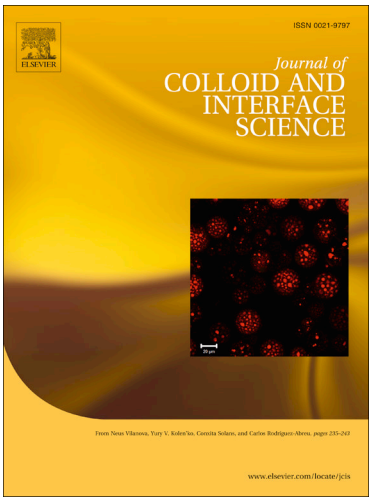


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# Breakup Characteristics of Aqueous Droplet with Surfactant in Oil under Direct Current Electric Field

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## Abstract:

The breakup process of aqueous droplet with surfactant suspended in oil under direct current (DC) electric field is investigated in this paper. The characteristics of the breakup process, stretching, necking and breakup, are discussed quantitatively with the electric capillary number *Ca* and the dimensionless surfactant concentration $C^*$ which is the ratio of surfactant concentration to the critical micelle concentration. The results show that the presence of surfactant reduces the steady deformation of droplet and significantly decelerates the stretching process, resulting from the redistribution of surfactant molecules within the oil/water interface. The law of droplet stretching process when $C^* \geq 1$ indicates that the exchange of surfactant molecules between the bulk phase and the interface could not catch up with the increase of oil/water interfacial area. *Ca* and $C^*$ count a great deal to the necking position and the daughter droplet size. The daughter droplet size decreases with the increase of surfactant concentration. These results provide a mechanistic framework to promote the electrocoalescence efficiency of oil/water emulsion and to the application of electric emulsification.

**Keywords:** droplet breakup; DC electric field; aqueous droplet in oil; surfactant

## 1. Introduction

In order to promote the separation efficiency of water-in-crude oil emulsions, the electrodehydration technology has been widely applied to the chemical industry [1,2]. The electric field induces attractive force between aqueous drops suspended in

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