Nanochemistry and Nanobiotechnology

Branched Copolymers Dextran-graft-Polyacrylamide as Nanocarriers for Delivery of Gold Nanoparticles and Photosensitizers to Tumor Cells

V.A. Chumachenko[1], N.V. Kutsevol[1], I.O. Shton[2], E.D. Shishko[2], N.F. Gamaleia[2]

[1] *Chemistry Department, Taras Shevchenko National University of Kyiv, 60 Volodymyrska Str., 01601 Kyiv, Ukraine, e-mail: chumachenko_va@ukr.net*

[2] *Laboratory of Quantum Nanobiology, R.E. Kavetsky Institute for Experimental Pathology, Oncology and Radiobiology, Kiev, Ukraine. Vasilkivska , 45, Kiev-03022, Ukraine, e-mail: gamaleia@onconet.kiev.ua.*

Currently, one of the directions in research devoted to the development of cancer diagnostic and treatment methods is focused on the use of gold nanoparticles (GNP) which can serve as vehicles for selective drug delivery to malignant cells. Photodynamic therapy is anticancer treatment method based on utilization of photosensitizers (PS), which are able to accumulate in a tumor tissue and, after light irradiation, promote generation of singlet oxygen and free radicals that trigger elimination of malignant cells. The promising way to increase PS targetness to tumors is its complexation with water soluble polymers, which due to their biocompatibility with living cells and tissues are used as nanotechnology-based drug delivery systems, as well as stabilizers for GNP.

The purpose of our study was to investigate *in vitro* the photodynamic activity of GNP-copolymer composite with PS chlorine e6.

Synthesized branched polymer Dextran-graft-Polyacrylamide appeared to be nontoxic to malignant human lymphocytes cell culture MT-4 in concentrations that exceeded ones used in further photodynamic experiments. This copolymer was utilized for *in situ* preparation of spherical positively charged GNP with average diameter of 7-10 nm. It was established that the GNP-copolymer composite was toxic to cells down to Au concentration of 5 mkg/ml, probably due to the presence in the colloid of small GNPs that are known to be toxic to cells. So, in our further experiments we used composites with Au concentrations below the cell damage limit. The GNP-copolymer was combined with hydrophobic PS chlorin e6. It was shown that in samples with the weight ratio of chlorin e6 to Au 1:10 all PS molecules where captured by the GNP-copolymer. *In vitro* photodynamic activity studies showed that after MT-4 cells preincubation with GNP-copolymer-PS composite and subsequent cell irradiation with 660 nm laser light, cell mortality by 30-50% exceeded that after using free chlorine e6.