Fusion Proteins for Biocatalyst-Based Polymer Degradation

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Currently, the accumulation of plastic waste due to inefficient degradation methods represents a growing environmental problem. In this regard, the use of polymer-degrading biocatalysts has been subject to many studies [1, 2, 3]. However, a biocatalyst needs an aqueous system in order to be active, while polymers such as polyolefins are highly hydrophobic. To maximize biocatalytic efficiency, methods to improve adsorption of the biocatalyst to the polymer surface have been explored. One possibility is the fusion of a hydrophobic anchor and thereby increase the protein's polymer-binding affinity. Hydrophobins, which are small fungal proteins that self-assemble on lipophilic surfaces, represent one option to enhance substrate binding [4]. In previous research, PET hydrolysis efficiency has been improved by the fusion of hydrophobins to a PET hydrolase [5]. In this research, the fusion of hydrophobins to a polyolefin-degrading biocatalyst is being studied. The hydrophobins (class II hydrophobins from *T. reesei* and a mutant class I hydrophobin from *G. frondosa*) were connected to the biocatalyst *via* molecular cloning and then produced in *E. coli*. For the analysis of the fusion protein-polymer interaction, different polyolefins were used. The assembly on the hydrophobic polymer surface and the efficiency of the polyolefin-degrading biocatalyst is analyzed using different surface analysis methods such as water contact angle measurement (WCA), surface plasmon resonance (SPR), attenuated total reflection Fourier transform infrared spectroscopy (ATR-FTIR), and x-ray photoelectron spectroscopy (XPS).

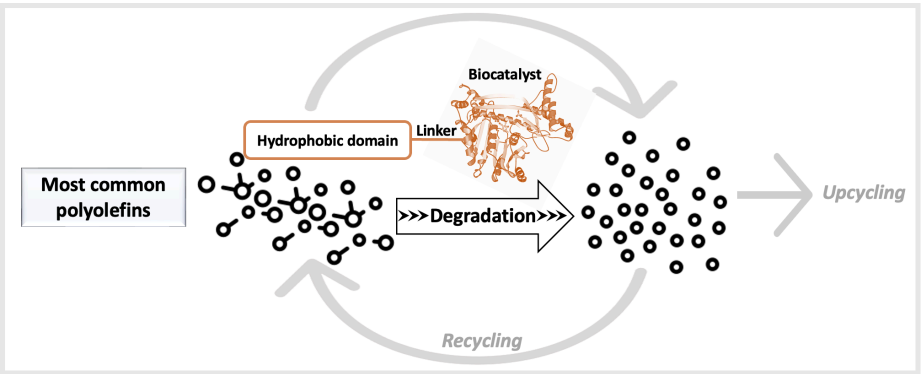

Figure 1. Schematic representation of the research topic. A hydrophobic domain (hydrophobin) is linked to a polyolefin-degrading biocatalyst.

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