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Photofuel - Biocatalytic solar fuels for sustainable mobility in Europe

Deliverable D3.5

Performance and Optimization of the biocatalytic strains outdoors Fuel samples for analysis to WP4

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Editorial	
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Publishable Summary

Three different partners from WP2 have engineered phototrophic microalgae and cyanobacteria to produce biofuel precursors. All the strains received, sent by partners to A4F, were able to grow in A4F Industrial Medium similarly or even better to the observed in optimized correspondent laboratorial media.

The pilot scale cultivation was performed using UHT-PBR since it presents better areal productivities than the conventional tubular PBR (MHT-PBR) and provides significant advantages in terms of CAPEX and OPEX savings.

The two cyanobacterial strains, *Synechocystis* sp. PCC 6803 BuOH-NP (1-butanol producer) and *Synechococcus* sp. PCC 7002 FFA1 (free fatty acid producer) presented a good performance outdoors in 180 L UHT-PBR. *Chlamydomonas reinhardtii* (bisabolene producer) was able to grow in flat panels but not in UHT-PBR due to the fragility of the cells and the shear stress of the circulation pump, rendering this strain challenging for the UHT-PBR.

Butanol was produced to levels similar to those observed in laboratory experiments even though producing capacity was lost after 12 days of outdoor production. The FFA1 strain displayed an extremely fast growth profile but only residual FFA levels were detected in the medium likely due to loss in the foam overflow. Given these results, *Synechocystis* PCC 6803 strains capable of producing 1-butanol and *Synechococcus* PCC 7002 strains capable of producing FFA were chosen as the best candidate strains that should be pursued for further investigation. Due to their optimal growth temperatures, these strains were also defined as most suitable for production in the summer (Synechococcus sp. PCC 7002) and in winter (Synechocystis sp. PC 6803). Improved strains of *Synechocystis* PCC 6803 and *Synechococcus* PCC 7002 are being further optimized by WP2 partners. After their characterization at lab scale by WP2 partners, the most productive ones will be used for the production of biofuel precursors at A4F's unit during task 3.7. Product separation will be performed in close collaboration with ICL, which have been developing continuous separation methods to be tested and implemented at A4F facilities.