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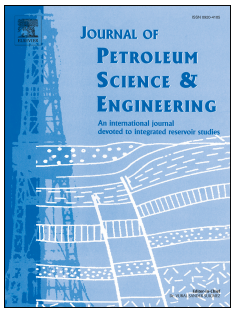

Low salinity polymer flooding: Lower polymer retention and improved injectivity

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Low salinity polymer flooding: lower polymer retention and improved injectivity

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Delayed arrival of the oil bank and reduced injectivity are risks which are commonly associated with low salinity polymer (LSP) flooding. In this study, experimental work was carried out to address these risks; the polymer retention and the cationic exchange in the presence of polymer were the main subjects of investigation. Single phase coreflood experiments were performed, where low and high salinity polymer (HSP) solutions, i.e., conventional polymer flood using formation brine, were injected in reservoir core plugs. The performance of the two polymer solutions were analyzed for polymer retention, injectivity and polymer acceleration. Compared to the HSP coreflood, the LSP coreflood showed considerably lower polymer retention and better long-term injectivity. There was no delay in polymer breakthrough, and the polymer acceleration was comparable to HSP floods. Analysis of produced effluent of the LSP coreflood detected divalent ion concentrations higher than the injected solution, and the solution which was already in equilibrium with the rock. This suggested that the divalent ions were released from the rock into the solution because of cation exchange in the presence of the LSP solution. Such increase in divalent ion concentration increased the polymer solution salinity and resulted in a viscosity loss. The results of the experimental study indicated that LSP flooding can be an attractive alternative to conventional polymer flooding, although viscosity loss due to cation exchange is a subject for further de-risking work. A numerical model which couples the cation exchange in presence of polymer with flow dynamics in core scale has also been developed. As the polymer was transported with the flow, it altered the equilibrium condition between the rock surface and the solution. The model was used to study the sensitivities around the geochemistry coupled flow process.

Nomenclature:
HSP : High Salinity Polymer
LSP : Low Salinity Polymer
S_{or} : Residual oil saturation
ρ_{rock} : rock density
ρ_{water} : water density
ϕ : rock porosity
PA : polymer acceleration
c_0 : polymer concentration injected
$f(c_0)$: polymer retention as a function of the polymer concentration.