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OPTIMIZING OPTICAL AND MAGNETIC PROPERTIES AT THE NANOSCALE: A STRATEGY FOR BIMODAL NANOPROBES

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Nanoparticles with both magnetic and luminescent properties have attracted scientific interest due to their potential applications in diagnostic imaging and therapeutic delivery systems [1]. The optical and magnetic properties of nanoparticles, as well as their viability as nanoprobes in the human body, are strongly related to their size and morphology. This study aims to precisely control the size of $NaGdF_4$-based nanoparticles by tailoring the synthesis parameters (temperature, duration, and reagent ratios) to maximize optical and magnetic response while not compromising their biocompatibility. The chosen synthesis route was thermal co-precipitation. The phase purity, particle size, and morphology of obtained nanoparticles were examined using X-ray diffractometry and transmission electron microscopy (TEM) imaging. The optical properties, including emission and excitation spectra, as well as decay curves, were analyzed using photoluminescence (PL) spectroscopy. Additionally, the magnetic properties of NPs were evaluated by a 3T clinical-grade MRI apparatus.

Three upconverting nanoparticle sample series doped with the sensitizer/activator pair Yb^{3+}/Er^{3+} were synthesized to examine how various synthesis parameters affect their size and optical response. The results indicated that increasing the synthesis temperature and duration, as well as decreasing the molar ratio of NH_4F/Ln^{3+} in the initial reaction mixture, resulted in nanoparticles with larger diameters, which exhibited higher upconversion emission intensities and longer lifetimes.

Another series of $NaGdF_4$ nanoparticles doped with Eu^{3+} ions were synthesized while varying the synthesis duration to determine the influence of dopant type on particle. Results showed that irrespective of dopants, the increased synthesis duration resulted in particles with larger diameters exhibiting stronger emission intensities. For these Eu^{3+}-doped NPs, the paramagnetic properties as a function of synthesis duration (particle size) were examined via 3T clinical MRI apparatus since it is established that Gd^{3+} ion present in the host matrix has strong paramagnetic properties and could change the relaxivity of water molecules [2].

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Bibliography

1. P. Das, S. Ganguly, S. Margel, A. Gedanken // Nanoscale Advances, 2021, **3**, 6762–6796.
2. L. Blomqvist, G.F. Nordberg, V.M. Nurchi, J.O. Aaseth // Biomolecules, 2022, **12(6)**, 742.