Computational Fluid Dynamics Simulations of Dispersed Flow of Viscous Oil in Water in a Horizontal Pipe

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Abstract

Heavy oil is a type of crude oil that has higher viscosity and heavier molecular composition than conventional oil. Our objective is to establish a methodology via Computational Fluid Dynamics simulations for efficient transportation of viscous oil in pipes in the form of dispersed oil droplets in water for oil and gas industry. Numerical simulations using Eulerian-Eulerian scheme are performed to model the experimental testing. Constant lift coefficient, C_L and oil droplet diameter, d, are assumed. Oil superficial-velocity (J_o) is kept constant at 0.64m/s, and water superficial-velocity (J_w) ranges from 2.2m/s to 2.6m/s. Simulation shows that positive C_L and large oil droplet diameters gives results resembling the experiments. In particular, C_L of 0.01 and oil drop diameter, d, of 4mm or 8mm show good agreement with the experiment. The results reveal insights into the mechanisms of dispersed oil-in-water flow and provide further understanding on how to control its flow mechanism.

Keywords: Viscous oil, dispersed oil-in-water, CFD simulations, pipe flow

Reference

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