Superparamagnetic poly(*N,N*-dimethylacrylamide) nano- and microspheres

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Abstract

We report two new procedures for the preparation of magnetic hydrophilic nano- and microspheres based on poly(*N,N*-dimethylacrylamide) (PDMAAm) and iron oxide (maghemite) core: inverse emulsion and solution polymerization. The inverse emulsion polymerization was performed in a toluene/trichloroethylene mixture, where cellulose acetate butyrate was employed as a stabilizer and 2,2'-azobisisobutyronitrile as an initiator. The solution polymerization was performed in water and initiated with 4,4'-azobis(4-cyanovaleric acid). While the inverse emulsion polymerization yielded *ca*. 300 nm microspheres containing predominantly the polymer, the solution polymerization produced *ca*. 7 nm core-shell nanoparticles, where the magnetic material was a core and the polymer formed a thin shell. The surface structure of the magnetic nanoparticles was analyzed by ATR FTIR spectroscopy, which confirmed the coverage of the surface of maghemite nanoparticles with linear PDMAAm. The effect of surface-attached linear polymer chains on colloid stability was examined by dynamic light scattering (DLS). DLS results provided an evidence of steric stabilization of nanoparticles by the growing PDMAAm chains. The particles obtained by the solution polymerization were successfully used as MRI probes for stem cell labeling. Some recent results on the application will be also briefly mentioned.