World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:12, No:10, 2018

The Effects of Water Fraction and Salinity on Crude Oil-Water Dispersions

Authors : Ramin Dabirian, Yi Zhang, Ilias Gavrielatos, Ram Mohan, Ovadia Shoham

Abstract : Oil-water emulsions can be found in almost every part of the petroleum industry, namely in reservoir rocks, drilling cuttings circulation, production in wells, transportation pipelines, surface facilities and refining process. However, it is necessary for oil production and refinery engineers to resolve the petroleum emulsion problems as well as to eliminate the contaminants in order to meet environmental standards, achieve the desired product quality and to improve equipment reliability and efficiency. A state-of-art Dispersion Characterization Rig (DCR) has been utilized to investigate crude oil-distilled water dispersion separation. Over 80 experimental tests were ran to investigate the flow behavior and stability of the dispersions. The experimental conditions include the effects of water cuts (25%, 50% and 75%), NaCl concentrations (0, 3.5% and 18%), mixture flow velocities (0.89 and 1.71 ft/s), and also orifice place types on the separation rate. The experimental data demonstrate that the water cut can significantly affects the separation time and efficiency. The dispersion with lower water cut takes longer time to separate and have low separation efficiency. The medium and lower water cuts will result in the formation of Mousse emulsion and the phase inversion happens around the medium water cut. The data also confirm that increasing the NaCl concentration in aqueous phase can increase the crude oil water dispersion separation efficiency especially at higher salinities. The separation profile for dispersions with lower salt concentrations has a lower sedimentation rate slope before the inflection point. Dispersions in all tests with higher salt concentrations have a larger sedimenting rate. The presence of NaCl can influence the interfacial tension gradients along the interface and it plays a role in avoiding the Mousse emulsion formation.

Keywords : oil-water dispersion, separation mechanism, phase inversion, emulsion formation
Conference Title : ICFD 2018 : International Conference on Fluid Dynamics
Conference Location : London, United Kingdom
Conference Dates : October 15-16, 2018