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Smart nano and nano-in-microparticles carrier systems for controlled pulmonary drug delivery

A substantial body of research has focused recently onto pulmonary drug delivery as a well-accepted treatment for many lung diseases. This work was aiming to develop and evaluate (in vitro and in vivo) new series of carriers for controlled pulmonary drug delivery. The developed carriers combine the benefits of nanoparticles (NPs) and respirable/swellable microparticles while avoiding their shortcomings. The carriers are based on PEG-grafted-chitosan (PEG-g-CS) and cross linked with sodium tripolyphosphate and/or sodium hyaluronate in form of hydrogel NPs. Drug-loaded hydrogel NPs were then used to develop respirable/swellable 2-5 microns size microparticles (MPs) through controlled spray drying of an aqueous suspension of the NPs and lactose as excipient. Particle size was determined by laser diffraction and DLS. Surface morphology was investigated by AFM and SEM. In vitro aerosolization was performed using a Next Generation Impactor. Dynamic swelling, in vitro biodegradation, particle density and moisture contents were also determined. In vitro release profile of the loaded drug was investigated in simulated body fluids. In vivo investigation of the drug was also performed using insufflation method. The average sizes of the PEG-g-CS NPs and MPs were found to be 83.2 ± 2.4 nm and 4.1 ± 0.03 μ m, respectively. The NPs-MPs carriers showed high swelling within few minutes, low aerodynamic density (0.2 ± 0.03 g/cc), moisture content of 4.1-9.0%, good in vitro biodegradation, high drug loading capacity exceeding 93% and a promising sustained drug release both in vitro and in vivo. In conclusion, the newly developed NPs-MPs systems are very promising and could be utilized as potential carriers for sustained delivery of various drugs to the lung.

Biography

Ibrahim M El-Sherbiny has earned his PhD in Smart Drug Delivery in 2007 from Massey University, New Zealand. He has joined the University of New Mexico as a Post-doctoral fellow, then Texas University, USA as Research Assistant Professor. He is currently a Professor of Nanomaterials and Director of the Center for Materials Science at Zewail City of Science and Technology. He has more than 50 papers in reputed journals and same number in international conferences. He is the author of three books, twelve book chapters and more than eight review articles. Besides, he is a named inventor on more than fifteen patents.

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