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Investigation of Polymer and Surfactant Adsorption on Glass Slides and Crushed Cores in Alkaline-Surfactant-Polymer EOR Method

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Abstract

Alkaline Surfactant Polymer (ASP) flooding is one of the chemical flooding methods where the synergistic effect of three chemicals (alkaline, surfactant and polymer) is utilized. The method is the current world wide focus of research and chemical trials in EOR. It can provide an incremental oil recovery over waterflooding of 5-27% OOIP. However for this method to be economically feasible; it is crucial to minimize the loss of chemicals to the reservoir for example adsorption.

A field located in center of Oman was considered to for ASP development. The field comprises sandstone reservoir containing medium to light oil with 33o API and a viscosity of 9 cP. Several lab experiments were conducted by PDO on the reservoir rock and fluid samples to assess the potential of ASP application. High adsorption rates were seen from coreflooding experiments. Hence this dissertation is dedicated to experimentally investigate the adsorption of surfactant and polymer by focusing on its morphology, binding energy and chemical composition.

In this study, the experiments were conducted using the field crushed core samples and brine, as well as the potential polymer and surfactant for the ASP development proposed for the field. In addition, glass slides were used as a substrate. The adsorption morphology was studied using AFM and TEM; while the adsorption chemical composition and binding energy were studied using XPS. The study also involved testing the effects of salinity, pH and surfactant on the adsorption process.

The study results demonstrated the polymer and surfactant adsorption through their binding energy and morphology images. A clear polymer desorption is seen while adding the surfactant in all experiments and a proportional relationship was established between increasing salinity and adsorption; while the pH effect induces a fluctuating trend that is caused by different minerals available in the field core.