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Radio Frequency Heating of Iron-Filled Carbon Nanotubes for Cancer Treatment

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Abstract : There exist more than one hundred different types of cancer, and therefore no particular treatment is offered to people struggling with this disease. The character of treatment proposed to a patient will depend on a variety of factors such as type of the cancer diagnosed, advancement of the disease, its location in the body, as well as personal preferences of a patient. None of the commonly known methods of cancer-fighting is recognised as a perfect cure, however great advances in this field have been made over last few decades. Once a patient is diagnosed with cancer, he is in need of medical care and professional treatment for upcoming months, and in most cases even for years. Among the principal modes of treatment offered by medical centres, one can find radiotherapy, chemotherapy, and surgery. All of them can be applied separately or in combination, and the relative contribution of each is usually determined by medical specialist in agreement with a patient. In addition to the conventional treatment option, every day more complementary and alternative therapies are integrated into mainstream care. There is one promising cancer modality - hyperthermia therapy which is based on exposing body tissues to high temperatures. This treatment is still being investigated and is not widely available in hospitals and oncological centres. There are two kinds of hyperthermia therapies with direct and indirect heating. The first is not commonly used due to low efficiency and invasiveness, while the second is deeply investigated and a variety of methods have been developed, including ultrasounds, infrared sauna, induction heating and magnetic hyperthermia. The aim of this work was to examine possibilities of heating magnetic nanoparticles under the influence of electromagnetic field for cancer treatment. For this purpose, multiwalled carbon nanotubes used as nanocarriers for iron particles were investigated for its heating properties. The samples were subjected to an alternating electromagnetic field with frequency range between 110-619 kHz. Moreover, samples with various concentrations of carbon nanotubes were examined. The lowest frequency of 110 kHz and sample containing 10 wt% of carbon nanotubes occurred to influence the most effective heating process. Description of hyperthermia therapy aiming at enhancing currently available cancer treatment was also presented in this paper. Most widely applied conventional cancer modalities such as radiation or chemotherapy were also described. Methods for overcoming the most common obstacles in conventional cancer modalities, such as invasiveness and lack of selectivity, has been presented in magnetic hyperthermia characteristics, which explained the increasing interest of the treatment.

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