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Experimental study of the hydrodynamic behaviour of slug flow in a horizontal pipe

M Abdulkadir^{1,2}, E Sam-Mbomah², I S Lowndes³ and B J Azzopardi³

¹Federal University of Technology, Nigeria

²African University of Science and Technology, Nigeria

³University of Nottingham, United Kingdom

In the oil and gas industry the persistence and sudden introduction of slug flow along horizontal pipes at low to intermediate liquid and gas velocities in gas-liquid flows have a serious influence in the design of surface facilities. A thorough understanding of the nature and hydrodynamics behaviour of slug flow is therefore of importance. This paper presents an investigation of the hydrodynamics behaviour of slug flow in a horizontal 67 mm internal diameter pipe. A series of pipe flow experiments concerned specifically with slug flow were performed for a range of injected air superficial velocities over the range 0.34 to 0.95 m/s, whilst the liquid superficial velocities ranged from 0.05 to 0.38 m/s. Electrical Capacitance Tomography (ECT) was used to determine: the velocities of the Taylor bubbles and liquid slugs, the slug frequencies, the lengths of Taylor bubbles and the liquid slugs, the void fractions within the Taylor bubbles and liquid slugs and the liquid film thicknesses. It was found that the translational velocity of a Taylor bubble was strongly dependent on the mixture superficial velocity. As the gas superficial velocity, was increased, the void fraction and the lengths of the liquid slugs and the Taylor bubbles were observed to increase. In addition, the frequencies of the liquid slugs were observed to increase as the liquid superficial velocity increases, but to be weakly dependant on the gas superficial velocity. Experimental data were also compared against empirical correlations for: slug frequency, translational velocity, lengths of liquid slug and Taylor bubbles and a reasonably good agreement was observed.

Biography

Mukhtar Abdulkadir has completed his PhD at the age of 34 years from the University of Nottingham, United Kingdom. He is a lecturer in the Department of Chemical Engineering, Federal University of Technology, Minna, Niger State, Nigeria. He is also a visiting Assistant Professor, Petroleum Engineering Department, African University of Science and Technology, Abuja, Nigeria. He has published more than 22 papers in reputed journals and 12 in international conference proceedings and serving as a reviewer for top journals of repute.

mukhau@futminna.edu.ng