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Effect of polymer coating on the calcium ferrite nanoparticles for biomedical applications

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Magnetic nano ferrites with superparamagnetic behaviour have attracted great interest in biomedicine. When these nano ferrites are coated, surface oxidation and aggregation can be reduced, enhancing their stability. In this work, CaFe2O4 nanoparticles (NPs) were synthesized through a glycol-thermal reaction method and coated with polymers viz: chitosan (CH) and polyvinyl alcohol (PVA) to yield CH–CaFe2O4 and PVA–CaFe2O4 NPs, respectively. Both naked and coated NPs were characterized by X-ray diffraction (XRD), which revealed the configuration of the cubic spinel structure. The crystallite sizes for CaFe2O4, CH–CaFe2O4 and PVA–CaFe2O4 NPs are 6.13 nm, 5.61 nm and 6.36 nm, respectively. Transmission electron microscopy (TEM) and scanning electron microscopy (SEM) showed spherical morphology for all NPs. The hydrodynamic size distribution observed for naked NPs (92 ± 4 nm) increased upon coating with CH and PVA to 169 ± 4 nm and 151 ± 14 nm, respectively. Magnetic analysis using a vibrating sample magnetometer (VSM) revealed that all NPs exhibited superparamagnetic behaviour with saturation magnetizations of ˜38.52 emu/g, 11.27 emu/g and 37.73 emu/g for CaFe2O4, CH–CaFe2O4 and PVA–CaFe2O4 NPs, respectively. Further, in vitro cytotoxicity profiling using the MTT assay showed that CH-CaFe2O4 NPs are well tolerated by the human embryonic (HEK 293) cell lines at concentrations of up to 100µg/ml. This trend was also observed in the human cervical cancer (HeLa) cell lines. Moreover, in HeLa cell lines, there was no significant toxicity with all NPs. The lowest reported viabilities were 67.6% at the high 400 µg/ml concentration for CH-CaFe2O4 NPs. Polymer coating seemed to result in improved cytotoxicity profiles. To this end, calcium ferrites and their polymer-coated derivatives can be explored as potential nanocarriers in gene and drug delivery.

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No

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Consent on use of personal information: Abstract Submission

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