Modelling and assessment of the storage of nutrients in a mixed green microalgae culture

Bregua de la Sotilla, Marta; Wágner, Dorottya Sarolta; Valverde Pérez, Borja; van Wagenen, Jonathan Myerson; Angelidaki, Irini; Smets, Barth F.; Plósz, Benedek G.

Publication date:
2014

Document Version
Publisher's PDF, also known as Version of record

Modelling and assessment of the storage of nutrients in a mixed green microalgae culture

Marta Bregua de la Sotilla, **Dorottya Sarolta Wágner***, Borja Valverde-Pérez, Jonathan Van Wagenen, Irini Angelidaki, Barth F. Smets, Benedek Gy. Plósz*

Department of Environmental Engineering, Technical University of Denmark, Miljøvej, Building 113, DK-2800, Kgs. Lyngby, Denmark, E-mails: s131537@student.dtu.dk, dosaw@env.dtu.dk, bvape@env.dtu.dk, jovw@env.dtu.dk, bfsm@env.dtu.dk, beep@env.dtu.dk, *Corresponding authors

Abstract Particular scientific interest focuses on the development of cost-effective ways to recover resources, mainly nutrients (nitrogen and phosphorus), from the wastewater. The photobioreactor (PhBR) unit process operation can be used to cultivate microalgae as a means to recover nutrients and/or as a tertiary wastewater treatment process. Due to the uptake and storage of nutrients the cultivated microalgae can be further used in agriculture, i.e. as fertilizer. The objective of this study is to assess the uptake and storage of nutrients by a mixed green microalgal culture, isolated in an open wastewater pond. Laboratory-scale batch experiments were carried out in a 24-L open air-lift PhBR with constant light intensity (600 µmol m^{-2} s^{-1} on the surface) and constant aeration mixed with CO_2 (6%). According to microscopic observations, the mixed microalgal culture consists mainly of *Chlorella sp.* and *Scenedesmus sp.* and it was cultivated using the MWC+Se synthetic medium. The growth of algae biomass and the amount of nitrogen and phosphorous were monitored in the bulk liquid as well as inside the biomass. Five different initial nitrogen concentrations were assessed, while the amount of the other nutrients were kept constant. Dilutions were made in the end of each cycle to avoid self-shading of the biomass. The algal growth rate and the internal cell quota were assessed. An ASM-based biokinetic algae model, developed in a previous study by Wágner et al. (2014), was used to simulate and compare the measurement data. Data suggest (Figure 1) that the model simulations can effectively predict the uptake and storage of phosphorous. This was also the case for the nitrogen uptake and storage (data not shown).

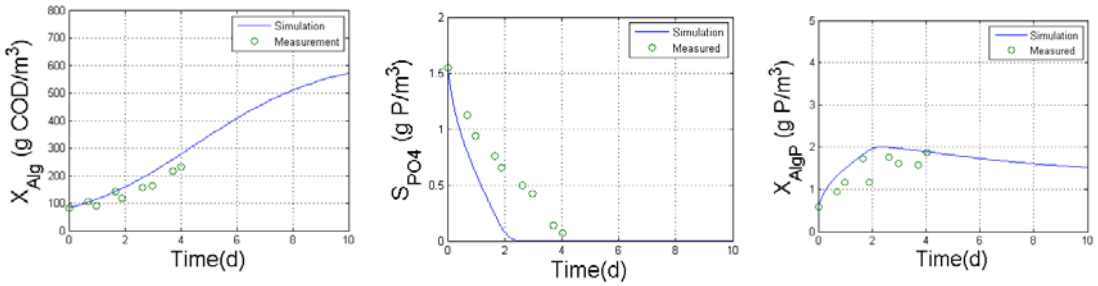

Figure 1: The growth, phosphorous uptake and internal phosphorous cell quota of the green mixed microalgae. The initial concentration of total phosphorous in the bulk liquid was 1.55 mg PO_4-P /l. Not all data is shown here.

Reference

Wágner D S, Valverde-Pérez B, Sæbø M, Van Wagenen J, Angelidaki I, Smets B F, Plósz B Gy. (2014). An activated sludge modeling framework for micro-algal growth in photobioreactors (ASM-A). *In preparation.*