

A complete gas analysis solution in mammalian cell culture processes

Gas analysis of mammalian cell cultures

Gas analysis involves the precise analysis of the component concentrations of inlet and outlet gases of the bioreactors. The main components measured are oxygen and carbon dioxide (CO₂), but nitrogen and argon are also measured to calculate the respiratory quotient, rate of oxygen consumption and the rate of CO₂ evolution. Additional components that can be measured include water vapor, hydrogen, methane, methanol, ethanol, ammonia, hydrogen sulphide and many others.

The need

In any gas analysis it is essential to monitor the state of the cell cultures, since its health determines the conversion rate of nutrients, the formation of unwanted by-products and, in the worst case, the onset of poisoning. Analysis of the respiratory gases being fed into and produced from the cell culture is an ideal way of characterizing the behavior and productivity of the cells during the process. It is non-invasive and enables monitoring of the physiological state of the mammalian cell culture, including growth kinetics and substrate consumption. It also helps determine the optimum point to halt the process for maximum yield.

The technology

Mass spectrometers

Many cell cultures are characterized by small changes in oxygen and carbon dioxide concentrations at critical phases of the process. It is vital that the method used for measuring off gas is capable of fast, precise analysis. The speed of mass spectrometers makes it ideal for these applications.

Two types of mass spectrometers have been used to monitor mammalian cell culture processes; magnetic sector and quadrupole. The magnetic sector analyzers in the Thermo Scientific™ Prima family of mass spectrometers are laminated allowing fast and stable analysis of an unlimited number of user-defined gases.

If the mass spectrometer is to monitor multiple bioreactors a fast switch between streams is required. Thermo Fisher Scientific developed the unique Rapid Multistream Sampler (RMS) that allows fast sample selection for up to 64 streams.

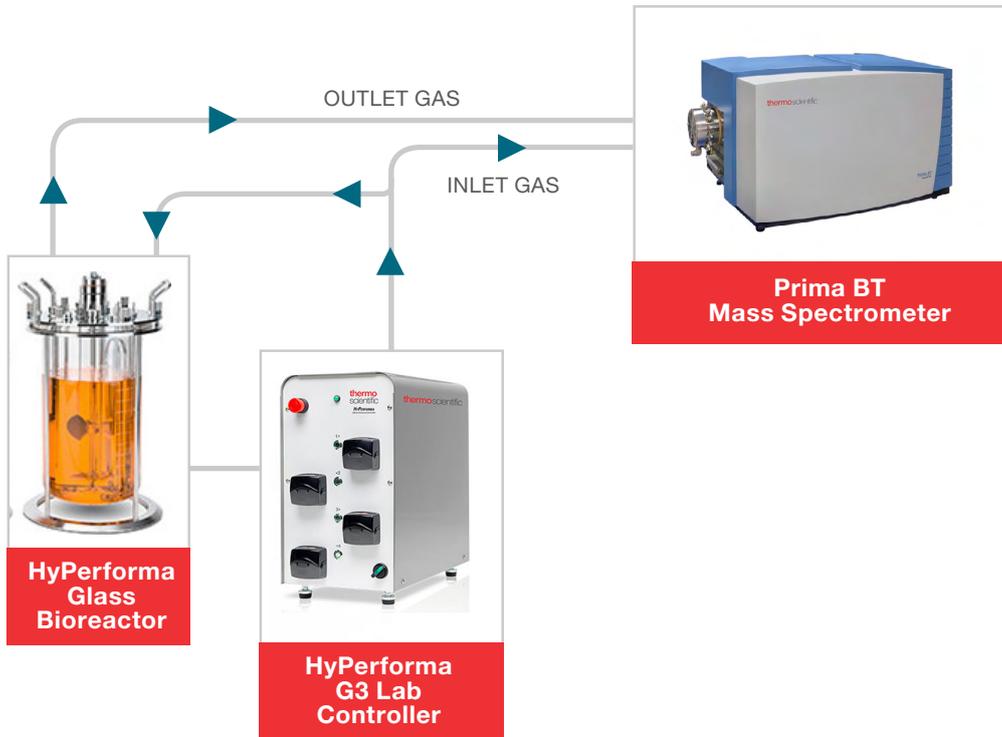
Bioreactors and controllers

Biopharmaceutical applications require a solution to support robust cell growth. At lab scale, Thermo Fisher offers some single use and glass bioreactors that are suitable for mammalian cell culture processes.

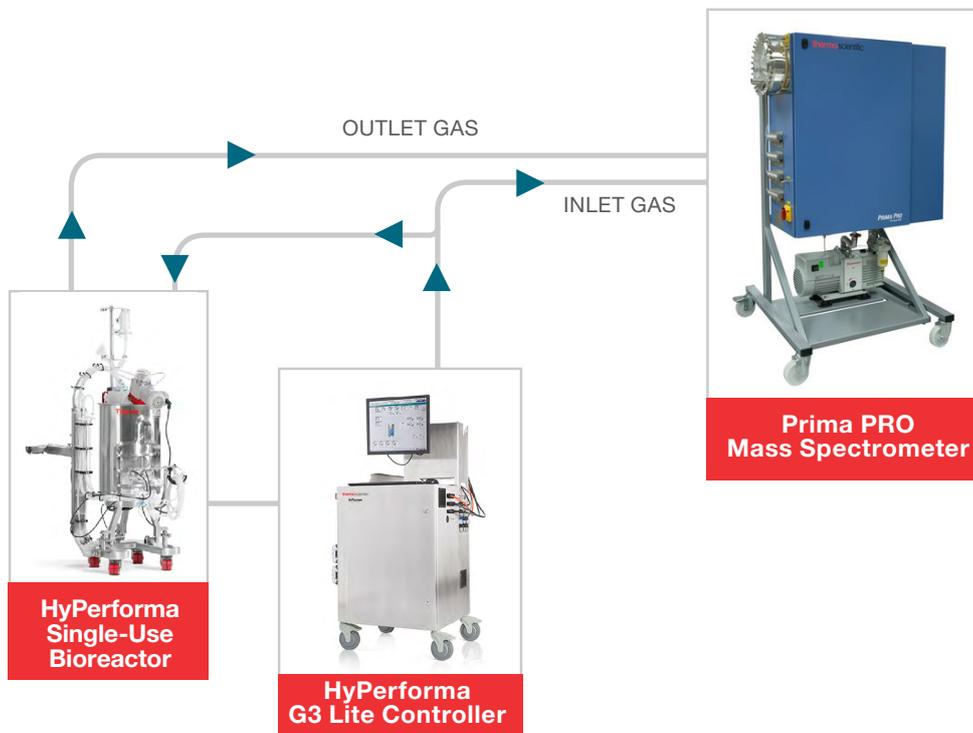
At the process development stage, the Thermo Scientific HyPerforma™ Single-Use Bioreactor (at scales of 30 L and 300 L) is optimized to meet the needs of mammalian cell culture processes. It is specifically engineered for cell culture processes by providing optimal oxygen mass transfer, mixing and temperature control. At the R&D and PD scale, the Thermo Scientific HyPerforma Glass Bioreactor is compatible.

The Thermo Scientific HyPerforma G3Lab Controller can control single-use bioreactors and autoclavable bioreactors. The controller operates using TruBio™ Software, which provides easy process scale-up or scale-down and the configurability to modify your control strategy along with your process. Large scale control platforms that also utilize the TruBio software are the Thermo Scientific HyPerforma G3Lite and G3 Pro Controllers that are suitable to operate production scale bioreactors.

The process: lab scale



The process: scale up



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