Functionalized nanoparticles for bioapplications

Jana Drbohlavová, Zdenka Fohlerová**,** Jana Pekárková, Jaromír Hubálek

CEITEC BUT, Technická 10, Brno, Czech Republic
Zdenka.fohlerova@ceitec.vutbr.cz

Abstract

Research on nanoparticles has evolved into biological applications with large expectations for the use of nanoparticles for imaging and drug delivery in humans and as probes at the cellular level. In our researches we are focused on several questions concerning as follow: i) production of monodispersed magnetic iron oxide nanoparticles (MNPs) as the suitable candidate for the assisted transfection of DNA expression plasmids. The nanoparticles are synthesized by co-precipitation method and stabilized with chitosan under physiological pH. DNA plasmids are expected to be integrated into the polymer coat, making the DNA-MNPs complex ready for the transfection and subsequently taken up by cells via endocytosis. Here, the DNA-MNPs complex is introduced in HEK cells to analyse the cellular toxicity and the effect on cell proliferation (1). ii) next, MNPs nanoparticles are used as a drug delivery system for miRNA to improve miRNA-based cancer treatment efficiency in glioblastoma. The delivery system was proposed on the super-paramagnetic iron oxide nanoparticles (SPIO)-based support for miRNA, covered with biopolymer protecting the active core such is chitosan (2). iii) the characterization, synthesis and functionalization of gold nanoparticles (AuNPs) based on the surface plasmon resonance imaging. Gold nanoparticles are synthetized by green methods to obtain stable colloid gold nanoparticles suitable for various biomedical applications; especially for in vivo and in vitro bioimaging. iv) the synthesis and characterization of SiO2/Au core/shell nanoparticles. The nanoparticles should, in their physical and chemical properties, improve signal of optical coherence tomography (3). v) the last point is focused on the development of biosensors based on modified semiconductor core/shell quantum dots (QDs) for protein detection. Synthesis of CdTe/ZnS core/shell QDs modified by glutathione and mercaptosuccinic acid (GSH, MSA) is performed, followed by the conjugation with biomolecules. Several coupling agents such as EDC with NHS are used. The final products were characterised by fluorescence spectroscopy and the emission spectra are analysed (4).

References

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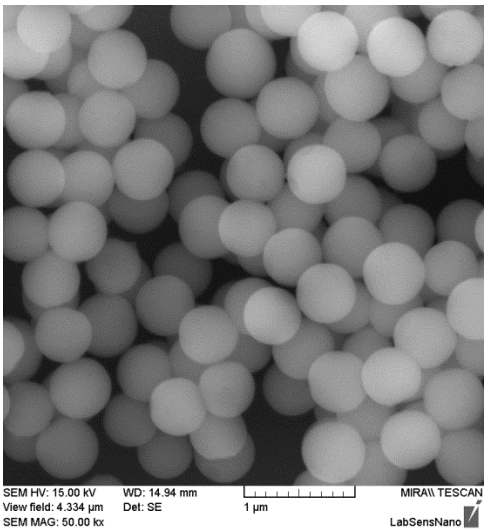

Fig. 1 SiO_2 nanoparticles