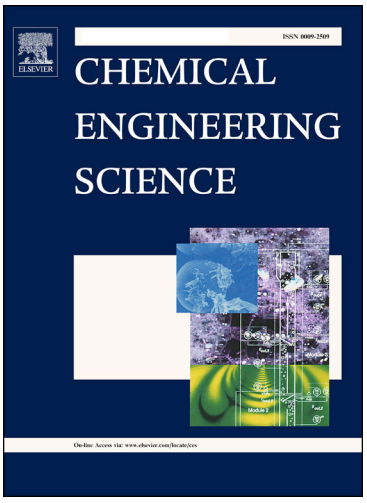

Interfacial behaviour, wettability alteration and emulsification characteristics of a novel surfactant: Implications for enhanced oil recovery

Nilanjan Pal, Neha Saxena, K.V. Divya Laxmi, Ajay Mandal

PII: S0009-2509(18)30276-8
DOI: https://doi.org/10.1016/j.ces.2018.04.062
Reference: CES 14194

To appear in: *Chemical Engineering Science*

Received Date: 5 February 2018
Revised Date: 11 April 2018
Accepted Date: 27 April 2018

Please cite this article as: N. Pal, N. Saxena, K.V. Divya Laxmi, A. Mandal, Interfacial behaviour, wettability alteration and emulsification characteristics of a novel surfactant: Implications for enhanced oil recovery, *Chemical Engineering Science* (2018), doi: https://doi.org/10.1016/j.ces.2018.04.062

Interfacial behaviour, wettability alteration and emulsification characteristics of a novel surfactant: Implications for enhanced oil recovery

Nilanjan Pal, Neha Saxena, K.V. Divya Laxmi, Ajay Mandal*

Department of Petroleum Engineering

Indian Institute of Technology (Indian School of Mines), Dhanbad-826004, India

**Corresponding Author, Email: ajay@iitism.ac.in*

Highlights

- A coconut oil-based anionic surfactant was synthesized and characterized.
- The surfactant showed ultra-low IFT values at the crude oil-aqueous interface.
- Surfactant showed good thermal stability and salt tolerance in aqueous phase.
- Rock wettability was suitably altered from intermediate-wet to water-wet state.
- Tertiary oil recovery improved significantly in the presence of polymer.

Abstract

The application of surfactants in enhanced oil recovery (EOR) processes aids in reducing interfacial tension at the oil-aqueous interface as well as altering the wetting nature of the reservoir rock. However, most commercial surfactants used in the petroleum industry are expensive. In an attempt to solve this issue, an anionic surfactant was synthesized from coconut oil as an alternative during oil recovery. The synthesized sodium ethyl ester sulfonate (SEES) surfactant was characterized by FT-IR, ^{1}H-NMR and TGA analyses. The critical micelle concentration (CMC) values of SEES surfactant were determined at different temperatures by electrical conductivity method. The interfacial tension (IFT) at the oil-aqueous interface was found to reduce to ultra-low magnitudes in the presence of salt. Alkali addition also plays a synergistic role in IFT reduction ability of SEES solutions. Surfactant solutions exhibited good salt tolerance levels and long-term thermal stability. SEES surfactant also showed improved wettability alteration property, changing the nature of oil-aged rock from intermediate-wet to water-wet. Synergism in wetting characteristics of SEES solution is achieved by salt addition. Additional recoveries of 20.05% was attained in the presence of 0.80 wt. % SEES only, which further increased to 33.49% and 34.79% by the addition of 0.01% and 0.02% PHPA polymer respectively.

Keywords