Electronic Supplementary Material (ESI) for Biomaterials Science.

Supplementary Figures: 'Combination of magnetic field and surface functionalization for reaching synergistic effects in cellular labeling by magnetic core-shell nanospheres'

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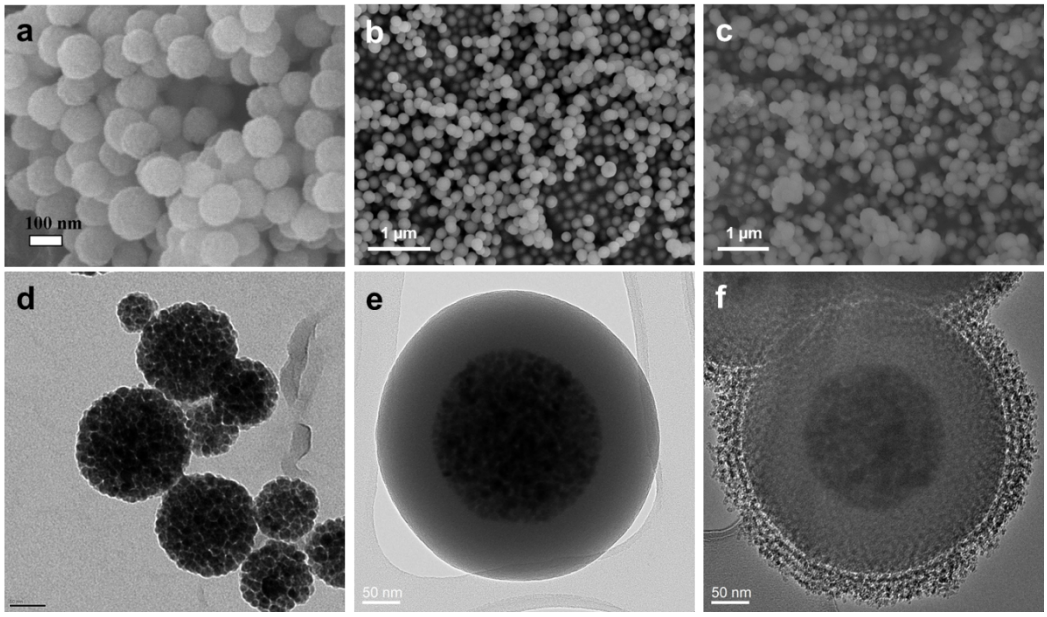

Fig. S1 Electron microscopy (SEM a-c, TEM d-f) of magnetite cores, Mag, (a. and d.), Mag@*n*SiO_2 (b. and e.) and Mag@*n*SiO_2@*m*SiO_2 (c. and f) nanospheres. Scanning electron microscopy (SEM) images were recorded on a Zeiss DSM 962 microscope operating at 5 kV (b. and c.). Transmission electron microscopy (TEM) images were obtained by a JEM 2200FS (JEOL, Japan) instrument with 200 kV acceleration voltage.

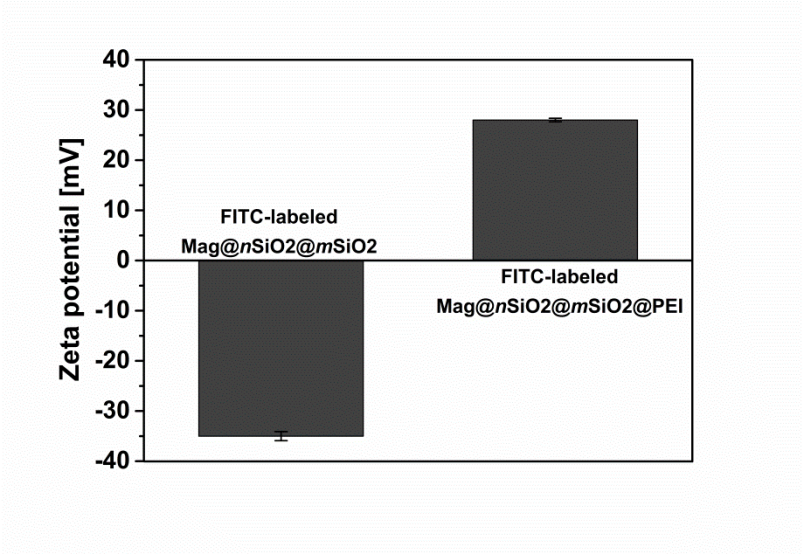

Fig. S2 Zeta potential of FITC-labeled Mag@nSiO$_2$@mSiO$_2$ and Mag@nSiO$_2$@mSiO$_2$@PEI nanospheres measured in HEPES buffer. FITC-labeling did not change the zeta potential of the particles noticeably.

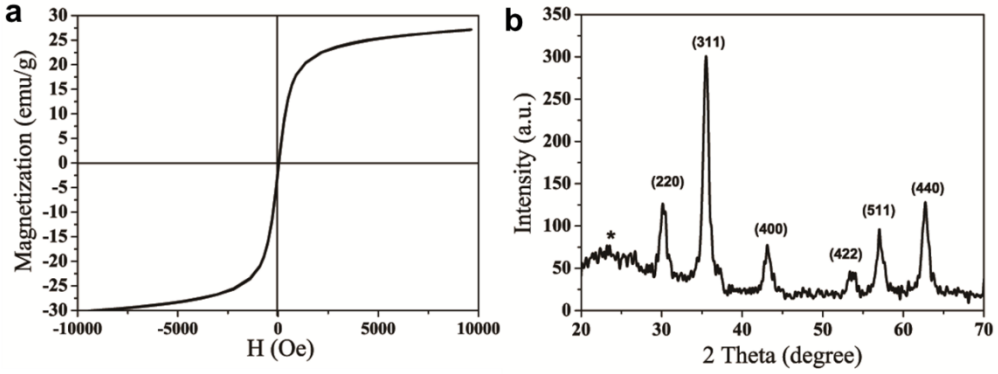

Fig. S3 (a) Magnetization curve of the magnetite composite nanospheres. No hysteresis was detected in the magnetization curve for the sample, revealing its superparamagnetism. The saturation magnetization value is 28 emu/g. Magnetization curve was obtained by using a Lakeshore 7407 Vibrating Sample Magnetometer at 300 K. (b) X-ray diffraction (XRD) pattern of the magnetite core (Mag). The crystalline structure of Mag can be easily indexed to Fe_3O_4 by the XRD pattern. X-ray diffraction (XRD) pattern was collected using a Rigaku D/max 2200 PC diffractometer with a CuKα radiation source at 20 mA and 40 kV.

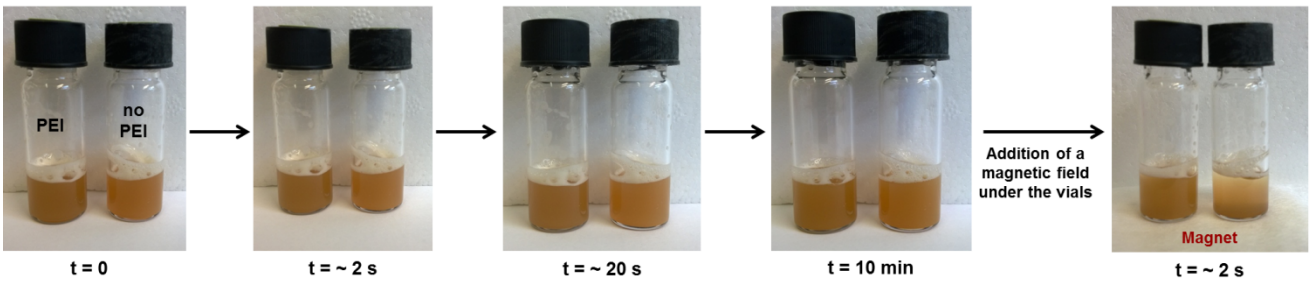

Fig. S4 Mag@nSiO$_2$@mSiO$_2$@PEI (left, "PEI") and Mag@nSiO$_2$@mSiO$_2$ (right, "no PEI") as freshly dispersed in cell media. No aggregation and/or sedimentation of the particles occurred even after 10 min. When a magnetic field was applied the Mag@nSiO$_2$@mSiO$_2$ particles started to sediment directly. More rapid sedimentation can be seen for the Mag@nSiO$_2$@mSiO$_2$ particles due to magnetically induced aggregation to larger clusters with, as a result, faster sedimentation.

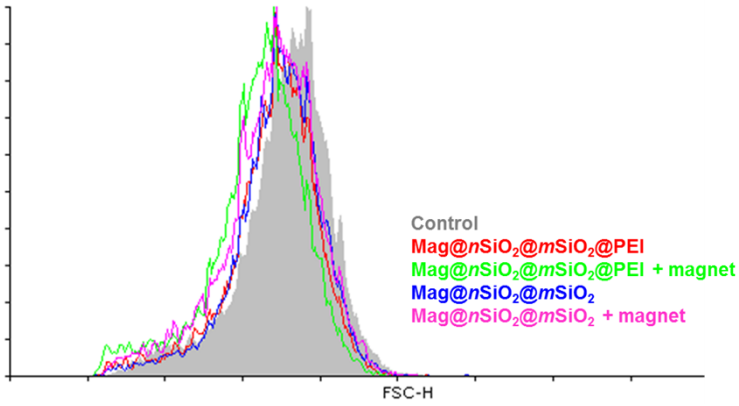

Fig. S5 Forward scatter (FSC) intensities, determined by flow cytometry, of cells labeled with Mag@nSiO$_2$@mSiO$_2$@PEI and Mag@nSiO$_2$@mSiO$_2$ nanospheres revealed that the cells did not show any change in size (FSC channel) regardless if a magnetic field had been applied or not. Since a change in size of the cells is an indirect method of measuring cell viability, it was affirmed that the particles did not affect the viability of the cells.