

Spring 5-12-2016

# Non-invasive real-time monitoring of glucose and lactate by NIR-spectroscopy during perfusion CHO culture

Jean Hamel  
MIT, jhamel@mit.edu

Anita Wamakima  
MIT

Ruifan Pei  
MIT

Follow this and additional works at: [http://dc.engconfintl.org/cellculture\\_xv](http://dc.engconfintl.org/cellculture_xv)

 Part of the [Biomedical Engineering and Bioengineering Commons](#)

---

## Recommended Citation

1 Pasquini, Celio. (2003). Near Infrared Spectroscopy: fundamentals, practical aspects and analytical applications. *Journal of the Brazilian Chemical Society*, 14(2), 198-219. doi.org/10.1590/S0103-50532003000200006 2 Goldfeld, M., Christensen, J., Pollard, D., Gibson, E. R., Olesberg, J. T., Koerperick, E. J., Lanz, K., Small, G. W., Arnold, M. A. and Evans, C. E. (2014), Advanced near-infrared monitor for stable real-time measurement and control of *Pichia pastoris* bioprocesses. *Biotechnol Progress*, 30: 749–759. doi:10.1002/btpr.1890 3Warkiani, M.E., Kah, A., Tay P., Guan, G., Han, J. (2015). Membrane-less microfiltration using inertial microfluidics. *Scientific Reports*, 5:11018. doi: 10-1038/srep11018

## NON-INVASIVE REAL-TIME MONITORING OF GLUCOSE AND LACTATE BY NIR SPECTROSCOPY DURING PERFUSION CHO CULTURE

Jean-François Hamel, Massachusetts Institute of Technology  
[jhamel@mit.edu](mailto:jhamel@mit.edu)

Anita Wamakima, Massachusetts Institute of Technology  
Ruifan Pei, Massachusetts Institute of Technology

Keywords: Perfusion, CHO bioprocess, NIR Spectroscopy

Near-infrared spectroscopy (NIR) has been used to monitor glycerol and methanol, non-invasively during cultures of *Pichia pastoris*<sup>1,2</sup>. In this work, glucose and lactate were measured in Chinese Hamster Ovary (CHO) perfusion culture, in real time, using an online advanced NIR monitor and a reference offline biochemical analyzer. The 1.8-L culture started in the batch phase at 4 g/L glucose with  $0.3 \times 10^6$  cells/mL and reached  $1.5 \times 10^6$  cells/mL after 90 hours. Perfusion was then initiated and conducted for 10 days at 0.7 vvd, using a spiral membrane-less microfluidic device<sup>3</sup>. The maximum cell concentration was  $4 \times 10^6$  cells/mL at 160 hours and was maintained until the termination of the experiment. Online and offline trends were similar (Figure 1). Final concentrations of glucose and lactate were 2.2 g/L and 1.8 g/L, respectively. High performance liquid chromatography (HPLC) was used to measure IgG<sub>1</sub>.

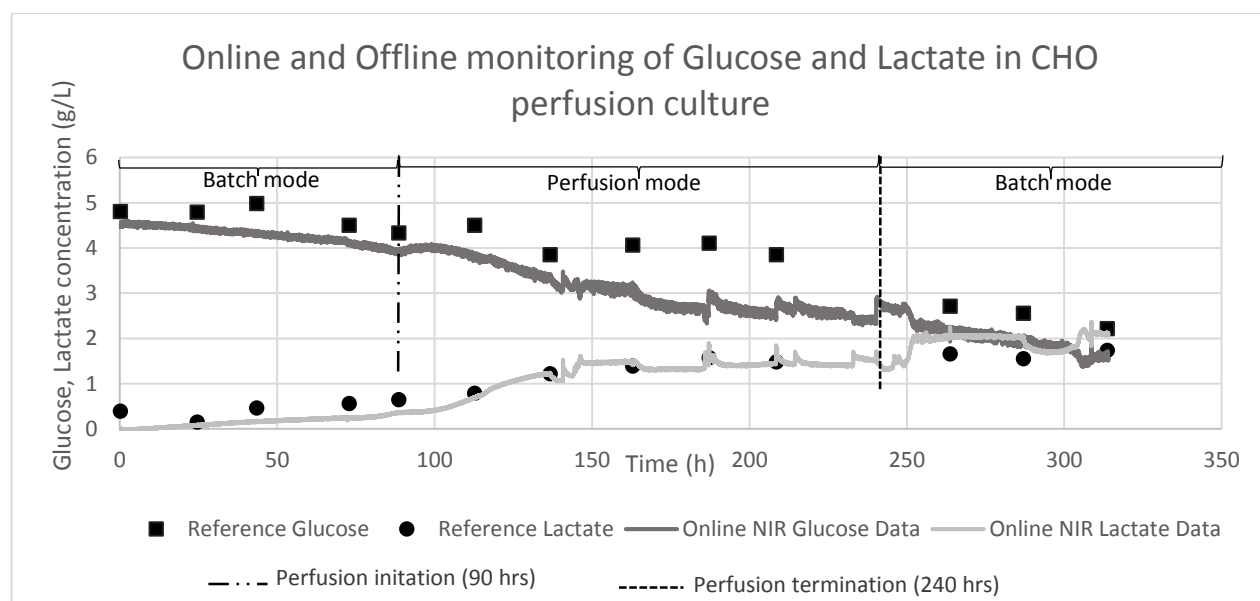


Figure 1. Glucose and lactate levels were measured online by the advanced NIR monitor and offline with a biochemical analyzer. Perfusion started at 90 hours, and terminated after 240 hours.

<sup>1</sup> Pasquini, Celio. (2003). Near Infrared Spectroscopy: fundamentals, practical aspects and analytical applications. *Journal of the Brazilian Chemical Society*, 14(2), 198-219. doi.org/10.1590/S0103-50532003000200006

<sup>2</sup> Goldfeld, M., Christensen, J., Pollard, D., Gibson, E. R., Olesberg, J. T., Koerperick, E. J., Lanz, K., Small, G. W., Arnold, M. A. and Evans, C. E. (2014), Advanced near-infrared monitor for stable real-time measurement and control of *Pichia pastoris* bioprocesses. *Biotechnol Progress*, 30: 749–759. doi:10.1002/btpr.1890

<sup>3</sup>Warkiani, M.E., Kah, A., Tay P., Guan, G., Han, J. (2015). Membrane-less microfiltration using inertial microfluidics. *Scientific Reports*, 5:11018. doi: 10-1038/srep11018