Evaluation of the energy efficiency of enzyme fermentation by mechanistic modeling

Modeling biotechnological processes is key to obtaining increased productivity and efficiency. Particularly crucial to successful modeling of such systems is the coupling of the physical transport phenomena and the biological activity in one model. We have applied a model for the expression of cellulolytic enzymes by the filamentous fungus Trichoderma reesei and found excellent agreement with experimental data. The most influential factor was demonstrated to be viscosity and its influence on mass transfer. Not surprisingly, the biological model is also shown to have high influence on the model prediction. At different rates of agitation and aeration as well as headspace pressure, we can predict the energy efficiency of oxygen transfer, a key process parameter for economical production of industrial enzymes. An inverse relationship between the productivity and energy efficiency of the process was found. This modeling approach can be used by manufacturers to evaluate the enzyme fermentation process for a range of different process conditions with regard to energy efficiency.

General information
State: Published
Organisations: Department of Chemical and Biochemical Engineering, Novozymes AS
Contributors: Albaek, M. O., Gernaey, K. V., Hansen, M. S., Stocks, S. M.
Pages: 950-961
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Biotechnology and Bioengineering (Print)
Volume: 109
Issue number: 4
ISSN (Print): 0006-3592
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.07 SJR 1.372 SNIP 1.186
Web of Science (2017): Impact factor 3.952
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.14 SJR 1.447 SNIP 1.178
Web of Science (2016): Impact factor 4.481
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 4.44 SJR 1.632 SNIP 1.355
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 4.16 SJR 1.612 SNIP 1.395
Web of Science (2014): Impact factor 4.126
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.44 SJR 1.637 SNIP 1.427
Web of Science (2013): Impact factor 4.164
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 4.04 SJR 1.62 SNIP 1.364
Web of Science (2012): Impact factor 3.648
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 4.08 SJR 1.668 SNIP 1.481