Petroleum Research

Petroleum Research, 2019(August-September), Vol. 29, No. 106, 29-31

DOI: 10.22078/pr.2019.3503.2602

Experimental Study of Polymer Injection on Enhanced Oil Recovery from Heavy Oil Reservoirs and Determination of Optimum Injection Concentration

Pourya Malmir, Abdolnabi Hashemi* and Bahram Soltani Soulgani

Petroleum University of Technology, Ahwaz Faculty of Petroleum Engineering, Iran

a.hashemi@put.ac.ir

DOI: 10.22078/pr.2019.3503.2602

Received: September/04/2018 Accepted: March/02/2019

INTRODUCTION

Polymer flooding is one of distinguished EOR methods which enhances oil recovery through reduction of mobility ratio [1]. As polymer was added to the water, the displacing phase mobility was reduced, and thereafter, the displacing sweep efficiency was modified [2]. The results of recent researches showed that polymer flooding could reduce the residual oil saturation which was trapped after water flooding [3].

Hydrolyzed polyacrylamide (HPAM) is one of polymers which is widely applied in as a chemical EOR agent [4- 6]. However, the recent researches are focused on new polymers which are tolerant at high salinity and high temperature conditions [7, 8].

The applicability of polymer EOR in heavy oil reservoirs is not well addressed. This research is aim to investigate the application of a new polymer to enhance oil recovery in heavy oil reservoir at high salinity-high temperature condition.

XPERIMENTAL PROCEDURE

FLOPPAM3630 from SNF was used as the polymer in this study. The polymer makeup solution was the formation water with the TDS of 200000 ppm. The stability of polymer solutions was checked by rheology test for 7 days. The crude oil of one of Iranian oil reservoir with API of 200 and viscosity of 2100 cP was used. The applicability of FLOPPAM3630 as an EOR method was studied through sandpack flooding at 400 °C.

The sand pack is fabricated by quartz glass beads with the purity of 99%. The sand pack is firstly saturated with reservoir brine. Afterwards, oil is injected to the sandpack to obtain the connate water saturation state. Reservoir brine is injected to the sandpack over 1.5 PV. Finally polymer solution is injected as tertiary EOR agent to the sandpack for 2 PV.

RESULTS AND DISCUSSION

STABILITY TESTS

The stability of polymer solutions with concentration of 500, 1000, 1500, 2000, 3000, and 4000 ppm was studied as a function of shear rate, temperature and time. The results showed that polymer solutions had good stability at high shear rate conditions. Also, temperature increase from 20 °C to 70 °C did not affect solutions viscosity which thermal stability of samples. The thermal stability of polymer solutions for 7 days is shown in Figure 1.

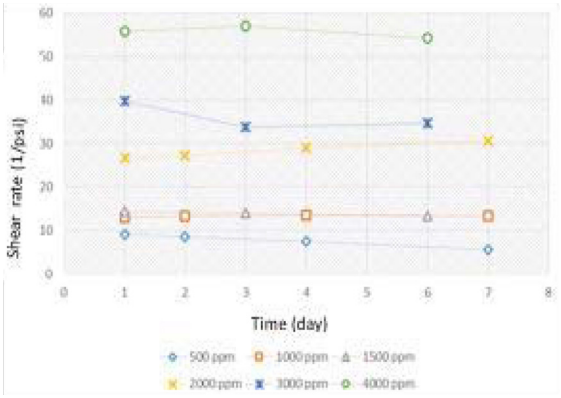

Figure 1: Shear rate vs. time of polymer solutions

POLYMER FLOODING TESTS

Based on the results of rheology tests, solutions of 500, 1000 and 2000 ppm were selected for flooding tests. Figure 2 shows the results of polymer flooding. As it is shown in the figure, secondary water flooding had recovery of about 30-40%. Injection of polymer enhances oil recovery. Injection of 500 ppm polymer solution increased the recovery as 29%. The oil recovery increased of about 40 and 43% for the case of 1000 ppm and 2000 ppm polymer solution injection, respectively.

This showed that 1000 ppm solution was the optimum concentration in both recovery and economical points of view. Also, the results of this study showed the potential of polymer to enhance oil recovery in samples saturated with 2100 cp oil.

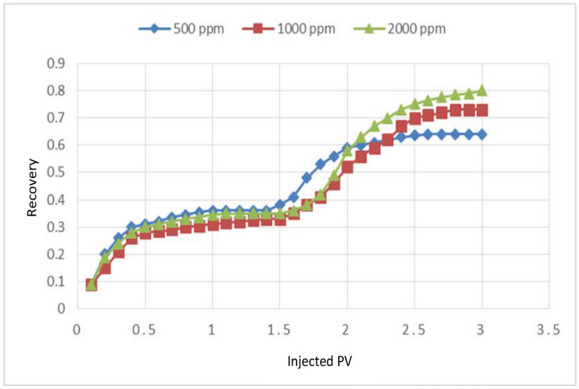

Figure 2: recovery factor as a function of polymer concentration.

CONCLUSION

Application of a new polymer to displace 2100 cp oil at high salinity condition was investigated in this study. The results showed that polymer solutions had stability versus temperature, shear rate and time. The results of polymer injection tests showed that tertiary injection of 1000 ppm polymer solution increases recovery of about 43% after water flooding. The results of this study approved the potential of polymer injection as an EOR method in heavy oil reservoirs.

REFERENCES

[1]. Kharat R., Asadollahi M., and Nemani M., *"Enhanced oil recovery,"* Nehare Danesh press, 2009.

[2]. Lake L. W., *"Enhanced oil recovery,"* Englewood Cliffs, New Jersey: Patent Hall, 1989.

[3]. Du Y. and Guan L., *"Field-scale polymer flooding: lessons learnt and experiences gained during past 40 years,"* SPE 91787, International Petroleum Conference, Puebla, Mexico, 8-9 November 2004.

[4]. Shupe R. D., *"Chemical stability of*

polyacrylamide polymers," J. Pet. Tech., Vol. 33, No. 8, pp. 1513-1529, 1981.

[5]. Akstinat M. H., *"Polymers for enhanced oil recovery in reservoirs of extremely high salinities and high temperatures,"* SPE 8979, Fifth International Symposium on Oilfield and Geothermal Chemistry, Stanford, CA, 28-30 May 1980.

[6]. Corredor Laura M., Maen M. Husein and Brij B. Maini., *"Effect of hydrophobic and hydrophilic metal oxide nanoparticles on the performance of xanthan gum solutions for heavy oil recovery,"* Nanomaterials, Vol. 9, No. 1, p. 94, 2019.

[7]. Rajiv D., Soroush M., Alexander D., Shahkarami A. R. and Boodlal D., *"Polymer flooding application in trinidad heavy oil reservoirs,"* In SPE Trinidad and Tobago Section Energy Resources Conference, Society of Petroleum Engineers, 2018.