Hydrophilic Ferrofluids for Tumor Therapy

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Biocompatible ferrofluids are magnetic nanoparticles, that can be used as a delivery system for anticancer agents in locoregional tumor therapy, called "magnetic drug targeting". By this method of drug application, one attempts to concentrate a pharmacological agent in the tumor mainly in order to minimize unwanted side effects in the organism and to increase its locoregional effectiveness [1]. The magnetic targeting method depends on the availability of biocompatible nanoparticles free of large particles or aggregates, which can cause embolic problems. However the nanoparticles for medical targeting applications have to depict a high specific magnetic moment to overcome the blood flow upon magnetic immobilization at the tumor site. A compromise in size and magnetic moment leads to particles with a diameter of about 100nm.

A promissing access to medium-sized magnetic nanoparticles was introduced by synthesis of Ferrofluid precipitates from iron-citrate mixtures and subsequent modification by pulse etching and size separation by fractionated sedimentation [2]. The method yields nanoparticles of the desired size, as a cluster of smaller spherical core particles of 6-8 nm size. The nanoparticles are stabilized by a citrate shell, which can subsequently exchanged by phosphodextrane. The final polymer shell is the acidic binding site for the basic drug load (Mitoxanthrone), which is added in the last step. The analysis of a phosphodextrane shelled product was investigated by direct electron microscopy (iron imaging, no stain) and dynamic light scattering. The DLS demonstrates the apparent particle size distribution of main population of 10-200nm size, whereas the biggest particles can still pass the smallest blood vessels. The current investigations focus on magnetic properties by EPR at different temperatures (77 - 240 K), on the ferric oxide structure by Mössbauer spectroscopy, on drug loading and on behavior of a final Ferrofluid in blood plasma.

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