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Experimental and theoretical study of crude oil pretreatment using low-frequency ultrasonic waves

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Abstract

In this work, an ultrasound experimental setup was designed to investigate the feasibility of using low-frequency ultrasonic waves as a substitute to reduce the consumption of chemical demulsifiers in the pretreatment of crude oil. The experiments were planned to study the effects of irradiation time, ultrasonic field intensity and initial water content on the efficiency of separation. The results of experiments showed that by selecting a proper irradiation time and field intensity, it is possible to decrease the usage of demulsifiers by 50%. Moreover, a population balance model was proposed to explicate the experimental data. A hybrid coalescence model was developed to determine the frequency of aggregation. The parameters of the model were estimated by linear regression. The parameter estimation was performed using a parallel execution of the particle swarm optimization algorithm. The results of the model showed a decent agreement with the experimental data.

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