SUMMARY

Anticancer therapies are not selective enough, what is one of the reasons why, despite many years of research, there are still no sufficiently effective anticancer drugs. High therapeutic hopes are associated with nanotechnologies. Nanostructures used in medicine are mainly metallic (e.g. gold) nanoparticles, liposomes, quantum dots or fullerenes.

This study aimed to develop syntheses of stable nanoparticles conjugated with anticancer drugs to improve their pharmacological performance, particularly gold nanoparticles and soluble fullerene nanoparticles. The central part of the work was the functionalization of fullerene C_{60}. A few functionalized highly hydrophilic fullerene products were obtained using the Bingel-Hirsch cyclopropanation in multistep syntheses. In particular, conjugates of gemcitabine (a cytostatic drug used to treat pancreatic cancer) were obtained. The photoreactivity, biological activity against cancer and normal cells, and potential utility in photodynamic therapy of the obtained compounds were also investigated.

Gold nanoparticles syntheses were also obtained using $HAuCl_4$ as a precursor, PVP as a stabilizer, and glycerol as a reductant. However, most of the obtained gold nanoparticles were too large for potential biomedical applications. Based on the analysis of UV-Vis spectra, DLS studies, and SEM and TEM images, the best synthesis variant was chosen in terms of homogenity and size of the resulting nanoparticles, selecting the concentrations of reactants and reaction time. The experiments also proved that the synthesis of gold nanoparticles could be performed using plant extracts as a reducing agent.

Currently, work continues on the potential applications of the obtained combinations.