DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

According to the World Health Organization data, in the next 20 years 70% increase in new cases of cancer will be observed. Considering also more than 14 million of new cases of cancer and mortality of about 8 million human beings, the fight against cancer can be regarded as the biggest challenge for the modern world. It is worth noticing that the therapeutic agent safety for a patient, has still not been developed yet, despite a large number of known and commercially available anticancer drugs. This fact is associated with the non-selective action of the anticancer drugs. For this class of biologically active compounds, the toxicity of the anticancer drugs towards patients healthy cells is always observed, beyond the desired therapeutic effect on tumor cells. Thus, modern science is increasingly focusing on targeting the effect of anticancer drugs only on tumor cells, in order to reduce the side-effects, which adversely affect the health and well-being of the patient.

The research that focused on designing the therapeutic systems dedicated to the so-called targeted therapies, contributed to the creation of novel class of molecular therapeutics, possessing both early diagnostic and therapeutic features, as well as the targeting system included in their structure. This type of complex materials are referred as nanotheranostics. In conjunction to very high bio-application potential of nanotheranostic systems, such materials can be confidently called a revolution in the treatments of serious diseases, including malignant tumors.

Our project is aimed at synthesizing a novel class of the nanotheranostics. A series of new hybrid carbon materials, comprising of structural elements possessing high bio-application potential, will be obtained. The structure of the obtained materials is presented in Fig. 1. Graphene-encapsulated iron nanoparticles were selected to be the fundamental building element of the system, due to their interesting early diagnostic potential, associated with magnetic resonance imaging (MRI) technique. The nanoparticles will be conjugated to polyethylenimine, a polymeric carrier, and the possibility of β-cyclodextrin attachment to the system, will be examined. It is known that β-cyclodextrin is able to complex anticancer drugs and increase the amount of the therapeutic released into the surrounding medium. The anticancer drugs will be complexed inside β-cyclodextrin cavity and the folic acid will be conjugated to the as-obtained carbon material, in order to introduce a targeting ligand to the systems and to target the action of the drug on the tumor cells. To the best of our knowledge, the obtained complex materials have not been described in the chemical literature up to date, and the synthesis of such hybrid carbon materials have not been studied before.

The release of the anticancer drugs from the nanotheranostics will be determined under *in vitro* conditions, in the time interval and in the variety of pH values, in order to examine the release profile of a therapeutic agent.

The obtained hybrid carbon materials on each step of the synthesis will be characterized by means of the spectroscopic methods and materials characterization techniques. The results of our studies on the synthesis of novel hybrid carbon materials will be published in prestigious worldwide scientific journals.

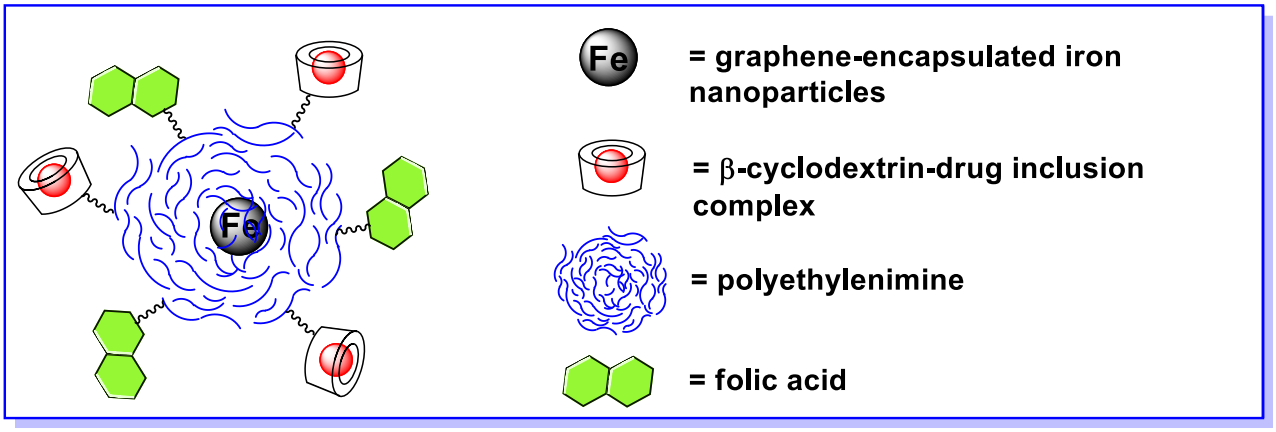

Fig. 1. Novel hybrid carbon materials which will be obtained during this project