World Academy of Science, Engineering and Technology
International Journal of Physical and Mathematical Sciences
Vol:11, No:08, 2017

Evaluation of the Heating Capability and in vitro Hemolysis of Nanosized MgxMn1-xFe2O4 (x = 0.3 and 0.4) Ferrites Prepared by Sol-gel Method

Authors : Laura Elena De León Prado, Dora Alicia Cortés Hernández, Javier Sánchez

Abstract : Among the different cancer treatments that are currently used, hyperthermia has a promising potential due to the multiple benefits that are obtained by this technique. In general terms, hyperthermia is a method that takes advantage of the sensitivity of cancer cells to heat, in order to damage or destroy them. Within the different ways of supplying heat to cancer cells and achieve their destruction or damage, the use of magnetic nanoparticles has attracted attention due to the capability of these particles to generate heat under the influence of an external magnetic field. In addition, these nanoparticles have a high surface area and sizes similar or even lower than biological entities, which allow their approaching and interaction with a specific region of interest. The most used magnetic nanoparticles for hyperthermia treatment are those based on iron oxides, mainly magnetite and maghemite, due to their biocompatibility, good magnetic properties and chemical stability. However, in order to fulfill more efficiently the requirements that demand the treatment of magnetic hyperthermia, there have been investigations using ferrites that incorporate different metallic ions, such as Mg, Mn, Co, Ca, Ni, Cu, Li, Gd, etc., in their structure. This paper reports the synthesis of nanosized Mg_xMn_{1-x}Fe₂O₄ (x = 0.3 and 0.4) ferrites by sol-gel method and their evaluation in terms of heating capability and in vitro hemolysis to determine the potential use of these nanoparticles as thermoseeds for the treatment of cancer by magnetic hyperthermia. It was possible to obtain ferrites with nanometric sizes, a single crystalline phase with an inverse spinel structure and a behavior near to that of superparamagnetic materials. Additionally, at concentrations of 10 mg of magnetic material per mL of water, it was possible to reach a temperature of approximately 45°C, which is within the range of temperatures used for the treatment of hyperthermia. The results of the in vitro hemolysis assay showed that, at the concentrations tested, these nanoparticles are non-hemolytic, as their percentage of hemolysis is close to zero. Therefore, these materials can be used as thermoseeds for the treatment of cancer by magnetic hyperthermia.

Keywords : ferrites, heating capability, hemolysis, nanoparticles, sol-gel
Conference Title : ICMMM 2017 : International Conference on Magnetism and Magnetic Materials
Conference Location : Barcelona, Spain
Conference Dates : August 17-18, 2017