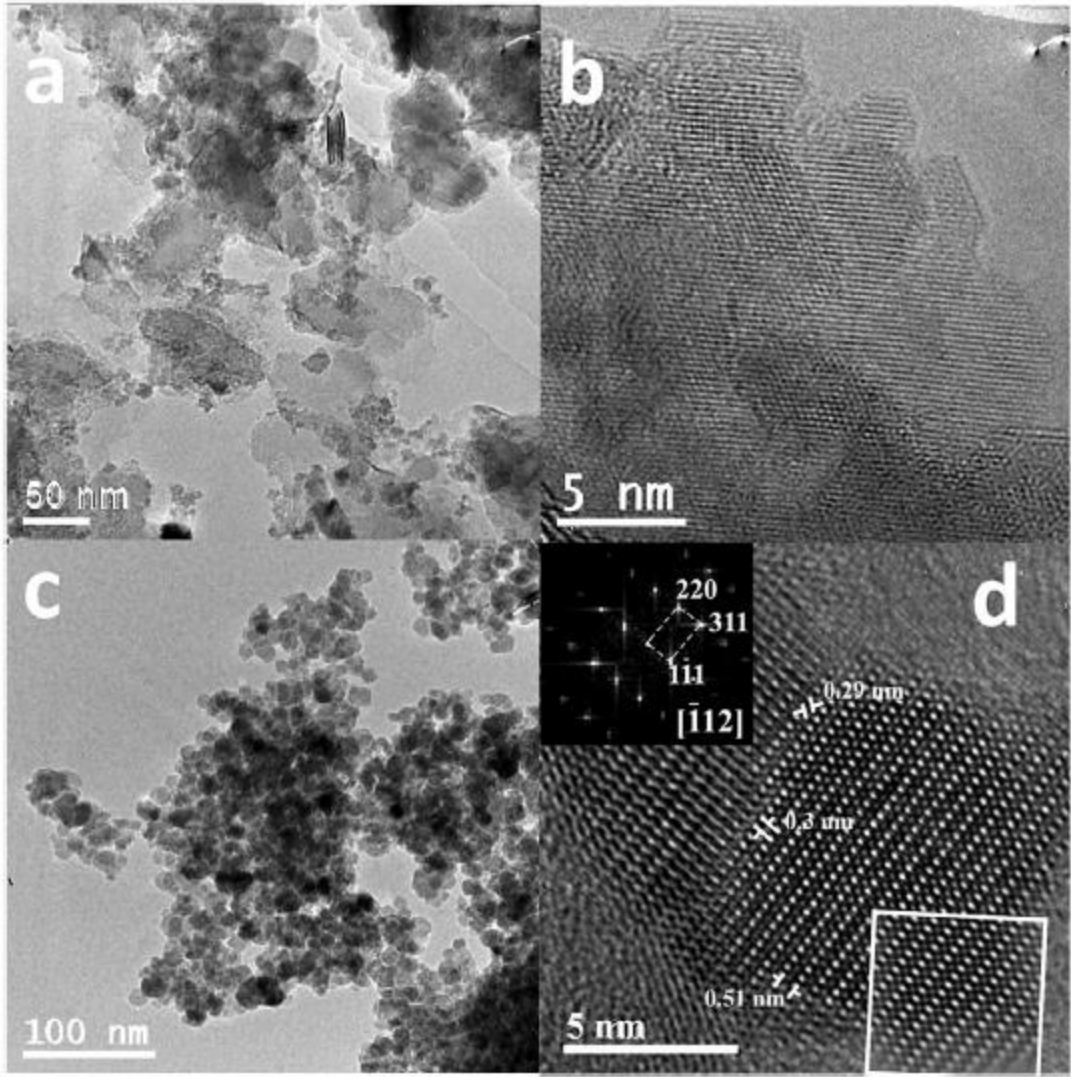
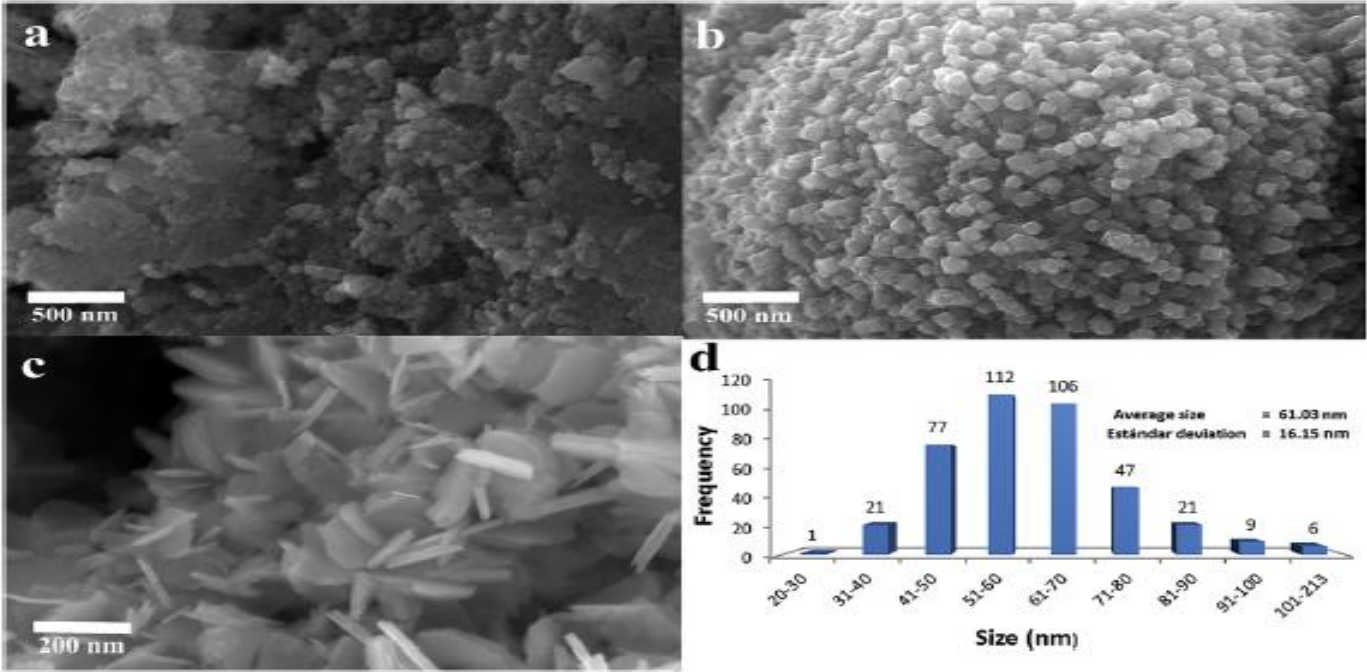


Synthesis: 5 g of steel wool from FibraSmex were washed in a solution of 50% acetone and 50% isopropyl alcohol using an ultrasonic cleaner for 30 min at room temperature. After 25 ml of white vinegar (pH 1.76) was added, and was allowed to stand for 24 h to form Fe²⁺. The resulting solution with pH 4.24 was divided into two beakers in a 2:1 ratio 5 drops of hydrogen peroxide (0.22 ml) were added dropwise to the beaker with the least amount of solution, inducing a transformation from Fe²⁺ to Fe³⁺ (pH 4.35). Fe³⁺ was added to the Fe²⁺ and ammonium hydroxide was slowly added until the substance became dark in color with pH 12.37. The reaction occurs as follows: $\text{Fe}^{2+} + 2\text{Fe}^{3+} + 8\text{OH}^- \rightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2\text{O}$

Before combining the Fe²⁺ and Fe³⁺, the beaker with the Fe²⁺ was placed between two 1200 G magnets (from this value begin to observe changes in the NPs shape). With this arrangement, we induce preferential crystalline directions for the growth of the NPs.

TEM analysis indicates that when the sample was not subjected to an EXMF, particles <200 nm with large particle size dispersions and irregular shapes were observed (Fig. 4a). Using HRTEM, we could observe the irregular shapes of the particles in more detail. Fig. 4c shows a typical image obtained using TEM at low amplification for NPs < 25 nm, obtained in the presence of an EXMF of 1200 G, we can identify particles with regular symmetry. Fig. 4d shows a HRTEM image of Fe₃O₄ nanoparticles with atomic resolution of size 10 nm and zone axes 112h i. In this figure an image simulation of the HRTEM image is inset, as well as its Fast Fourier Transform (FFT) with its corresponding indexing.



Conclusions: Iron oxides NPs were synthesized through a simple method based on a chemical reaction under the influence of two magnets. Regular shapes NPs of average size 18.37 nm. TEM micrographs show changes in the shapes and sizes of particles when an EXMF is applied. Without the magnetic field, the shapes are mostly irregular and have sizes in the range 2– 200 nm. Some NPs with nanoflake shapes were also identified in smaller proportions.