Vesicles from natural proteins (HFBI): characteristics and chances

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Hydrophobins are a family of surface-active proteins known for their small size and strong amphiphilicity. HFBI is a protein from this family produced by *Trichoderma reesei.* We use these proteins to form artificial bilayers [1] and vesicles [2]. Compared to ordinary lipid bilayers, hydrophobin bilayers are similar in thickness but can maintain a much higher lateral tension [1], which makes them interesting for artificial vesicles. These artificial vesicles could be of great importance for drug delivery, but also for vaccines, which have recently attracted a lot of interest. A fundamental property of drug carriers is the exchange with their environment. The water permeability of these protein vesicles is therefore a crucial parameter to explore. We measured the permeability of HFBI membranes using the droplet interface bilayer technique. By measuring the volume change of two droplets of different salt concentration connected by a bilayer, the permeability can be derived. Our experiments showed that HFBI bilayers have a very low water permeability, about two orders of magnitude lower than conventional lipid bilayers, which are known for their low permeability. They also withstand much higher osmotic pressure than lipid membranes. This ensures safe packaging of potential compounds in the vesicles. Furthermore, we can manipulate these properties by inserting other proteins or channels, as we have already done with a hydrophobin mutant or the rather simple ion channel gramicidin A [2]. In this context, we are exploring a vesicle formation technique to create a large number of vesicles that can be filled with drugs or specific solutions. We achieve this with a combination of microfluidics and centrifugation.

[1] Hähl, H. et al., Langmuir 34, 8542 (2018).

[2] Hähl, H. et al., Adv Mater 29, 1602888 (2017).