Using ARGET ATRP to synthesize block copolymers containing PDMAEMA and characterizing smart properties using DLS and UV-Vis

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Smart polymers are polymers that change their properties depending on their surroundings. The smart polymer poly((2-dimethylamino) ethyl methacrylate) (PDMAEMA) is pH- and temperature-sensitive and can switch between being soluble and insoluble in water. Activator ReGenerated Electron Transfer-Atom Transfer Radical Polymerization (ARGET ATRP) was used to synthesize PDMAEMA with a macroinitiator to form tri- and di- block copolymers. ARGET ATRP was used for its environmental benefits, low costs and because of its reduced sensitivity to oxygen as compared to ATRP. Different synthetic conditions were used to obtain various target ratios of the block copolymer. After synthesis, Nuclear Magnetic Resonance (NMR) Spectroscopy and Gel Permeation Chromatography (GPC) were used to determine the relative ratio of PDMAEMA to macroinitiator and the dispersity. Once the target ratio and low dispersity were reached, characterization of smart properties was done by UltraViolet-Visible spectroscopy (UV-Vis) and Dynamic Light Scattering (DLS). Polymer composition and polymer concentration of samples were varied to observe trends. The UV-Vis determined the cloud point, or the temperature at which the polymer switches from being soluble to insoluble in aqueous solution. The DLS determined the change in radius as a function of temperature, from individual polymer chains to micelles or aggregates above the cloud point. Results obtained differed for the various polymer compositions tested. By studying the structure-property relationships of this smart polymer, uses can be optimized in drug delivery and enhanced oil recovery.