Microwave assisted hydrothermal synthesis and characterization of cobalt and manganese ferrites: *In vitro* application of magnetic hyperthermia in cancer cells

The controlled synthesis of magnetic nanoparticles is a scientific subject of great interest in the field of nanotechnology. This is due to the special properties which these materials exhibit and the wide range of applications they can cover - ranging from electronics to medicine and biology. Among the kinds of magnetic nanoparticles which have appeared, the most prevalent in literature are the ferrites (MFe_2O_4, M = Mn, Fe, Co, Ni). Ferrites are spinel oxides with ferrimagnetic structure.

In the present study we synthesized samples of manganese and cobalt ferrite nanoparticles using a microwave assisted hydrothermal technique. The goal was to investigate how the experimental conditions can affect the final products and the possibility of biomedical applications. Microwave assisted synthesis is a new, "green" chemistry approach, with low cost and low energy consumption due to the different heating mechanics.

As precursor compounds, we used complexes of acetylacetonate with trivalent iron and trivalent manganese/cobalt. The solvent that was used for all the samples was distilled water and the surfactant Octadecylamine (ODA).

The characterization of the samples was achieved using the following techniques: XRD, SEM, VSM, TGA and FTIR. The results showed that the properties of the synthesized nanoparticles - high magnetization (48-69.5emu/g) and small size (11-14.2nm) - make them possible candidates for biomedical applications.

For our in vitro application, human osteosarcoma Saos-2 cells were incubated with manganese ferrite nanoparticles. During the hyperthermia experiment, AC magnetic field remained on until the upper limit of 45^oC was achieved. After the first hyperthermia treatment cycle viability dropped to 72.2% and after the second cycle to 79.3%, resulting in a total of over 40% viability drop. The small concentration of nanoparticles that was used (0.5-1mg/ml) is also noteworthy.