The meta-transcriptome of a fern (Pteridium sp.) reveals the presence of five hydrophobin sequences

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Introduction

Hydrophobins are amphiphilic proteins found around the aerial hyphae of many different fungal species. These secreted proteins have functions in reducing the surface tension of water, assist in adhesion and provide protective surface coatings [1]. On the protein level hydrophobins share the conservation of eight cysteine residues forming 4 disulphide bridges and a size of 10-15 kDa [2].

Structure-Function Relationship

On the structural level hydrophobins are characterized by opposing polarities since one side of the protein is made up of very hydrophobic amino acid side chains while the other is hydrophilic in nature. It can therefore be interpreted as a „protein-surfactant“.

Figure 1: Schematic of the hydrophobin structure (HFBI). The hydrophobic patch is marked in green. The right panel shows the conserved cysteine rich motif found in all hydrophobin sequences. Within the protein all 8 cysteines form disulfide bridges.

Cloning, Expression, Purification

The respective genes were codon optimized for P. pastoris and cloned under the control of P\textit{AOX1}. The protein expression was performed under methanol induction and the cell supernatants were purified using reverse phase chromatography. RP-chromatography was successful in purifying four out of the five expressed hydrophobins.

Figure 4: RP-chromatography profile. The red rectangle shows the elution time of the hydrophobin, the green line represents the acetonitrile gradient starting at 0%. Pink, red and blue show UV detector signal at different wavelengths.

Surface Activity

The surface activity of purified hydrophobins was tested on glass and polyethylene terephthalate (PET). The values depicted in figure 5 show the water contact angle in comparison to a buffer blank. Three hydrophobins showed activity on glass, while no activity could be detected for the PET surface.

Figure 5: Water contact angle measurement of four hydrophobins on glass and polyethylene terephthalate (PET) surfaces. Buffer was used as a blank for both surfaces.

Future Outlook

The protein binding on glass can be used for the specific functionalization of glass surfaces, which tend to be very challenging to specifically coat. Fusion proteins with other partners would broaden the scope of functionalization.

References