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Characterizing Adsorption of Associating Surfactants on Carbonates Surfaces

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Abstract

Hypothesis

The adsorption of anionic surfactants onto positively charged carbonate minerals is typically high due to electrostatic interactions. By blending anionic surfactants with cationic or zwitterionic surfactants, which naturally form surfactant complexes, surfactant adsorption is expected to be influenced by a competition between surfactant complexes and surfactant-surface interactions.

Experiments

The adsorption behavior of surfactant blends known to form complexes was investigated. The surfactants probed include an anionic C₁₅₋₁₈ internal olefin sulfonate (IOS), a zwitterionic lauryl betaine (LB), and an anionic C₁₃-alcohol polyethylene glycol ether carboxylic acid (L38). An analytical method based on high-performance liquid chromatography evaporative light scattering detector (HPLC-ELSD) was developed to measure three individual surfactant concentrations from a blended surfactant solution. The adsorption of the individual surfactants and surfactant blends were systematically investigated on different mineral surfaces using varying brine solutions.

Findings

LB adsorption on calcite surfaces was found to be significantly increased when blended with IOS or L38 since it forms surfactant complexes that partition to the surface. However, the total adsorption of the LB-IOS-L38 solution on dolomite decreased from 3.09 mg/m² to 1.97 mg/m² when blended together compared to single surfactant adsorption, which is beneficial for applications such as enhanced oil recovery.

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