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Adsorption and Wettability Alteration of Polymer and Surfactant Using Native Core from Omani Oilfield for Alkaline-Surfactant-Polymer EOR Technique

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Abstract

Abstract

This study provides experimental investigation for surfactant and polymer adsorption on crushed core from Omani oilfield and Berea cores. Polymer and surfactant concentrations were measured using total organic carbon (TOC) analyzer and potentiometric titration, respectively. Also, the effect of surfactant and polymer adsorption on surface wettability was investigated by measurements of contact angle using glass slides and by Amott test using Cores from field of interest. The polymer and surfactant adsorptions were conducted at 50 ^{o}C for different salinities and pH conditions. Additionally, the adsorption of surfactant and polymer on glass beads, glass slides, and crushed cores were also qualitatively analyzed by SEM-EDS.

Results of this study showed that the polymer and surfactant adsorption followed Langmuir adsorption isotherm. The polymer adsorbed amount on crushed Cores from field of interest was around 450 mg/100 g at the plateau region while surfactant adsorption on crushed Berea core and crushed Cores from field of interest at the plateau region were almost 700 mg/100 g and 400 mg/100 g, respectively. Generally, polymer and surfactant adsorption increased with the increase in brine salinity from 0.5 to 3%. On the other hand, polymer adsorption indicated a complex behavior with pH where a deflection point at pH >6.0-8.0< was observed and surfactant adsorption show a parabolic trend (concave up) for pH. The SEM-EDS analysis showed higher adsorption of surfactant on crushed cores as compared to glass beads. Contact angle measurements for glass/brine/hexadecane and glass/brine/crude oil from field of interest systems revealed that the increase in salinity did not affect the wettability of glass slides incubated in brine and polymer, but at higher salinity (3 and 5%) surfactant treated slides showed reduction in contact angle. In addition, contact angle measurements for glass/brine/hexadecane showed that the increase in pH increased the contact angle for glass slides incubated in brine but it remained unchanged for polymer treated slides and higher contact angel observed at PH 8 for surfactant treated slides. While, For glass/brine/ crude oil from field of interest system, contact angle increased for brine, polymer, and surfactant when pH increased till pH 8, whereas in pH 12 treated slides, the oil drop spread immediately and the system became oil-wet. Amott tests using cores, brine and oil from field of interest confirmed the observations made by the contact angle measurements where surfactant made the core more oil-wet.