HPLC, LCMS, and FTIR Analysis of Cyanobacterial Metabolite Overflow for Energy Management

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Recent report indicated that overflow of alpha-ketoglutarate and pyruvate may be an alternative energy management mechanism in a mutant of cyanobacteria (Cano et al 2018). However, the molecular details of overflow metabolisms are not completely known. We hypothesize that using analytical chemical methods, we can monitor the detailed changes of overflow metabolism in cyanobacteria and offering insights into their energy management strategies during growth. In this work, we use HPLC, LCMS and FTIR to analyze the growth medium of wild-type cyanobacterium *Synechocystis* sp. PCC 6803 at high light conditions (500 uE) as shown in Figure 1. LCMS results identified 56 targeted and 170 untargeted metabolite end-products of overflow metabolism in cyanobacteria. The 226 metabolites include organic acids, amino acids, organic bases, esters, alcohols, ketones, aldehydes, and sugars. HPLC data showed that pyruvate overflow is sensitive to the presence of nitrate and lower pH in the growth medium. FTIR analysis showed the changes in overflow metabolites end-products in cyanobacterium *Synechocystis* 6803 at high light condition between day 0 and day 13. FTIR results also showed the apparent different IR profiles of the cells of *Synechocystis* 6803 and *Synechococcus* 7942 from day 0 to day 4, which suggested the feasibility of FTIR analysis on the intact cells. The preliminary data provide new information of the cyanobacterial overflow metabolisms. This work may open new route in assessing the energy management in cyanobacteria for bioproducts production. This work was supported by the U.S. Department of Energy, Office of Science Energy Earthshot Initiative, as part of the Science Foundations for Energy Earthshot (DOE SFEE) Projects under grant number DE-SC0024702.

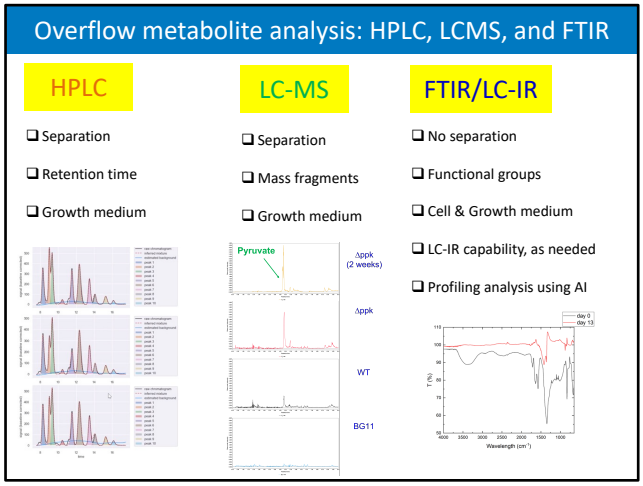

Figure 1: HPLC, LCMS and FTIR analysis of cyanobacteria at high light conditions.

Cano et al (2018) Manipulation of glycogen and sucrose synthesis increases photosynthetic productivity in cyanobacteria, Front Microbiol. 14: 1124274.