Abstract Title

Lipid layers for Biocomposite Colloids _Novel Devices with Biological Functions

Symposium Track

Authors' names

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Abstract body

Biological membranes consisting of proteins embedded in a lipid matrix serve crucial for life functions such as energy conversion, transport, recognition and information exchange. From the point of view of nanotechnology they can be seen as soft matter nanodevices capable of performing a variety of astonishing processes ensuring the very existence of life. While in biotechnology these systems are exploited on the level of living cells, it would be also desirable to be able to fabricate nanocomposite devices with selected biological functions which do not have metabolic activities. Many applications can be foreseen for these constructs. Since biological key functions are of membrane origin the challenge is to engineer a supported membrane with biological functions. A promising concept is to employ a polyelectrolyte multilayer cushion supporting a lipid membrane which itself carries the biological functions. The multilayer cushion stands for stability and multifunctionality while the membrane with the embedded proteogenic elements takes the biological functionality.
To this aim lipid membranes were engineered on polyelectrolyte multilayer coated colloids and capsules . Their properties were investigated by means of colloidal force spectroscopy (CFS). In a typical experiment a colloidal probe engineered with an layer-by-layer film and a lipid bilayer on top is approached to a planar surface coated in a symmetrical way. Interaction forces were studied as a function of lipid composition and charge. Fluorescence techniques were employed to study the lipid coverage and lipid mobility. CFS allowed for the identification of vesicles and lipid tether pulling upon retraction. The assembly of

phospholipids on polymer cushions was also followed with the quartz crystal microbalance with dissipation (QCM-D), which allowed us to distinguish between deposited lipid bilayers and a layer of adsorbed vesicles.
Biological functions were then added to the system by fusing viral building blocks with the supported lipid membrane. Fusion of enveloped viruses was controlled by mimicking the pH conditions met by the virus via the endosomal pathway of infection. Our strategy involves the development of viral building blocks specifically designed for nanotechnology by molecular biology techniques. This involves i) the creation of viral constructs lacking infectivity and, ii) the display of selected functionalities on the viral surface.
Examples are provided which show that the suggested approach permitted to fabricate truly authentic biological functions on colloidal particles. Such systems can be used for combinatorics, diagnosis, vaccination and other means.

Keywords

Colloids, Membranes, Nanocomposites, Polyelectrolytes, Viruses

References

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