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Inhalable powders loaded with chitosan nanoparticles for protein drug delivery

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This work aimed at developing inhalable powders of insulin-loaded chitosan nanoparticles (INS-CS NPs), by microencapsulation method, and investigating their pulmonary absorption *in-vivo*. To this end, INS-CS NPs were prepared by incorporating insulin (INS) into nanoparticulate entities (NPs), consisting of the polysaccharide chitosan (CS) and the cross-linker sodium tripolyphosphate (TPP), using ionotropic gelation. Afterwards, INS-CS NPs were characterized with respect to morphology, size, zeta potential and loading capacity. Next, the inhalable powders were produced by co-spray drying the suspensions of INS-CS NPs with the sugar mannitol (thermoprotectant), resulting in microstructured powders with adequate aerodynamic properties for lung deposition. *In-vivo* performance of INS-CS NPs spray-dried powders was assessed via monitoring plasma glucose levels, following intratracheal administration in rats. The spray-dried INS-CS NPs were successfully microencapsulated into mannitol microspheres, forming powders with appropriate aerodynamic properties for deep lung deposition. The IN-CS NPs/mannitol weight ratios as well as spray drying process parameters affected the properties of the microspheres obtained. Additionally, the NPs were easily recovered after reconstitution of the spray-dried powders in aqueous media. The *in-vivo* study revealed that the microencapsulated INS-CS NPs induced a more pronounced and prolonged hypoglycaemic effect, as compared to the controls, including INS-loaded mannitol microspheres, native INS solution and the suspension of INS-CS NPs. Overall, besides the advantage of non-invasive administration and the desired stability of dry formulations, when compared to their liquid counterparts, inhalable micro/nanoparticulate systems may hold promise for lung delivery of therapeutic macromolecules for systemic or local effects (e.g., Cystic fibrosis, lung cancer).

Biography

Sonia Al-Qadi is working as an Assistant Professor at Birzeit University, Palestine. She earned her MSc and PhD in Pharmaceutical Technology from Santiago de Compostela University, Spain. She worked as a Post-doctoral fellow at the Department of Physics, Chemistry and Pharmacy, University of Southern Denmark and, then at the Department of Pharmacy, Copenhagen University. She thereafter worked as an Assistant Professor at the Faculty of Pharmacy, Isra University, Jordan. Her research interest focuses on nano-drug delivery systems, biomaterials, and drug testing models. She has many publications, presented her research work at different international conferences as posters or oral presentations and reviewer for some international journals.

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