BIOFUNCTIONALIZED NANOCOMPOSITES BASED ON MAGNETITE AND CHITOSAN FOR MEDICAL APPLICATIONS

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Nanometer-sized particles have optical, magnetic, chemical and structural properties that set them apart from bulk solids and control the applications in nanomedicine [1]. Highlights key themes for nanomedicine refer to: (1) interaction, because the cells are active participants in any treatment or experiment and are able to influence the interactions with nanomaterials and adapt their response; (2) alteration, which is connected with the bio-activity, which can, and usually does, change the physiochemical properties of the nanomaterials, either through coating of the particle surface with bio-molecules or through chemical reaction with components from particles shell and core; (3) adaptation, because changes are essential when dealing with dynamic biological systems able to respond and adapt. Successfully delivering a nano-therapeutics to a cell and performing a favorable outcome require the control of a series of spatial and temporal parameters [2]. Nanotechnology holds key to a number of recent and future breakthroughs in medicine, like us: screening (specific markers, molecular whole body imaging, desease inception, lab-on-a-chip), diagnosis and staging (image structure and function, noninvazive, increased sensitivity), treatment and monitoring (tissue-specific targeting, theranostic, mini-invasive surgery) [3].

In this context, the paper presents the synthesis and characterization of magnetic nanoparticles based on magnetite [4] and chitosan [5] and functionalized with biomolecules, and their potential applications in diagnosis and treatment. These nanoparticles were prepared in two steps: in a first step the magnetic nanoparticles based on chitosan and magnetite were synthesized, through ionic gelation with sodium tripolyphosphate; in the second phase nanoparticles were functionalized by immobilization of the biomolecules (biotin, enzymes) onto surface, using water-soluble carbodiimide chemistry. Also, the self-assembling method was tested, in the aim to optimize the nanocomposites characteristics. Functionalized magnetic nanoparticles were characterized in terms of size, Zeta potential, composition, morphology, cito- and hemocompatibility and their potential applications.

The obtained results confirmed that proposed formulations preserve the biological molecules activity, which is dependent on magnetic particles concentration and the quantity of bioactive immobilized onto nanoparticles surface. Nanoparticles application in targeted antioxidant enzyme therapy, targeted drug delivery, biosensors and detoxification was tested with promising results.

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