Investigation of Controlled on Demand Self-Assembly/Disassembly of Polymer Nanostructures

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Pristine structure allows proteins to perform complex functions and behaviors; epitomizing the structure/function relationship in polymeric materials.[1,2] Protein-inspired polymeric materials have the potential to contribute to many technological grand challenges, such as environmental pollution, energy storage and delivery, and human health.[3] Single-chain nanoparticles have been studied as structures that mimic the secondary and tertiary structures of proteins.[4] The capability of protein molecules to assemble on demand into complex hierarchically ordered mesoscale machines that perform complex functions and then disassemble as required has not been met in synthetic polymer systems.

This work utilizes RAFT to successfully produce norbornene functionalized block co-polymers with two unique characteristics: hydrophilicity and thermoresponse. These block copolymers are then polymerized through ROMP to produce ABA triblock multicompartment brush polymer particles (MCBP). These ABA triblock MCBP are used to investigate controlled, on demand self-assembly/disassembly of polymer nanostructures. They contain spatially arranged thermoresponsive units that are expected to permit segmented isolation of domains to afford appropriate architectures for self-assembly/disassembly upon temperature change. The target polymer systems are simplified synthetic models of quaternary protein structure and as such explore the ability of a synthesized polymer to model protein function and to mimic protein's quaternary structure.

Reference

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