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P67 - Investigation of intracellular multilayer decomposition of Layer-by-Layer self-assembled particles by means of ion beam analysis

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Layer-by-Layer (LbL) microcarriers represent a novel group of drug delivery systems. The modular design of the polymer multilayer in nanometer thickness provides a multifunctional transport system: The step-by-step assembly of oppositely charged biopolymers on a dissolvable core allows the integration of active substances into different layers. Further functionalizations of the surface facilitate a local, targeted transport and time-controlled release of active agents into cells.
The understanding of uptake and processing of the carriers in cells and organs play a major role concerning the development of new drug delivery systems. Hence, the integration of a reporter for visualization of cytoplasmic processing was aimed allowing the time-dependent investigation of multilayer decomposition within cytoplasm by means of an element-sensitive method, Proton Induced X-Ray Emission (PIXE). As basis multilayer protamin sulfate and dextran sulfate has been assembled onto a $CaCO_3$ core (5 µm). Fe_3O_4 nanoparticles (NP) were then integrated into the multilayer in different layer numbers. To select microcarriers which are already released into cytoplasm, cell staining was applied by LysoTracker-FITC and confocal images of the regions of interest were obtained. Release profiles were then taken by PIXE after co-incubation of the carriers with Vero cells for 24 h, 48 h, 72 h, and 120 h. Comparing the Ca profiles of the cores with the Fe profiles of the NP in the multilayer, after 72 h and 120 h an increasing difference between the profiles could be detected indicating an increasing decomposition of the multilayer components and release of the NP.

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