

Comparative Study of Enhanced Oil Recovery (EOR) Surfactant from Palm Oil and Stearic Acid to Improve Thermal Stability

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Abstract:

The most efficient enhanced oil recovery (EOR) method is chemical enhanced oil recovery (CEOR), in which the use of surfactants is considered a beneficial and efficient process. However, the use of surfactants based on vegetable oils, such as palm oil, can encounter thermal stability issues at high temperatures. The objective of this study is to improve the thermal stability of surfactants by selecting raw materials containing higher proportions of saturated fatty acids. To this end, a series of surfactants were synthesized from palm oil and stearic acid, each containing varying proportions of saturated fatty acids, to assess the impact of these components on thermal stability. The synthesized surfactants were then subjected to a comprehensive characterization approach, encompassing FTIR, EDX, TGA, and IFT analyses. The FTIR results revealed the presence of functional groups indicative of biodiesel and the synthesized surfactant. Furthermore, the TGA analysis revealed that stearic acid-based surfactants exhibited superior thermal stability compared to those derived from palm oil. IFT tests revealed that surfactants synthesized from palm oil had lower values, with concentrations of 0.1%, 0.5%, and 1% being 4.9×10^{-2} ; 4.3×10^{-2} ; and 2.8×10^{-2} dyne/cm, while surfactants synthesized with stearic acid at equivalent concentrations exhibited values of 5.8×10^{-2} ; 5.4×10^{-2} ; and 4.5×10^{-2} dyne/cm.

Keywords:

Chemical enhanced oil recovery, saturated fatty acid, unsaturated fatty acid, stearic acid, surfactant.