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Synthesis of iron oxide nanoparticles using different stabilizers and study of their size and properties

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Magnetic nano particles of ferric chloride were synthesised using a co-precipitation technique. For the optimal results, ferric chloride at room temperature was added to different surfactant with different ratio of metal ions/surfactant. The samples were characterised using Transmissionelectron microscopy, X-ray diffraction and Fourier transform infra red spectrum to show the presence of nano particles, structure and morphology. Magnetic measurements were also carried out on samples using a Vibrating Sample Magnetometer. To show the effect of surfactant on size distribution and crystalline structure of produced nano particles, surfactant with various charge such as: anionic cetyltrimethyl ammonium bromide (CTAB), cationic sodium dodecyl sulphate (SDS) and neutral TritonX-100 was employed. We obtained that by changing the surfactant and ratio of metal ions/surfactant the size and crystalline structure of these nano particles were controlled. We also show that using anionic stabilizer leads to smallest size and narrowest size distribution and the most crystalline (polycrystalline structure).

In developing our production technique, many parameters were varied. Efforts at reproducing good yields indicated which of the experimental parameters were the most critical and how carefully they had to be controlled. The conditions reported here were the best that we encountered but the range of possible parameter choice is so large that these probably only represent a local optimum. The samples for our chemical process were prepared by adding 0.675 gms ferric chloride ($FeCl_3$, $6H_2O$), to three different surfactant in water solution. The solution was sonicated for about 30 min till transparent solution achieved. Then 0.5 gms sodium hydroxide (NaOH) as a reduction agent was poured to the reaction drop by drop which resulted to participate reddish brown Fe_2O_3 nanoparticles, after washing with ethanol the obtained powder was calcinated in 600°C for 2hrs. Here the sample 1 contained CTAB as a surfactant with ratio of metal ions /surfactant 1/2, sample 2 with CTAB and ratio 1/1, sample3 with SDS and ratio 1/2, sample 4 SDS 1/1, sample 5 is triton-X-100 with 1/2 and sample 6, triton-X-100 with 1/1.

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