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Applicability of a modified breakage and coalescence model based on the complete turbulence spectrum concept for CFD simulation of gas-liquid mass transfer in a stirred tank reactor

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Highlights

- The Original model over-predicts bubble sizes since it considers only the sub-range of turbulence scales.
- The Complete Energy cascade improves the accurate in gas-liquid CFD-PBM models.
- Hybrid geometries (axial-radial flow patterns) increase simulated $k_L a$ in a stirred bioreactors.

Abstract

Functions) code. CFD results are compared with experimental data obtained from Sauter mean diameter measurements at different bioreactor positions and stirred by a Rushton turbine. A reasonable prediction is obtained in comparison with the original Coulaloglou and Tavlarides (Break up) and Prince and Blanch (Coalescence) model. Further, the generalized model was extended to other stirring and aeration geometries using the same 10 litter tank bioreactor. The latter for evaluating strategies for overcoming gas-liquid mass transfer problems commonly found in bioreactors and a significant effect of the energy spectrum is reached in the geometries studied. The above, explained by the $k_L a$ oxygen transfer rate and bubble size determinations. It is numerically demonstrated that flow patterns and bubble size significantly influence the average $k_L a$ mass transfer in a bioreactor.

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Keywords

Bioreactor; , $k_L a$, Gas-liquid mass transfer; Energy spectrum; Population balance

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