Electronic Supplementary Information (ESI) for

Water dispersible iron oxide nanoparticles coated with covalently linked chitosan

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Thermogravimetric Analysis

We measure the organic and inorganic content of the nanoparticles to be characterized magnetically using a TA Instruments TA-2950 thermogravimetric analyzer (TGA). Sample weight was monitored in the temperature range of 25 to 800 °C with a heating rate of 10 °C/min using air at 60 ml/min. As shown in Fig. ESI-1, major weight losses were observed at similar temperatures in both samples, but the CS coated nanoparticles were found to have ~97% organic content, whereas the CSO coated nanoparticles were found to have ~55% organic content.

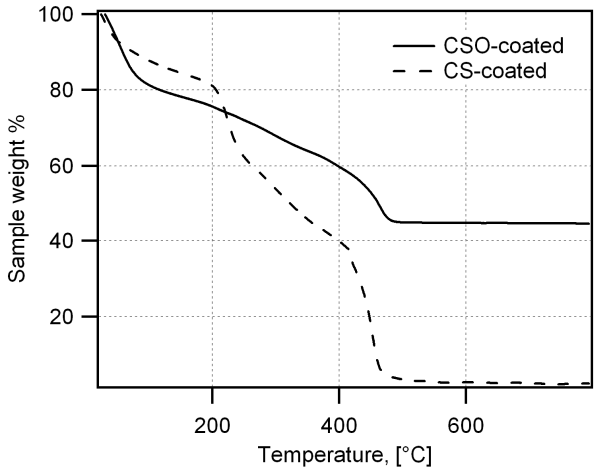

Fig. ESI-1. TGA results for CSO- and CS-coated nanoparticles, from 25 to 800 °C with a heating rate of 10 °C/min using air at 60 ml/min.

Measurements of Temperature Dependence of Magnetization:

We also measured the temperature dependence of the magnetization of the CSO and CS coated nanoparticles. In what are called zero field cooled (ZFC) measurements, we cooled the samples to 4 K at zero field, applied a magnetic field of 10 Oe and warmed the sample to 300 K taking magnetization measurements at regular temperature intervals. In what are

called field cooled (FC) measurements, the sample under a field of 10 Oe was cooled from 300 K to 4 K taking magnetization measurements at regular temperature intervals. Figure ESI-2 shows the zero field cooled and field cooled curves for the CSO and CS coated nanoparticles. Two important features of ZFC/FC curves are the temperature at which peaks are observed in the ZFC curve, called the blocking temperature, and the temperature at which the ZFC and FC curves diverge, called the irreversibility temperature. The ZFC/FC curves for the CSO coated sample are characteristic of superparamagnetic magnetite nanoparticles, with a blocking temperature of ~40 K and an irreversibility temperature of 100 K. The large difference between the blocking and irreversibility temperatures indicates a distribution of magnetic anisotropy in the sample, most likely due to the polydispersity in the primary particle diameter. On the other hand, the CS coated sample has a blocking temperature of ~175 K and an irreversibility temperature of ~200 K. A shoulder in the ZFC curve is also evident for the CS coated nanoparticles at ~50 K. Both samples consist of the same primary magnetic particles, but they differ in the aggregation state of the particles. While the CSO coated particles are well dispersed, each coated with a CSO corona, the CS coated particles consist of aggregated clusters, in which the particles have dipole-dipole interactions which result in a higher blocking temperature observed in the sample. The presence of a low temperature shoulder in the ZFC curve of the CS coated sample, indicates there are particles for which dipole-dipole interactions do not affect the temperature dependence of the magnetic response.

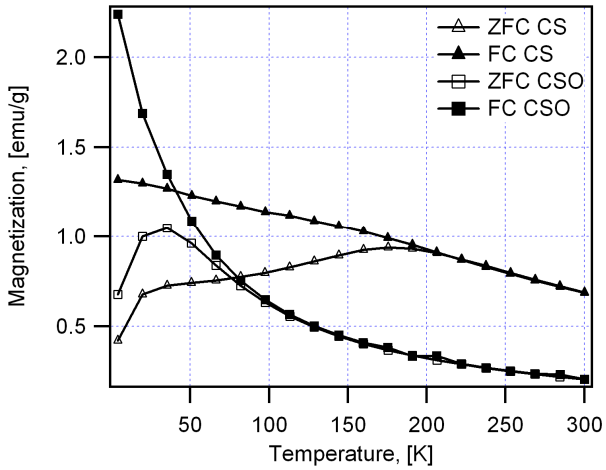

Fig. ESI-2. Zero field cooled (ZFC) and field cooled (FC) temperature dependence of magnetization of CSO and CS coated samples in an applied field of 10 Oe.