

## DEVELOPMENT AND QUALIFICATION OF A SCALE-DOWN MODEL OF A COMMERCIAL MAMMALIAN CELL CULTURE BIOREACTOR USING COMPUTATIONAL FLUID DYNAMICS

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The use of computational fluid dynamics (CFD) techniques can be used to develop and/or optimize a scale-down model to investigate mixing, oxygen mass transfer characteristics and turbulence, strain rate, and bubble size distribution in laboratory-scale stirred-tank bioreactors. In this work, CFD was used to test and modify a laboratory-scale bioreactor model of a manufacturing-scale bioreactor. The laboratory-scale model was originally established based on power per volume (P/V) and volume of gas per bioreactor volume per minute (vvm). CFD simulations of mixing time, power input, and gas volume hold-up were performed to demonstrate comparability between the laboratory-scale model and the manufacturing-scale bioreactor. These simulations were verified with experimental measurement of mixing time and gas hold-up. The results were used to propose sparge rate and impeller agitation as factors in a Design of Experiments (DoE) study in laboratory-scale bioreactors. The impact of sparge rate and impeller agitation on cell growth, productivity, and product quality attributes were evaluated in the DOE study. The laboratory-scale production bioreactor model was compared to the manufacturing-scale production bioreactor. The results confirmed that CFD techniques could be used to establish sparge rate and impeller agitation to improve a scale-down model.