Fine Tuning the Nonequilibrium Features of Oppositely Charged Polyelectrolyte/Surfactant Mixtures

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Abstract

The aqueous nanoassemblies of oppositely charged polyelectrolytes (PE) and surfactants (S) are usually interpreted assuming thermodynamic equilibrium. However, recent reports have demonstrated that these systems can easily be kinetically arrested at low ionic strengths. This also means that the extension of the precipitation concentration range as well as the size and properties of the formed assemblies are strongly dependent on the applied preparation protocols of the mixtures. These nonequilibrium features are important from fundamental point of view as well as they could also crucially affect the efficacy of different products based on oppositely charged macromolecules and amphiphiles. One important aspect of the development of nonequilibrium states is related to the recent observations that the PE/S mixtures could be trapped in the kinetically stable colloidal dispersion state within the two-phase composition region of these systems. Building on this concept, we demonstrate the impact of mixing protocols and various additives on the phase properties and nonequilibrium assembly formation of polyelectrolyte/surfactant systems. Finally, the potential utilization of kinetically arrested PE/S templates for the fabrications of novel hybrid nanosystems will also be discussed.