

Movement of Taylor bubble in various fluids through vertical and inclined tube

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Abstract

This study investigated gas-liquid or liquid-liquid slug flow and the formation of Taylor bubble, driven by buoyancy and drag forces resulted from three different lighter fluids' movement in water. The fluids chosen were soybean oil, diesel and kerosene. The fluid flow was experimentally investigated for inclination angles of 90°, 70°, 10° and 5°. Runs were conducted in a 0.03 m ID, 1 m long glass tube utilizing tap water and atmospheric air. Taylor bubble rise velocities with these specified fluids ranged from 0.038 to 0.25 ms⁻¹. The effect of distortion and deformation of the Taylor bubble showed that at higher inclinations with respect to horizon, rise velocity increased. At near horizontal inclination, the Taylor bubble rise velocity decreased with decreasing inclination as predicted by previous workers. The squared residual sum showed the variation of the theoretical to experimental value of Froude number. Different correlations of previous research for air-water flow could be used to predict the rise velocity of the Taylor bubble of oils/air in denser fluid environment. The equation derived utilizing linear regression relating Taylor bubble rise velocity to density, viscosity and surface tension of the bubble could be used to define the Taylor bubble rise for any oil through a water medium.

Keywords: Taylor bubble, vertical tube, inclined tube, air-water, oil-water, rise velocity.

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