CFD-PBE model with drag and breakage correction factors for an air-kerosene bubble column operating at high pressure

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A gas-liquid Eulerian computational fluid dynamics (CFD) coupled with the population balance equation (PBE) was developed in an air-kerosene bubble column at elevated pressure. The drag force and bubble breakup are two important factors influencing the hydrodynamics. Low drag force shortened the bubble's residence time, which led to the decrease of gas holdup. High bubble breakage produced small bubbles leading to the increase of gas holdup. High pressure and low surface tension enhanced bubble breakup and hindered bubble coalescence. Two parameters in the CFD-PBE model including the drag and breakage correction factors (DBCFs) accounted for the effect of pressure on drag force and bubble breakup. The DBCFs were estimated using CFD-PBE simulations which were fitted with experimental data in terms of gas holdup, pressure drop, bubble size, gas-liquid interfacial area and bubble size distribution. The CFD-PBE model with DBCF has a potential to predict hydrodynamics of a gas-organic liquid bubble column.