

Structural response of biopolymer coated delivery-nanoparticles to interaction with syntetic and cellular model mucus.

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The in situ delivery of drugs to pathological tissues is one of the most convenient strategies to improve the therapy of several disease. [1] Aerosol or nasal-administered nanovectors interact with mucus, covering lung and nasal tissue at the air interface. Mucus is a viscoelastic hydrogel based on mucins, high molecular weight glycosylated proteins. Mucus is able to trap pathogens, dust, particles and drugs, then eliminated through continuous mucociliary clearance. Nanocarriers are highly desirable, as they can change the *in vivo* fate of the drug without altering its chemical structure. However, the efficacy of nanoparticles for pulmonary or nasal delivery is hindered by the filtering action operated by the mucins hydrogel.[2] This is particularly true for Cystic Fibrosis CF treatment, due to the extremely high density and viscosity of the mucus produced by the pulmonary cells. Different strategies are adopted according to the specific target. By applying USAXS and SAXS we have performed structural characterization of different mucus models at the nanoscale. In particular we have investigated a new model consisting in healthy and CF cellular mucus, obtained from human airway epithelia reconstituted in vitro. We selected classes of nanovectors for lung or nasal delivery of drugs, vaccine and siRNA,[3] composed of highly biocompatible and biodegradable materials, and studied their structure before and after the interaction with mucus. Nanoparticles are characterized by their specific coating at the interface: chitosan-based (muco-adhesive glycopolymer), hyaluronate-based (less adhesive) or pegylated nanoparticles (designed to penetrate the mucus barrier due to PEG high hydration). We classified different behaviours of the vectors in the mucus models, from fast degrading to persistent, and we followed their diffusion through the net of mucins hydrogel.

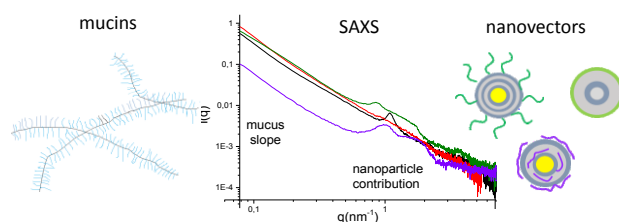


Figure 1. SAXS spectra of CF mucus in interaction with nanoparticles.

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References

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