Polymer-driven control of aggregation of different amyloid proteins and enzymes

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Since the enzymes are increasingly used for creation of drugs, biosensors, and bioreactors, they should be stabilized at elevated temperature and adjusted for the practical use. Besides, stabilization of amyloidogenic proteins can help for treatment of neurodegenerative diseases. Recently we demonstrated antiaggregation activity of synthetic polyanions including the capability of release the enzyme from the aggregates accompanied with partial reactivation. In the present work, we investigated interaction of model enzymes with thermoresponsive polymers. Chaperone-like activity based on recognition of the unfolded state of the enzyme was observed. Then we tested chaperone-like activity of different polymers, including synthetic sulfated polymers, sulfated polysaccharides, and polycations on amyloidogenic proteins such as ovine prion protein and alpha-synuclein. It was shown that amphipathic sulfated polymers suppress formation of amyloid fibrils of both proteins in contrast to sulfated polysaccharides which activate amyloid aggregation. According to electron microscopy data, relatively small particles were formed in the presence of the polyanions instead of long fibrils. Furthermore, treatment with these polymers resulted in significant decrease of the toxicity of prefibrillar oligomers. The obtained results suggest a new approach for the control of protein aggregation prospective for a practical use of enzymes as well as for treatment of amyloid aggregation.