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Fully automated single-use stirred-tank bioreactors for parallel microbial cultivations

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Abstract:

Single-use stirred tank bioreactors on a 10-mL scale operated in a magnetic-inductive bioreaction block for 48 bioreactors were equipped with individual stirrer-speed tracing, as well as individual DO- and pH-monitoring and control. A Hall-effect sensor system was integrated into the bioreaction block to measure individually the changes in magnetic field density caused by the rotating permanent magnets. A restart of the magnetic inductive drive was initiated automatically each time a Hall-effect sensor indicates one non-rotating gas-inducing stirrer. Individual DO and pH were monitored online by measuring the fluorescence decay time of two chemical sensors immobilized at the bottom of each single-use bioreactor. Parallel DO measurements were shown to be very reliable and independently from the fermentation media applied in this study for the cultivation of *Escherichia coli* and *Saccharomyces cerevisiae*. The standard deviation of parallel pH measurements was pH 0.1 at pH 7.0 at the minimum and increased to a standard deviation of pH 0.2 at pH 6.0 or at pH 8.5 with the complex medium applied for fermentations with *S. cerevisiae*. Parallel pH-control was thus shown to be meaningful with a tolerance band around the pH set-point of \pm pH 0.2 if the set-point is pH 6.0 or lower.

Key-words: Fermentation, stirred-tank, microbioreactor, stirrer-speed, pH, dissolved oxygen, fluorescence decay time