Evaluation of the photodynamic activity of upconversion nanoparticles coated with photosensitizers under infrared excitation *in vitro* and *in vivo*

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We studied the photodynamic activity of upconversion nanoparticles coated with photosensitizers under infrared excitation *in vitro*, using biological tissue phantoms, and *in vivo*, on laboratory mice.
Upconversion nanoparticles $NaGdF_4$:Yb-Er were synthesized by the anhydrous method in oleic acid. The clinically approved photosensitizers Photosens, Photoditazin, Temoporfin, and Phthalosens not yet used in clinical practice were selected for the studies.
At the first stage, we studied the efficiency of singlet oxygen generation by nanoparticles coated with a photosensitizer upon excitation in the IR range in the absorption band of ytterbium ions. Since upconversion is a non-linear process, the intensity of upconversion luminescence depends on the pumping power density. At the same time, the power density of the exciting radiation decreases significantly in the thickness of biological tissues. According to this, studies of photodynamic activity *in vitro* were carried out. Multilayer phantoms of biological tissues, consisting of fat emulsion and erythrocyte mass were prepared, in the depths of which the studied particles were placed. The phantoms were irradiated from the upper side using 980 nm wavelength, power density was in 500-2500 mW/cm^2 range. To evaluate the generation of singlet oxygen, a singlet oxygen sensor green was added to the phantom layer in which the nanoparticles were located. *In vivo* photodynamic activity was studied after intramuscular administration of the studied nanoparticles to mice. Photodynamic activity was photodynamic assessed using histological cryosections of biological tissues prepared post-mortem after irradiation.
The efficient generation of singlet oxygen by the studied nanoparticles coated with a photosensitizer upon excitation in the IR range has been demonstrated.

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