



Design of a gas-inducing impeller using Computational Fluid Dynamics

Pereira Rosinha Grundtvig, Ines; Hybschmann, Tim; Gernaey, Krist V.; Svendsen, Tore C.; Krühne, Ulrich

Publication date:
2017

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

[Link back to DTU Orbit](#)

Citation (APA):
Pereira Rosinha Grundtvig, I., Hybschmann, T., Gernaey, K. V., Svendsen, T. C., & Krühne, U. (2017). *Design of a gas-inducing impeller using Computational Fluid Dynamics*. Abstract from 10th World Congress of Chemical Engineering (WCCE10), Barcelona, Spain.

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.

Design of a gas-inducing impeller using Computational Fluid Dynamics

Ines Rosinha Grundtvig¹, Tim Hybschmann¹, Krist Gernaey¹, Tore C. Svendsen², Ulrich Krühne¹

¹CAPEC-PROCESS Research Center, Department of Chemical and Biochemical Engineering, Technical University of Denmark, Søtofts Plads, Building 229, 2800 Kongens Lyngby, Denmark

²BIO-AQUA, Strøbjergvej 29, 3600 Frederikssund, Denmark

Industrial bioreactors are commonly characterized by non-uniform substrate and microorganism concentration profiles due to poor mixing which subsequently results in low yield reaction systems. The impeller design is a critical component to promote the mixing inside the bioreactors.

In this work computational fluid dynamics (CFD) is used as a tool in order to model and improve the design and performance of a gas-inducing impeller from BIO-AQUA. BIO-AQUA is a Danish company specialized in developing wastewater treatment solutions for industry. The company has developed a fixed biological film reactor for aerobic decomposition of organic matter. The dispersion of air in the bioreactor is achieved by a gas-inducing impeller. A gas-inducing impeller provides both the agitation in the reactor and promotes the self-induction of air by reducing the pressure at the tip of the impeller. The rotational speed of the impeller leads to a decrease of the pressure due to the acceleration of the liquid around it. The rotation of the impeller generates a pressure difference inside the hollow shaft which promotes the transport of air from the opening at the top of the shaft into the liquid medium.[1]

The main goal of this computational investigation is to make a test design of the impeller developed BIO-AQUA. The original impeller designed is characterized by 30 blades and by a cover with a shape of a hat that sits on top of the impeller (see Figure 1). The “hat” has demonstrated to help on the dispersion of air throughout the tank. The test design will include 3 different designs which are based on the original impeller shape. The 3 new designs include different shapes of blade tips and different configurations of the “hat”.

The main result of this study is to find the most energy efficient design with the optimal air dispersion in the bioreactor.

References

- [1] A.W. Patwardhan, J.B. Joshi, Design of Gas-Inducing Reactors, Ind. Eng. Chem. Res. 38 (1999) 49–80