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## **Milliliter-Scale Stirred Tank Reactors for the Cultivation of Microorganisms**

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### **Abstract:**

This review focuses on recent developments in the field of miniaturized stirred tank bioreactors for application in high-throughput bioprocess development. Different reactor concepts and their potential for parallel bioprocess development are discussed. A detailed description of important engineering state variables, their measurement at small-scale and their implication for scale-up and scale-down of bioprocesses are given. Examples of two different parallel cultivations at small-scale are presented: one with *Escherichia coli* and the other one with the filamentous microorganism *Streptomyces tendae*. It is shown that results obtained in parallelized milliliter-scale stirred tank reactors can be scaled up to the laboratory- and/or pilot-scale in a highly reliable manner. This helps to reduce development times for bioprocesses significantly. Finally, directions for future research are presented.

Key-words: miniaturized stirred tank bioreactor, high-throughput, parallel bioprocess development, oxygen transfer, power input