UFZ-Seminar „Wasser and Environment“

HELMHOLTZ ZENTRUM FÜR UMWELTFORSCHUNG UFZ

14th December 2015, 3pm

Saal, Brückstr. 3a, Magdeburg

Liisa K. Rihko-Struckmann

Group of Process Systems Engineering, Max Planck Institute for Dynamics of Complex Technical Systems

gives a talk on:

Green Microalgae – Cell factories for the production of chemicals and fuels?

Photosynthetic microorganisms such as green microalgae are promising option for the production of chemicals and fuel compounds from renewable source. These microorganisms are capable of synthesizing a wide range of compounds from sunlight and carbon dioxide at higher volumetric and areal productivities compared to terrestrial crops. From a commercial perspective, carotenoid pigments from natural origin are of great industrial relevance. Dunaliella salina is an example of microalgae species, which is commercially cultivated in saline open ponds for the production of natural carotenoids. We have carried out the mathematical modelling supported by lab-scale cultivations of D.salina for the b-carotene production [1]. The modeling and control of micro-organic cultivations is a very challenging task, because the biological cell populations represent a complex dynamic system. Additionally, biological systems exhibit strong variability in the phenotype, e.g. metabolite dynamics, which renders difficult experimental probing for model identification. The profile likelihood approach was applied, because it characterizes the model parameters and facilitates the development of predictive models.

The understanding of cellular up-/downstream interlinkages provides the basis for optimization on unit as well as on plant level. On the upstream side, accumulation of natural b-carotene in D. salina is a consequence of growth under adverse conditions (e.g. high light intensities or nutrient depletion). The environmental stress factors triggers a cellular response, which ultimately leads to storage of the high-value compound b-carotene in intracellular oil globules. However, the underlying cellular stress response can result in impaired growth or even cell death and thus negatively affect process robustness. On the downstream side, the initial, extreme low concentration of microalgal cells creates a challenge for existing separation and extraction techniques. Some experimental techniques of flocculation have been compared and analyzed to declare the potential to cope with product purification and ultimate extraction of b-carotene in D. salina. For that reason chemical and physical flocculation

methods are investigated as a ß-carotene harvesting approach for microalgae in comparison to the conventional method of centrifugation [2].

[1] M. Fachet, R. J. Flassig, L. K. Rihko-Struckmann and K. Sundmacher, A dynamic growth model of Dunaliella salina: Parameter identification and profile likelihood analysis, Bioresource Technol. 173 (2014) 21-
31.
[2] K. Pirwitz, L. K. Rihko-Struckmann, and K. Sundmacher, Comparison of flocculation methods for harvesting Dunaliella. Bioresource Technol. 196 (2015)145-152.

If you are interested to join via Video-Conference to UFZ Halle or UFZ Leipzig, please send a note to nina.baumbach@ufz.de by Friday, 11.12.15, 12am.