Poster

Characterization of an innovative agitation and aeration system for the optimization of industrial bioprocesses

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ABSTRACT

Motivation: In the biotechnology industry, optimizing bioprocesses is crucial for improving efficiency, sustainability, and competitiveness. Stirred-tank bioreactors are widely used, but traditional aeration and agitation systems face challenges like inefficient oxygen transfer and high energy consumption, which drive the need for more effective, sustainable solutions (Shukla et al., 2001).

Biomixing S.L. addresses this gap by developing innovative agitation and aeration systems that improve oxygen transfer, nutrient distribution, and reduce shear stress on microorganisms. The company uses advanced tools like computational fluid dynamics (CFD) and mathematical modeling to optimize system performance (Doran, 2013).

Methods: This study characterizes and validates the Biomixing system using methods based on the DECHEMA protocol, focusing on mixing time and volumetric oxygen transfer coefficient (kLa).To achieve this objective, we compared the performance of bioreactor from a golden brand using two different agitation/aeration systems: (1) the Biomixing system and (2) the widely used Rushton system. These methods allow for a thorough evaluation of system performance, providing insights into mixing efficiency, oxygen transfer, and biological impact in industrial bioprocesses (Meusel et al., 2016).

Results: The results showed improvements in mixing time and kLa values compared to the traditional Rushton turbine, confirming better oxygen transfer and mixing efficiency. These improvements were mainly observed at low rotation speeds, such as 400 and 250 rpm, where kLa increased by up to 150%. However, at speeds above 1000 rpm, the improvement were not so significant. Regarding mixing time, a 24% improvement was achieved at 700 rpm.

Conclusions: In conclusion, the optimized agitation and aeration system can lead to significant energy and resource savings by enhancing mixing efficiency and oxygen transfer. The system we have characterized is particularly well-suited for bioprocesses that demand rapid and uniform distribution of gases, nutrients and additives, ensuring optimal conditions for microbial or cellular growth. Additionally, its ability to improve oxygen transfer efficiency makes it especially beneficial for processes with high oxygen requirements, where maintaining adequate aeration is crucial for productivity and overall process performance.

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