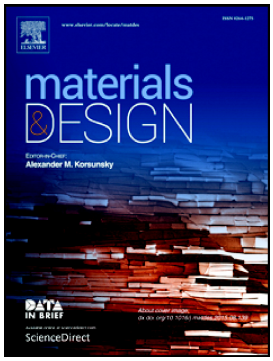

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Self-organizing silver and ultrasmall iron oxide nanoparticles prepared with ginger rhizome extract: characterization, biomedical potential and microstructure analysis of hydrocolloids

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Abstract

Multimodal nanoparticles (NPs) that may be used for therapies and diagnostics is the most promising trend for efficient therapy. We demonstrate that nanocomposite based on self-organizing silver and ultrasmall magnetic iron oxide NPs (MAg) produced in one-step synthesis revealed unique combination of fluorescence, bactericidal, fungicidal properties and have a potential as magnetic resonance imaging (MRI) contrast agent. Using the green chemistry approach, ginger (*Zingiber officinale*) rhizome extract was applied as capping agent for MAg synthesis, providing also additional fluorescent properties of NPs and inducing hydrocolloids structuring. The MAg were investigated by X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), energy dispersive microanalysis (EDS), fluorescence microscopy, cryo-SEM, dynamic light scattering (DLS) techniques, Fourier transform infrared (FTIR) and ultraviolet–visible (UV-Vis) spectroscopies. MAg dispersions in water and some biological media are very stable which is important for biomedical application. The existence of microstructure in MAg hydrocolloids was proved. The hierarchical character and high ordering of this microstructure were discovered and its level-by-level building blocks were investigated. The microstructure was found to be responsible for fluorescence emittance of MAg hydrocolloids. The properties as well as potential application of the MAg hydrocolloids is yet to be discovered.

Keywords: ultrasmall; silver; ginger; nanoparticles; hydrocolloid; microstructure.