

Ultrasonic Techniques to Characterize and Monitor Water-in-Oil Emulsion

Authors : E. A. Alshaafi, A. Prakash

Abstract : Oil-water emulsions are commonly encountered in various industrial operations and at different stages of crude oil production and processing. Emulsions are often difficult to track and treat and can cause a number of costly problems which need to be avoided. The characteristics of the emulsion phase can vary with crude composition and types of impurities present in oil. The objectives of this study are the development of ultrasonic techniques to track and characterize emulsion phase generated during production and cleaning of crude oil. The position of emulsion layer is monitored with the help of ultrasonic probes suitably placed in the vessel. The sensitivity of the technique and its potential has been demonstrated based on extensive testing with different oil samples. The technique is also being developed to monitor emulsion phase characteristics such as stability, composition, and droplet size distribution. The ultrasonic parameters recorded are changes in acoustic velocity, signal attenuation and its frequency spectrum. Emulsion has been prepared with light mineral oil sample and the effects of various factors including mixing speed, temperature, surfactant, and solid particles concentrations have been investigated. The applied frequency for ultrasonic waves has been varied from 1 to 5 MHz to carry out a sensitivity analysis. Emulsion droplet structure is observed with optical microscopy and stability is examined by tracking the changes in ultrasonic parameters with time. A model based on ultrasonic attenuation spectroscopy is being developed and tested to track changes in droplet size distribution with time.

Keywords : ultrasonic techniques, emulsion, characterization, droplet size

Conference Title : ICOGR 2017 : International Conference on Oil and Gas Research

Conference Location : Montreal, Canada

Conference Dates : May 11-12, 2017