Performance of Appliflex ST single-use bioreactors for Sf9 insect cell cultivation

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Background

The threat of new viral diseases, such as the recent global COVID-19 outbreak, urges the need for rapid development of new vaccines. The baculovirus insect cell expression system can be used for the production of such vaccines. Insect cells grow well in suspension, allowing easy scale-up in stirred tank bioreactors (Van Oers, Pijlman, & Vlak, 2015), while the baculovirus can be quickly adapted to new virus strains.

When establishing the production process, rapid process development is of utmost importance. By avoiding cleaning and validation requirements, single-use bioreactors have the potential to achieve substantial time reductions and offer increased flexibility in both existing and new processes. The recent developments in the field of 3D printing technology further enhance the flexibility of single-use bioreactors.

In this study we compare the performance of 3D printed Appliflex ST single-use bioreactors with miniBio autoclavable glass bioreactors during cultivation of sf9 insect cells.

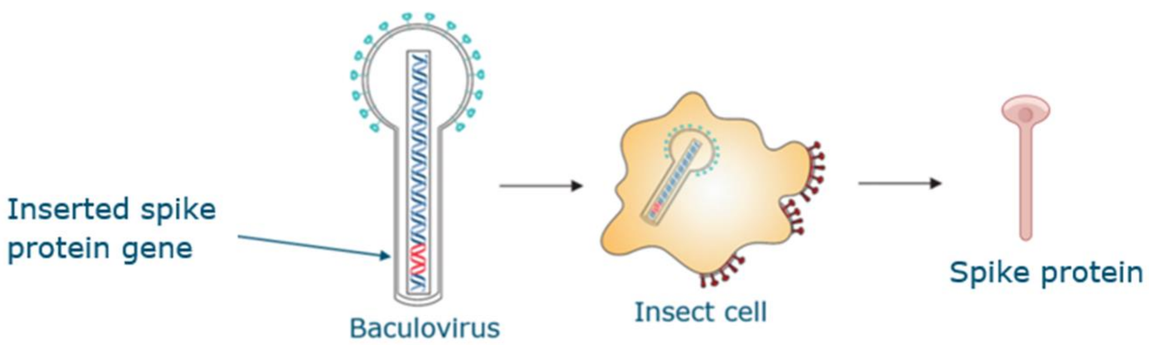

Figure 1: Schematic representation of protein expression using the baculovirus insect expression system (adapted from Sedova et al., 2012).

Objective

Evaluate the performance of single-use bioreactors for the cultivation of Sf9 insect cells.

Methods

- ExpiSf9 cells (ThermoFisher) were cultured in chemically defined ExpiSF medium (ThermoFisher)
- miniBio 500 and Appliflex ST 500 bioreactors operated with 400mL working volume, DO=30%, T=27ºC, 600 rpm (Applikon)
- Pure O_2 added through open hole or porous spargers
- Cell density and viability determined by TC20 automatic cell counter (BioRad)

Preparation Time	
Appliflex ST single-use bioreactor	**miniBio autoclavable bioreactor**
1-2 hours	1-2 days

Figure 2: Experimental reactor setup with miniBio (left) and Appliflex ST (right) bioreactors.

Results

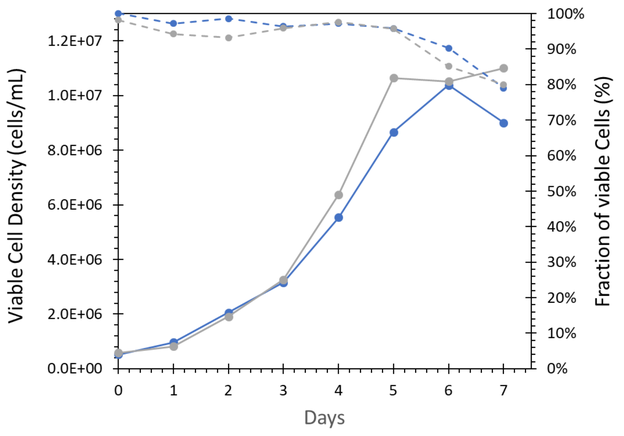

Figure 3: Viable cell densities and viabilities during Appliflex ST (silver) and miniBio (blue) bioreactor runs using a porous sparger.

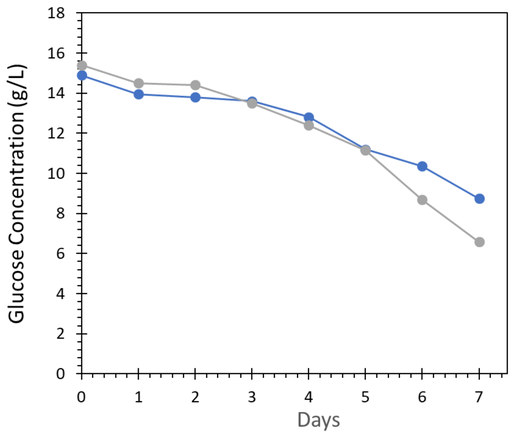

Figure 4: Glucose concentrations during Appliflex ST (silver) and miniBio bioreactor (blue) runs using a porous sparger.

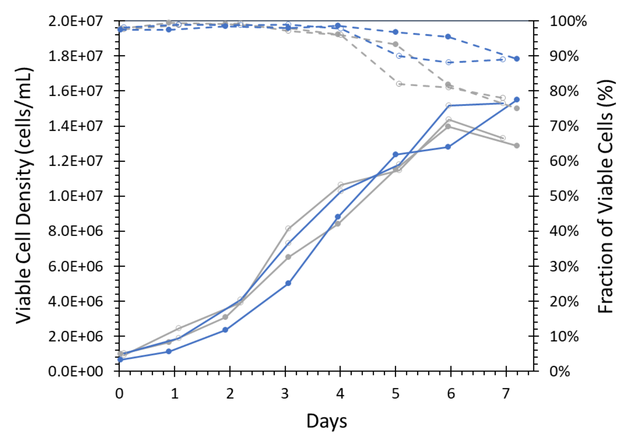

Figure 5: Viable cell densities and viabilities during Appliflex ST (silver) and miniBio bioreactor (blue) runs using an open hole sparger. Open and closed markers indicate duplicate experiments

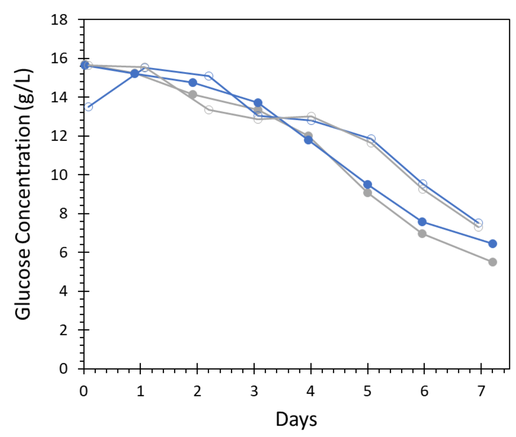

Figure 6: Glucose concentrations during Appliflex ST (silver) and miniBio bioreactor (blue) runs using open hole sparger. Open and closed markers indicate duplicate experiments

Conclusions

- Performance in the Appliflex ST is comparable to the miniBio system in terms of cell growth, viability and glucose consumption
- Higher maximum viable cell densities reached using open hole spargers
- Significantly simplified and faster workflow with Appliflex ST single-use bioreactors

Acknowledgements

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