

A photobioreactor system for computer controlled cultivation of microalgae

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Abstract A bioreactor system was developed for the cultivation of the microalgae *Synechocystis* sp. PCC6803 under controlled physiological conditions. The determination of the actual physiological state of the microalgae was provided by *inline* recording of chlorophyll fluorescence parameters. A feed-back loop was employed to keep the microalgae in a defined physiological state. For the construction of this feed-back loop, the temporal behaviour of the system was investigated using changes in light conditions (as caused by modulated UVB radiation) as input signal and chlorophyll fluorescence as output signal. The reproducibility of the responses was high. Kinetic analysis based on curve fitting revealed two time constants in the UVB-induced responses. The knowledge of these time constants was utilised for the development of an efficient feed-back loop which allows the cultivation of the microalgae in a defined physiological state. This new process strategy (called *physiostat*) was successfully tested. The performance in a culture of growing microalgae is shown.

Key words chlorophyll fluorescence - control loop - frequency analysis - optical sensors - *physiostat* - UVB-radiation