Biocatalytic Functionalization of Biopolyesters

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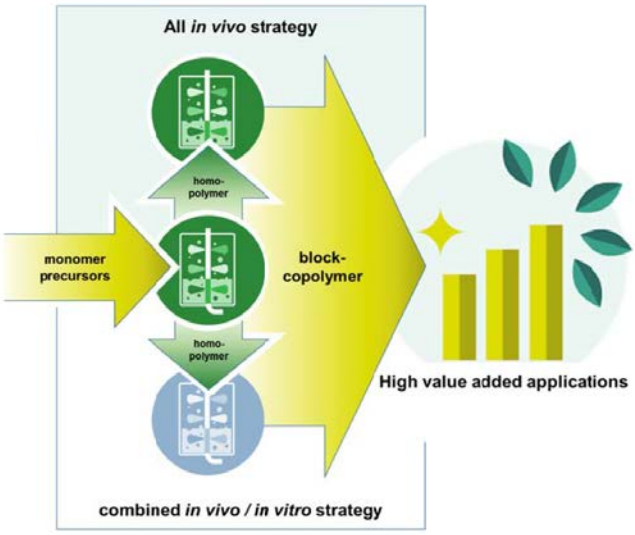
Project Summary

The proposed project aims at the enzymatically catalyzed modification of biorenewable and biodegradable polyhydroxyalkanoates (PHA) and to form well-defined block-copolyesters. Such materials are recognized to increase available PHA properties and architect res (i.e. viscosity, flexibility, rigidity, crystallinity, block-copolymer systems, crosslinkable systems). Such materials have gained increased attention due to their recognized potential for high- value added applications (e.g. bio-implants, tissue engineering, drug delivery and smart materials). While current chemical synthesis strategies encumber economically realistic access due to reaction complexity, a distinct need for new methods of their preparation has been identified.



Two methods with a different range of combinations of PHA block segments will be developed in parallel. The first method employs the enzymatic machinery of the mutant strain *Pseudomonas putida KTQQ20* cultured in a multistage fermentation system to achieve an all *in vivo* approach to biocatalytically transform appropriate precursor molecules into chiral, block-copolymeric medium-chain-length PHAs. The second method utilizes the provided polymeric material from fermentative biotransformation as substrates for their enzymatically catalyzed conversion into novel block-copolymeric PHAs and thus omitting the use of bio-incompatible reagents, reactants or catalysts. This second method will be developed within a transdisciplinary cooperation between the HES-SO Valais-Wallis, Switzerland and the BOKU University Vienna, Austria. Bringing together the existing fermentation expertise by Prof. Zinn with the expertise in enzymatic polymer transformation by Prof. Gübitz – a so far missing practical knowledge in Switzerland.

Finally, the two novel methods will be compared with respect to efficiency and feasibility for the consideration of further scale-up, thus preparing the low barrier entry into subsequent industrialization processes.