

# Optimization of EOR after combined flooding

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**Abstract.** After polymer flooding treatment, the oil recovery can be enhanced through the application of advanced technology. However, in practical applications, excess residues will be generated after polymer flooding treatment. Therefore, in the analysis and treatment of residues, the distribution law of residues after polymer flooding is analyzed, and the recovery process and distribution treatment process are carried out. optimization to achieve enhanced oil recovery after polymer flooding. After the polymer flooding treatment, the high concentration and high molecular weight polymer treatment can improve the recovery rate of crude oil, and on the basis of the polymer flooding treatment, the polymer flooding effect can be improved, which can effectively improve the crude oil recovery rate. recovery and improve the development efficiency of oilfields.

**Keywords:** Polymer flooding, Recovery ratio, Optimize.

## 1. Introduction

After polymer flooding, the oil recovery in water flooding stage will decline. Therefore, in order to improve oil recovery, the actual situation and recovery potential of polymer flooding blocks are analyzed, and the practical application of polymer flooding technology is optimized, which can improve the oil recovery of polymer flooding. In the process of analyzing the application of polymer flooding technology, it is necessary to discuss the practical application of polymer flooding technology, deal with the recovery process, improve the polymer flooding recovery scheme and further improve the recovery efficiency of polymer flooding [1].

## 2. Residual distribution law after polymer flooding

After the oil field is treated by polymer flooding, the recovery factor of the water flooding stage will decrease. In order to improve the recovery factor and improve the recovery efficiency, the oil treatment level of polymer flooding can be improved under the analysis of residues after polymer flooding. Combined with the actual situation, in the process of analyzing the dynamic changes of the oil layer, it is necessary to analyze the actual situation of the reservoir after the polymer flooding treatment. The thickness of the oil reservoir is about 25%, and it is basically distributed on the top of the thick oil layer. The physical properties of the reservoir are relatively poor. After the polymer flooding treatment, the remaining oil is scattered and not concentrated, and the water injection recovery rate is relatively low, which

increases the production cost. In the process of improving the utilization rate of residual oil, in the process of polymer flooding, under the action of polymer profile control, the water flooded amount of reservoir increases, and there will be anhydrous crude oil in the anhydrous section. The pore volume of the reservoir increases gradually, and the volume of crude oil produced will also increase. Under polymer profile control treatment, the viscosity of injected water is lower than that of crude oil. In the process of water injection development, high fluidity fluid replaces low fluidity fluid. In this case, it is necessary to optimize the low permeability process and improve the level of crude oil treatment. In the process of controlling polymer flow, the flow control of polymer solution will have a direct impact on polymer flooding treatment. Under normal water flooding conditions, the viscosity of injected water will be lower than that of crude oil. The proportion distribution of oil and water in the process of oil displacement is unreasonable, resulting in the decline of production quality. After polymer is injected into the reservoir, the oil-water flow ratio in the process of polymer flooding can be improved and the final oil displacement efficiency can be obtained [2]. From the perspective of the distribution law of residual oil, by analyzing the well washing conditions of the main oil layer, the residual oil in the washed layer and the residual oil in the unwashed layer can be inspected and analyzed to improve the utilization rate of residual oil. The remaining oil in the water washing layer is to control the thick oil layer and oil storage under the concentrated distribution of remaining oil in the elution layer, so as to improve the utilization rate of the weak water section of the thick oil layer [3].

### 3. Ideas for improving oil recovery after polymer flooding

#### 3.1 Underground polymer flocculation

After the oil field is treated by polymer flooding, the residual oil can be treated and analyzed to control the water flooding recovery ratio and improve the practical application effect of fixed profile control technology. In the process of underground polymer flocculation treatment, it is necessary to control from the perspective of solid particles and polymer residues to improve the effective utilization rate of residues. Underground polymers often flocculate, and commonly used flocculants include sodium soil, calcium soil, fly ash, sodium hydroxide and other solid particles. Compared with other flocculants, the relatively good suspending property is sodium soil, which is an ideal flocculant. To further improve the suspending power of sodium soil, stabilizers can be added, and the flocculation treatment effect can be adjusted to improve the comprehensive level of polymer flooding treatment. After adding stabilizer sodium soil, the dosage of flocculant is reduced, which can reduce the dosage, and the problem of high cost can be solved through configuration adjustment and treatment of oilfield wastewater, and the mass fraction can be adjusted to improve the flocculation treatment level of polymer flooding [4].

The residual resistance coefficient can be used to evaluate the plugging effect of the flocculant on the formation. The calculated ratios also have certain differences with different permeability. The plugging effect after flocculation of different concentrations of polymers is treated with 3% stabilized sodium-soil flocculant, which can improve the plugging effect. In the process of experimental analysis and treatment, the flocculant and the oil displacement polymer can interact with each other. After mixed flocculation, the plugging effect of the formation will gradually improve. Moreover, the strengthening of the flocculant plugging effect can improve The overall concentration of a substance.

#### 3.2 Fixation of residual polymer in formation

After polymer flooding, polymer crosslinking fixative can be injected into the formation to achieve the purpose of residual polymer crosslinking treatment. In practical application, polymer crosslinking fixative can achieve the functions of plugging and profile control. Considering the different strata, there are some differences in the salinity of the allocated water. Therefore, in actual operation, it is necessary to choose different fixatives for treatment to improve the comprehensive treatment level of polymer. The formulation of fixative needs to be continuously optimized. In the process of optimization, based on the core experiment, 0.3Vp polymer oil displacement agent is injected into the formation, and the mass fraction of fixative is 0.5Vp, and various fixatives are used for treatment. Measure the residual resistance coefficient of the core after standing at formation temperature for 24h. The group with the largest residual drag coefficient was selected and optimized by the mass fraction of

fixative. At the same time, according to the actual situation, increasing the application amount of the fixative can improve the effect of the fixative on the oil recovery, but the mass fraction of the input-output ratio is 0.05Vp. In this process, the lifting effect of the fixative is a part. The supramolecular oil displacement agent can also achieve the purpose of oil displacement and oil washing. Under the condition of proper concentration and Bose injection, the effect of oil displacement and oil washing will be reduced. Further improvement, after the profile control treatment, the quick use of supramolecular oil displacement agent to drive oil can further improve the oil displacement treatment effect. The application of this method is better than the oil displacement recovery effect of flocculation polymer [5].

#### 3.3 Deep profile control treatment

Depth profile control is to treat the residual polymer in the bottom layer after reuse, which will not have a direct impact on reservoir recovery. In order to improve the oil recovery after polymer flooding, under the treatment of deep profile control of oil layer, the formation temperature can be controlled by polymer. At the same time, the salinity of water is relatively low, and the gel profile control agent is in the best state, thus improving the recovery treatment effect. In the process of profile control, the process of profile control is directly related to time change and formation depth. Therefore, under different formation depths, different profile control agents should be used. For example, according to the freezing mode of high-valence metal ion cross-linked gel and resin cross-linked gel, the formula is selected, and the comprehensive level of deep profile control treatment is improved through gel treatment. In the process of analysis and treatment with polymer, it is necessary to carry out profile control treatment in the process of polymer flooding to improve the comprehensive level of polymer flooding treatment.

### 4. Case analysis

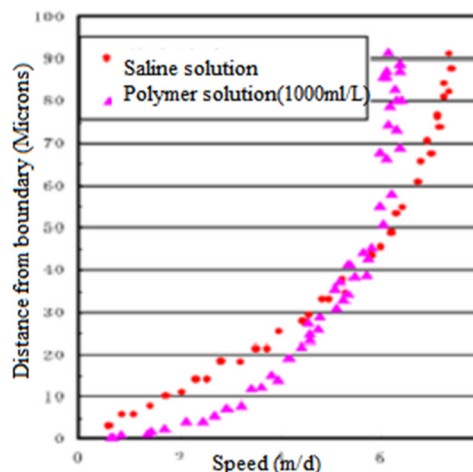
Considering that the velocity gradient of the polymer solution at the capillary boundary is higher than that of water, and the viscosity of the residual oil surface of the polymer solution on the machine is higher than that of water, in the optimization of the polymer flooding treatment process, the treatment process of polymer flooding and the influencing factors of water flooding treatment process can be comprehensively designed, which can improve the recovery ratio after polymer flooding. In order to test the application effect of the post-treatment technology of polymer flooding mentioned above, during the analysis of polymer flooding treatment process, taking Well C5, Well PO5 and Well Gao 122-Jian 45 as the research objects, the self-absorption and oil discharge, permeability and wetting index were tested and analyzed. The specific results are as follows:

**Table 1** Analysis of measurement results

Well number	Rock sample number	Penetration	Self-absorption and oil discharge	Self-sucking displacement	Wetting index	Wettability	Remarks
Well C5	10-1	1524	0.4	0.6	-0.42	Oleophobic	Original wettability
			1.64	0.48	0.15	Weakly hydrophilic	After polymer flooding
	10	1560	0.04	0.5	-0.37	Oleophobic	Original wettability
			0.33	0.3	-0.14	Ruophilic	Water drive treatment
Well P05	193	2066	0.4	1.21	-0.31	Oleophobic	Original wettability
			0.8	0.15	0.08	Neutral	After polymer flooding
	183-1	1945	0.033	1.2	-0.35	Oleophobic	Original wettability
			0.32	0.6	-0.11	Weakly lipophilic	After polymer flooding
Gao 122-jian 45 well	233	830	0.2	0.71	-0.17	Weakly lipophilic	Original wettability
			0.51	0.22	0.03	Neutral	After water flooding
	288	888	0.35	0.6	-0.15	Weakly lipophilic	After polymer flooding
			0.83	0.23	0.08	Neutral	Original wettability

Combined with the above information and data, in the analysis of polymer flooding treatment process, the hydrophilic treatment effect can be improved through polymer and water flooding treatment. In the process of polymerization treatment and analysis, it is necessary to optimize the polymer flooding water treatment process to improve the oil recovery of polymer flooding. In practical application, polymer solution can reduce blind residual oil. On the basis of driving treatment and analysis, the comprehensive level of polymer flooding treatment can be improved through water flooding treatment and optimization. In the process of crude oil treatment and analysis, the treatment process of polymer flooding can be optimized through flow direction control, so as to reduce the impact of residual oil on oil displacement treatment and improve the recovery after polymer flooding. From the angle of distribution change of polymer solution and water flooding, through density adjustment and control of polymer solution, the average flow rate of polymer flooding can be controlled, with the flow rate of  $4.0 \times 10^{-5}$

5m/s as the basic condition, and its velocity distribution is as follows:



**Fig.1** Velocity distribution of polymer solution and water

In the process of polymer flooding treatment, reducing the influence of residual oil on polymer flooding treatment will play a positive role in improving the recovery level of subsequent water flooding. By using the elasticity of polymer solution, the treatment process and flow rate of polymer flooding can be controlled, which can not only ensure the recovery of polymer flooding, but also solve the problem of decreasing recovery effect in water flooding stage.

### 5. Conclusion

Polymer flooding treatment includes underground polymer flocculation treatment, underground residual polymer fixation, deep analysis treatment and other processes. Therefore, in the process of polymer flooding treatment, the application of advanced technology can improve the recovery factor, among which Including flocculation treatment, fixation, depth profile control and other treatment methods. In the process of fixing formation residues, an effective fixative can be selected according to the salinity of different formations and different configurations, and the core treatment level can be improved through the optimization and treatment of fixative cultivation. In the process of polymer flooding treatment, considering that the formation temperature is not high and the water salinity is relatively low, gel profile control agent is used to control the deep profile control and improve the comprehensive level of polymer flooding treatment. In practical application, the profile control agent has a direct relationship with the time and the depth of the formation. Therefore, in the process of processing different formation depths, the formula of the profile control agent needs to be adjusted. Analysis and treatment, optimize the post-treatment process of polymer flooding in the main oil layer, and improve the oil recovery after polymer flooding.

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