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Energetic analysis and modeling of metabolic functioning of eukaryotic microalgae under growth conditions in photobioreactor

G Cogne[1], **A Martzolff**[1], **A Bockmayr**[2], **C G Dussap**[3] and **J Legrand**[1]
[1]Université de Nantes, France
[2]DFG Research Center Matheon, Freie Universität, Germany
[3]Clermont Université, France

A constraint-based model for autotrophic growth of *Chlamydomonas reinhardtii* was developed. Special efforts were made to gather and integrate the set of known valuable constraints that can be expressed in biological systems such as microalgae. The model explicitly includes thermodynamic and energetic constraints on the functioning metabolism. A mixed integer linear programming method was used to determine the optimal flux distributions with regard to this set of constraints. Constraint-based modeling methods that facilitate predictions of reactant concentrations, reaction potentials, and enzyme activities are introduced to identify putative regulatory and control sites in biological networks by computing the minimal control scheme necessary to switch between metabolic modes. The developed model is used to apprehend bioenergetic adaptations in cells growing with reduced kinetic performance due to the existence of an increasing dark zone inside photobioreactors.

Biography

Guillaume Cogne was born in 1975. He graduated in 1999 from the Biochemical Engineering Department of Clermont-Ferrand University School of Engineering (CUST). Between 1999 and 2000, he worked for the European Space Research and Technology Centre (ESTEC) in Noordwijk, in the Netherlands, within the Thermal and Environmental Control section. He obtained his Ph.D. degree in Biochemical Engineering from Université Blaise Pascal in Clermont-Ferrand (2003). He joined the Laboratoire de GEnie des Procédés -Environnement-Agroalimentaire (GEPEA-UMR CNRS 6144) in 2005. His skills are related to study and modelling of culture processes of photosynthetic microorganisms. He particularly investigated analysis of light energy and mass transfer phenomena in reactors, and metabolic flux computation-based modelling of microbial behaviour. He has a strong experience in biological process engineering and (photo) bioreactor design.

guillaume.cogne@univ-nantes.fr