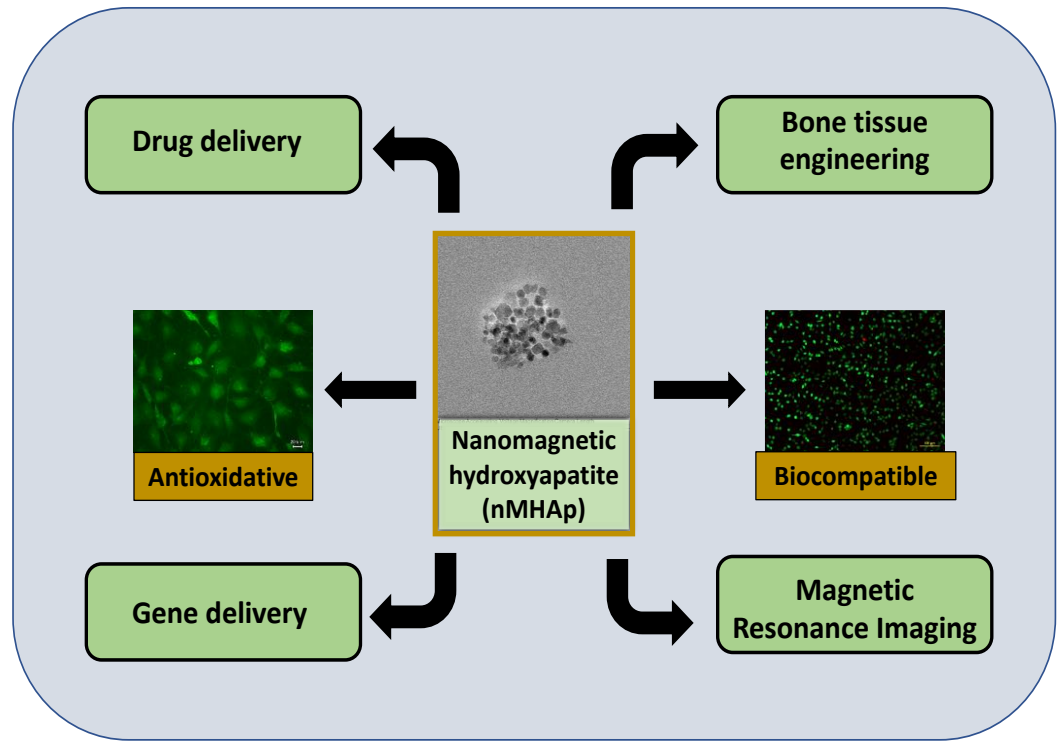
Enhanced bioactivity of hydroxyapatite with iron oxide nanoparticles for theranostics

Hydroxyapatite is a widely used biomaterial for bone tissue engineering and other biomedical applications. It occurs naturally in a mineralized form known as calcium phosphate. Hydroxyapatite resembles like a bone apatite but lacks mechanical strength and is less bioactive in nature. To overcome these shortcomings there are several metal ions used for doping hydroxyapatite including iron oxide nanoparticles. The synthesis process is carried out by various different routes such as hydrothermal, spray drying, ultrasonic irradiation etc. Incorporating different metal ions such as iron, copper, strontium and manganese with hydroxyapatite had shown enhanced bioactivity and cellular response. In our recently published study on doping iron oxide nanoparticles with hydroxyapatite (10.1016/j.ceramint.2020.07.285), we have reported the accelerated synthesis of nanomagnetic hydroxyapatite (nMHAp) in simulated body fluid which is one of the novel methods so far. The study confirmed the initial nMHAp precipitation in 3 h than the conventionally used duration (over 24 h) through a bio-mimetic approach. The physicochemical properties were checked using XRD, FTIR, TGA, XPS, DLS, SEM, TEM and VSM.

The results suggested that the synthesized nMHAp contains magnetic properties and resembles carbonated apatite with the traces of Na, Mg, K, Cl and Fe. Cellular biocompatibility and the measurement of reactive oxygen species using L929 cells confirmed the biocompatible and antioxidative nature of nMHAp. Hence, Our studies showed that nMHAp can be synthesized biomimetically in 3 hrs and potentially could be used for various biological and biomedical applications including bone tissue engineering, contrast reagent for MRI, nanocarrier for gene and drug delivery.



Graphical Abstract

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