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Hydrodynamics Study of Gas Hold-Up and Bubble Rise Velocity in Quadrilateral Bubble Column at Different Superficial Gas Velocity and Sparger Design

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Abstract. This project is motivated from the difficulties in understanding the complexity of the fluid dynamics of gas-liquid in bubble column reactor mainly in industrial processes. Numerical simulation on multiphase models is the best method for fluid dynamics investigations. CFD analysis is useful for understanding multiphase reactors for precise design and scale-up. To ensure the success of the simulation technique, a complete description of the actual system developed is outlined including details of parameters used and data acquisition aspects. Multiphase model use resolves the time-dependent, three-dimensional motion of uniform size of gas bubbles in liquid using ANSYS CFX 14.0 software. A standard k-ε model is used to describe turbulence occurring in the continuous fluid. Experimental data from bubble column with a ratio of height to column diameter of 10 : 1 are compared with numerical model of bubble column with ratio of 5 : 2 with two different types of sparger design will be optimized. For this study, the spargers are tested for three different value of superficial gas velocity of 0.0125 m/s, 0.0501 m/s and 0.0627 m/s. Each spargers design was modelled to provide sufficient mixing in the reactor for scale-up purposes. In addition to enhancing technical understanding, the validation of the models was applied and the comparison with numerical technique will improve the accuracy in analyzing the hydrodynamics of multiphase system.

Keywords: Bubble Column Reactor, CFD, Hydrodynamics, Gas Hold-Up, Superficial Gas Velocity