No. 1202

Fabrication of Ion Recognition Nano-Sized Particles Using Graft Polymerization of Crown Ether and Its Application to a New Membrane Separation System

Taichi Ito

School of Medicine, The University of Tokyo

Summary

We aimed to fabricate an ion recognition nano-sized particle system, which aggregates or disperses in response to K^+ concentration in a molecular recognition manner. In this study, we utilized polyglycerol (PG) as a core initiator, from which poly(NIPAM-*co*-BCAm) was graft copolymerized via ATRP (atom transfer radical polymerization). This copolymer showed a star-like shape, and it was expected to be soluble and dispers as a single molecule when its crown ether receptors capture K^+ ions. On the other hand, the copolymers is expected to gathere and aggregate when only Na^+ ions exist, due to its increasing of hydrophobicity of grafted chains composed of NIPAM and BCAm.

In fact, we toughly investigated the polymerization conditions, and chose Me_6TREN as a ligand and mixture of water and organic solvents, and succeeded to prepare PG-*g*-NIPAM-*co*-BCAm. Interestingly, phase transition phenomena depended greatly on the graft density of PG. When the grafting density was high as 8.5 polymers/nm^2, the copolymers always aggregated even below LCST (Lower critical solution temperature). On the other hand, they showed reversible aggregation and dispersion when the grafting density was lower than 5.0 polymers/nm^2. By optimizing graft density and copolymerization ratio of BCAm to NIPAM, we successfully showed the ion recognition aggregation and dispersion of star-shaped PG-*g*-NIPAM-*co*-BCAm.

In future, the core of PG can adsorb various low molecules. Thus, it will be expected as a new membrane separation system by combining with ultrafiltration. Also, it can be expected as a new K^+ sensing probe in a bioengineering field by adding florescent control functions.