Photobiocatalytic whole-cell biotransformations

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Oxidative-reductive transformations belong to the most important reactions in organic synthesis. Redox-active enzymes such as oxygenases, alcohol dehydrogenases, amine dehydrogenases, and ene-reductases, selectively catalyse the introduction and modification of functional groups under mild reactions conditions. All these enzymes need a stoichiometric supply of electrons that is usually provided from petrol-based or agricultural cosubstrates. Photobiocatalytic water oxidation is a sustainable strategy for the supply of electrons for redoxtransformations without the need of organic electron donors. However, the coupling of enzymes to light-harvesting systems *in vitro* is still challenging.

Whole-cell biotransformation in cyanobacteria is an easy and elegant approach to use natural photosynthesis for the supply of NADPH. A method for the expression of selective biocatalysts in the cyanobacterium *Synechocysts sp. 6850* was established [1]. Whole-cell biotransformation using cyanobacteria bearing an recombinant ene-reductase [2] and monooxygenases allow to use photosynthesis for cofactor-regeneration. Physiological effects of the oxidoreductases as additional electron sinks and strategies for the increase of the specific activity of the cells will be discussed.

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[2] K. Köninger, A. Gomez-Baraibar, C. Mügge, C. Paul., F. Hollmann, M. Nowaczyk and R. Kourist, *Angew. Chem.-Int. Edit.* **2016***, 55, 5582.*