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Magnetic Bio-Nano-Fluids for Hyperthermia

Authors : Z. Kolacinski, L. Szymanski. G. Raniszewski, D. Koza, L. Pietrzak

Abstract : Magnetic Bio-Nano-Fluid (BNF) can be composed of a buffer fluid such as plasma and magnetic nanoparticles such as iron, nickel, cobalt and their oxides. However iron is one of the best elements for magnetization by electromagnetic radiation. It can be used as a tool for medical diagnosis and treatment. Radio frequency (RF) radiation is able to heat iron nanoparticles due to magnetic hysteresis. Electromagnetic heating of iron nanoparticles and ferro-fluids BNF can be successfully used for non-invasive thermal ablation of cancer cells. Moreover iron atoms can be carried by carbon nanotubes (CNTs) if iron is used as catalyst for CNTs synthesis. Then CNTs became the iron containers and they screen the iron content against oxidation. We will present a method of CNTs addressing to the required cells. For thermal ablation of cancer cells we use radio frequencies for which the interaction with human body should be limited to minimum. Generally, the application of RF energy fields for medical treatment is justified by deep tissue penetration. The highly iron doped CNTs as the carriers creating magnetic fluid will be presented. An excessive catalyst injection method using electrical furnace and microwave plasma reactor will be presented. This way it is possible to grow the Fe filled CNTs on a moving surface in continuous synthesis process. This also allows producing uniform carpet of the Fe filled CNTs carriers. For the experimental work targeted to cell ablation we used RF generator to measure the increase in temperature for some samples like: solution of Fe2O3 in BNF which can be plasma-like buffer, solutions of pure iron of different concentrations in plasma-like buffer and in buffer used for a cell culture, solutions of carbon nanotubes (MWCNTs) of different concentrations in plasma-like buffer and in buffer used for a cell culture. Then the targeted therapies which can be effective if the carriers are able to distinguish the difference between cancerous and healthy cell's physiology are considered. We have developed an approach based on ligand-receptor or antibody-antigen interactions for the case of colon cancer.

Keywords : cancer treatment, carbon nano tubes, drag delivery, hyperthermia, iron
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