BIOCATALYSIS IN GREEN AND BLUE: SYNECHOCOCCUS PCC11901 AS A NEW WORKHORSE?

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Can we exploit Photosynthesis for Whole-cell-catalysis? In oxygenic, photoautotrophic organisms, light energy provides redox-energy and oxygen accumulates. An ideal "reaction-vessel" for oxygenating enzyme-catalyzed reactions. Fast co-factor recycling without the need for sacrificial co-substrates and thus for whole-cell catalysis[1].
Cyanobacteria, ancient photoautotrophic prokaryotes, have gained interest by the biotechnology community for good reasons. They grow faster than other photosynthetic active organisms and their comparatively simple genetic built render them accessible to genetic engineering. Despite their advantages, Cyanobacteria lag behind more commonly commonly used, heterotrophic microbes, as they grow more slowly and less densely compared to common heterotrophs and reliable high expression of enzymes is often difficult to achieve[2].
The newly discovered *Synechococcus PCC 11091*. This strain is one of the fastest cyanobacteria in terms of growth and reach the highest cell density ever measured in cyanobacteria grown in a shake flask[3].
In our project, we integrated a **P**henolic **A**cid **D**ecarboxylase (**PAD**)[4], into the host genome. We were able to fully transform 10 mM of ferulic acid to 4-vinyl-guaicol within 5 h, by employing a two-phase system, circumventing product-toxicity. We currently investigate to monitor the reaction in realtime by measuring dissolved oxygen (dO_2). The oxygen evolution rate is determined by external factors, mainly by light and inorganic carbon availability and so allows an indirect measurement of the reaction under saturated light condition. The next step involves the further reaction of 4-vinyl-guaicol to vanillin by an **A**romatic **Dio**xygenase (**ADO**). This reaction is oxygen dependent and so eventually benefits from the increase oxygen evolution by the released CO_2.
We proved the applicability of *Synechococcus PCC11901* for whole-cell catalysis and will further investigate its capabilities to increase enzymatic oxygenation reaction.

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