POLYAMPHOLYTE MICROGELS: FROM TAILORED SYNTHESIS TO DESIGN OF FUNCTIONAL MATERIALS

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Aqueous polymer microgels bearing ionisable groups are interesting macromolecular colloidal structures with a strong application potential in drug delivery, biomaterials, adsorbents and coatings. In a large family of polyelectrolyte microgels polyampholyte microgels exhibit extraordinary properties due to the co-existence of oppositely charged groups in crosslinked polymer networks. Such colloids can invert their surface charge or exhibit reversible ionic crosslinks at different pH leading to the strong change in the size and swelling degree.

Present paper will present an overview about synthesis, characterization, functionalization and application of polyampholyte microgels as building blocks for design of functional materials. In particular, different synthesis methods (precipitation polymerization, polymerization in W/O emulsion) will be described that allow application of different molecular reactive building blocks (monomers, macromonomers, crosslinkers) and control the amount and distribution of ionisable groups and charges in microgels. Using controlled synthesis methods microgels with controlled size, narrow size distribution and statistical, [1] core-shell [2,3] and Janus-like distribution of ionisable groups were synthesized.

The behavior of polyampholyte microgels in aqueous solutions was investigated to understand their properties like swelling/deswelling, charge modulation and colloidal stability. The experimental data combined with theoretical calculations and simulations indicate that amount, distribution and balance between ionisable groups in microgels govern their properties in aqueous solutions.

Ampholyte microgels were used as cargo for the uptake/release of polyelectrolytes and proteins, colloidal templates for the biomineralisation as well as building blocks for design of functional biointerface coatings. [4-5]

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