Abstract

In this work, zinc ferrite magnetic nanoparticles (NPs) were synthesized, and compounds integrated by nanoparticles embedded in carbonated hydroxyapatite (NPsHA) were made. Both samples were characterized morphologically and structurally, obtaining an average nanoparticle diameter of (18 ± 3) nm. Magnetization vs applied field experiments were conducted and a saturation magnetization of (56 ± 2) emu/g was obtained for NPs. The synthesized samples were dispersed in media with different viscosities to perform magnetic hyperthermia experiments. These resulted in a value of nanoparticles specific power absorption of ∼111 W/g. It was confirmed that the nanoparticles are suitable to produce heating by magnetic hyperthermia both in viscous and non-viscous media, a necessary condition to apply these materials in biological systems. The sensitivity of X-ray irradiated hydroxyapatite (HA) synthesized at low temperature was studied by electronic paramagnetic resonance (EPR). In addition, the effect of annealing before irradiation on the stability of the observed radicals was analyzed. The EPR signal suggests that the concentration of paramagnetic defects stabilizes in ∼1 month after irradiation. CO_2^- was the main defect observed with the presence of secondary species whose intensity varies according to the treatment. The NPsHA compounds were irradiated and the paramagnetic signal from the radicals generated in HA was detected and identified. Finally, in-vitro experiments with glioblastoma human cells were carried out and a concentration-dependent cytotoxic effect of NPsHA and HA samples was determined. These promising results demonstrate the bifunctionality of the synthesized nanocomposite, and call forth the development and application of new materials for oncological therapies for magnetic hyperthermia and as local ionizing radiation sensors.

BIFUNCTIONAL COMPOUND, MAGNETIC NANOPARTICLES, MAGNETIC HYPERTHERMIA, HYDROXYAPATITE, RADIATION SENSOR