Computational fluid dynamics of gas-organic liquid bubble column under high pressure

Tran Van Bay, Ngo Ich Son[1], 임영일[1,†], 배건[2], 이동현[2], 고강석[3], 노 남선[3]
한경대학교; [1]CoSPE; [2]Sungkyunkwan University; [3]KIER
(limyi@hknu.ac.kr[†])

A two-phase computational fluid dynamics (CFD) model coupled with the population balance equation (PBE) was developed in a homogeneous air-kerosene bubble column under high pressure (P). The hydrodynamics in terms of specific pressure drop ($\Delta P/L$), gas holdup (α_G), and Sauter mean diameter (d_{32}) were experimentally measured in a bubble column with 1.8 m height and 0.1 m inner diameter, which was operated at a superficial gas velocity of 12.3 mm/s, and P = 1-35 bar. The drag coefficient model was modified to consider the effect of both bubble swarm and pressure on the hydrodynamics. The modified Luo breakage model accounted for the liquid density, viscosity, surface tension and gas density. The calculated $\Delta P/L$, α_G, and d_{32} were compared with experimental data, and the gas density-dependent parameters of the CFD model were identified. With increasing P from 1 to 35 bar, the α_G varied from 5.4% to 7.2% and the d_{32} decreased from 2.3 to 1.5 mm. The CFD-PBE model is applicable to predict hydrodynamics of homogeneous bubble columns for gas-organic liquid under elevated pressure.