PC 20

MONODISPERSE MAGNETIC POLYMERIC COMPOSITE PARTICLES FOR BIOMEDICAL APPLICATIONS

S. Lu[a], J. Ramos[b], J. Forcada[a]

[a]*Institute for Polymer Materials (POLYMAT) and Grupo de Ingeniería Química*
[b]*Servicio de Caracterización de Polímeros: Microscopía*
Facultad de Ciencias Químicas, The University of the Basque Country, Apdo. 1072, Donostia-San Sebastián ES-20080, Spain

Currently, there is an immense interest in the preparation of magnetic polymeric composite particles (MPCPs) for their application in biomedical, bioengineering, and biotechnology fields, such as cell separation, immunoassays, nucleic acid purification and DNA separation, enzyme immobilization, magnetic resonance imaging, hyperthermia, and so on. This interest is because the MPCPs exhibit high magnetic susceptibility to an external magnetic field; and in addition, they are easily further functionalized and surface modified by the attachment of various bioactive molecules.

MPCPs should fulfill certain criteria to be suitable for biomedical applications: no sedimentation, uniform size and size distribution, high and uniform magnetic content, superparamagnetic behavior, no toxicity, no iron leaking, and so on. But in general, the polymerization process for the encapsulation of magnetite may produce three possible types of particles in the resulting magnetic latex, i.e., magnetic polymeric composite particles (MPCPs, with magnetite encapsulated inside), pure polymer particles (PPPs, without magnetite inside) and exposed (free) magnetite particles (BMPs, without polymer coating). The existence of PPPs is not desirable because the magnetic properties of the composite particles will be reduced, and the existence of BMPs is also not desired because they cannot be further functionalized due to the lack of polymer on their exposed surfaces. In addition, the particle size distribution (PSD) should be as narrow as possible so that MPCPs can respond to external magnetic field as uniformly as possible. Therefore, the challenges in almost all the strategies to prepare MPCPs are to minimize, even eliminate, the formation of PPPs and BMPs in production. A more difficult challenge is to obtain MPCPs with very narrow PSD. These important issues, however, have not been reported and discussed in detail in the literature.