A Well-mixed, Polymer-based Microbioreactor with Integrated Optical Measurements - DTU Orbit (08/12/2018)

A Well-mixed, Polymer-based Microbioreactor with Integrated Optical Measurements

We describe a 150 µL microbioreactor fabricated in poly(methylmethacrylate) (PMMA) and poly(dimethylsiloxane) (PDMS) to cultivate microbial cell cultures. Mixing is achieved by a small magnetic stir bar and fluorescent sensors are integrated for on-line measurement of pH and dissolved oxygen. Optical transmission measurements are used for cell density. The body of the reactor is poly(methylmethacrylate) with a thin layer of poly (dimethylsiloxane) for aeration. Oxygen diffuses through this gas-permeable membrane into the microbioreactor to support metabolism of bacterial cells. Mixing in the reactor is characterized by observation of mixing of dyes and computational fluid dynamics simulations. The oxygenation is described in terms of measured KLa values for microbioreactor, 20–75/h corresponding to increasing stirring speed 200–800 rpm. Escherichia coli cell growth in the microbioreactor is demonstrated and the growth behavior is benchmarked with conventional bench-scale bioreactors, flasks and tubes. Batch culture experiments with Saccharomyces cerevisiae further demonstrate the reproducibility and flexibility of the microbioreactor system. © 2005 Wiley Periodicals, Inc.
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