

## PRELIMINARY STUDIES ON MAGNETIC AND NON-MAGNETIC CORE SILICA GELS BY SAXS, SANS, ESR, AND VSM METHODS

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The work is dedicated to application of magnetic nanomaterials as biological active substances sorbents. It is a very important topic in medicinal and environmental protection of point of view [1-2]. Nanoparticle used for this purpose should consist from bioavailable components. Newly synthesized nanomaterials composed with: iron oxides magnetic core, silica or carbon nanotubes and bioavailable modifiers are investigated in accordance to sorption of biological active compounds.

Here were presented preliminary results on nanoparticles with the magnetic and non-magnetic core in silica shells modified with functional groups by small-angle X-ray and small-angle neutron scattering as well as electron spin resonance (ESR) and vibrating sample magnetometer (VSM) methods. The materials are potentially intended as drug carriers because of their unique magnetic and biological properties. The SAXS experiments were made at Frank Laboratory of Neutron Physics and the SANS experiments were conducted at the nuclear reactor LVR-15 operated by Research Centre Řež. The measurements were performed by Adani SPINSCAN X benchtop ESR spectrometer intended for spectra registration with continuous wave using the second modulation. Studies of magnetic-core particles with different functional groups using ESR methods are challenging due to the different responses under the influence of the silicone shell and its modification of the sample [3]. Research procedures applied to analyze magnetic-core particles take into account the impact of various functional groups on analyzed samples to achieve comparable results. We also presented results studies by vibrating the sample magnetometer at 100Hz at room temperature for each sample. In the research size distribution among magnetic nanoparticles and characterization of physical-chemical properties were provided.

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[2] M. Lewandowski (2017). Nitroxides as Antioxidants and Anticancer Drugs. *International Journal of Molecular Sciences*. 18, 2490.

[3] R. Krzyminiewski (2019). ESR as a monitoring method of the interactions between TEMPO-functionalized magnetic nanoparticles and yeast cells. *Scientific reports - Nature*. 9:18733