STUDY OF THE EFFECTS OF NaCl REDUCTION IN OIL RECOVERY DURING THE CALIBRATED WATER INJECTION INTO DOLOMITE ROCKS

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Abstract. Offshore carbonate reservoirs have the seawater injection as a powerful conventional secondary recovery mechanism, not only for their availability and low operating cost but also for having active ions such as magnesium (Mg2+), calcium (Ca2+) and sulfate (SO42-). These active ions act on the surface of the carbonate rocks altering their electric charge, releasing the carboxylic components and, therefore, increasing the recovery factor. Sodium (Na+) and chlorine (Cl-) ions interfere in this ionic interaction and can have an impact on the efficiency of water injection. The creation of this ionic substitution model, related to the alteration of the carbonate wettability, also led to the idea of modifying or calibrating the composition of the injection water to cause or even increase the effect of changing the rock surface to preferentially oil wet. Several studies have been carried out seeking a better understanding of the phenomena involved, and numerous calibrated water compositions have already been investigated, however, there is still no consensus in explaining the results. Thus, this publication presents a study of the reduction of sodium chloride during the injection of seawater into dolomite rocks, once the ions Na+ and Cl- are fundamental agents in the rock/fluid interaction. For this, four coreflooding tests were carried out in two dolomite samples. In each test, a sequence of four brines was injected, starting with seawater and decreasing the composition of NaCl in 50%, 90% and 95%. In addition, effluents were collected, and by ion chromatography, the ion variation before and after the tests were compared. The first two tests used a conventional aging method, while the next two used an improved aging method on the same samples. The coreflooding tests lasted around 50 hours and were obtained high percentages of oil recovered with seawater, around 50%, in the first two experimental tests. In both tests, more than 90% of the recovered oil was obtained before the first porous volume injected, one of the possible causes indicated is that the sample was not sufficiently oil wet. The comparison of results showed a better appreciation of the ionic substitution model for the two final experimental tests. In these tests the brines with reduced NaCl concentration obtained significant oil recoveries, especially in the second brine, indicating that a 50% NaCl reduction is sufficient to achieve significant oil recoveries.