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Research Article

Experimental and Computational Fluid Dynamics-Based Simulation of Oil-in-Water Emulsion Flow through a Pipeline

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Abstract

Due to its high viscosity, heavy crude oil (HCO) is often transported through pipelines as concentrated oil-in-water emulsion. Here, emulsions were prepared with different concentrations of polyoxyethylene (5) sorbitan monooleate to study their flow characteristics through a horizontal pipeline. Laminar flow of HCO and an emulsion with 75 % (v/v) HCO and 25 % (v/v) water was simulated by using Ansys Fluent 2019 R3 to study the effect of temperature, volumetric flow rate, and surfactant concentration on pressure drop, dynamic viscosity, hydrodynamic entrance length, flow behavior index, consistency index, and pumping power requirement. Laminar flow of the emulsion was simulated by using a two-phase mixture flow model considering the emulsion as a pseudo-homogeneous mixture, while the flow of HCO was simulated as viscous laminar flow. Flow behavior index and consistency index were predicted from experimental viscosity data and used to predict pressure drop and, hence, the pumping power requirement.

References

- 1 R. Martínez-Palou, M. de Lourdes Mosqueira, B. Zapata-Rendón, E. Mar-Juárez, C. Bernal-Huicochea, J. de la Cruz Clavel-López, J. Aburto, *J. Pet. Sci. Eng.* 2011, **75**, 274–282. DOI: <https://doi.org/10.1016/j.petrol.2010.11.020>