# *The use of FTIR spectroscopy for process optimization of microalgae biotechnology*

Heiko Wagner, Christian Jebsen, Anne Jungandreas, Zhixin Liu, Christian Wilhelm

Universität Leipzig Biologie I -Pflanzenphysiologie

The research in microalgal biotechnology is recently forced to develop new solutions for the next generation of biofuels or the production of high valuable algal products e.g. carotenoids. Thus, the optimization of algal growth is of general interest. Furthermore, the cell specific macromolecular composition has to be optimized for the accumulation of the molecules of interest e.g. lipids or carbohydrates, whose cellular concentrations are strictly nutrient dependent and species specific. However, the chemical analysis of elemental cell quota for a nutrient dependent growth prediction or the measurement of cellular contents in carbohydrates, proteins or lipids by means of biochemical methods is time consuming and needs relative high amounts of cell material. Fourier transformed infrared spectroscopy (FTIR) can overcome some of these limitations due to its high reliability, sensitivity, and the potential for high throughput analysis. We show that with the help of a microtiterplate reader or a microscope based setup, FTIR spectra can be analyzed quantitatively from a few ng of cell material or only a small number of cells. We present recent FTIR models based on partial least square (PLS) algorithms for the determination of growth determining cell internal nutrient ratios like C:N, C:P and C:Si (in Diatoms), for several ecosystem dominating phytoplankton groups. Furthermore, the macromolecule composition like general protein:carbohydrate:lipid ratios is investigated by FTIR methods with the perspective to replace biochemical methods which can substantially increase the efficiency of screening processes and metabolic engineering.