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Detailed Analysis of Mechanism of Crude Oil and Surfactant Emulsion

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Abstract : A number of surfactants which exhibit ultra-low interfacial tension and an excellent microemulsion phase behavior with crude oils of low to medium gravity are not sufficiently soluble at optimum salinity to produce stable aqueous solutions. Such solutions often show phase separation after a few days at reservoir temperature, which does not suffice the purpose and the time is short when compared to the residence time in a reservoir for a surfactant flood. The addition of polymer often exacerbates the problem although the poor stability of the surfactant at high salinity remains a pivotal issue. Surfactants such as SDS, Ctab with large hydrophobes produce lowest IFT, but are often not sufficiently water soluble at desired salinity. Hydrophilic co-solvents and/or co-surfactants are needed to make the surfactant-polymer solution stable at the desired salinity. This study focuses on contrasting the effect of addition of a co-solvent in stability of a surfactant –oil emulsion. The idea is to use a co-surfactant to increase stability of an emulsion. Stability of the emulsion is enhanced because of creation of micro-emulsion which is verified both visually and with the help of particle size analyzer at varying concentration of salinity, surfactant and co-surfactant. A lab-experimental method description is provided and the method is described in detail to permit readers to emulate all results. The stability of the oil-water emulsion is visualized with respect to time, temperature, salinity of the brine and concentration of the surfactant. Nonionic surfactant TX-100 when used as a co-surfactant increases the stability of the oil-water emulsion. The stability of the prepared emulsion is checked by observing the particle size distribution. For stable emulsion in volume% vs particle size curve, the peak should be obtained for particle size of 5-50 nm while for the unstable emulsion a bigger sized particles are observed. The UV-Visible spectroscopy is also used to visualize the fraction of oil that plays important role in the formation of micelles in stable emulsion. This is important as the study will help us to decide applicability of the surfactant based EOR method for a reservoir that contains a specific type of crude. The use of nonionic surfactant as a co-surfactant would also increase the efficiency of surfactant EOR. With the decline in oil discoveries during the last decades it is believed that EOR technologies will play a key role to meet the energy demand in years to come. Taking this into consideration, the work focuses on the optimization of the secondary recovery(Water flooding) with the help of surfactant and/or co-surfactants by creating desired conditions in the reservoir.

Keywords : co-surfactant, enhanced oil recovery, micro-emulsion, surfactant flooding
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