Supplementary information

Nanoparticle Calculations:

A combination of DLS particle size distribution, EDAX and certain basic assumption was used to determine the number of magnetite particles per gram of the powder for bare magnetite and magnetite-silica composite.

The magnetite unit cell parameters are: a=b=c=8.39 Å, which translates to a unit cell volume of 590.5 $Å^3$ i.e. 590.5 x 10^{-24} cm^3. There are 8 Fe_3O_4 units per unit cell, which gives a volume of 73.8 x 10^{-24} cm^3 per Fe_3O_4 unit. Total number of Fe & O atoms per unit cell is 24 and 32 respectively. The weight of one unit cell can be calculated from the weight of individual Fe atoms (55.84/6.02x10^{23} = 9.275x10^{-23} g) and O atoms (16/6.02x10^{23} = 2.657x10^{-23} g) to be 307.6 x10^{-23} g. The table below gives the detailed calculations:

Size in nm	Number in %	Volume of the particles ($4/3\prod r^3$) in cm^3	No. of unit cell/ particle	Tot no of unit cells	Number of Fe atom/particle	Total No. of Fe atoms	weight of single particle in g	Total weight of particles in g
24	9	7.234x10^{-18}	12261	110349	294264	2648376	37.721x10^{-18}	335.439x10^{-18}
28	27	11.488x10^{-18}	19471	525717	467304	12617208	59.897x10^{-18}	1616.139x10^{-18}
33	32	18.806x10^{-18}	31875	1020000	765000	24480000	98.055x10^{-18}	3137.760x10^{-18}
38	21	28.715x10^{-18}	48669	1022049	1168056	24529176	149.717x10^{-18}	3144.057x10^{-18}
44	9	44.578x10^{-18}	75557	680013	1813368	16320312	232.444x10^{-18}	2091.996x10^{-18}
51	2	69.419x10^{-18}	117660	235320	2823840	5647680	361.969x10^{-18}	723.939x10^{-18}
	100		305493	3593448	7331832	86242752		11049.330x10^{-18}

From the above table, it is clear that for a set of 100 nanoparticles, total number of unit cells = 3593448.

Weight of one unit cell = 307 x 10^{-23} g; which gives the weight of all unit cells = weight of 100 nanoparticles to be 11.05 x 10^{-15} g.

If the weight of 100 nanoparticles is known, one can estimate the number of nanoparticles per gram of the powder to be: 9.04 x 10^{15}

To understand the amount of silica, we need to calculate in terms of Fe: Si ratio. Hence by simple calculations, we can estimate the number of Fe atoms per gram to be:

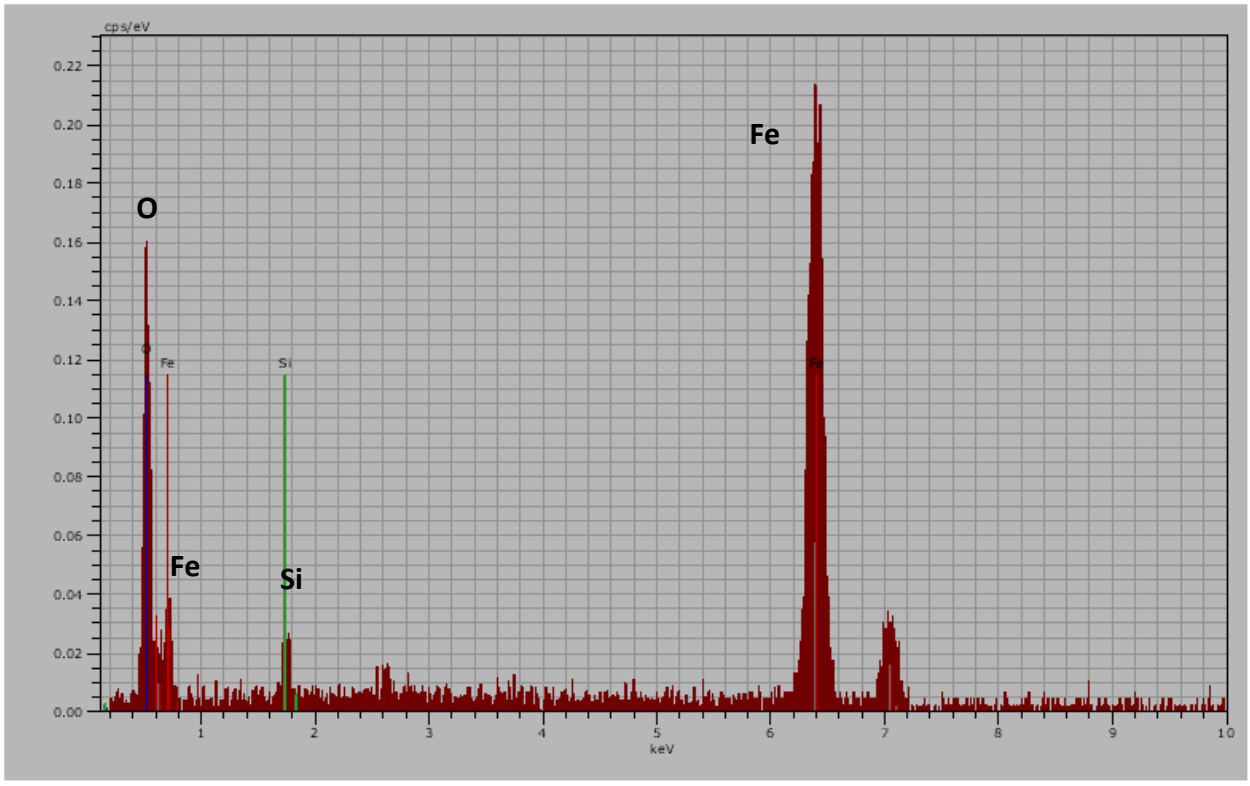
100 Nanoparticles correspond to 86242752 Fe atoms. Since we know the number of nanoparticles per gram, we can determine number of Fe atoms per gram of nanoparticles to be: 77.96×10^{20}

By EDAX, (Figure S1), the Si : Fe ratio is 1:43. Hence for every 43 atoms of Fe, there is 1 Si atom (or SiO_2 unit). Hence for 77.96×10^{20} Fe atoms, this translates to 1.81×10^{20} units of SiO_2 per gram of nanoparticles.

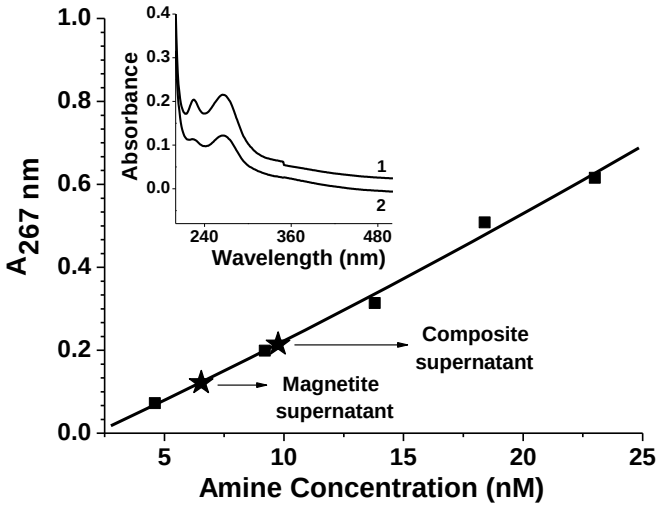
Weight of SiO_2 unit $(60.08/6.023 \times 10^{23}) = 9.97 \times 10^{-23}$ g.

Hence the total weight of all SiO_2 units per gram of nanoparticles is: 0.018 g.

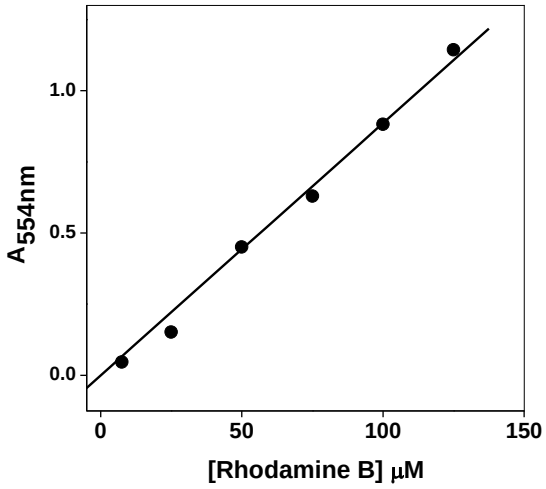
Here we make an assumption that the size of magnetite is same in case of magnetite and magnetite-silica composite. This is not far from true if one takes in to account the average DLS sizes for magnetite (~ 37 nm) and magnetite silica composite (~46 nm); with the TEM size in the range of 29 nm. Taking this into consideration, the magnetite-silica composite contains 1.8 % of silica.



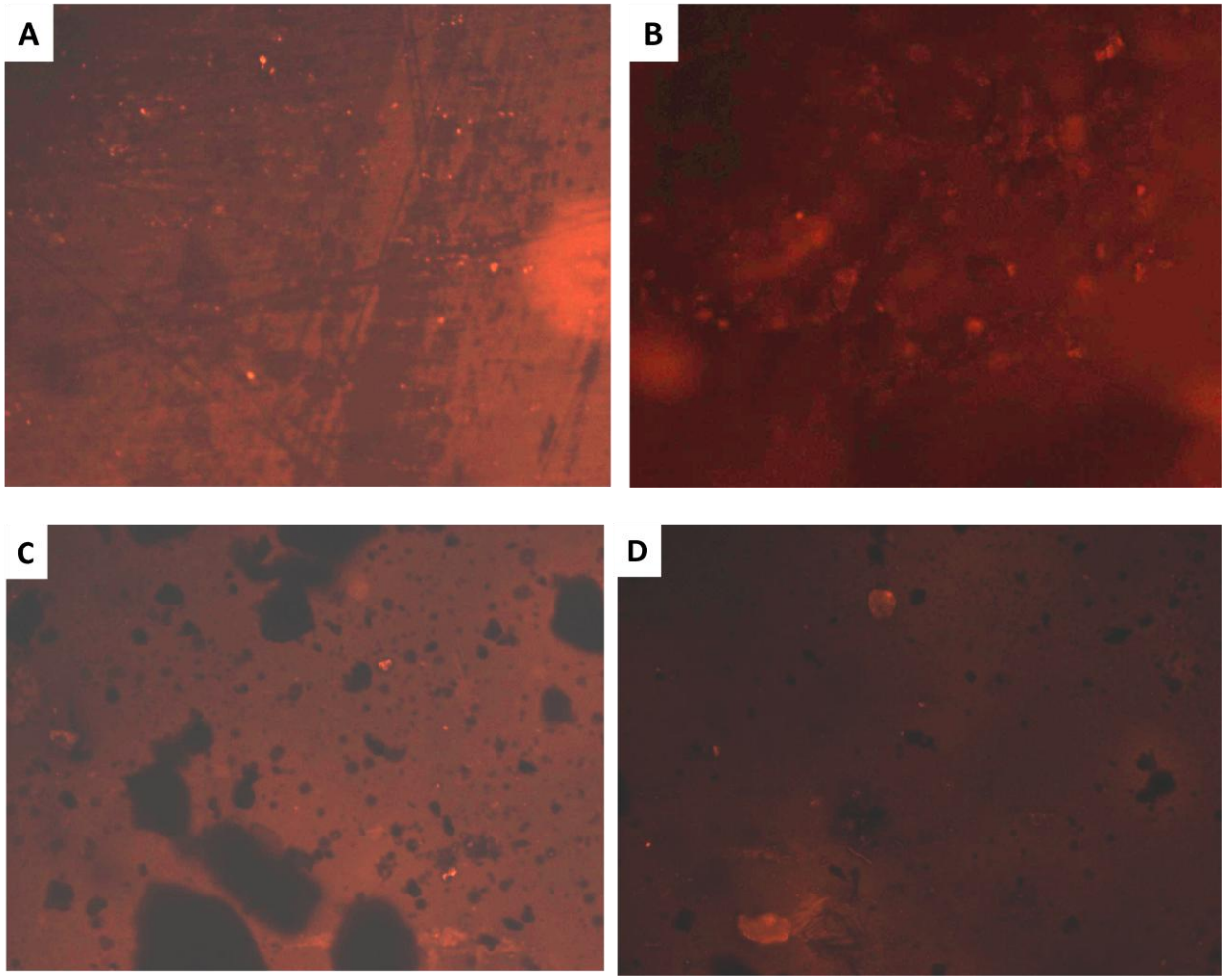
Supplementary information S1: EDAX analysis of magnetite –silica nanocomposite



Supplementary information figure S2: Amine quantification standard curve. Inset shows the curves for composite (curve 1) and magnetite (curve 2).



Supplementary information figure S3: Rhodamine B standard curve recorded as a function of dye concentration and measuring the absorbance at 540 nm.



Supplementary information figure S4: Fluorescence images of Rhodamine B tagged particles: A & B: Rhodamine B tagged magnetite-silica composite; C&D: Rhodamine B tagged bare magnetite particles.