic origin [3]. Further, using SAXS and complementary methods, a cation-specific tunability of the phase behaviour of BSA is revealed [5]. Finally, cation mixtures are shown to have a strong influence on the phase separation kinetics of BSA [6]. The results presented indicate that cation-specific effects can be used to fine-tune protein interactions and phase behaviour. Our results are of strong relevance for a fundamental understanding of protein and soft matter thermodynamics.

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