Building Functional Surfactant/Chitosan Complexes with Chemically Modified Chitosan

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By means of light scattering and small-angle neutron scattering (SANS) experiments we could show that surfactant/polyelectrolyte complexes (SPECs) of chitosan with alkylethoxy carboxylates form stable complexes in aqueous solution, where the structure depends strongly on the mixing ratio and pH [1]. This structural flexibility has also been employed to use such systems for selective separation of hydrophobic and hydrophilic organic compounds or sequestration of metal ions [2].
These are very interesting properties, but due to the intrinsic pH dependence of chitosan, which renders it insoluble above pH 6, we were now pursuing to extend this responsiveness to a much higher and larger pH-range. This was done by quaternising the chitosan and for further amphiphilic modification we also introduced hydrophobic moieties (like dodecyl chains). A particularly interesting SPEC system here are multilamellar vesicles (MLVs), where the number of vesicle layers can be controlled by the mixing ratio (Fig. 1). These MLVs are very interesting for delivery applications as they are fully composed of biocompatible components and even their surface charge can be controlled by the mixing ratio. In our experiments we now studied how the precise modification of the chitosan (quaternisation and hydrobisation) affects the structure of the MLVs formed with the alkylethoxy carboxylate, and this was done by light scattering, SANS and zeta-potential measurements. In addition, we also investigated the release kinetics of a model drug out of these differently structured MLVs. From the combination of the structural properties with the release properties one can deduce in a systematic fashion what are the optimum conditions for designing SPECs for a desired delivery behaviour, depending on the modification of the chitosan and its content in the formulation.

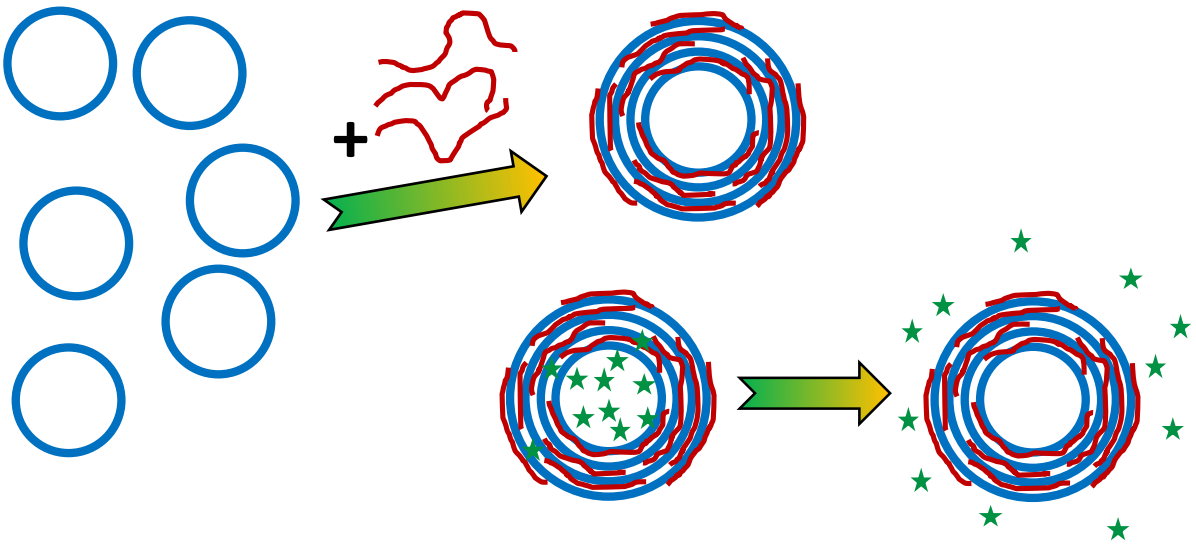

Figure 1 Controlling the lamellarity of MLVs by chitosan addition (left) and drug release from such MLVs (right).

[1] L. Chiappisi, S. Prévost, I. Grillo, M. Gradzielski, *Langmuir*, 2014, **30**, 10608.
[2] L. Chiappisi, M. Simon, M. Gradzielski, *ACS Appl. Mat. Interfaces*, 2015, **7**, 6139.