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EFFECTS OF WETTABILITY, LITHOLOGY, AND PERMEABILITY ON THE OPTIMUM SLUG SIZE OF LOW SALINITY WATER FLOODING IN CARBONATES: AN EXPERIMENTAL APPROACH

By

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Abstract

Low salinity water flooding has attracted the academic and industry communities due to its relatively simple and applicable technology. One of the drawbacks of applying this IOR/EOR technique is the lack of the availability of the low salinity water in large quantities at reasonable cost required for a technically and environmentally successful project. To overcome this problem, the industry proposed to use produced water/sea water after dilution, and reverse osmosis filter technology to achieve the required salinity. Both techniques are quite costly and might hinder the project economic success. A low salinity water as slug size followed by high salinity water was proposed to reduce the project requirement of sweet water and make the project technically and economically more attractive. In this project, the effect of the carbonate reservoir wettability, reservoir lithology (limestone and dolomite), and permeability (low and high) on the design of low salinity slug injection have been investigated. Oil wet and water wet high permeability limestone cores and high and low permeability oil wet dolomites cores were flooded in a secondary mode by the following low salinity slug sizes 10, 20, 30, and 40% of pore volumes followed by continuous flooding with high salinity water until reaching stable value of 100% water cut. Results indicated that in the case of limestone environment, wettability of the reservoir has a significant impact on the optimum LSW slug size and a lower slug size requirement was observed in the case of oil wet system 10% PV as compared to 30%PV for water wet system. In addition to the that, 90% of the oil in place was recovered as compared to 60% OIP for the water wet system. The lithology of the system had no noticeable impact on the requirement for the slug size in oil wet environment. Low salinity flooding required relatively a smaller slug size in a high permeability environment for the dolomite oil wet system, while low permeability system exhibited a higher oil recovery as compared to high permeability environment. Therefore, in preforming a reservoir simulation of low salinity flooding of a mixed wettability and heterogenous system, a laboratory work is recommended using reservoir rock and fluid data to the determine optimum slug size and relative permeability data various sections of the reservoir.

Keywords: Low salinity water, Limestone, Dolomite, Slug, Permeability, Wettability, Lithology.