

Drug-loaded magnetite-based nanocontainers: new way of thrombosis treatment

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Introduction. Magnetic gels are fast developing areas in the material science. For biomedical application these materials should fit criteria such as large specific surface area, well-developed microstructure and biocompatibility [1, 2]. Among all magnetic materials only two of them are considered biocompatible and regarded as safe to be applied for biomedical applications, namely magnetite and maghemite [3]. In the ideal situation, the magnetic carrier consists of only magnetic material, but due to the chemical nature and surface properties of these two oxides, difficulties in covalent condensation of iron oxide nanoparticles, they cannot be used directly for the creation of magnetic capsules.

Methods. Magnetite-based nanocontainers (designated as MNCs) were prepared by template-promoted formation of magnetite gel using the microemulsion technique.

Results and discussion. Using microemulsion technique helps to synthesize the magnetite-based nanocontainers with adjustable size. The diameter of NCs can be varied in a wide range by the regulation of microemulsion composition and emulsifying conditions. The MNCs exhibit a developed microstructure and textural properties with total surface area up to 135 m²/g, excellent magnetization up to 60 emu/g and low cytotoxicity against both HeLa and postnatal human fibroblast (up to 260 µg/mL). Synthesis conditions allow to immobilize molecules of various nature, including complex and labile biomolecules such as thrombolytic enzymes and other proteins. The applied magnetic field can concentrate MNCs in the necessary place, keeping for a certain period of time, until the encapsulated preparation is released, thereby minimizing the side effects caused by nonspecific distribution.

References:

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