

## Synthesis and Preparation of Carbon Ferromagnetic Nanocontainers for Cancer Therapy

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**Abstract :** In the article the development and demonstration of method and the model device for hyperthermic selective destruction of cancer cells are presented. This method was based on the synthesis and functionalization of carbon nanotubes serving as ferromagnetic material nano containers. Methodology of the production carbon - ferromagnetic nanocontainers includes: the synthesis of carbon nanotubes, chemical and physical characterization, increasing the content of ferromagnetic material and biochemical functionalization involving the attachment of the key addresses. Biochemical functionalization of ferromagnetic nanocontainers is necessary in order to increase the binding selectively with receptors presented on the surface of tumour cells. Multi-step modification procedure was finally used to attach folic acid on the surface of ferromagnetic nanocontainers. Folic acid is ligand of folate receptors which is overexpression in tumor cells. The presence of ligand should ensure the specificity of the interaction between ferromagnetic nanocontainers and tumor cells. The chemical functionalization contains several step: oxidation reaction, transformation of carboxyl groups into more reactive ester or amide groups, incorporation of spacer molecule (linker), attaching folic acid. Activation of carboxylic groups was prepared with triazine coupling reagent (preparation of superactive ester attached on the nanocontainers). The spacer molecules were designed and synthesized. In order to ensure biocompatibility of linkers they were built from amino acids or peptides. Spacer molecules were synthesized using the SPPS method. Synthesis was performed on 2-Chlorotrityl resin. The linker important feature is its length. Due to that fact synthesis of peptide linkers containing from 2 to 4  $\alpha$ -Ala- residues was carried out. Independent synthesis of the conjugate of folic acid with 6-aminocaproic acid was made. Final step of synthesis was connecting conjugate with spacer molecules and attaching it on the ferromagnetic nanocontainer surface. This article contains also information about special CVD and microwave plasma system to produce nanotubes and ferromagnetic nanocontainers. The first tests in the device for hyperthermal RF generator will be presented. The frequency of RF generator was in the ranges from 10 to 14Mhz and from 265 to 621kHz.

**Keywords :** synthesis of carbon nanotubes, hyperthermia, ligands, carbon nanotubes

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