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Upconverting $NaGdF_4$: 5% Er^{3+}, 20% Yb^{3+} nanoparticles for theranostics

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Upconverting nanoparticles (UCNPs) have expanded possibilities in the development of advanced nanomaterials for nanomedicine and healthcare applications, including photodynamic therapy, bioimaging, and temperature sensors[1]. In this sense, herein, Er^{3+}, Yb^{3+} co-doped $NaGdF_4$ were synthesized using an EDTA-assisted hydrothermal method. Transmission Electron Microscopy (TEM) images revealed that the nanoparticles have a spherical shape with a narrow size distribution of approximately 250 nm. Photoluminescence spectroscopy under near-infrared (NIR) excitation at 980 nm showed intense visible upconversion (UC) emission from ensemble and also from a colloidal dispersion of nanoparticles in cell culture medium (depicted in Figure 1). The UC emission spectra show narrow bands centralized at 520 nm assigned to $^2H_{11/2} \rightarrow 4I_{15/2}$ and $^4S_{3/2} \rightarrow {}^4I_{15/2}$ in green region and 630 nm, assigned to $^4F_{9/2} \rightarrow {}^4I_{15/2}$ under excitation at 980 nm. The cytotoxicity of these nanoparticles was assessed using the resazurin colorimetric test on glioblastoma multiforme cell lines, KNS42, U87MG, and T98G, after 3 hours of incubation. The cell viability remained around 70% for U87MG and T98G, while it was around 40% for KNS42. These preliminary results suggest that rare-earth-doped fluoride-based nanoparticles hold potential as luminescent probes and light converters in photodynamic therapy for brain tumor treatment.

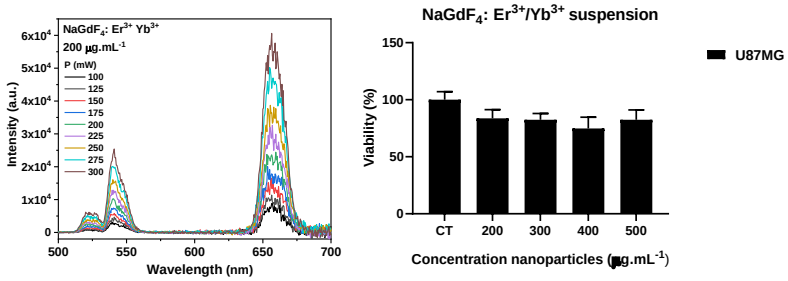

Figure 1. Upconversion emission spectra from Er^{3+}, Yb^{3+} $NaGdF_4$ nanoparticles suspended in culture cell medium and cytotoxic viability of the particles in U87MG cells.

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