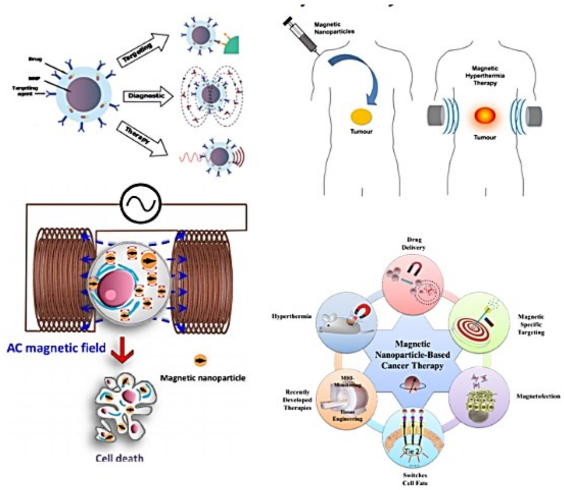

Abstract

This bachelor thesis is the outcome of an experimental series which aimed at the specification of the effect that magnetic fields have on the temperature response of nanoparticles in modern nano-biomedical treatments. Magnetic nanoparticles were examined in two different experimental setups, a) magnetic hyperthermia and b) transcranial magnetic stimulation. Magnetic hyperthermia is a technique, used in cancer tumor treatment. It is based on the fact that cancer cells are more prone to temperature increases than the healthy ones. Thus, by accurately injecting magnetic nanoparticles and by applying alternating magnetic fields, we achieve cells' temperature raise in the region of 41°C and 45°C. In this thesis, we utilized seven different types of ferrite-based nanoparticles, three of which were used as references, and the rest (four) of them were more complex combinations of the first ones. The samples were structurally and magnetically specified and afterwards were examined in the hyperthermia setup, wherefrom we gathered heating and cooling curves, via which after fitting we designated the samples' specific loss power. In the second thesis' part, we dealt with trascranial magnetic stimulation, which is a non-invasive method that aims at small brain's areas' stimulation and has a variety of applications in basic and clinical neurophysiology. It has been used to measure the connection between brain and muscles, in order to estimate injuries caused by a stroke, movement disorders and other injuries or disorders that affect facial nerves and nerves of the brain and the spine. Encouraging results of Parkinson's treatment were recorded, as well as schizophrenia's with auditory hallucinations and other emotional disorders'. In this technique, we affect the electric fields existing in the head and the brain by exposing them in a magnetic field, produced by a dynamic and rapidly changing electric current that is applied near the patient's head through a magnetic field generating device. Thereafter, the magnetic field induces weak currents in the brain electric fields, through electromagnetic induction, which stimulate various neural processes. In this thesis, we used agar as a phantom system to mimic tissue with homogeneous dispersion of magnetite nanoparticles exposed in variable magnetic fields with the use of transcranial magnetic stimulation experimental setup. Via two, different sized magnetite nanoparticles samples, we studied the size effect on the temperature variation results. Thereupon, we studied the effects of nanoparticle concentration and pulses number on local temperature variations. Consequently, both attempts to incorporate magnetic nanoparticles in current biomedical modalities show great perspectives and open a novel pathway towards nanobiomedicine.