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Synthesis of PVA/γ-Fe2O3 Used in Cancer Treatment by Hyperthermia

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Abstract : In recent years a new method of combination treatment for cancer has been developed and studied that has led to significant advancements in the field of cancer therapy. Hyperthermia is a traditional therapy that, along with a creation of a medically approved level of heat with the help of an alternating magnetic AC current, results in the destruction of cancer cells by heat. This paper gives details regarding the production of the spherical nanocomposite PVA/γ-Fe2O3 in order to be used for medical purposes such as tumor treatment by hyperthermia. To reach a suitable and evenly distributed temperature, the nanocomposite with core-shell morphology and spherical form within a 100 to 200 nanometer size was created using phase separation emulsion, in which the magnetic nano-particles γ-Fe2O3 with an average particle size of 20 nano-meters and with different percentages of 0.2, 0.4, 0.5, and 0.6 were covered by polyvinyl alcohol. The main concern in hyperthermia and heat treatment is achieving desirable specific absorption rate (SAR) and one of the most critical factors in SAR is particle size. In this project all attempts has been done to reach minimal size and consequently maximum SAR. The morphological analysis of the spherical structure of the nanocomposite PVA/γ-Fe2O3 was achieved by SEM analyses and the study of the chemical bonds created was made possible by FTIR analysis. To investigate the manner of magnetic nanocomposite particle size distribution a DLS experiment was conducted. Moreover, to determine the magnetic behavior of the γ-Fe2O3 particle and the nanocomposite PVA/γ-Fe2O3 in different concentrations a VSM test was conducted. To sum up, creating magnetic nanocomposites with a spherical morphology that would be employed for drug loading opens doors to new approaches in developing nanocomposites that provide efficient heat and a controlled release of drug simultaneously inside the magnetic field, which are among their positive characteristics that could significantly improve the recovery process in patients.

Keywords : nanocomposite, hyperthermia, cancer therapy, drug releasing
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