Synthesis and Characterization of Thermoresponsive Cationic Diblock Copolymers and Their Interaction with Bile Salts

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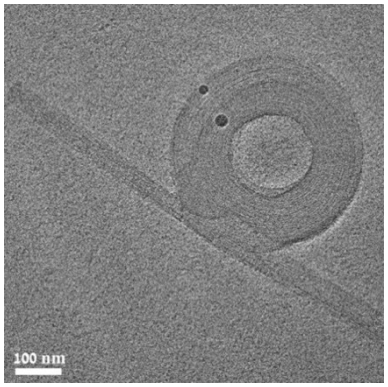
The number of applications for thermoresponsive polymers has expanded significantly within the biomedical field over the last few decades. Notable examples include their use for controlled-release formulations. Concurrently, cationic polymers have gathered some attention as drug carriers in gene or peptide therapy, and bile salt sequestrants used for bile acid related diseases and hypercholesterolemia.
Herein, a series of novel nonionic-cationic diblock copolymers were synthesized comprising one permanently charged cationic block, and one nonionic thermoresponsive block. The latter is a statistical copolymer of two temperature-sensitive monomers in relative proportions adjusted so that the endothermic phase transition of the polymer occurs at 38 °C as found by high-sensitivity differential scanning calorimetry measurements.
Dynamic light scattering and small-angle X-ray scattering measurements provided insight on the size of single polymer coil, and on the self-assembly behaviour at elevated temperature. Further research conducted on these block copolymers mixed with oppositely charged bile salt biosurfactants confirmed the retained capacity of the block copolymers to act as bile salt sequestrants. Moreover, cryogenic transmission electron microscopy revealed the capacity of certain mixtures to assemble into supramolecular structures with intricate, chiral internal structures with potential to act as drug carriers of chiral drugs.

Keywords:
Diblock copolymer, polyelectrolytes, thermoresponsive, bile salts, DLS, DSC, SAXS, cryo-TEM, supramolecular structure, self-assembly, drug delivery.



Cryogenic transmission electron microscopy image of block copolymer-bile salt complexes at 25 °C.

References:

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