ACCESSing the Carbon Uptake Dynamics of Cyanobacteria

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Quantification of CO_2 uptake rates in cyanobacteria is a vital parameter for assessing their biotechnological potential. However, high resolution and *in situ* CO_2 uptake measurements from active cyanobacterial cultures have so far remained elusive. To solve this problem, an automated carbon and CO_2 experimental sampling system (ACCESS) was developed. ACCESS is based on an Arduino-controlled mini-solenoid array that systematically diverts the off-gas from cyanobacterial cultures towards a flow sensor and infrared gas analyzer which allows for high resolution quantification of CO_2 uptake rate as well as the total amount of fixed carbon. The accuracy of this novel system was independently verified by elemental analysis. Using four cyanobacterial strains under various light and CO_2 regimes, ACCESS data reveals that the CO_2 uptake rate of a cyanobacterial batch culture is dynamic, accelerating linearly to a maximum before decaying monotonically to cessation. This low-cost system simultaneously provides accurate CO_2 uptake rates, total amount of fixed carbon, instantaneous specific growth rates, and specific CO_2 uptake rates, thus illuminating vital parameters to assess the dynamics of carbon uptake by cyanobacteria.

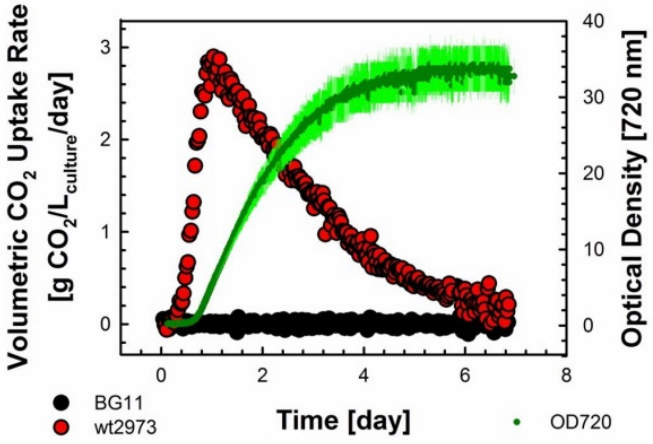

Figure 1. ACCESS data for wild type *Synechococcus* UTEX 2973 grown in BG11 media at 1000 μE illumination and fed 1% CO_2

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