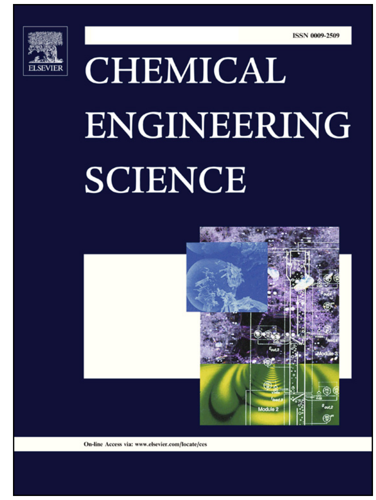

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VOID FRACTION, BUBBLE SIZE AND INTERFACIAL AREA MEASUREMENTS IN CO-CURRENT DOWNFLOW BUBBLE COLUMN REACTOR WITH MICROBUBBLE DISPERSION

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Abstract

Microbubbles dispersed in bubble column reactors have received great interest in recent years, due to their small size, stability, high gas-liquid interfacial area concentrations and longer residence times. The high gas-liquid interfacial area concentrations lead to high mass transfer rates compared to conventional bubble column reactors. In the present work, experiments have been performed in a downflow bubble column reactor with microbubbles generated and dispersed by a novel mechanism to determine the gas-liquid interfacial area concentrations by measuring the void fraction and bubble size distributions. Gamma-ray densitometry has been employed to determine the axial and radial distributions of void fraction and a high speed camera equipped with a borescope is used to measure the axial and radial variations of bubble sizes. Also, the effects of superficial gas and liquid velocities on the two-phase flow characteristics have been investigated. Further, reconstruction techniques of the radial void fraction profiles from the gamma densitometry's chordal void fraction measurements are discussed and compared for a bubble column reactor with dispersed microbubbles. Empirical correlations are also proposed to predict the Sauter mean bubble diameter. The results demonstrate that the new bubble generation technique offers high interfacial area concentrations (1,000 to 4,500 m^2/m^3) with sub-millimeter bubbles (500 to 900 μm) and high overall void fractions (10% – 60%) in comparison with previous bubble column reactor designs.