

Investigations of bubble size, gas hold-up, and bubble rise velocity in quadrilateral bubble column using high-speed camera

ABSTRACT

In this work, we have quantified the influence of superficial gas velocity and sparger design on bubble size, gas hold-up, and bubble rise velocity in quadrilateral bubble column test rig (0.2 x 0.2 m in cross-section and 2 m in height). Six sparger designs were used to generate homogeneous to heterogeneous flow regime for the investigation of the effect of superficial gas velocity and sparger design on gas holdup and bubble size distribution in a bubble column. This study has proved that the air distributor optimization can be recognized using high-speed camera technique. The size of bubbles inside the column is also affected by the size of orifice diameter and number of holes of the sparger. This study concludes that Sparger C and Sparger D design with orifice size 0.5 mm may use optimum gas flow rate to generate homogeneous bubbly flow with higher gas hold-up for better mixing process in this bubble column reactor. At heterogeneous flow regime, it was observed that the sparger orifice diameter shown little impact on the column behavior. The experimental results also can subsequently be applied to the development and validation of the proper mathematical model.

Keyword: Bubble column reactor; High-speed camera; Gas hold-up; Sparger plate; Superficial gas velocity; Bubble rise velocity