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CASE STUDY No. 003

Inline Monitoring of hiPSC Growth and Differentiation

Researchers' affiliations

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This work was developed at iBET, a private not-for-profit research-intensive institution with over 30 years of experience in developing innovative solutions in Biotechnology and Life Sciences.
Key areas of expertise include the bioprocessing and in-depth characterization of Advanced Therapeutic Medicinal Products (ATMPs) such as stem cells for cell therapy. The study was performed in close collaboration with Clinica Universidad de Navarra and Takara Bio Europe AB.

Equipment

> DASGIP® Parallel Bioreactor System
> DASGIP glass vessel
> Incyte® permittivity sensor with Arc® View 265 controller (Hamilton®)

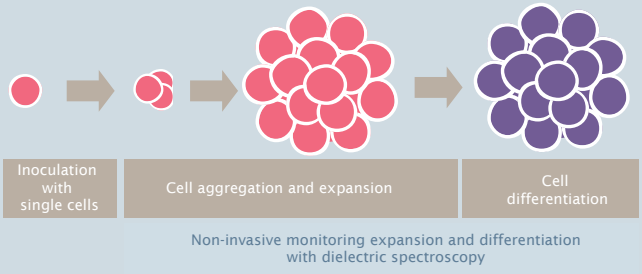
Challenge

Hepatocyte-like cells derived from human-induced pluripotent stem cells (hiPSCs) hold great promise in drug screening and regenerative medicine applications. They can be obtained in high numbers by culturing 3D cell aggregates in stirred-tank bioreactors in a well-defined and controlled environment.

As with other biomanufacturing processes, monitoring cell quality attributes is crucial. Conventional methods for monitoring the viability of cells in aggregates requires enzymatic disruption of the aggregates and is time-consuming and prone to error.

Strategy

To monitor hiPSC growth and differentiation as 3D cell aggregates in real-time in a non-invasive manner, dielectric spectroscopy was used. To do so, an *in situ* sensor was introduced to the bioreactor via a headplate port and permittivity was monitored with an Arc View controller.



Non-invasive monitoring expansion and differentiation with dielectric spectroscopy

Results

The permittivity signal correlated with the aggregate biovolume calculated by offline methods and can therefore be used to estimate the viable cell concentration. Furthermore, the permittivity scan at different frequencies (beta-dispersion curve) changed over culture time and, therefore, could potentially be used as an indicator for cell differentiation.

Conclusion

The study demonstrates the use of dielectric spectroscopy tools for monitoring expansion and differentiation of hiPSC aggregates in stirred-tank bioreactors. This PAT tool has the potential to improve bioprocess understanding, reduce costs, and increase quality consistency.

Read the full story

Isidro et al. Online monitoring of hiPSC expansion and hepatic differentiation in 3D culture by dielectric spectroscopy. *Biotechnology and Bioengineering*, 2021.

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