Preparation of Colloidal Dispersions of Magnetic Nanoparticles Coated with Biocompatible Polymers

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Abstract

In recent years much interest has been dedicated to the use of magnetic nanoparticle dispersions for the diagnostic and treatment of diseases [1]. The colloidal dispersions need to have several characteristics such as biocompatibility, colloidal stability, suitable size and narrow size distribution to be used in biomedical applications. The size of the nanoparticles has an influence not only in the magnetic properties and colloidal stability but also in the possibility of crossing biological barriers such as cell junctures and membranes [2]. To assure biocompatibility, magnetic nanoparticles require an appropriate coating. Besides making the dispersions biocompatible, the coating is essential because it protects magnetic nanoparticle surface from oxidation, increases blood circulation time, provides specificity for biological target sites and gives steric repulsion acting as a barrier against the interaction between the particles thereby providing colloidal stability [3, 4]. The objective of this work was to prepare dispersions of magnetic nanoparticles coated with biocompatible polymers showing colloidal and physicochemical characteristics suitable for biomedical applications. Three different polymers were used for coating: polyacrylic acid (PAA), polyethylene glycol (PEG) and polyethylene glycol bisamine (PEG bisamine). Iron oxide nanoparticles were used as core. The coated nanoparticle dispersions were characterized in terms of stability, iron content, size and morphology of the nanoparticles and amount of coating. The dispersions prepared showed stability over a month, concentrations of iron over 5mg/ml, and resulted in coated nanoparticles with small diameters (around 100nm by DLS and 10nm by TEM) and concentrations of organics between 5 and 13%. The results showed that the coated magnetic nanoparticles could be suitable for further biomedical applications.

References

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