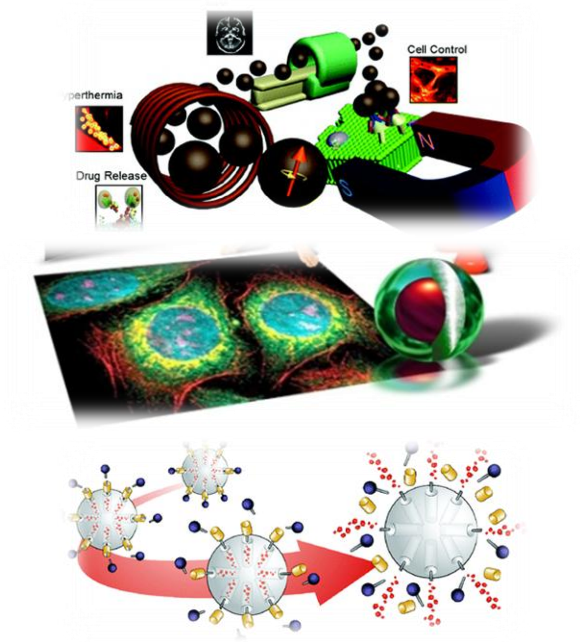

Biomedical Applicability of Magnetic Nanoparticles

The treatment of cancer is one of the most important issues facing science nowadays.

This thesis deals with the study materials for use in magnetic hyperthermia for tumor suppression.

Human cells are when subjected to temperatures above 42 to 43 oC undergo a thermal shock and potential apoptotic death which is practically the direction of hyperthermia.

Because of the network of vessels that feed them, cancerous tissues are more vulnerable in cases of interior heat transfer. The target of this thesis is the synthesis and study of the properties of nanoparticles of iron oxide (magnetite) to evaluate the materials and the research for the most suitable combination of properties for magnetic hyperthermia.

The growth of nanoparticles was performed with the coprecipitation method, where the solid phase created by the precipitaton of salts in solution under certain conditions. There were prepared six different solutions changing each time the compounds, ($FeCl_2$, $FeSO_4$, $Fe_2(SO_4)_3$, $FeCl_3$, $(NH_4)_2Fe(SO_4)_2$) that are precipitated and the composition temperature (20 and 70 ^oC). The nanoparticles prepared are iron oxides in sizes 19-35 nm and they are ferromagnetic. The aim is to determine the structural and magnetic characteristics of each system to provide the most suitable for use in magnetic hyperthermia. The samples synthesized from $(NH_4)_2Fe(SO_4)_2$ and $FeSO_4$ and no heating treatment were bigger than those prepared by $FeCl_2$ and $FeCl_3$.

Moreover, there is chemical analysis by titration of magnetic nanoparticles in order to find the rate of Fe^{2+} and find out if they have been oxidized. The greatest ratio of Fe^{2+} was at the nanoparticles prepared at elevated temperatures (70 ^oC). Also, there was a region of pH 6-7.5 that the solution is unstable which was found by measuring the isoelectric point of each sample. Thus the pH was adjusted to a value less than the isoelectric point in order to enhance colloidal stability.

Finally, the assessment of implementation capacity nanomaterials as magnetic hyperthermia materials was based on the specific loss power (SLP) quantifying heat transfer rate under an alternating magnetic field. The index is calculated from the thermal response of the systems studied at two frequencies (210 kHz and 765 kHz). At low frequency the sample synthesized by compounds of $(NH_4)_2Fe(SO_4)_2$ and $FeSO_4$ in room temperature yield the highest value SLP (37 emu/g) among the samples. For the frequency of 765 kHz the samples prepared at elevated temperatures by the same compounds SLP has the highest value at 500-550 emu/g. Generally, the heating treatment during synthesis seems to enhance SLP values.

This thesis aims in the synthesis and evaluation of thermal response of aqueous magnetite nanoparticles. Via co-precipitation method, a facile route, high-yield particle production and adequate parameter tuning, an enhancement of heating efficiency was observed under specific conditions.