

Abstract of PhD thesis by Karolina Urbaś

„Developing the biofunctionalization technology of graphene with controlled size of flakes”

Graphene has attracted recently growing interest in the scientific community. Owing to its unprecedented combination of unique electrical, thermal, optical, as well as mechanical properties, its potential application may include wide spectrum of areas, e. g. biomedicine. The aim of the PhD thesis was to develop the technology of functionalization of graphene oxide for biomedical uses, e.g. for biosensing and drug delivery.

The theoretical part describes the structure and properties of graphene and its derivatives, the synthesis methods and potential applications of the graphene-based materials. The synthesis and detailed characterization of graphene oxide was described in the experimental part as well as the synthesis and characterization of graphene-based nanocomposites, which potentially may serve as components of biosensors. Another part of the research focused on complete characterization of graphene oxide samples with various sizes of flakes. The samples were obtained via oxidation of the graphite samples of different origin. In the next research stage, the samples were functionalized with magnetic nanoparticles. Next, the effect of dispersion of pristine graphene oxide samples, nanocomposites as well as magnetic nanoparticles in various concentrations on the mitochondrial activity of fibroblasts cell line (L929) in mouse was evaluated with WST-1 assay.

Then, the study focused on developing methods for linking graphene oxide and graphene-based nanocomposites with anticancer drug – hydroxycamptothecin, commonly used in antitumor therapy. The obtained systems are characterized in details. The kinetics of drug release and the stability of dispersions in various concentrations were evaluated. Finally, cytotoxicity of the systems with anticancer drugs were studied on the cancer cells (MCF-7 cell line) to evaluate the application potential of obtained materials.