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Quality of Mixedness Using Information Entropy in a Counter-Current Three-Phase Bubble Column

Publication date:	27.04.2024
Publication title:	Quality of Mixedness Using Information Entropy in a Counter-Current Three-Phase Bubble Column
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Journal information:	Processes

Knowledge of mixing phenomena is of great value in the mineral and other chemical and biochemical industries. This work aims to analyze the quality of mixedness (QM), the intrinsic mass transfer (MT) number, and the MT efficiency based on information entropy theory in the counter-current microstructured slurry bubble column. A thorough analysis is conducted to assess the effects of particle loading, gas and slurry velocity, and axial variation on the QM. The range of gas velocity, slurry velocity, particle size, and particle loading was 0.011–0.075 m/s, 0.018–0.058 m/s, 242.72–408.31 µm, and 15.54–88.94 kg/m3, respectively. QM is a time-dependent parameter, and the concept of contact time has been used for scale-up purposes. The maximum QM was achieved at dimensionless times of 0.40 × 10−3, 0.15 × 10−3, and 0.85 × 10−3 for the maximum superficial gas velocity, particle loading, and axial height, respectively. The gas velocity positively influenced both the intrinsic MT number and its efficiency. In contrast, the slurry velocity and particle loading had a negative effect. The present theoretical analysis will pave the path for industrial process intensification in counter-current flow systems.

Metryczka

Published by:	Marek Tańczyk
Published at:	08.05.2026 13:22
Number of views:	19