513c Synthesis and Steric Stabilization of Magnetite Nanoparticles

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Magnetic nanoparticles are of great interest in developing new drug delivery systems and in medical diagnostic tests. The stabilization of nanoparticles of magnetite coated with a biocompatible polymer is of particular interest. The adsorption of novel triblock copolymers with end blocks of poly(ethylene oxide) (PEO) and a carboxylic acid/urethane center block was studied on particles of magnetite, Fe_3O_4 approximately 10 nm in diameter in aqueous media. Adsorption occurred via the carboxylic acid-containing center block and led to the formation of a PEO brush layer that sterically stabilized the particles. The extension of the PEO brush layer from the particle surface was modeled using mean field theory and the resulting steric contribution to the modified DLVO theory was sufficient to stabilize the particles in aqueous buffer for periods of weeks. Particle size with the adsorbed triblock stabilizer was measured by dynamic light scattering and by electron microscopy. The particle surface area was measured by the BET method and the amount of bound polymer was measured by thermal gravimetric analysis. The zeta potential was measured with an electrophoretic dynamic light scattering instrument. The effect of an external magnetic field on the colloid stability of the particles was also accounted for in the DLVO theory. The triblock copolymer composition was varied and the resulting effect on particle stabilization will be discussed.