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Development of experimental approaches to the application of polymers as nanocarriers of porphyrin photosensitizers

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Photodynamic therapy (PDT) is a promising alternative approach for the treatment of cancer and a number of other diseases. PDT uses special compounds photosensitizers (PS), which can be activated by light of a certain wavelength and causes selective damage to the tumor and its surrounding vasculature. The success of PDT is often limited by the problem of the introduction of photosensitizers with low solubility in water, which complicates the clinical use of many effective PS. The inclusion of PSs in nanostructured drug delivery systems is a potential strategy to overcome this difficulty. In addition, application of nanocarriers can improve PS penetration across epithelial and endothelial barriers and enable simultaneous co-delivery of two or more drugs.

Systematic studies have been conducted at the Belarusian State University to study the possibility of using various polymer-based nanostructures for the introduction of photosensitizers with different physico-chemical properties. The processes of interaction of a number of photosensitizers with various polymer micelles, cyclodextrins, thermosensitive dextran copolymers were studied. The results obtained showed that the use of nanostructured materials has significant effect on nonpolar photosensitizers distribution in cellular and tissue systems. It was shown that the applicability of polymer-based structures is strongly related with the factors controlling the equilibrium and kinetic characteristics of PS binding to nanostructures, determining the complexes stability in blood in tissues. It can be assumed that the features of the structure of nanoscale materials will allow us to develop methods for controlling the PS release from complexes in biological systems. It has been established that for different types of nanocarriers, the mechanisms for controlling the release of photosensitizers can differ significantly. The results obtained indicate the possibility of developing new methods of using nanoparticles in order to achieve a controlled distribution of photosensitizers in the body.