

Supporting Information

Multifunctional Superparamagnetic MnO@SiO₂ Core/Shell Nanoparticles and their Application for Optical and Magnetic Resonance Imaging

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APS-quantification with fluoresceinisothiocyanate (FITC)

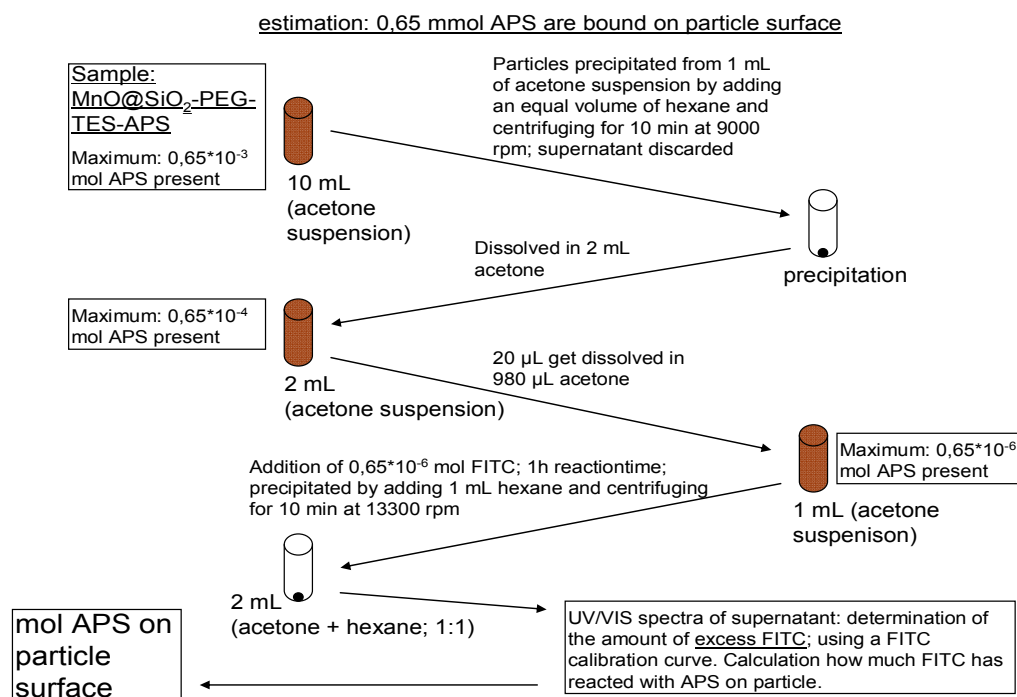


Figure S1. Experimental procedure for the quantification of surface amino groups.

Calculation method to get the approximate average number of NH₂-Groups on the surface of a particle:

First, it is necessary to calculate the number of particles in 1 mg particle powder. For this geometric calculation the particles are understood to be spherical and monodisperse, whereby the volume can be obtained by the common formula for volumes of spheres. In this special case of core/shell particles the different densities of MnO and SiO₂ must be taken into account. In approximation to the density of the bulk material MnO of 5.45 g/cm³, a mass of $2,87 \cdot 10^{-18}$ g is obtained for a diameter of 10 nm. The mass of the silica-shell with a thickness of 3 nm (total diameter of the core/shell particle: 16 nm) is $3,55 \cdot 10^{-18}$ g. The total mass is $6,42 \cdot 10^{-18}$ g per particle. Therefore, 1 mg particle powder contains $1,56 \cdot 10^{14}$ particles. Using the amount of amino-groups calculated by the procedure described in Figure S1 (2.4 µmol/mg NH₂ groups) the average number of amino groups per particle is obtained as 9.3 million.

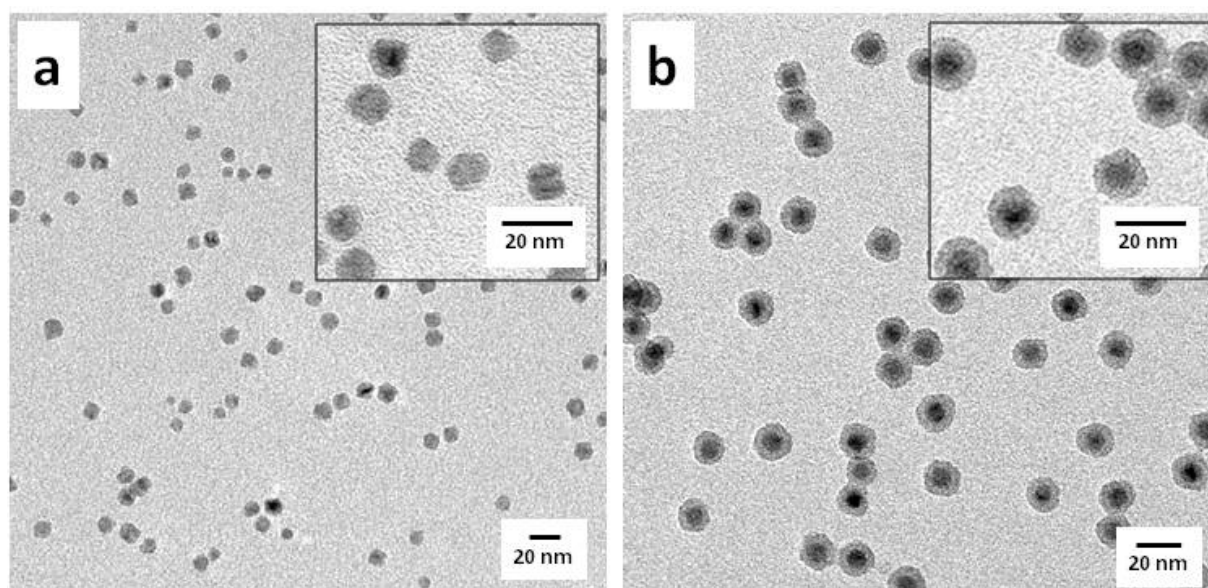


Figure S2. TEM images of (a) dopa-PEG functionalized and (b) silica coated MnO nanoparticles after the leaching experiments (enlarged images are shown in the insets).

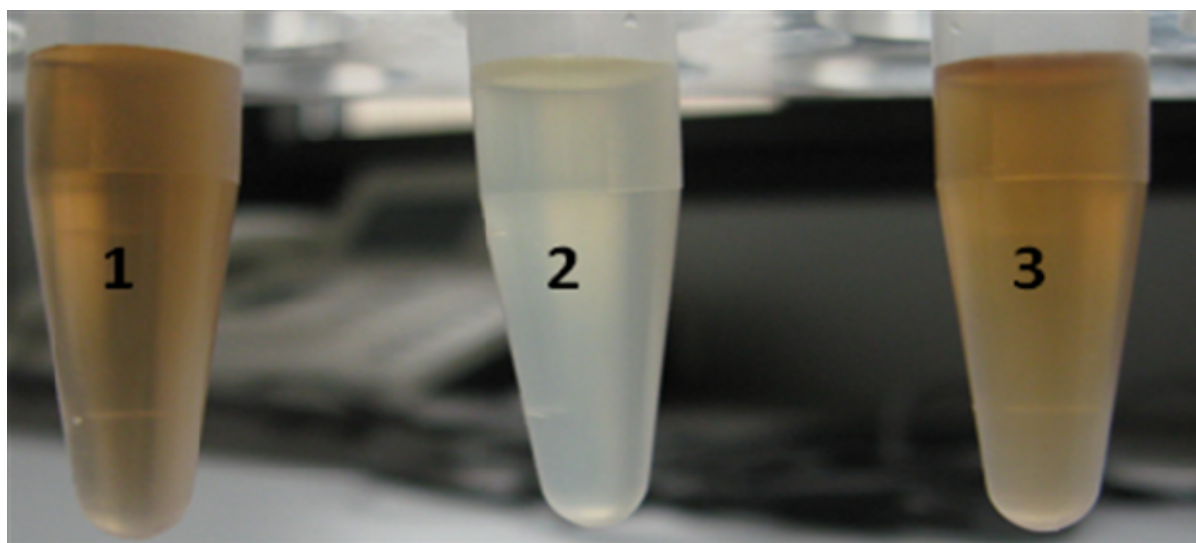


Figure S3. Images of nanoparticles in water (1) and in human blood serum (3) as well as human blood serum (2) after incubation at 22°C after 24h. The different color of the samples was due to the brown color of silica coated MnO nanoparticles and is not related to changes in the blood serum.

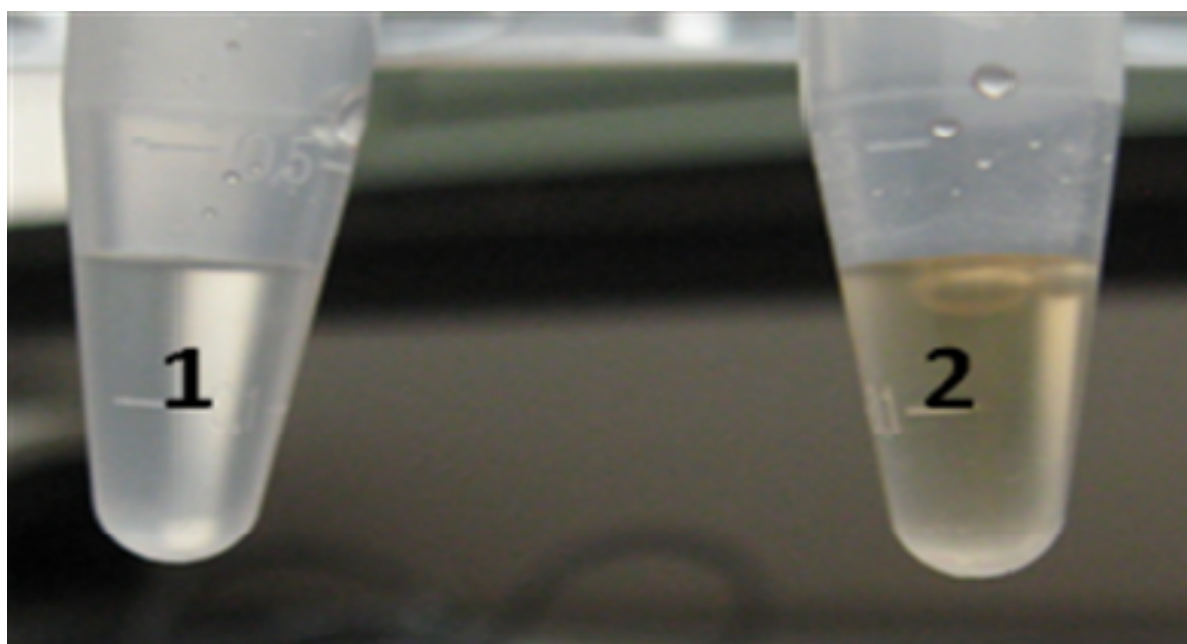


Figure S4. Silica coated nanoparticles in water (2) and citrate/KOH buffer at pH 5. The samples were more diluted than the sample in Figure S3.

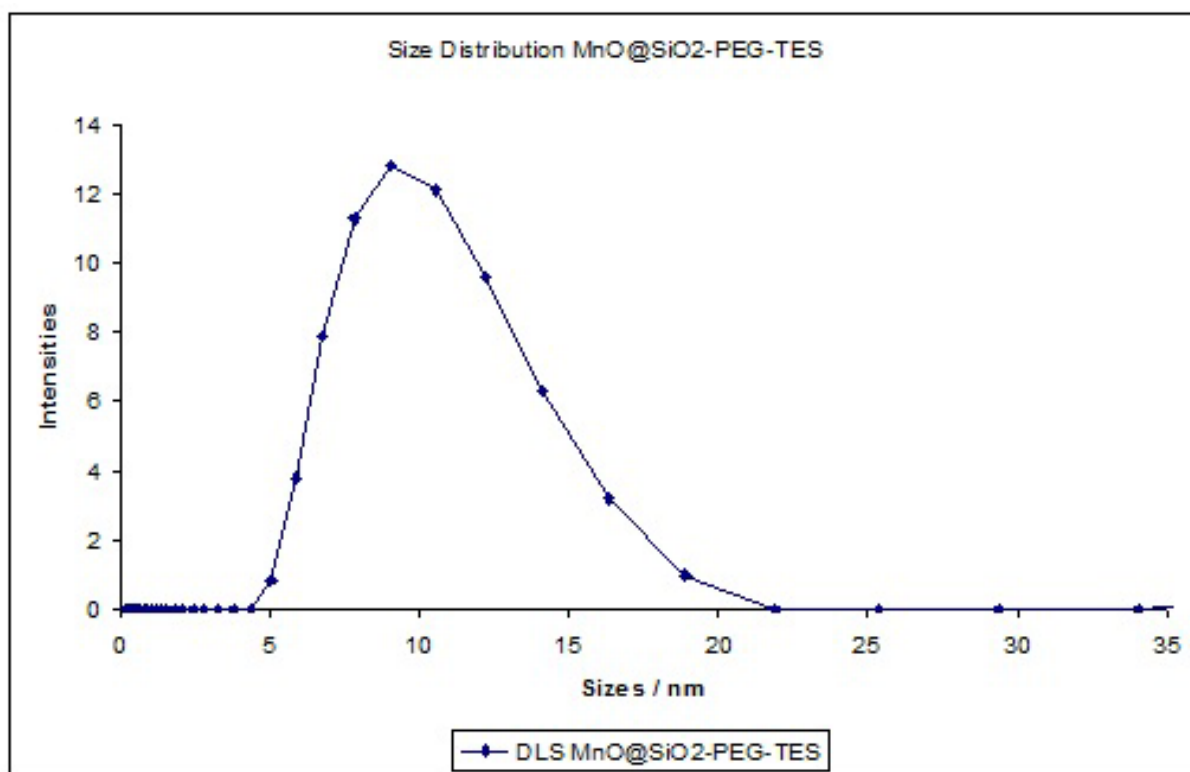


Figure S5. DLS-size distribution of MnO@SiO₂-PEG NPs with an average size of 12.5 nm.