Study on the Adaptability of Reservoir Polymer Flooding III Types Based on Computer Monitoring

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Abstract. With the continuous expansion of polymer flooding area of main reservoirs, the remaining oil reserves of class I and class II reservoirs decrease year by year. With the continuous decline of polymer flooding production, the difficulty of oil recovery will gradually increase. Therefore, we must explore III types of reservoir polymer flooding development, which can better improve the recovery of polymer flooding. At the same time, with the rapid development of wireless technology, we can monitor the polymer flooding of III types of reservoirs by computer. Through monitoring, we can better detect the effect of polymer flooding, which will better solve the problem of low fishing success rate and high cost. This paper analyzes the sedimentary characteristics of III types of reservoirs, and then analyzes the main influencing factors of polymer flooding effect.

Keywords: Computer Monitoring, III Types of Reservoir, Polymer Flooding, Adaptability

1. Introduction

In the process of oilfield development, the method of oil recovery using natural energy of reservoir is called primary oil recovery. After the primary oil recovery, we can increase the reservoir pressure by water injection or immiscible gas injection, which will drive the crude oil in the reservoir. This method of production is called secondary recovery. Tertiary oil recovery is a method of oil displacement after secondary oil recovery through new technologies such as physics, chemistry and biology [1]. Since the mid-1960s, more than 200 oil fields around the world have carried out polymer flooding experiments. At present, most of the oil fields in the east of China have entered the middle and high water cut stage. Therefore, we must take various methods to keep the stable production and increase efficiency. Among them, the polymer flooding method in chemical flooding has entered the stage of large-scale industrial application, which has also achieved good effect of increasing oil and precipitation [2]. The III types of oil layers are the areas of delta inner and outer front facies deposition, which will develop into the form of thin difference layer and outer surface reservoir. There are still many problems in the development of polymer flooding. First, the demonstration of fine combination and well pattern well spacing...
adaptability of III types of reservoir polymer flooding is insufficient. Second, the reasonable injection parameters need to be further optimized. Third, the supporting adjustment measures for tapping potential need to be improved[3].

2. Distribution types of in surface and out surface reservoirs in III types of reservoirs

2.1. Application of network monitoring system

The monitoring system is composed of many components, including front camera point, center platform, monitoring center, remote monitoring terminal, etc. The front camera point is composed of the host and the camera during the polymer drive. The central platform is the monitoring system. The monitoring center is a centralized monitoring center set by users. The remote monitoring terminal is PC browser login monitoring. The network monitoring system is shown in Figure 1.

![Figure 1. The network monitoring system](image)

2.2. Reservoir distribution in the table

For the inner surface reservoir, in the large and shallow lake basin of Songliao Lake Basin, with the repeated water advance and retreat process, different macroscopic delta geometry and sand body combination types are formed. There are four main types of medium low permeability reservoirs in the surface. First, the Tuo delta sand body. The underwater channel in the inner front facies will present discontinuous Tuo like and banded distribution. There is a large area of sheet sand between underwater channels, and the main sheet sand is relatively thick. Second, the branch delta sand body. The underwater channel in the inner front is banded and connected with thin sand, which will become a complex branch. It is generally formed in the period of extremely shrinking Lake Basin and extremely shallow water body. Third, transitional delta sand body. The sand body of inner front is developed between the sand body of Tuo Delta and branch Delta. The underwater channel presents a narrower strip, during which a very thin non main sheet sand is distributed. Fourth, sheet delta sand body. The leading edge is a sheet like state. In sedimentary period, fluvial action is weak and clastic supply is insufficient[4].

2.3. Reservoir distribution outside the surface

Off surface reservoir refers to the part of reservoir with oil-bearing characteristics but not calculated reserves below the reserves calculation standard. They are mainly argillaceous siltstone with oil invasion and oil-bearing occurrence of oil spots, with a small amount of very thin oil sands or oil-bearing belts. In the core, the outer reservoirs are mainly in the form of plaques, bands and lenses. The average air
permeability is $0.02 \times 10^{-3} = 0.03 \times 10^{-3} \mu m^2$. Compared with the main sandstone, the physical properties of the reservoir outside the surface are significantly worse [5]. According to the relative stability of the distribution of off surface reservoirs, we can divide them into four types. First, the formation of the outer surface reservoir. Their distribution on the profile is relatively stable, which can be traced back to more than three well spacing. Second, the lenticular reservoir. There are only 1-2 well spacing in the profile. Third, the extended reservoir. On one side, it is connected with the reservoir in the surface, and on the other side, it will be pinched out after extending 1-2 well spacing. Fourth, the connection type outer surface reservoir. Both ends are connected with the reservoir in the surface, with an extension range of 1-2 well spacing [6].

3. Distribution pattern of outer surface reservoir based on sedimentary genesis

3.1. Flooding type

The flood type is the reservoir outside the crevasse surface in the fluvial facies sand body, as shown in Figure 2. Flood type outer reservoir is formed in the geographical environment of flood plain, distributary plain and branch Delta, which is based on the role of river crevasse, flood and river filling. The flood type is mainly distributed at the top of the channel sand body, the edge or between the channel sand body and the river sand body.

![Figure 2. The flood type](image)

3.2. Local type

The local type is the external reservoir with local variation in the stable sheet sand of delta front, as shown in Figure 3. In the outer front of the Tuo Delta and the stable Delta, the surface and inner sheet sand will be distributed in the sedimentary environment, which will result in the lack of local coarse clastic material supply.
Figure 3. The local type

3.3. Continuous type

The continuous type is to fill the outer surface reservoir of the continuous type in the unstable sand body of the delta front, as shown in Figure 4. In the sedimentary environment with unstable distribution of internal sand body, the supply of coarse clastic material will be seriously uneven, which will cause inadequate waves. The sand body in the surface is not stable, which will form a filling and connecting type of outer surface reservoir.

Figure 4. The continuous type

3.4. Sand mat type

The sand sheet type is a stable sand sheet type outer reservoir on the delta margin, as shown in Figure 5. The sand sheet type is mainly formed in the marginal zone of the outer front of the Delta, which belongs to the extensive extension of the inner surface sand body to the front Delta.
4. Development effect of polymer flooding in III types of reservoirs

Taking 8-182 well area of Daqing Oilfield as an example, this is the main replacement layer of polymer flooding in Lamadian oilfield. The well pattern adopts the five point method area well pattern of 5 central wells produced by 12 injection 13. Blank water flooding started in November 2005 and polymer injection started in March 2007. The development effect of polymer flooding in III types of reservoirs is summarized as follows.

4.1. The injection pressure increases greatly and the utilization degree is high

In the initial stage of polymer injection, compared with the second type polymer flooding, the pressure rise of the third type reservoir is 2.4Mpa, the pressure rise of the second type reservoir is 4.5MPa, and the pressure rise of the third type reservoir is lower than that of the second type reservoir. Polymer flooding injection production profile improvement. According to the production of sandstone, the difference between layers is small, and the proportion of water absorption thickness after polymer injection is large, among which the relative water absorption ratio of outer surface layer increases from 70.2% before polymer injection to 76.2%. According to statistics, there are continuous production profile test data. The sandstone production proportion of the production wells is 81%, and the sandstone thickness proportion of the three consecutive production is 65.2%.

4.2. The effect of polymer flooding in the third type reservoir is early, and the water cut decreases slowly

Under the condition of 150m well spacing, polymer flooding effect can be seen by injecting 0.032pv polymer solution into the third type reservoir four months later, which is two months earlier than that of the second type reservoir. After 9 months of polymer injection, polymer recovery was found in the third type of reservoir, which was 2 months earlier than that in the second type. The main reasons are as follows: III types of oil layers advance slowly when injecting the same PV. Because the distance between the well and the oil wall is smaller, the effect is earlier. The reason for the small decrease of water content is as follows. First, the reservoir is relatively homogeneous and the injection volume PV number is small, which results in a small water cut decrease. Numerical simulation shows that the smaller the permeability variation coefficient is, the later the effective time of polymer flooding wells is, and the longer the stable period of low water cut is. The third kind of oil reservoir has a high degree
of polymer flooding, some developed well, high connectivity, single layer breakthrough, and small water cut drop.

5. Conclusion

Polymer flooding of III types of reservoirs can reduce the contradiction between layers, which will improve the degree of oil production. The rules of polymer flooding effectiveness are different in III types of reservoirs, which are mainly affected by reservoir properties, matching of injection parameters and injection production relationship.

Acknowledgments

The tertiary-main layers reservoir description and chemical oil-driven reagent study

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