



The effect of design and scale on the mixing and mass transfer in U-loop bioreactors

Petersen, Leander Adrian Haaning; Villadsen, John; Jørgensen, Sten Bay; Christensen, Ib ; Eliasson Lantz, Anna; Gernaey, Krist V.

Publication date:
2017

Document Version
Peer reviewed version

[Link back to DTU Orbit](#)

Citation (APA):
Petersen, L. A. H., Villadsen, J., Jørgensen, S. B., Christensen, I., Eliasson Lantz, A., & Gernaey, K. V. (2017). The effect of design and scale on the mixing and mass transfer in U-loop bioreactors. Abstract from Recent Advances in Fermentation Technology (RAFT 2017), Bonita Springs, United States.

DTU Library

Technical Information Center of Denmark

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

The effect of design and scale on the mixing and mass transfer in U-loop bioreactors

Leander Petersen^{1,2}, John Villadsen¹, Sten Bay Jørgensen¹, Ib Christensen², Anna Eliasson Lantz¹ and Krist V. Gernaey¹,

1)Technical University of Denmark, Kgs. Lyngby, Denmark,

2)Unibio A/S, Odense M, Denmark

Abstract

A system capable of handling a large volumetric gas fraction while providing a high gas to liquid mass transfer is a necessity if the methanotrophic bacterium *Methylococcus capsulatus* is to be used in single cell protein (SCP) production.

Previous studies have proven that a U-loop fermenter, a novel vertical forced flow loop reactor where gas and liquid are driven through a series of static mixers in a U-shaped pipe, is quite capable of coping with these challenges in pilot scale. The critical question remains; what happens when the scale undergoes a more than 10 fold increase and the geometry is altered?

In this study we have investigated the mixing time and mass transfer capabilities of U-loop reactors of different geometries (high vs. diameter ratio) in pilot (0.15m³) and semi-industrial scales (2.2m³). A new expression for the mechanical power input into the system is also proposed, which indicates that an even more favorable relationship between power input and mass transfer rate (compared to previous literature) applies to U-loop fermenters.