

Annotations of Doctoral Thesis Topics for Degree Course in “Nanotechnology and Advanced Materials”

Topic:	Preparation of coated magnetic nanoparticles for drug delivery applications
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Annotation:

The fabrication of magnetic nanoparticles (MNPs), which can be used for the delivery of chemotherapeutics has attracted considerable attention. MNPs are becoming a cutting-edge tool in medicine because they can be simultaneously functionalized with biocompatible polymers, guided to tumor by a magnetic field, and visualized by magnetic resonance imaging (MRI). Coating of MNPs by acidic polysaccharides provide stability against aggregation, reduce clearance from body, and provide reactive sites suitable for the further binding of drugs or targeting vectors.

Topic of the Ph.D. thesis will be the preparation of magnetic or superparamagnetic nanoparticles and their surface modification by acidic polysaccharides. Initially, synthesis of iron oxide MNPs (magnetite, maghemite) will be performed using variety of approaches including highly effective microwave assisted solvothermal polyol method and optimized to obtain optimal NPs size distribution and dispersion stability. Doping of iron oxide by lanthanide ions will be investigated in order to improve their magnetic properties. MNPs will be subsequently modified by acidic polysaccharides, including 2,3-dicarboxy cellulose, and characterized (FTIR, DLS, SEM, TEM). Their stability with respect to various ionic strength will be evaluated by means of variation of hydrodynamic diameter. Prepared nanoparticles will be loaded with anticancer drugs such as cisplatin and drug loading and release profiles studied. Coated nanoparticles can be modified by biological targeting vectors to further increase their tumor targeting capabilities. Prepared drug-delivery systems will be tested under in vitro conditions (external collaboration).

Requirements:

Talented, enthusiastic and motivated candidate with a Masters' Degree in Chemistry/Material Science/Nanoscience and Nanotechnology or related subject areas. Good command of English or a potential to the improvement.

Literature:

- 1) M. B. Schütz, L. Xiao, T. Lehnen, T. Fischer, S. Mathur, *Int. Mater. Rev.* 2017, 1–34.
- 2) Z. Medříková, V. Novohradsky, J. Zajac, O. Vrána, J. Kasparkova, A. Bakandritsos, M. Petr, R. Zbořil, V. Brabec, *Chem. Eur. J.* 2016, 22, 9750–9759.
- 3) R. S. Yadav, I. Kuřitka, J. Vilcakova, J. Havlica, L. Kalina, P. Urbánek, M. Machovsky, D. Skoda, M. Masař, M. Holec, *Ultrasonics Sonochemistry* 2018, 40, 773–783.
- 4) M. Muthana, A. J. Kennerley, R. Hughes, E. Fagnano, J. Richardson, M. Paul, C. Murdoch, F. Wright, C. Payne, M. F. Lythgoe, et al., *Nature Communications* 2015, 6, 8009.