SYNTHESIS AND CHARACTERIZATION OF SUPERPARAMAGNETIC IRON OXIDE NANOPARTICLES FOR PHOTODYMAMIC THERAPY

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Superparamagnetic iron oxide nanoparticles (SPIONs), with appropriate surface coating, are commonly used for biomedical applications such as photodynamic therapy (PDT)[1]. This work describes the preparation and characterization of methylene blue (MB)-containing silica-coated SPIONs. Upon exposure to light, MB reacts with molecular oxygen and generates singlet oxygen ($^1O_2$) which is cytotoxic and causes irreversible damage to tumor tissues. In this work, SPIONs were synthesized by co-precipitation and coated with a single/double silica layer. The photoactive molecule MB was entrapped in the silica layer deposited on the surface of SPIONs, leading to the formation of hybrid nanomaterials composed of a magnetic core and silica layer. The nanocomposite exhibited magnetic behavior at room temperature due to the presence of its Fe_3O_4 core. Structural and morphological characterizations were performed by X-ray diffraction (XRD), Fourier transformed infrared (FTIR), SQUID magnetic measurements, ultraviolet-visible spectroscopy, scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), and dynamic light scattering. The results showed the presence of a crystalline Fe_3O_4 magnetic core and amorphous silica phases. Kinetic measurements revealed $^1O_2$ generation by the nanoparticles upon irradiation with visible light (λ = 532 nm or λ = 633 nm). The results highlight the potential uses of SPIONs coated with MB-entrapped silica for PDT, whereby a sustained and localized generation of $^1O_2$ was successfully achieved.

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