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Pore-Scale Insights into In-Situ Mixing Control By Polymer-Enhanced Low-Salinity Waterflooding (PELS)

Monday, 30 May 2022 11:05 (15 minutes)

Physical dispersion and in-situ mixing of brines during low-salinity waterflooding (LSWF) occurs due to the unfavorable mobility ratio between high- and low-salinity brines. Dispersion negatively affects the performance of miscible processes, such as LSWF, and their economic viability. In our previous publication (Darvish Sarvestani et al., Energy & Fuels, 2021), we demonstrated that adding a viscosifying agent like polymer to the injected low-salinity brine can be an efficient solution to overcome this challenge and suppress the mixing of brines. Adding polymer alters the mobility ratio (between the injection brine and the resident brine) toward a more favorable state and improves the displacement front integrity throughout the porous media. This study focuses on the pore-scale investigation of physical dispersion during LSWF in absence/presence of HPAM (partially hydrolyzed polyacrylamide) polymer. Using purpose-built micromodels with special design of inlet and outlet sections, a series of single-phase mixing experiments was performed and the impact of polymer concentration, injection rate and degree of heterogeneity of porous medium on salt dispersion were studied. The high-resolution images captured during the tests were analyzed for quantitative determination of the salinity breakthrough curves, the length of mixing zone length, the breakthrough time and the effective dispersion coefficient (using advection-dispersion theory). The results show that adding only 250 ppm of HPAM reduces the salt dispersion by up to 62%. A higher dispersivity reduction can be obtained by adding a further amount of polymer. In absence of polymer, non-uniform salinity transport and fingers of low-salinity brine into the high-salinity brine were clearly visible. By adding polymer, the mobility ratio became favorable, thus fingering was suppressed, the displacement front became sharper, and the breakthrough time of the injected low-salinity brine was delayed. It was also found that higher injection rates negatively affects the mixing control. Increasing the injection rate from 0.5 ml/hr to 1.0 ml/hr reduced the Peclet number by up to 28%. Increasing heterogeneity of porous medium increased the salt dispersivity by up to 41% depending on the polymer concentration. This can be compensated for by increasing the polymer concentration. The results of this study provides novel pore-scale insights into the mixing control by polymer-enhanced low-salinity brine (PELS) and supports the our previously published results at the core-scale. The results imply that the performance of LSWF can be improved and a lower pore-volume of low-saline brine would be required to establish low-salinity condition in the porous medium.

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References

1- Darvish Sarvestani, A., Rostami, B. and Mahani, H., 2021. Polymer-Enhanced Low-Salinity Brine to Control In Situ Mixing and Salt Dispersion in Low-Salinity Waterflooding. Energy & Fuels, 35, 13, 10540-10550. https://doi.org/10.1021/acs.energyfuels.1c00871

2-Namaee-Ghasemi, Arman , Ayatollahi, Shahab , and Hassan Mahani. "Pore-Scale Simulation of the Interplay between Wettability, Capillary Number, and Salt Dispersion on the Efficiency of Oil Mobilization by Low-Salinity Waterflooding." SPE J. (2021;): doi: https://doi.org/10.2118/206728-PA

Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

In person

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