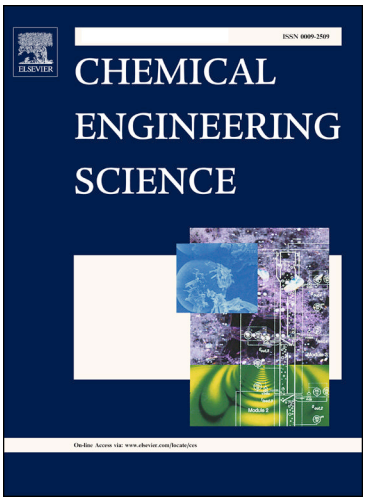

A comprehensive CFD study on the effect of dense vertical internals on the hydrodynamics and population balance model in bubble columns

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A comprehensive CFD study on the effect of dense vertical internals on the hydrodynamics and population balance model in bubble columns

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Highlights:

A CFD model for bubble columns equipped with dense vertical internals was developed.

The population balance model was coupled to the CFD model to study the bubble size distributions.

The inclusion of lift and wall lubrication forces was studied by applying different models.

The effect of the internals with different arrangements on the hydrodynamics in bubble columns was investigated.

A modification factor for the breakage and coalescence kernels was proposed.

Abstract

In this paper, the effects of dense vertical internals (rods) on gas holdup and local gas and liquid velocities were investigated by using the Eulerian-Eulerian model coupled with the population balance model. The inclusion of lift and wall lubrication forces was studied by applying different models. The results indicated that just by choosing the appropriate interfacial forces, the numerical model agrees well with the experimental data. A sharper gas holdup, a stronger gas velocity gradient, and a more intense liquid recirculation were observed as the important impacts of the internals. Moreover, three circular internals' arrangements were considered to study the effect of wall and core clearance distances on the bubble column hydrodynamics. The results revealed that by increasing the wall clearance distance, flatter gas holdup and velocity distributions could be achieved. Also, the turbulence parameters were used to evaluate the capability of the model in the prediction of the bubble size distribution. A modification factor for

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