Polyelectrolyte complexes with surfactants or other polyelectrolytes as colloidal aggregates for controlling rheology and having enhanced solubilisation of active agents

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Ionic assembly of polyelectrolytes and oppositely charged surfactants and polyelectrolytes in aqueous solution leads to polyelectrolyte surfactant complexes (PESCs) or interpolyelectrolyte complexes (IPECs). This is a way for constructing more or less complexly structured colloidal systems in aqueous solution, whose structure and properties can vary largely, depending on the type of polyelectrolytes and surfactants employed, their mixing ratio and total concentration, and external parameters like pH and ionic strength. For long polyelectrolyte chains elongated structures can become formed that can be interconnected. Such physical crosslinks have a marked effect on the rheological properties and thereby allow to control them, which is of high interest for a number of applications of colloidal formulations.

In recent work we have studied a number of such PESC systems with a focus on the relation between mesoscopic structure and the rheological properties of the resulting systems. Mainly we employed for this task polycations like cationically modified cellulose and PDADMAC with anionic surfactants like SDS or alkylethoxysulfates. The structure of the formed PESCs was characterized by light scattering and small-angle neutron scattering (SANS), which gave very detailed structural information. This was complemented by comprehensive rheological characterization by means of oscillatory and constant shear experiments. These experiments showed a clear relation between the mesoscopic structure of the PESCs, which depends on their molecular composition, and the rheological properties. Especially via the ratio of surfactant to polyelectrolyte one can control the rheology largely, allowing to change the viscoelastic moduli by 3-4 orders of magnitude. Very interesting was here that we were able to induce such large viscosity changes also by the addition of very small amounts of cosurfactants, like medium-chain alcohols.

In a second part, we looked at the effect of employing hydrophobically modified polyelectrolytes in forming IPECs and how the presence of the hydrophobic modifications affects their ability to solubilise sparingly soluble drug molecules. Systematic variations of type and extent of the hydrophobic modification show how these parameters can be used to control the solubilisation properties of different drug molecules.