Experimental Investigation of Pressure Drop for Gas / Shear Thinning Fluid Flows in a Horizontal Pipe

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Abstract

The objective of the study focuses on gas/non-Newtonian liquid horizontal flow in a pipeline. The gas and the liquid flow rates were varied over a wide range of flow conditions. The flow rate of the non-Newtonian liquid ranged from 0.023 to 0.115 m^3/s, while that of the gas ranged from 0.023 to 0.160 m^3/. The experiment was conducted to determine the pressure drop using a transparent pipe of 76.2 mm diameter and 2.44 m long horizontal pipe. Xanthan gum solution was used to simulate non-Newtonian fluid. The pressure drop gradient model of Lockhart-Martinelli was modified for gas/shear thinning fluid flow. The theoretical predictions of pressure loss were compared with the experimental data for air/shear thinning fluid flow results. From the experimental work, it was observed that the pressure drop was directly proportional with the concentration of Xanthan gum (shear thinning fluid). The flow regimes of bubbly, slug, plug and wavy flow were also captured by a high-speed camera.

Keywords

Gas/non-Newtonian liquid; shear thinning fluid; Pressure drop; Two-phase flow rates; visualization.