Nano-Engineered Capsules Based On Chemically Modified Polysaccharides As Multicompartment Drug Carriers

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Administration of drugs is often limited by problems of insolubility, inefficient distribution, enzyme hydrolysis, lack of selectivity and side-effects raising health concerns. Hollow capsules prepared by the layer-by-layer assembly of oppositely charged polyelectrolytes on a colloidal template, following by its decomposition, have recently emerged as attractive vehicles in the field of drug delivery.[1-3] These capsules possess a fascinating multicomparment structure, with the possibility to introduce a high degree of functionality at the nanometer scale within their shell. For drug delivery applications, a prerequisite is to use biocompatible and biodegradable polyelectrolytes for the construction of the nanoshell. In this context, we have proposed to exploit the specific properties of natural polysaccharides to design tailor-made biocompatible capsules as novel drug carriers.

In a previous work, we demonstrated the ability to prepare stable capsules based on hyaluronic acid (HA), a highly hydrated anionic polysaccharide which is ubiquitous in the body, and various cationic polymers.[4-5] By investigating the morphology properties of capsules, we assessed which parameters are important to obtain capsules that are stable under physiological conditions. Based on these results, our objective is now to encapsulate various types of biologically active molecules taking advantage of the multicompartment structure of capsules. This will involve polysaccharide chemistry as well as physico-chemical and biological studies to control the (i) synthesis of stable capsules made solely from polysaccharides, (ii) mechanical and biodegradation properties of the multilayer wall, (iii) entrapment and release of drugs inside the core and within the nanoshell which are still a challenge and, (iv) transport of the drug to the targeted cells.

Preliminary studies established the feasibility to encapsulate both hydrophilic and hydrophobic molecules in these core/shell systems.