

Self-assembly of building blocks with conformational switches

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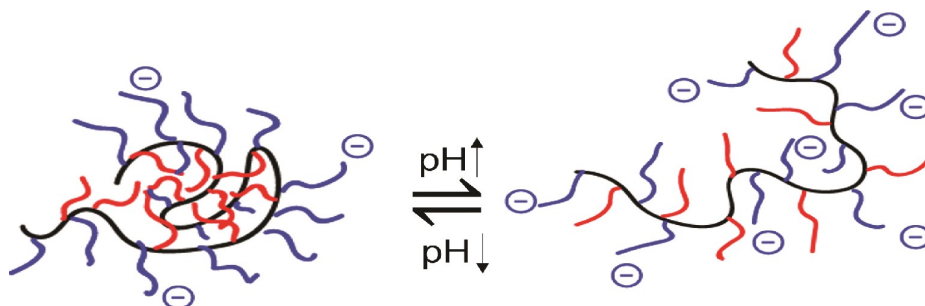


The chemical, architectural, and size versatility of copolymers makes them ideal molecules to probe fundamental self-assembly concepts. The main aim of the project is to design and characterise polymers that exhibit conformational switches. These may be triggered by external factors such as pH or be implicit to the molecular architecture.

One family of pH sensitive polymers are hydrophobic polyelectrolytes (HPEs), which contain both ionizable and hydrophobic groups. They present sharp pH-induced conformation (see figure) and solubility transitions due to the competition between their amphiphilic components [1]. These transitions can be compared to statistical mechanical models to gain a better insight into the origin of sharp transitions, which are very prevalent in biological processes. An example of such a polymer is poly(butyl-acrylate)-*statistical*-poly(acrylic acid) which can be synthesized with a very low polydispersity using radical polymerization techniques. HPEs show great promise for chemical and biological sensing [2], for targeted drug delivery into tissues with pH gradients, such as cancerous tissue [3], and they are extensively used in the solubilization of cell membranes allowing for the characterization of proteins in their native environment [4]. Polymer architecture plays an important role in polymer conformation, surface adsorption and membrane solubilization ability, therefore this is an area of research in the project too.

By combining a hydrophobic polyelectrolyte block with other blocks to create a diblock or multiblock copolymer cargo-delivery nanoparticles can be designed. The use of HPEs may allow for drug release at very specific pHs and within very small pH ranges.

The phenomena behind the formation of copolymer assemblies can be very complex. This project also aims to look at the possible hysteresis that may be present in systems which contain conformational switches. It has been proposed that the anomalous stability of viral capsids relies on a similar mechanism [5].



References:

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