DOUBLE STIMULI-RESPONSIVE PHENYLBORONIC ACID-CONTAINING COPOLYMERS FOR SELECTIVE POLLUTANT REMOVAL AND NANOPARTICLE FUNCTIONALIZATION

Katarzyna Byś[1], Palash Banerjee[1], Radek Ostruszka[2], Karolína Šišková[2], Mariusz Uchman[1]

[1]Department of Physical and Macromolecular Chemistry, Charles University, Prague, Czechia
[2]Department of Experimental Physics, Palacký University, Olomouc, Czechia

Abstract

Effective purification of wastewaters containing pollutants such as antibiotics and endocrine disruptors requires advanced functional materials for their selective removal. Stimuli responsive copolymers bearing phenylboronic acid (PBA) moieties selectively and reversibly bind vicinal diols in aqueous solutions. These copolymers can be structurally tailored to optimize both their binding activity and responsiveness to external stimuli. Combining pH-responsive PBA-containing monomers with thermoresponsive di(ethylene glycol) methyl ether acrylate (DEGMA) provides a double stimuli-responsive system for efficient and selective pollutant binding.

To investigate the tunability and efficiency of such copolymers, we prepared a series of poly(di(ethylene glycol) methyl ether acrylate-*co*-3-acrylamidophenylboronic acid) (p(DEGMA-*co*-AAPBA)) copolymers with varying monomer ratios via reversible addition-fragmentation chain-transfer polymerization enabling precise control over their chain length and composition. We characterized their structure using ^{1}H NMR spectroscopy and SEC, confirming successful copolymerization. The DEGMA units exhibit lower critical solution temperature (LCST), which was characterized by cloud point temperature measurements, whereas the PBA units exhibit pH-dependent covalent binding of vicinal diols, evaluated using model molecules. Such copolymers can be further employed as functional shells on magnetic plasmonic bimetallic nanomaterials, providing colloidal stability and functionality at the nanoparticle interface, further demonstrating that these hybrid nanomaterials provide efficient pollutant binding, magnetic-assisted separation, and potential detection *via* surface-enhanced Raman spectroscopy.