The Influence of Coating on Properties of Iron-based Nanoparticles for Biomedical Applications

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The substantial effort made in the research and study of nanomaterials and their properties resulted in broadening the capabilities of applied sciences. The discovery of diverse fields of their applications is an asset in all areas of society. Magnetic nanoparticles (MNPs) are widely-used in biomedicine as contrast agents in MRI, carriers in targeted drug delivery and agents in magnetic fluid hyperthermia (MFH) treatment. Being much more effective, the application of MNPs in cancer diagnostics and treatment offers little or no side effects in comparison with the currently widely-used methods such as chemotherapy and radiation therapy. Magnetic nanoparticles can be subject to aggregation which is one of critical parameters that needs to be taken into consideration. The main objective of my study was to assess the influence of coating and surfactant dispersion on zeta potential, MNPs aggregation and magnetic properties. Commercial equipment Malvern Zetasizer and SQUID magnetometer (Quantum Design) were used to determine zeta potential, MNPs size distribution and magnetic properties. I studied five iron and iron oxide-based samples coated in different inorganic shells dispersed in certain solutions. In isolated Fe@Au nanoparticles the size 10nm, zeta potential $|\zeta|$=70mV and magnetic moment mp=149μB were observed. The MNPs encapsulation in combination with the utilization of oleate sodium as dispersant turned out to be sufficient in terms of surface stability and non-aggregation character. All-in-all, the outcome of this research is having found three specific MNPs solutions (with optimized magnetic properties and values of zeta potential) to be applied as ferrofluids for magnetic hyperthermia.