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Exploring the Effects of Aromatic Molecules in Chemical Enhanced Oil Recovery

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ABSTRACT

Chemical enhanced oil recovery (cEOR) methods are being used as a viable contributor to the world's growing energy demands. Due to the complex chemical composition of crude oil, attempting to optimize the surfactant concentration and salinity of formulations is done empirically. This process can be very time intensive due to the wide variety of surfactant structures available for cEOR. Surfactant selection is typically done by matching the average chain length of the oil with that of the surfactant. In this study, we are trying to understand how aromatic structures present in Illinois Basin crude oil interact with surfactants. This will potentially help guide the process of surfactant selection. For this experiment, we used three model oils: dodecane, dodecane + 10% toluene, and dodecane + 35% toluene. We performed phase behavior testing with two anionic surfactants at a variety of salinities with the model oils. One surfactant is an alkyl propoxy sulfate and the other is alkyl benzene sulfonate. Measurement of the interfacial tension (IFT) between the oil and surfactant dissolved in an aqueous solution provides a quantitative measure of how efficiently the surfactant interacts with the oil. The lower the IFT, the more effective the surfactant. So far, we have observed significant differences in the micro emulsions when the model oil contains aromatics. The results suggest that surfactants containing aromatics play an important role in interacting with the aromatic groups present in the oil. It is anticipated that these results will provide mechanistic insight about the contribution of aromatic structures in surfactant selection.

KEYWORDS

Enhanced oil recovery, surfactant flooding, phase behavior, ultra-low interfacial tension