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# Enhancement Of Water-Oil Separation By Electrocoalescence

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*Vincenzino Vivacqua, Ph.d; Sameer Mhatre; Mojtaba Ghadiri; Aboubakr Abdullah; Ali Hassanpour; Mohammed Al-marri; Barry Azzopardi; Buddhika Hewakandamby; Bijan Kermani*

Corresponding author :
viva@qu.edu.qa
Qatar University, Doha, Qatar

## Abstract

Dispersed water droplets in organic liquids are commonly encountered in the oil, chemical and biochemical industries. A typical example is the separation of dispersed water drops in crude oil, in order to prevent catalyst fouling, viscosity and volume increase, and to meet quality specifications of the crude oil.
Water drops can be removed from a continuous oil phase by various techniques, such as chemical demulsification, gravity or centrifugal separation, pH adjustment, filtration, heat treatment, membrane separation and electrostatic-enhanced coalescence. Compared to other methods, electrical demulsification is considered to be superior in terms of energy efficiency.
The electrostatic effects arise from the much higher values of dielectric permittivity and conductivity of water in comparison to oil. However, the mechanism of electrocoalescence is still not fully understood and most of the conventional electro-separators are rather bulky. There is, therefore, a compelling need to optimize the design and operation of these separators by means of a better fundamental understanding of the underlying physics.
This study aims at investigating the coalescence behaviour of water droplets in sunflower oil when the aqueous phase is present in the form of a chain of droplets. Chains easily form in an emulsion, since droplets tend to align themselves with the direction of the electric field.
A pair of ladder-wise electrodes was implemented to set up an electric field almost parallel to the flow direction of the droplets. This design ensures that adjacent droplets in a chain experience the maximum attractive force and does not significantly disturb the hydrodynamics of the continuous phase. The effect of the electric field strength, frequency and waveform on the process performance has been investigated. Both constant and pulsed dc fields have been applied to the dispersion. Sinusoidal, sawtooth and square waves have been employed as pulsed dc waveforms. Droplet size distributions at the outlet of the device were measured by image analysis.
The outcomes of the research suggest that it is possible to find a combination of electrical field intensity, frequency and waveform to maximize the separation efficiency.

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