

Ordered Structure and Dynamics of Polymer Vesicle Multi-Layered Films

Yuji Higaki

Faculty of Science and Technology, Oita University

Polymer micelles are valid for the bio-compatible smart molecular system in the field of nanomedicine. Double zwitterionic diblock copolymers composed of a poly(carboxybetaine methacrylate) (PCB) chain and a poly(sulfobetaine methacrylate) (PSB) chain (PCB-*b*-PSB) were synthesized by radical addition fragmentation chain transfer polymerization. Well-defined diblock copolymers with narrow molecular weight distribution were systematically produced. The hydrodynamic radius of gyration of the particles produced by the PCB-*b*-PSB aggregation was determined by dynamic light scattering measurement. The PCB-*b*-PSB diblock copolymers with high molecular weight PSB block produced uniform micellar aggregates with narrow size distribution in the salt-free aqueous solution. Because the sulfobetaines show electrostatic and/or dipolar cohesive interactions to produce sulfobetaine couples in salt-free water, the PSB chains yield insoluble core with network structure to produce micellar aggregates. The micellar structure depends on the concentration of co-existing zwitterions. The PCB-*b*-PSB micellar aggregates transformed in the presence of sulfobetaine compounds, whereas the other zwitterions including glycine and taurine hardly induced the transformation of the aggregates. The zwitterion-specific structure modulation is rationalized by the complementary interaction of the zwitterions depending on the charged groups, charge density balance, and geometric form. The micellar structure transform efficiency also depends on the charge spacer length (CSL) of the sulfobetaine compounds. The dissociation of PCB-*b*-PSB chains from the micellar aggregates was preferentially induced through the interactions with sulfobetaines with long CSL. The electrostatic and dipolar interactions are encouraged in the long CSL sulfobetaines because the dipole moment and charge density are augmented by separating the charges.