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High and Low Salinity Polymer in Omani Oil Field

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Abstract : In recent years, some research studies have been performed on the hybrid application of polymer and low salinity water flooding (LSWF). Numerous technical and economic benefits of low salinity polymer flooding (LSPF) have been reported. However, as with any EOR technology, there are various risks involved in using LSPF. Ions exchange between porous media and brine is one of the Crude oil/ brine/ rocks (COBR) reactions that is identified as a potential risk in LSPF. To the best of our knowledge, this conclusion was drawn based on bulk rheology measurements, and no explanation was provided on how water chemistry changed in the presence of polymer. Therefore, this study aimed to understand rock/ brine interactions with high and low salinity brine in the absence and presence of polymer with Omani reservoir core plugs. Many single-core flooding experiments were performed with low and high salinity polymer solutions to investigate the influence of partially hydrolyzed polyacrylic amide with different brine salinities on cation exchange reactions. Ion chromatography (IC), total organic carbon (TOC), rheological, and pH measurements were conducted for produced aqueous phase. A higher increase in pH and lower polymer adsorption was observed in LSPF compared with conventional polymer flooding. In addition, IC measurements showed that all produced fluids in the absence and presence of polymer showed elevated Ca^{2+}, Mg^{2+}, K+, Cl- and SO_4^{2-} ions compared to the injected fluids. However, the divalent cations levels, mainly Ca^{2+}, were the highest and remained elevated for several pore volumes in the presence of LSP. The results are in line with rheological measurements where the highest viscosity reduction was recorded with the highest level of Ca^{2+} production. Despite the viscosity loss due to cation exchange reactions, LSP can be an attractive alternative to conventional polymer flooding in the Marmul field.

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