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Investigation of Temperature and Hydrolyzed Polyacrylamide Polymer on Adsorption Density of the Triton X-100 Surfactant in Carbonate Rocks

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INTRODUCTION

Surface active agents used for EOR processes in the petroleum industry are mostly of chemical origin, but it has been occasionally observed that surface active agents of natural origin have also been used [1, 2].

One of the limitations of using surfactants is their high cost and high volume required for injections into the reservoirs [3]. Therefore, their adsorption rate on the surface pores in the porous media should be economically viable. On the other hand, if these materials are not absorbed, their efficiency will be reduced to change the surface wettability [4].

Therefore, the choice of materials must be such that it is both economically viable and efficient.

MATERIALS

In this study, materials which are used are as follows:

Core plug: Carbonate core (Lithology: Dolomite + Anhydrite)

Liquid phase: Distilled water+ NaCl (Salinity: 180000 ppm)

Surface active agent: TritonX-100

Polymer: Hydrolyzed Polyacrylamide

EXPERIMENTAL PROCEDURE

At the first, the mentioned core plug was cleaned by Soxhlet and cleaning fluid toluene and methanol. Then, the cleaned plug was dried and crushed. preparing different concentration of TritonX-100 (50-1000 ppm) and Hydrolyzed Poly

acrylamide (250-2500 ppm) solution is the next step. The next stage is separating 3 g of rock powder and mixing it with 60 g of surfactant at different temperatures. After that, adsorption experiments at different concentrations of surfactant at different temperatures was made. The pH and conductivity measurement methods were used to measuring CMC of surfactant and polymer and the experiments repeated at 80, 90 and 100 centigrade degree. Adding polyacrylamide to the surfactant solution at CMC concentration and repeating experiments at four different temperatures and salinity 180000 ppm is the final step.

RESULTS AND DISCUSSION

Table 1 and Figure 1 indicate the results of nine experiments at different temperatures. As observed, the adsorption density decreases by increasing temperature, and addition of polymer to the surfactant causes that the adsorption density is reduced.

Table 1: Adsorption density of Surfactant, polymer and surfactant+polymer at 80, 90 and 100 ℃.

Exp.No	1	2	3
Used Material	Surfactant	Polymer	Surfactant+Polymer
(Initial surfactant/Polymer (ppm	450	1300	875
Residual Surfactant/Polymer (ppm) @ 80 ℃	302.6	1174	765
Adsorption Density of Surfactant/ Polymer(mg/gr) @ 80 ℃	2.948	2.52	2.2
Residual Surfactant/Polymer (ppm) @90 ℃	309.6	1180	769.2
Adsorption Density of Surfactant/ Polymer(mg/gr) @ 90 ℃	2.808	2.4	2.116
Residual Surfactant/Polymer (ppm) @100 ℃	315.1	1184	733.8
Adsorption Density of Surfactant/ Polymer(mg/gr) @ 100 ℃	2.698	2.32	2.024

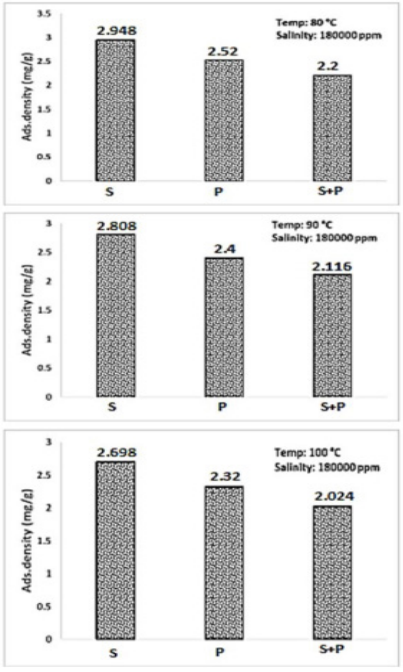

Figure 1: Effect of Hydrolyzed Polyacrylamide on Tritonx-100 adsorption at different temperatures.

CONCLUSIONS

1: The effect of temperature on the adsorption density is reversed such that as the temperature increases, the adsorption density of polymer and surfactant decreases.

2: The results of the experiments showed that the hydrolyzed polyacrylamide had a positive effect on the reduction of the surfactant adsorption.

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