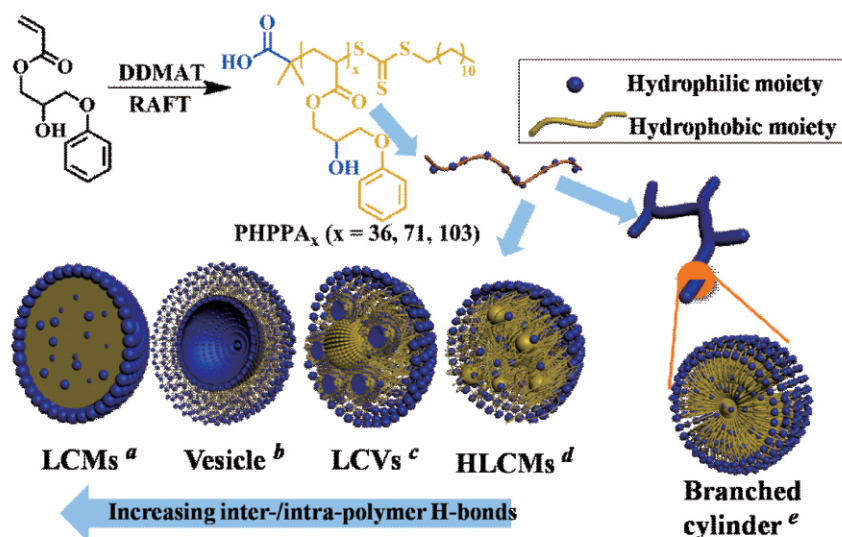


Homopolymer self-assembly: A new opportunity for multifunctional polymeric nanomaterials

With the support by the National Natural Science Foundation of China, Prof. Du Jianzhong's laboratory at the School of Material Science and Engineering, Tongji University, reported the self-assembly of the amphiphilic homopolymers, which was published in *Macromolecules* (2013, 46: 194–203).

Self-assembly of amphiphilic homopolymers composed of both hydrophilic and hydrophobic components in every repeat unit is burgeoning in recent years due to their facile synthesis compared to block copolymers. However, ordered homopolymer nanostructures are very limited. Designed carefully, a range of amphiphilic homopolymers, poly(2-hydroxy-3-phenoxypropylacrylate) (PHPPA) with various molecular weights (MWs) were synthesized. Polar hydroxyl group has been introduced into the repeating unit to afford both inter- and intra-polymer hydrogen bonds. Upon simply changing the chain length or co-solvents, a range of new nanostructures can be obtained such as large compound micelles (LCMs), simple vesicles, large compound vesicles (LCVs), and hydrated large compound micelles (HLCMs). The inter-/intra-polymer hydrogen bonding effect plays a key role in the formation of various nanostructures by homopolymers. A new membrane structure of homopolymer vesicles is proposed (consisting of both hydrophilic and hydrophobic moieties), which is completely different from the traditional bilayer or interdigitated membranes of block copolymer vesicles. Overall, homopolymer is fully capable of forming different nanostructures with either thermodynamic or kinetic stability, yet only one-step of polymerization is required. This offers a much convenient and effective way to prepare vesicles or other structures for potential applications in drug delivery, biosensor, enzyme-catalyzed reaction and nano-reactor for water remediation (also reported by Prof. Du Jianzhong in *ACS Nano*, 2014, 8: 5022–5031).



Scheme Preparation of PHPPA homopolymers which can be self-assembled into a range of nanostructures induced by inter-/intra-polymer hydrogen bonding. ^a Large compound micelles (LCMs), composing of hydrophilic surface (blue) and hydrophobic body (yellow). ^b vesicles with a membrane, consisting of both hydrophilic (blue) and hydrophobic (yellow) moieties in the membrane. ^c large compound vesicles (LCVs): the yellow cores inside LCVs are hydrophobic zones with highly intensive inter-/intra-polymer H-bonding. ^d hydrated large compound micelles (HLCMs) with large amount of unbonded-OHs or-COOHs inside its body. ^e cross-section model of a branched cylinder with-OHs or-COOHs covered on its surface which only emerges in homopolymer binary system.