Mesoporous silica particles as inhalable carriers for the pulmonary delivery of antimicrobial peptides

Alexander Pochert[1], Katharina Braun[1], Ewa Selg[2], Per Gerde[2] and Mika Linden[1]

[1]Ulm University, Germany
[2]Inhalation Science, Sweden
E-mail: mika.linden@uni-ulm.de

Mesoporous silica nanoparticles reveal several characteristics that could be beneficial for drug delivery, including a narrow pore size distribution, adjustable particle size and shape as well as it's possible to modify the surface with different functional groups. These characteristics are useful to optimize mesoporous silica nanoparticles as carriers with respect to peptide adsorption, release characteristics and formulation properties. High pore volumes and their large surface area are also advantageous for a high drug loading capacity.[1,2] We successfully loaded cationic antimicrobial peptides from aqueous solution to reach loading degrees as high as 20wt%. The adsorption pattern of the cationic antimicrobial peptide followed a Langmuir type adsorption behavior, which allows the peptide loading to be rationally tuned. The particles showed good aerozolization properties, which allowed detailed characterization of physiological lung-function variables. Respirable aerosols with similar deposition patterns in the rat airways, quite peripherally in the rat lung, were generated from the powders of the two tested mesoporous silica excipients. The physiological lung-function variables and perfusate flow rates of the treated lungs were not significantly changed during the entire 120-min period post exposure, as compared with normal control lungs treated with sham (air). The perfusate flow rate in all lungs was slightly decreased over time, which is typical of the rat IPL. In conclusion we could show that besides high loading capacities of the antimicrobial peptide on the mesoporous silica particles, no acute lung toxicity was observed in the rat lungs exposed *ex vivo* to a high dose of mesoporous silica carriers.

References

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