CHITOSAN BASED DRUG DELIVERY SYSTEMS

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Abstract
One of the research area in which polymeric materials are intensively explored, deals with the controlled drug delivery systems (DDSs), allowing for drugs distribution directly to the desired site of biological activity. The morphology of polymeric colloidal drug carriers can be described as a construction of a core-shell type. Depending on the chemical or physical bonds providing stability of those systems and the type of interactions between the drug and the polymer, among polymeric DDSs the following morphological structures can be distinguished: micelles, dendrimers, liposomes, niosomes, polymerosomes and micro- and nanocapsules [1]. The main advantages of those systems are the preparation of particles with desired size (diameter from nano to micrometers) during their synthesis / formation and high specific surface area, which can be modified by the appropriate chemical composition of the surface improving the efficiency of a drug delivery.

Chitosan is biopolymer derived from chitin, that is characterised by biodegradability, biocompatibility, mucoadhesion and antimicrobial activity [2,3]. Taking into account the overall advantages of this polymer and the possibility of modification due to the accessible functional groups i.e. hydroxyl and amine, chemically modified chitosan is one of the most promising biomaterials for DDS. In order to obtain micelle structures by self-assemby in aqueous environment several hydrophobically modified chitosan derivatives, such as – stearic acid-modified chitosan [4], palmitic anhydride-modified chitosan [5], linolenic acid-modified chitosan [6], have been synthesized. The micelles prepared by these derivatives in the aqueous medium contain internal hydrophobic moieties as drug reservoir and external hydrophilic chitosan chains as surrounding shell. The above mentioned micellar systems allow encapsulation of hydrophobic antitumor drugs e.g. doxorubicin or paclitaxel due to the compatibility between the hydrophobic core and hydrophobic drug affecting the drug loading and regulate drug release.

Another important group of chitosan based micro- and nanoparticles are those dedicated for gastric infection treatment. The use of chitosan in this specific application is mainly related with the mucoadhesive properties of chitosan resulted from the electrostatic interactions between its positively charged free amine groups and the negatively charged gastric mucins at the acidic stomach pH. Several problems such as high solubility of chitosan under stomach acidic conditions, low retention time and difficulty in crossing the mucus barrier have been observed in those systems [7]. Therefore various crosslinking methods e.g. with glutaraldehyde [8], genipin [9] or sodium triphosphate pentabasic (TPP) solution [10] were investigated in order to minimize these problems.

The nanotechnological production of the polymeric drug carriers, as well as the disadvantages of already developed chitosan based drug delivery systems induce the NANOENCAP project concept on the development and characterization of new dendrimeric micelles polymeric systems, with rigidly defined chemical structure, allowing the encapsulation of several drugs and their controlled release, and thus forming the so-called multidrug therapy systems. To provide the biocompatibility of new polymeric materials the monomer / reactant with proven biocompatibility or naturally occurring in the human body are chosen.

According to the assumptions of the project the amphiphilic character of the proposed multi-functional polymeric drug delivery systems is going to enable the encapsulation of at least two drugs, matching latest trends in the research on DDS models in multi-therapy. As an exemplary multi-drug therapy in this project, the combine therapy of peptic ulcer disease was chosen.

In this work we would like to present the short review of chitosan based drug delivery systems and the concept of the project as well as preliminary studies on new chitosan derivatives and the possibility of synthesis new micellar structures.

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