Title:

Production of Valuable Carbon Containing Products with a new Module-Based Vector System in Cyanobacteria

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Abstract:

Regarding climate change, the reduction of CO_2 emissions became one of the major topics in the last few years. On the one hand, photosynthetically active organisms, like cyanobacteria, offer a great possibility to reduce CO_2 emissions by using photosynthesis and to synthesize various biofuels and chemicals by genetic engineering. On the other hand, this strategy leads to a reduction of the dependency on petrol-based fuels in our society. Gao et al. [1, 2] showed enhanced ethanol production up to 5.5 $g \cdot l^{-1}$ by using the genetically engineered cyanobacteria Synechocystis sp. PCC6803. Based on these improvements, strategies for obtaining higher cell densities and a further enhanced ethanol yield were developed. Therefore, a new module-based expression vector system with the possibility for easy exchange of DNA fragments, such as homologous integration sites, promoters and genes, was designed and will be presented. For ethanol production, the genes encoding alcohol dehydrogenase and pyruvate decarboxylase will be integrated into the cyanobacterial genome. Constitutive as well as inducible promoters will be tested for maximum ethanol production in Synechocystis sp. PCC6803 in a single or a two-step cultivation process. Strategies and gene constructs for high ethanol production in Synechocystis sp. PCC6803 will be presented.

[1] Z. Gao et al. , “Photosynthetic production of ethanol from carbon dioxide in genetically engineered cyanobacteria,” Energy Environ. Sci., vol. 5, no. 12, pp. 9857–9865, 2012.
[2] X. Gao, et al., “Cyanobacterial chassis engineering for enhancing production of biofuels and chemicals,” Appl. Microbiol. Biotechnol., vol. 100, no. 8, pp. 3401–3413, 2016.