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Therapeutic effects of chitosan nanoparticles

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Dear editor,

Various pathetic drugs prescribed to kill or inhibit the growth of microbes such as bacteria, fungi, and viruses. Although the therapeutic efficacy of these drugs has been well established, inefficient delivery could result in an inadequate therapeutic index and local and systemic side effects including dermal irritation, paring and scaling, and gut flora reduction. Nanostructured biomaterials, nanoparticles, in particular, have distinctive physicochemical properties such as ultra-small and controllable size, large surface area-to-mass ratio, high reactivity, and functionalizable structure.[1]

Chitosan is a congenital polysaccharide prepared by the *N*-deacetylation of chitin. It has been broadly used in food and bioengineering industries, including the encapsulation of active food component, in enzyme immobilization, and as a carrier for determined drug delivery, due to its remarkable biological and chemical patrimony such as biodegradability, biocompatibility, bioactivity, and polycationicity.[2]

The physicochemical nature of chitin and chitosan, which affects the biomedical venture of these compounds, is firmly related to the origin of chitin and the state of the chitin/chitosan making process. The solubility of chitin and chitosan in water and organic solvent will be influenced thoroughly by weight-averaged molecular weight (MW) and degree of *N*-acetylation, other physicochemical parameters such as polydispersity (MW/MN), crystallinity, or composition of pattern of acetylation.[3]

Catheter-related bloodstream infections (CRBSIs) represent a vital part of the ardnons of critically and persistently ill patients. Since the treatment for CRBSIs is often difficult due to the microorganisms evolution of impedance to the drug being used several, specific biofilms were composed. To overpower antibiotic resistance, chitosan nanoparticles encapsulating a biofilm-degrading enzyme, β-N-acetylglucosaminidase were elevated through an ionic gelation method.[4]

Intranasal mucoadhesive nanoparticles of rizatriptan benzoate (RZB) were formed for the cure of migraine. RZB-loaded chitosan nanoparticles prepared by ionic gelation method was uncomplicated, replicable, and also led to coherent entrapment. Spray-dried nanoparticles were assessed by differential scanning calorimetry (DSC), X-ray diffraction (XRD) pattern to study crystalline/amorphous nature of nanoparticles, and mucoadhesive test. The proportion mucoadhesion on nasal mucosa of goat was found to be 29.4%. The release behavior of CS nanoparticles was assessed in phosphate buffer pH 6.5, divulged that RZB-loaded CS nanoparticles are most suitable for intranasal drug delivery.[5]

In another research study of chitosan efficiency determination, chitosan nanoparticles loaded by ketoprofen were prepared by sonication and centrifugation methods. Its initial tests were brought by managing optimization situation of sonication including amplitude and sonication time. Turbidity data revealed that the perfect condition for sonication on amplitude and sonication time are 20% and 60 min, respectively. Prostate-specific antigen analysis showed that reducing of turbidity number of emulsion was also diminished particle size. Scanning electron microscope and XRD analysis showed that chitosan nanoparticles loaded by ketoprofen have rounded form and semi-crystalline belongings, respectively.[6]

Chitosan polymer is pondered one of the best polymers used in the field of nanomedicine due to its safety, biocompatibility, biodegradability, and environment-friendly. Henceforth, evolution a new technique for making of chitosan nanoparticles has to immense importance for the pharmaceutical industry applications. From their study, chitosan sulfate was enabled to carry drug molecules which could expound significance of such technique. The size of chitosan sulfate nanoparticles was decided using different low-molecular-weight chitosan HCl, and sodium sulfate was confirmed by laser diffraction, DSC, and Fourier-transform infrared spectroscopy, and it was examined for its dissolution rate.[7]

Hydrophilic nanoparticles were scrutinized by other groups. They studied it as delivery systems for therapeutic macromolecules such as antigens. The *in vitro* release of nanoparticles revealed a preliminary burst release of almost 60% in the first 10 h, followed by a steady and much depleted further release for about 60 h. It is proposed that the chitosan nanoparticles fabricated in our study may provide a suitable alternative to traditional adjuvant systems.[8]

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