Title: Optimized bioreactor setup for scale-up studies of extreme halophilic cultures

Authors: Nicole Mahler, Sebastian Tschirren, Stefan Pflügl, Christoph Herwig

PII: S1369-703X(17)30313-3
DOI: https://doi.org/10.1016/j.bej.2017.11.006
Reference: BEJ 6819

To appear in: *Biochemical Engineering Journal*

Received date: 7-6-2017
Revised date: 14-11-2017
Accepted date: 17-11-2017

Please cite this article as: Nicole Mahler, Sebastian Tschirren, Stefan Pflügl, Christoph Herwig, Optimized bioreactor setup for scale-up studies of extreme halophilic cultures, Biochemical Engineering Journal https://doi.org/10.1016/j.bej.2017.11.006

OPTIMIZED BIOREACTOR SETUP FOR SCALE-UP STUDIES OF EXTREME HALOPHILIC CULTURES

Nicole Mahler[1,2], Sebastian Tschirren[1], Stefan Pflügl[1,*], Christoph Herwig[1]

[1] TU Wien, Institute for Chemical, Environmental and Biological Engineering, Gumpendorfer Straße 1a, 1060 Vienna, Austria

[2] Kompetenzzentrum Holz GmbH, Altenbergerstraße 69, 4040 Linz, Austria

*Corresponding author:
E-Mail: stefan.pfluegl@tuwien.ac.at
Phone: +43 (1) 58801 166484

HIGHLIGHTS

- A customized bioreactor for continuous cultivation of halophilic organisms in pilot scale is proposed.
- The bubble column reactor design ensures more energy efficient processing than a conventional stirred tank reactor.
- Cell retention with a tangential flow filter enables high volumetric productivities that exceed the growth rate of the organisms.
- Saline industrial waste streams can be recycled and be used as source for salt in halophilic processing without pretreatment.

ABSTRACT

Adaptation to highly saline conditions required halophilic organisms to develop unique features. The mounting interest in those features has resulted in a number of potential applications for moderate and extreme halophiles. However, industrial exploitation has been reported only for few instances. With the aim to bring concepts from laboratory to pilot-scale a customized bioreactor for halophilic cultures was developed. The setup combined a bubble column reactor (BCR) with a membrane module for cell retention. The BCR was compared to a conventional stirred tank reactor (STR) in terms of physiological and hydro-dynamical parameters. The results showed that the BCR is preferable in terms of energy efficiency. The BCR reached a maximum k_La of 84 h^{-1} at ambient pressure, which equals an oxygen transfer rate (OTR) of 6 mmol/(L*h) in medium with 150 g/L NaCl. To reach this mass transfer a STR required more than 3-fold the amount of energy. Cultivation of the extreme halophilic archaeon *Haloferax mediterranei* showed suitability of the BCR for continuous halophilic processes.