FKKT | UNIVERZA V LJUBLJANI
Fakulteta za kemijo in kemijsko tehnologijo

VABILO NA PREDAVANJE
V OKVIRU DOKTORSKEGA ŠTUDIJA
KEMIJSKE ZNANOSTI / INVITATION TO THE
LECTURE WITHIN DOCTORAL PROGRAMME IN
CHEMICAL SCIENCES

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z naslovom / title:

Blue-green sustainability: A synthetic biology approach to use the cyanobacterium *Synechocystis* as an efficient cell factory

v sredo, 26. 2. 2025 ob 15. uri
v predavalnici 1 v 1. nadstropju Fakultete za kemijo in kemijsko tehnologijo, Večna pot 113 ***/***
on Wednesday, 26. 2. 2025 at 15.00
in lecture room 1, 1st floor at the Faculty of Chemistry and Chemical Technology, Večna pot 113

Vljudno vabljeni! / Kindly invited!

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Abstract:

Pharmaceutical and chemical industries provide most of society's daily used materials, however they are major polluters contributing significantly to carbon emissions and generating 5-100x more waste than product. In this context, biocatalysis became a promising approach to develop greener, more sustainable and cheaper chemical manufacturing with cyanobacteria emerging as alternative chassis to the heterotrophic workhorses currently used. Aiming at expressing industrially relevant heterologous enzymes, such as hydrogenases and monooxygenases [1], several *Synechocystis* mutants with streamlined photosynthetic electron flow were generated. Our targets included genes encoding putative competing electron sinks such as: bidirectional hydrogenase Hox, flavodiiron proteins Flv1/3, NdhD2 subunit of NDH-1 complex, COX terminal oxidase and a native CYP120A1. Currently, the effectiveness of these chassis, in terms of electron flow redirection towards redox enzymes, is being evaluated using a P450 sensor protein (CYP1A1) via an ethoxyresorufin-O-deethylase (EROD) assay. Preliminary results indicate that CYP1A1 activity is higher in the mutants compared to the wild-type.

In parallel, envisaging large-scale outdoors cultivation, *Synechocystis*-chassis harboring a synthetic device for the production of the compatible solute glycine betaine (Ahbet) were generated and tested. The presence of this device in a *Synechocystis* mutant deficient in the production of the native compatible solute glucosylglycerol (Δ*ggpS*) enhanced growth in 3% NaCl compared with the wild-type [2,3]. The effects of the impairment of putative carbon competing pathways, namely extracellular polymeric substances (EPS), on glycine betaine production was assessed by introducing the Ahbet device into a mutant impaired in EPS production, Δ*kpsM*. The Δ*kpsM*_Ahbet mutant produced 2x more glycine betaine than the Δ*ggpS*_Ahbet and increasing the availability of the precursor glycine, resulted in even higher glycine betaine production. However, the Δ*kpsM*_Ahbet mutant did not show an increased growth under 3% NaCl as the Δ*ggpS*_Ahbet. Therefore, aiming at large scale cultivation in seawater like conditions the Ahbet is being introduced into chromosomal neutral site(s) [4].

References

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3. Ferreira et al. (2022) Front. Bioeng. Biotechnol., doi.org/10.3389/fbioe.2021.821075
4. Pinto et al. (2015) DNA Res., doi.org/ 10.1093/dnares/dsv024

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