

Laboratory Investigation of Low Salinity Water flooding for Carbonate Reservoirs

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Abstract

Low salinity water flooding (LSW) research has been gaining more momentum in recent years for both sandstone and carbonate reservoirs. Published laboratory data and field tests have shown an increase in oil recovery by changing injected brine salinity, especially for sandstone reservoirs. It is widely accepted that low salinity water alters the wet ability of the reservoir rock from less to more water-wet conditions, oil is then released from rock surfaces and recovery is increased. The main objectives of the current study are to: test the potential of increasing oil recovery by LSW of a carbonate reservoir and to investigate the factors that control it. The impact of LSW on oil recovery was investigated by conducting core flood and spontaneous imbibitions experiments at 70 oC using Lekhwair limestone core samples, crude oil and synthetic brine (194,450 ppm) which was mixed with distilled water in four proportions twice, 5 times, 10 times and 100 times dilution brines. Moreover, both crude oil/brine interfacial tension measurements (IFT) and ionic exchange experiments were carried out at room temperature (25 oC).

The results of the study show higher oil recovery as a result of reducing injected water salinity in both core flood and spontaneous imbibitions experiments. Core flood experiments showed an increase in oil recovery by 3 to 5 % of OOIP, while spontaneous imbibitions experiments showed an increased by 16 to 21 %. Additionally, spontaneous imbibitions experiments provide direct evidence of wet ability change by the LSW. The study also shows that the increase in oil recovery was obtained at much higher water salinity than the one observed in the case of sandstone rock. However, no relation was found between oil/brine IFT and ionic exchange analysis and the observed response of LSW in core flood experiments.