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Characterization and application of an optical sensor for quantification of dissolved O₂ in shake-flasks

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Abstract:

On-line measurement of dissolved O₂ in shake-flasks was realized via immobilized sensor spots containing a fluorophore with an O₂-dependent luminescent decay time. An unaffected sensor signal during 80 autoclaving cycles suggests multi-usage of sensor equipped shake-flasks. The sensor had a response time of 6 s. Quantification of gas-liquid mass transfer revealed maximum k_la values of 150 h⁻¹, from which maximum O₂ transfer capacity of 33 mM h⁻¹ was calculated. Liquid volume and shaking frequency have a strong influence on k_la. Exemplified by cultivations of *Corynebacterium glutamicum* the importance of shaking rate for O₂ supply of bacterial cultures is shown. Sampling of microbial cultures with intermittent shaking of a few minutes can cause O₂ limitation. Based on the results of this work a simple and straightforward tool is now available for accurate O₂ sensing in shake-flasks, which are widely used in microbial cultivations.

Key-words: *Corynebacterium glutamicum*, gas-liquid mass transfer, optical sensor, oxygen, shake-flask