Responsive polymeric nanocapsules and multicompartments as cellular mimics

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Polymeric micro- or nanocapsules and multicompartment systems are highly interesting in the field of nanoreactors and in mimicking biological systems and processes. Of special interest is the introduction of a stimuli-responsiveness into the capsule shell to be able to control the traffic of small and larger compounds and particles into and out from the capsule interior. We will report on robust, pH-responsive and multifunctional photocrosslinked polymersomes, which are interesting for studies in synthetic biology, but also for application as nanoreactors in microsystem devices and in nanotechnology [1-3]. While pH sensitive polymersomes usually disassemble upon acidification, ours show a definite swelling, since the cross-linked membrane remains intact, and they allow pH-dependent diffusion of small molecules through the membrane. Thus, cascade enzyme reactions could be carried out under pH control using polymersome-encapsulated enzymes and specific features of organelles could be mimicked. In such pH-responsive and photo-crosslinked polymersomes various function can be integrated e.g. additional light or redox responsiveness [4], and they can be decorated with various functionalities and bioactive biomacromolecules to achieve specific binding properties, targeting or therapeutic action. Larger proteinosomes (up to 50 micrometer), prepared by Pickering emulsion from BSA-PNIPAAm bioconjugates, have been realized as synthetic cell wall, and those compartments have been equipped with the smaller pH-responsive polymersomes, mimicking organelle structures in a cell [5,6,7]. Examples will be given how these multicompartments can be used to study complex cellular functions controlling cellular traffic.

Keywords: nanocapsules, polymersomes, multicompartment, responsive, cellular mimics

References

[1] J. Gaitzsch, D. Appelhans, L. Wang, G. Battaglia, B. Voit, Angew Chem Int Ed, **2012**, 51, 4448.
[2] X. Wang, Moreno S, Boye S, Wang P, Liu X, Lederer A, Voit B, Appelhans D, Adv Sci. **2021**, 8, 2004263.
[3] X. Wang, S. Moreno, S. Boye, P. Wen, P. Formanek, A. Lederer, B. Voit, D. Appelhans, Chem. Mater. **2021**, 33, 6692.
[4] S. Moreno, H. Hübner, C. Effenberg, S. Boye, A. Ramuglia, D. Schmitt, P. Formanek, B. Voit, I. Weidinger, M. Gallei, D. Appelhans, Biomacromolecules, **2022**, 23, 4655.
[5] P. Wen, X. Wang., S. Moreno, D. Voigt, B. Voit, X. Huan, D. Appelhans, Small **2021**, 17, 2005749.
[6] D. Wang, S. Moreno, S. Boye, B. Voit, D. Appelhans, Chem. Commun. **2021**, 57, 8019.
[7] X. Xua, S. Moreno, M. Gentzel, K. Zhang, D. Wang, B. Voit, D. Appelhans Small Methods, **2023**, in print.