Magnetite-Chitosan Core-Shell Nanoparticles - Controlled Drug Delivery Vehicle

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Extended Abstract

Chitosan, an abundant natural polysaccharide well known for its biodegradable and non-toxic properties, is popular in the field of biomedicine due to its interesting physicochemical properties and potential for a wide range of applications (Grumezescu et al., 2012a,b). One of the applications that received much attention in the last years is related to the potential uses of chitosan in the process of wound healing (Archana et al., 2013).

Magnetite is widely used for medical and non-medical applications. The main medical applications can be divided in both diagnosis (magnetic contrast agent) and therapy (drug delivery, drug carrier and hyperthermia) (Andronescu et al., 2010).

Freshly prepared Fe₃O₄ nanoparticles were loaded with gentamicin as model drug and incorporated into a chitosan solution in weight ratios ranging from 1:1 to 10:1. Starting from the ratio of 3:1 the chitosan solution was transformed into a gel with a high consistency, which incorporates 10 mL water for only 0.1 g solid substance. The powders obtained after drying the gel were characterized by X-ray diffraction (XRD), transmission electron microscopy (TEM) and thermal analysis (TG-DSC). The electronic (UV–Vis), infrared (FTIR) and photoluminescence (PL) spectra were also recorded.

The aim of this study was to develop a newly Fe₃O₄–chitosan based controlled release nanosystem, with great absorptive properties, for improving the efficiency of antibiotics in external infections. This material may be successfully used in wound care, the potential applications being derived from its enhanced antibacterial activity, along with the high water content that helps in maintaining a moist environment at the wound interface, providing a cooling sensation and soothing effect, while slowly releasing the antibiotic, on the other side.

The antimicrobial assay demonstrates that the prepared material has a great antimicrobial activity in both planktonic and surface-attached conditions. Results obtained after the qualitative assay demonstrated that growth inhibition diameters are significantly enhanced by the addition of active antibiotic-nanosystem.