Proceedings of the World Congress on New Technologies (NewTech 2015)
Barcelona, Spain – July 15 - 17, 2015
Paper No. 406

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

Ovidiu Oprea, Denisa Ficai, Bogdan Vasile, Georgeta Voicu, Anton Ficai
University Politehnica of Bucharest, Faculty of Applied Chemistry and Materials Science
Gh. Polizu 1-7, Bucharest, Romania
Ovidiu73@yahoo.com; denisaficai@yahoo.com; vasile_bogdan_stefan@yahoo.com;
getav2001@yahoo.co.uk; anton_ficai81@yahoo.com

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 Fe_3O_4 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 Fe_3O_4–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.

Andronescu, E., Ficai, M., Voicu, G., Ficai, D., Maganu, M., & Ficai, A., (2010). Synthesis and Characterization of Collagen/Hydroxyapatite: Magnetite Composite Material for Bone Cancer Treatment. *J. Mater. Sci. Mater. Med., 21*, 2237

Archana, D., Dutta, J., & Dutta, P.K., (2013). Evaluation of Chitosan Nano Dressing Forwound Healing: Characterization, In Vitro and In Vivo Studies. *Int. J. Biol. Macro-mol., 57*, 193–203.

Grumezescu, A.M., Andronescu, E., Ficai, A., Bleotu, C., & Chifiriuc, M.C., (2012a). Chitin Based Biomaterial for Antimicrobial Therapy: Fabrication, Characterization Andin Vitro Profile Based Interaction with Eukaryotic and Prokaryotic Cells. *Biointerface Res. Appl. Chem., 2*, 438–445.

Grumezescu, A.M., Andronescu, E., Ficai, A., Bleotu, C., Mihaiescu, D.E., & Chifiriuc, M.C., (2012b). Synthesis, Characterization and In Vitro Assessment of the Magnetic Chitosan–

Carboxymethylcellulose Biocomposite Interactions with the Prokaryotic and Eukaryotic Cells. *Int. J. Pharm., 436*, 771–777.