Ensuring defined oxygen levels in stem cell cultivation - a novel approach using DO online monitoring in multiwell plates

Arain S, John GT, Krause C

PreSens Precision Sensing GmbH, Josef-Engert-Str. 11, 93053 Regensburg, Germany

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At cultivation of stem cells, defined in-vitro conditions are important. Differentiation largely depends on the biological environment and growth conditions. Therefore, monitoring of essential parameters like oxygen and pH is of vital importance and enables systemic optimization of culture conditions for complex differentiation processes.

Differentiation of haematopoietic and neuronal stem cells needs exact hypoxic conditions to guarantee reproducible results. The SDR SensorDishR Reader enables for the first time non-invasive online monitoring of dissolved oxygen (DO) and pH in 24-well multidishes. Optical sensors for DO or pH are located at the bottom of each well and read out through the bottom of the multidish by a small and robust 24-channel reader. This reader can be placed in an incubator or on a shaker for continuous monitoring during the whole period of cultivation.

The application of the SensorDish Reader is demonstrated with examples for cultivation of human embryonic stem cells and haematopoietic stem/progenitor cells (HSPC). The cells were cultivated directly in the OxoDishR for online oxygen monitoring. Different oxygen levels of the gas phase were applied and the dissolved oxygen in the medium was measured for the whole time of the cultivation. The influence of opening the incubator, lifting the lid of the multidish, and of media change was also investigated as well as different cell concentrations.

With the SDR SensorDishR Reader, negative effects can be detected and resolved in time. Effects which had not been considered before can now be obtained and regarded, e.g. too high oxygen content in the medium can be avoided by media change under hypoxic incubator atmosphere. The non-invasive method of the system guarantees continuous monitoring during the whole cultivation and reduces the risk of contamination.