Influence of water salinity and hardness on the static adsorption of extended surfactants for enhanced oil recovery into the porous medium

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Up to date, the adsorption is one of the main problems to implement surfactant injection as a chemical Enhanced Oil Recovery method (EOR). This is because a large amount of the surfactant is trapped onto the rock, avoiding the surfactant to migrate to the interface and reduce the interfacial tension between water and oil. Different variables have been identified as promoters of this phenomenon, among which the electrolyte concentration of the medium is highlighted because it promotes the adsorption of the surfactant on the rock surface in most of cases. The influence of the salinity has been studied by different authors; however, the effect of the hardness on the surfactant adsorption is a subject that has not been deeply investigated. In this work, the influence of NaCl and $CaCl_2$ concentration on static adsorption of an anionic surfactant (Petro step S13D) on a mineral substrate (composed by Ottawa sand and Kaolin) was evaluated. For this purpose, several systems keeping the same surfactant concentration were prepared, in order to study the combined effect of both types of salts at high concentrations. Surfactant concentration were measured by two different titration methods depending on the surfactant concentration and surfactant adsorption isotherms were calculated by mass balance. Results confirmed that higher salinities lead to an increase in the amount of surfactant adsorption due to the interactions of the ions with the amphiphilic molecules and the substrate. However, when evaluating the effect of the hardness on the adsorption, it was shown that this parameter has a more complex effect on the system behavior, as the hardness ratio in the study system increased. Moreover, it has been shown that the interactions between surfactant molecules, divalent ions and porous medium is far more complicated than expected.

Biography: Christian Alberto Paternina Ortiz is a petroleum engineer driving his researches in the field of Enhanced Oil Recovery (EOR) at the Petroleum School of the Industrial University of Santander (Colombia). He holds a BSc in Petroleum Engineering and currently is pursuing a master of Hydrocarbon Engineering degree at the School of Petroleum Engineering in the same University. Christian worked during 2 years for the Energy Forecast Research Group. There, he developed some researches concerning the effect of geopolitics behavior on oil price. He has also worked in the Enhanced Oil Recovery Research Group, specifically in the subject of surfactant injection for EOR processes in collaboration with the Colombian Institute of Petroleum. Nowadays he is driving his research in the field of Surfactant-Polymer-Nanoparticle formulation for EOR.

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