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Optimal Surfactant Selection for Chemical Enhanced Oil Recovery in Low Temperature, Low Salinity, High Hardness Reservoirs

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ABSTRACT

Based on the properties of the reservoir, only 20-30 % of the oil can be recovered using primary and secondary extraction methods. The remaining stranded oil can only be recovered via various enhanced oil recovery methods. Chemical enhanced oil recovery (EOR) uses specialty chemicals to extract trapped oil in rock layers by generating in-situ microemulsion in the presence of reservoir brine and oil. In this case study, phase behavior tests are conducted for microemulsion formation between the surfactant solution and the oil. The phase behavior tests model reservoirs with low temperature and low salinity. In order to narrow the selection of surfactants for testing, phase behavior tests and interfacial tension experiments were used to determine the equivalent alkane carbon number (EACN) of the oil in this reservoir. Along with phase testing, extensive interfacial tension measurements were carried out with the model oil and the reservoir fluid at various salinities. The reservoir sample oil was determined to have an EACN of around 12, which effectively models the hydrocarbon part of the multicomponent crude oil similar to a dodecane system. These results facilitate in method development for EACN determination and in the selection of the surfactants that will create optimum emulsion for high efficiency oil recovery in low temperature and low salinity reservoirs typical to the Illinois basin in the United States.

KEYWORDS

surfactant, microemulsion, equivalent alkane carbon number, phase behavior, interfacial tension