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Potential use of fluoride nanoparticles and rare earth doped fluoride nanoparticles in biomedicine (photodynamic therapy): Cytotoxicity and photoinduced toxicity

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Rare-earth doped fluoride nanoparticles (NPs) are promising photosensitizers for photodynamic therapy. In this study, intrinsic cytotoxicity and photoinduced toxicity of two different preparations of Pr:LaF₃ (CPr=30%), PrF₃ and LaF₃ NPs were explored. NPs intrinsic cytotoxicity was tested toward four eukaryotic cell-model systems (A459, SW837, MCF7 and Colo320, human tumor cell lines) and prokaryotic (*Salmonella typhimurium* TA 100) as well. Cancer cell overgrowth (A459, SW837 and MCF7) was detected after treatment with the first NPs preparation at three concentrations (5 mM, 1 mM, 0.5 mM). To overcome this issue, a new NPs synthesis was performed. New Pr:LaF₃ NPs (hydrodynamic radius 18±1 nm) were not toxic toward Colo320 and *Salmonella* cells at millimolar concentrations (survival 96% and 94% for 1 mM and 0.5 mM respectively), whereas for the other three cell lines experiments are ongoing. NPs photoinduced toxicity was obtained with lasers at 473, 532, 605, and 750 nm continuous wave (CW) as well as pulse lasers (average power density 1.3 mW/cm²). Best phototoxicity was achieved in *Salmonella* in presence of Pr:LaF₃ (survival of 51%, 20%, 36%, and 29% for 473, 532, 605 and 750 nm respectively). Furthermore, pulse laser irradiation itself was toxic for bacteria at 1.3 mW/cm² and the survivals were 62%, 61%, 48%, and 46% for 473, 532, 605 and 750 nm respectively. Survivals of the bacteria for 473, 532 nm CW irradiations were 25%, 41% for 473 nm, 532 nm respectively. Finally, 473, 532 nm CW laser irradiations were not toxic against bacteria at 1.3 mW/cm².

Biography

Maksim Pudovkin completed his Graduation from Kazan Federal University, Institute of Physics. He is pursuing his PhD at Kazan Federal University. His academic advisor is Professor Vadim Semashko. He has published four papers in reputed journals and taken part in more than six international conferences. His scientific interests include "Biophysics, optics, microbiology, EPR spectroscopy and medical physics".

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