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Photofuel - Biocatalytic solar fuels for sustainable mobility in Europe

Deliverable D3.7

Report on and biocatalytical production of fuel compounds at pilot level



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Publishable Summary

Genetically modified strains from *Synechocystis* sp. PCC6803 were chosen, during task 3.5, for production of butanol as biofuel precursor during task 3.7. Two engineered strains from WP2 partners University of Uppsala (UU) were received at A4F and successfully cultured at pilot scale. Butanol production and accumulation in the culture broth was achieved but productivities and maximal concentrations were much lower when compared to laboratory results with the same strains.

A4F used two different photobioreactor (PBR) configurations to culture these strains – 50L Glass Flat Panel PBR (GFP-PBR) and 180L and 1200L Unilayer Horizontal Tubular PBR (UHT-PBR).

Butanol is a volatile compound, and using a condensing system connected to the air outlet of the GFP-PBR it was possible to determine that butanol was being lost by evaporation due to the aeration used as homogenization system. Due to these results a UHT-PBR configuration was adopted using a pump as homogenization system. This configuration was capable of preventing loss of butanol through the off gases of the PBR, obtaining higher concentrations of butanol.

Despite strict chemical and thermal disinfection cycles, under normal cultivation conditions, contamination by bacteria were impossible to avoid. Bacterial load steadily rose with time and were correlated with eventual butanol depletion from culture. An attempt to prevent these contaminations was to cultivate butanol producing *Synechocystis* sp. PCC6803 strain under alkaline pH. This approach proved hard to implement correctly and was not capable of avoiding the appearance of contaminations.

Bacteria from *Rhizobium* genus were identified, by sequencing analysis (performed by WP2 partners from University of Bielefeld) of biomass from a pilot scale assay, as the major group contaminants that may be responsible for butanol consumption. With these results, specific countermeasures can be developed to avoid the appearance of this type of contaminants.

Table of contents

Publishable Summary.....	3
Table of contents	4
1. Deliverable objectives	5
2. Introduction	5
3. Sterilization of pilot scale photobioreactors	7
4. Pilot scale production of <i>Synechocystis</i> sp. PCC6803 BuOH-1.....	8
4.1. Production in UHT-PBR	9
4.2. Production in GFP-PBR	11
5. Pilot scale production of <i>Synechocystis</i> sp. PCC6803 BuOH-2.....	13
5.1. Production in UHT-PBR	15
5.2. Production in GFP-PBR and condensation of 1-butanol from the off-gases	17
5.2.1. Condensing system capacity trial.....	19
5.3. Cultivation in GFP-PBR under Continuous Regime at optimum pH.....	21
5.4. Cultivation in GFP-PBR under Continuous Regime at alkaline pH	24
6. Pilot scale cultivation of <i>Synechocystis</i> sp. PCC6803 BuOH-2 in UHT-PBR under Continuous Regime	27
6.1. Production at optimum pH	28
6.1.1. Identification of contaminants present in culture by 16S Sequencing.....	31
6.2. Production at alkaline pH	33
7. Conclusions	36
8. References	38