

CHAPTER V

CONCLUSIONS

We reported the synthesis of water dispersible magnetite nanoparticles having with bilayer surface of hydrophobic inner shell and hydrophilic corona of mPEG-polyester amphiphilic block copolymer. The hydrophobic shell of polyester was hypothesized to physically adsorb onto the particle surface pre-coated with oleic acid for efficient entrapment of hydrophobic drug, whereas hydrophilic corona provided steric stabilization to the particles and enhances their dispersibility in the aqueous dispersion. The mPEG-polyester copolymer was prepared *via* a direct condensation reaction between mPEG, diol and diacid compounds in such a way that various polyester structures and different \bar{M}_n s of mPEG were obtained, which eventually reflects different degrees of polarity of each block in the copolymer. It was anticipated that the molecular weight of mPEG might affect dispersibility of the particles in water, while different structures and degree of polarities of polyester inner shell might influence the drug entrapment and loading efficiencies and the releasing behavior of the complexes.

It was found that magnetite nanoparticles stabilized by the polyester made of 1,6-hexanediol, regardless of types of diacid used, resulted in good dispersibility in water, as indicated by a slight precipitant observed. In addition, black color of the dispersion is another indicator of well dispersed nanoparticles in water. The particles were stable in water during the first week after preparing and showed some aggregation afterward. This indicated that these complexes might be suitable for use in short term applications. The particles were about 10 nm in diameter and exhibited superparamagnetic behavior at room temperature with M_s about 40 emu/g magnetite. TGA revealed the existence of Fe_3O_4 less than 37%, signifying that there was high percentage of the polymer in the complexes.

From the above experiments, the Ma/He/M5 copolymer seemed to be a suitable one for stabilization of the particles. Therefore, three types of copolymer-stabilized complexes having Ma/He/M5 copolymer-based structures were prepared; sat-coated particle, unsat-coated particle and crosslinked-coated particle. The unsat-

coated particle showed a lower %EE and %DLE than those of the sat-coated particle probably due to the relatively high polarity of double bonds in the unsaturated polyester, resulting in the suppression of the entrapment and loading efficiencies of the hydrophobic drug in the polyester layer. Crosslinking the unsaturated moiety resulted in the enhancement of the drug entrapped in the network structure. In addition, the crosslinked-coated particle exhibited a good potential to efficiently sustain the entrapped drug to be released from the complexes.

Hence, these complexes were hypothetically applicable to effectively load any other hydrophobic drugs by partitioning to the hydrophobic inner shell on the particle surfaces. The structures of the polyester inner layer can be modified to obtain desirable releasing properties. These aqueous dispersions with tunable properties might be potentially used as magnetic field-directed drug delivery vehicles.