NANOPARTICLES IN THE BIOLOGICAL ENVIRONMENT: COLLOIDAL STABILITY AND THEIR CELLULAR UPTAKE

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Upconverting nanoparticles (UCNPs) doped with trivalent lanthanide ions can convert near infrared excitation into ultraviolet, visible and shorter wavelength NIR light. For this reason, UCNPs are regarded as perspective agents for biolabeling, biosensing, theranostic, nanothermometry, solar cell, etc. [1]. UCNPs have many appealing optical and physicochemical properties that are necessary for biological applicability; such as – excitation with deep tissue penetrating light, imaging without autofluorescence, non-photobleaching and non-photoblinking, having sharp emission peaks, low toxicity, and being endowed with multifunctionality [2].

In order to use UCNPs in biomedicine it is very important to understand the effect of biological fluids on nanoparticles' (NPs) stability and biocompatibility. Immediately upon fusing with the cell growth media or corporal fluids, NPs associate with a variety of biomolecules, like proteins, following the so called "protein corona" formation. These nanoparticle-protein complexes may have generally positive effects as better accumulation in the cells, greater colloidal stability [3].

The aim of this study was to investigate the effects of human blood plasma on UCNPs, their colloidal stability, cytotoxicity and accumulation in the cancer cells.

In this work, colloidal stability of $LiYF_4$:Yb^{3+}, Tm^{3+} coated with citrate, phospholipids and silica, in biological medium was investigated using fluorescence spectroscopy. To provide a model system for the biological fluid, human plasma was added to a cell culture medium. In order to prevent plasma from clotting heparin was added to medium as well. For UCNPs biocompatibility and accumulation experiments human breast cancer MDA-MB-231 cell line was used. Cells were incubated for 24 hours with UCNPs and their viability was assessed by XTT assay. The uptake dynamics of UCNPs in cancer cells was evaluated by measuring emission of UCNPs accumulated in the cells. The qualitative evaluation of UCNPs accumulation in cells was assessed using confocal microscopy.

Research results show that silica and phospholipids coated $LiYF_4$:Yb^{3+}, Tm^{3+} NPs are more colloidally stable and possess greater accumulation rate in cancer cells than their citrate coated counterpart.

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