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Increased carbon fixation and biofuel production in the *Cyanobacterium Synechocystis* PCC 6803

Claudia Durall and Peter Lindblad
Uppsala Universitet, Sweden

It is possible to genetically engineer cyanobacteria to produce a variety of biofuels. However, the level of the selected product is low but increasing carbon fixation can increment the production of carbon based substances in photosynthetic organisms. In addition to RuBisCO, Phosphoenolpyruvatecarboxylase (PEPc) may also fix carbon in cyanobacteria. This study designed three different engineered strains by overexpressing the native pepc (encoding PEPc) in the *Cyanobacterium Synechocystis* PCC 6803 resulting in strains with one (WT+PEPc) or two (WT+2xPEPc) additional copies of pepc and with additional copies of pepc, ppsa and mdh (WT+PPSA+PEPc+MDH). However, the additional copy of pepc is identical with the native, single recombination with the native pepc occurred in all engineered cells. SDS-PAGE/Immunoblot demonstrated that more PEPc protein is present in the engineered cells compared to in wild type cells. Interestingly, the WT+2xPEPc engineered cells grow faster than the control strain in low light (2-3 μE • m-2 • sec-1) with a corresponding higher in vitro PEPc activity. According to our experience, heterologous expression show better results in terms of protein level and activity. We have characterized the PEPc from the fast growing *Cyanobacterium Synechococcus* PCC 7002 and it showed higher Vmax and lower Km for bicarbonate compared to PEPc from Synechocystis PCC 6803. In addition, the pepc from *Synechococcus* PCC 7002 was introduced into the engineered strain WT+2xPEPc using a shuttle vector. Interestingly, the in vitro PEPc activity increased compared to in WT+2xPEPc cells. The WT+2xPEPc strain was been further engineered with the ethylene pathway and higher ethylene production was observed compared to in the control strain.

Biography

Claudia Durall is currently pursuing her PhD at Uppsala University, Sweden. Her interest is to reduce the CO2 levels and produce sustainable and environmentally friendly fuels.

claudia.durall@kemi.uu.se

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