**The Characterization of the Central Carbon Metabolism of Arthrospira Platensis Brings Insights to Its Original Polysaccharides (PS) Composition.**

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**Highlights**

* Primary metabolite profiling using routine combined metabolomics approach
* The combined metabolomics approach consisted in using GC-MS and MFA
* *Arthrospira platensis* was cultivated in photobioreactor under various light conditions
* *Arthrospira platensis* EPS and PS fractions were modulated according to the incident light

**1. Introduction**

Micro-algae are photosynthetic micro-organisms that are able to produce at reduced cost high value products. To control this potential, the understanding of the photosynthetic and energetic metabolism of these micro-organisms at cellular and molecular level is often mandatory. Among the latest available approaches, the characterization and the analysis of the metabolic fluxes distribution is known to contribute accurately to a better understanding of the mobilized metabolic pathways and of the micro-organism behavior in response to environmental changes. For that purpose, metabolomics plays a key role since it enables to characterize these fluxes through high-throughput profiling of tremendous number of metabolites. Among the most cultivated photosynthetic micro-organisms, *Arthrospira platensis* is a cyanobacteria known to produce exopolysaccharides (EPS) and more particularly under light stress. Even though it is worldwide cultivated, only few major articles ([1],[2]) focused on the characterization of its central metabolism since Cogne [3]. Therefore, there is a lack of knowledge to understand the effect of environmental conditions on its energetic regulation metabolism. Knowing these mechanisms, would finally enable more efficient production of the specific PS or EPS.

In this study, the characterization of the carbon central metabolism of Arthrospira platensis cultivated in photobioreactor under growth with different light conditions and regarding EPS and PS production conditions was performed. For that purpose an original combined metabolomics approach was developed. It consisted in a profiling approach [4] allowing to quantifiy in routine the metabolites of the central carbon metabolism of the *Spirulina,* that was combined to a MFA calculation method used to estimate the dynamic of the metabolism thru the estimation of the biochemical reaction rates.

**2. Methods**

The central carbon metabolism of the *Spirulina* was characterized using the following GCMS analaysis workflow. It was combined to MFA calculation approach constrained by an accurate biochemical profiling approach. The results (absolute quantification and simulated reaction rate) were mapped on a extended central carbon metabolism map in order to check the influence of high light conditions on the PS and EPS fate and composition.

**3. Results and discussion**

The approach allowed assessing a better understanding of *Spirulina’s* behavior facing high light environmental changes impacting more particularly its EPS and PS composition. Indeed, in the tested cultivation conditions (increasing light) it was possible to increase the amount of EPS, but also to modify its composition. The main observed differences concerned the amount of the uronic acids that was found to be drastically inferior to what was previously described [3]. The GCMS profiling of the carbon central metabolism extended to the elementary bricks constitutive of the protein, lipids and polysaccharides suggested more over that an alternative pathways for the uronic acid biosynthesis could be used. The Metabolic Flux Analysis data reinforced the observed hypothesis found using the low resolution metabolomic approach.

**4. Conclusions**

Finally in this study we were able to demonstrate that using routine low resolution metabolomics profiling approach, it was possible to bring insight to carbon fate regarding more particularly the PS and EPS fractions. Such a routine approach should be used in the next future to bring more informations of the *Spirulina*’s PS and EPS under differents cultivations conditions.

**References**

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