Mesoporous silica nanoparticle-based protein delivery systems for biomedical applications

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Stellingen

Behorende bij het proefschrift

Mesoporous Silica Nanoparticle-Based Protein Delivery System for Biomedical Applications

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1. Proteins used as a therapeutic are usually characterized by their short plasma half-life, high elimination rate, limited ability to cross cell membranes, and poor bioavailability through intestinal administration. **Chapter 1**, this thesis.

2. It was shown that phospholipid membranes are able to assemble into different structures upon contact with a hydrophilic surface, involving vesicle adsorption, rupture and spreading into planar membranes. **Chapter 1**, this thesis.

3. Small (< 200 nm) MSNs with ordered large pores (> 5 nm), capable of encapsulating therapeutic small molecules suitable for delivery applications *in vivo*, are rare however. **Chapter 2**, this thesis.

4. Encapsulating proteins in MSNs is still challenging however, and only a few publications concerning the design of MSNs with a morphology that enables the effective encapsulation of a broad range of proteins are available. **Chapter 2**, this thesis.

5. Most of the current vaccines are delivered by intramuscular or subcutaneous injection, but the inherent limitations are obvious, such as the risk of the needle-related disease induced by reusing needles and syringes, the needle fear by children and patients, and the need for maintaining a proper cold chain during storage and transport. **Chapter 3**, this thesis.

6. Protein delivery into the cytosol of cells is a challenging topic in the field of nanomedicine, because cellular uptake and endosomal escape are typically inefficient, hampering clinical applications. **Chapter 4**, this thesis.

7. Mesoporous silica nanoparticles (MSNs) can be used as protein delivery carriers due to their unique properties, namely biocompatibility, chemical inertness, large surface area and controllable pore size. **Chapter 5**, this thesis.

8. In (bio)nanotechnology, individual nanoparticles are as unique as people's fingerprints, therefore it becomes imperative to find methods for the full characterization of nanoparticles. **Chapter 6**, this thesis.