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On-line oxygen uptake rate and culture viability measurement of animal cell culture using microplates with integrated oxygen sensors

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Abstract:

O_2 uptake rates of animal cells (Chinese hamster ovary-CHO) were measured in 96-well microtiter plates by integrating with fluorescent sensors thereby measuring fluorescence intensity ratios of an O_2-sensitive and an insensitive fluorophor. O_2 consumption rate was estimated from measured dissolved O_2 and from O_2 mass transfer coefficient determined in advance. Specific uptake decreased with time from 3.2×10^{-13} mol O_2 $cell^{-1}$ h^{-1} at 15 h cultivation to 1.8×10^{-13} mol O_2 $cell^{-1}$ h^{-1} at 48 h. Specific O_2 uptake was also determined by sampling from a spinner-flask culture giving identical values. A cell viability assay for cultures based on O_2 measurements is described in which cells are incubated outside the fluorescence reader and then the dissolved O_2 is measured only once at a fixed time after the start of incubation. This protocol can be directly applied for high-throughput measurements.

Key-words: CHO cells, culture viability, fluorescent oxygen sensor, microtiter plates, oxygen uptake rate