DOCTORAL DISSERTATION ABSTRACT

The dissertation concerns formation of organic/inorganic materials based on iron oxide nanoparticles and polymers. These materials were obtained using RAFT/MADIX (*reversible addition-fragmentation chain transfer polymerization/macromolecular design by interchange of xanthates*) polymerization method and two strategies: 'grafting form' and *in situ* formation.

In the literature review (Chapters 1-2), methods of reversible deactivation radical polymerization (RDRP) were briefly presented (Chapter 1). RAFT polymerization was discussed in details in terms of its mechanism, kinetics, monomers, chain transfer agents and conditions (Chapter 1). In Chapter 2, main strategies used for formation of organic/inorganic nanohybrids based on iron oxides and polymers synthesized by RAFT method were described.

In Chapters 3, 4, and 5 results of doctoral research study were presented and discussed. 'Grafting from' strategy led to the formation of two kinds of polymer-inorganic hybrids (Chapters 3 and 4). In the first case, magnetic cores were modified with aminosiloxane shell, which was further used for covalent functionalization with dithiocarbonates (Chapter 3). In the second case, magnetic particles were covered with gold, and then modified by disulfides chemisorption (Chapter 4). In this manner, two types of magnetic chain transfer agents were obtained. Surface-initiated RAFT/MADIX polymerizations of commercially available (styrene, ethyl acrylate, buthyl acrylate) and synthesized (thiosemicarbazide derivatives) monomers were performed to create polymeric layers around magnetic particles. Aggregates of magnetic cores surrounded by polymeric shells in the size range from 50 to 200 nm were obtained. Their magnetic, complexing and bactericidal properties were investigated.

In Chapter 5, the results of studies related to *in situ* formation of polymer-magnetic nanohybrids were presented and discussed. RAFT/MADIX polymerization was employed to form double hydrophilic block copolymers (DHBCs) containing poly(ethylene glycol) (PEG) and poly(vinyl phosphonic acid) (PVPA). PEG block plays the role of a protective layer which offers the advantage of being water soluble, whereas PVPA block is responsible for binding polymers to iron oxide nanocores by formation of strong Fe-O-P bonds. PEG-*b*-PVPA DHBCs were used to prepare stable polymer-magnetic nanohybrids. It was demonstrated that the obtained nanohybrids are

superparamagnetic at room temperature, stable in aqueous solutions, and hemocompatibile.

In the experimental section of the dissertation, methods used for characterization of the obtained compounds and materials were presented (Chapter 6). The detailed procedures of polymer/inorganic hybrids preparation by ‘grafting from’ (Chapter 7) and in *in situ* formation (Chapter 8) strategies were described.