A CFD model for determining mixing and mass transfer in a high power agitated bioreactor

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A CFD model for determining mixing and mass transfer in a high power agitated bioreactor

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Prediction of mixing and mass transfer in agitated systems is a vital tool for process development and scale up in industrial biotechnology. In particular key process parameters such as mixing time and k_La are essential for bioprocess development [1]. In this work the mixing and mass transfer performance of a high power agitated pilot scale bioreactor has been characterized using a novel combination of computational fluid dynamics (CFD) and experimental investigations. The effect of turbulence inside the vessel was found to be most efficiently described by using the k-ε model with regards to computational effort and required accuracy for industrial application. Mixing time was determined by carrying out sodium chloride tracer experiments at various bulk viscosities and agitation speeds, while tracking the conductivity. The mixing performance was predicted with one-phase CFD simulations and showed good agreement with the experimental data. The mass transfer coefficient was determined during three fed batch *Trichoderma reesei* fermentations at different process conditions previously described in [2]. Similarly the mass transfer was predicted by Higbie's penetration model [3] from two-phase CFD simulations, and the overall mass transfer coefficient was found to be in accordance with experimental data. This work illustrates the possibility of predicting the hydrodynamic performance of an agitated bioreactor using validated CFD models. These models can be applied in the testing of new bioreactor configurations, and to illustrate the effect of changing the physical process conditions.
This is a showcase of how we have expanded our work in the area of mixing from microscale reactors to pilot scale industrial systems and we would like to present this work in order to receive feedback.

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