Analysis on anti-corrosion and anti-scaling technology of water injection well in oil production plant

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Abstract. Petroleum resources are an important resource used in modern industrial production and a very widely used resource. In the current oil extraction plant, the phenomenon of corrosion and scaling of water injection wells is an important issue affecting the efficiency of oil extraction. The application of anti-corrosion and anti-scaling technology for water injection wells can not only reduce the scaling phenomenon of water injection wells, but also help the exploitation of the current petroleum industry. In this paper, the author analyzes the causes of corrosion and scaling in long oil-injection wells based on specific examples, and puts forward the application of anti-corrosion and scaling technology in wells of oil production plants.

Keywords: Production Plant; Water injection well; Anti-corrosion and anti-scale technology.

1. Brief introduction of water injection well in oil production plant

1.1. Overview of water injection wells
The oil injection well in the oil extraction plant is an important part of the oil extraction process of the oil extraction plant. In the normal oil extraction process of the oil extraction plant, the water injection well is responsible for injecting water into the oil layer. Ensure that the produced oil reservoir has a certain driving capacity, so as to increase the production speed of the entire oil well and increase the efficiency of the oilfield production. At present, according to the scale of oil well reservoirs, different mining areas and different structural forms, there are different choices for water injection methods and construction locations of water injection wells. Among them, the principle of selecting the location of the water injection well is to maintain a reasonable distance from the reservoir location, and the reservoir location can receive sufficient water injection. In addition, the pressure of the water injection pump directly determines the suction power of the water injection well. Generally, the pressure of the water injection pump should be less than the pressure of the rupture of the oil layer to ensure the normal water absorption of the oil layer.

1.2. Classification of water injection wells
A water injection well is a device that injects water into the reservoir. From a structural perspective, the water injection well can be divided into an aboveground part and an underground part. The water injection wellhead is an intermediate device for water to enter the oil well, which can control the water...
injection amount and the well washing method. Current well washing methods include forward injection, reverse injection, co-injection, forward washing and backwashing, and downhole operations. In addition, from a functional perspective, water injection wells can be divided into layered injection wells and general injection wells. To distinguish from the pipe string structure, it can be divided into two ways of supporting the injection well and hanging the injection well. Finally, according to the casing and well conditions of water injection wells, it can be divided into three types: large casing wells, normal water injection wells and small diameter wells.

2. Analysis on the causes of corrosion of water injection wells in oil production plants and the use of anti-corrosion technology

2.1. Analysis on the cause of corrosion of oil production and injection well

The working environment of oilfield water injection wells is relatively complicated, so there are many causes and substances that lead to corrosion of oil wells. For example, dissolved carbon dioxide, oxygen, hydrogen sulfide, salts, fungi and other substances will cause oil production plant injection Water wells form corrosion phenomena [1]. In addition, due to the large amount of chemicals used in the oil recovery process, when the chemical substances flow through the injection well pipeline, it will cause corrosion of the injection well. The current substances that affect the corrosion of the injection well injection pipeline include three categories; the first is dissolution Corrosion caused by gas to water injection pipe. The second is corrosion of water injection pipes caused by sulfur compound wastewater. The third is corrosion of water injection pipes caused by high-speed rail and high-salt content substances.

2.2. Anti-corrosion technology of water injection well pipeline

Corrosion of water injection well pipelines in oil production plants is an important issue that affects the efficiency of oil production in oil production plants. The application of anticorrosion technology for water injection well pipelines is aimed at solving the problem of corrosion. The current anticorrosion technologies for corrosion problems of water injection well pipelines generally include three types; 1. Removal of corrosive substances in water injection well pipes. 2. Replace the water injection pipe itself. 3. Targeted use of anti-corrosion pipes, and develop new types of water injection well pipes with high anti-corrosion performance.

![Technical principle of water injection well pipeline in oil production plant](image)
At present, the relatively widely used anti-corrosion technologies include the following: First, the anti-corrosion technology of nitrided pipelines. The use of anti-corrosion technology of nitrided pipeline materials is to use the principle of improving the anticorrosive performance of pipes. The current application effects in nitrided pipes Good types include nitriding tubing, well repair tubing, titanium nanotube tubing, stainless steel tubing, etc. After many anti-corrosion pipe application tests, it is found that the anti-corrosion performance of the nitriding material is the best. Compared with other anti-corrosion pipes, the process of the nitriding pipe is more sophisticated, and the pipe surface itself is smoother and flatter, which is beneficial to The circulation of substances prevents the corrosion of substances caused by blockage and retention. In addition, according to relevant data, the corrosion resistance of nitriding pipes is 3-8 times that of ordinary tubing materials. After the nitrided tube is applied, a protective film is formed on the surface of the nitrided tube. It forms an adsorption effect on the corrosives and other substances in the pipe, thereby reducing the corrosion of the corrosives.

Second, increase the protection of corrosion inhibitors. Corrosion retarder is a corrosive agent for the corrosion of water injection wells, which can effectively reduce and alleviate the corrosion of water injection wells in oil production plants. The following is the research on the anti-corrosion agent of water injection well in an oil field in S city. The waterflood control area of the water injection well of the oil production plant is 32.55 square kilometers, and the waterflood control amount is $1425.06 \times 10^4$ tons, the actual water injection area is 50.6% of the development and utilization area, and the water drive control reserves are 60.66% of the utilization reserves. In the injection well area of the oil production plant, the corrosion of pipelines and wells is very serious. In order to do well in anti-corrosion and anti-scaling work of water injection wells, the oil production plant conducted rigorous experiments to conduct corrosion rate test and water quality analysis on the oil injection plant water injection wells. According to relevant data, it is found that the corrosion rate of the water injection well to carbon steel reaches 0.253 mm / a. In terms of the corrosion rate, it can be included in extremely severe corrosion. Severe corrosion also brings about scaling. In addition, after analyzing the water quality, it was found that the water quality condition of the oil extraction plant was about 6.8, which was a relatively acidic water quality. The mineralization of the water quality was relatively high, which was one of the main reasons for the serious corrosion of the injection wells of the oil production plant [2]. In view of the water quality of the oil injection well in the research process, three corrosion inhibitors of PA PE, HEDP and PA A were selected for pipeline corrosion prevention. Compared with other corrosion inhibitors, these three corrosion inhibitors are not toxic and easier. It is compatible with water and has no corrosiveness. The relevant data results show that when PAPE and HEDP are used, the ratio is 1: 2 and the concentration is 30m g / L and 60m g / L. The most obvious.
Third, the oil production casing annulus technology is used to prevent corrosion of water injection wells. In the actual oil production process, the outer wall of the water injection well pipeline may also be corroded, so the annulus protection fluid technology is a technology to solve the problem of external wall corrosion of the outer water injection well pipeline. Corrosion ring equipment is installed during the inspection of the outer wall of the water injection well pavilion. Quantitative microbial preparations, anti-corrosion agents and other solutions are added inside the corrosion ring casing to protect the water injection well pipe. The more advanced technology in the anti-corrosion work has played an important role in improving the anti-corrosion performance of the outer pipe wall of the water injection well, which can effectively prevent the growth of bacteria, corrosion and scale on the outer pipe wall.

In addition, the cathodic protection technology is also one of the anti-corrosion and anti-fouling technologies in oilfield water injection wells. The cathodic protection short section is the key to the implementation of cathodic protection technology. It refers to the process of implementing the cathodic protection technology. Corresponding short sections are added to the pipelines of water injection wells, and short-circuiting has strong anti-corrosion and anti-scale capabilities, thereby enhancing the overall anti-corrosion and anti-scale technology.

**Figure 3.** Anti-scaling and descaling technology of water injection wells in well pipeline oil production plant

2.3. *Ways to effectively enhance the anticorrosion effect of oil injection wells*

The anticorrosion technology of the wellhead and pipeline of the injection well includes the selection of anticorrosive pipeline materials, the application of antisepsics and the addition of anticorrosion devices, which have a great effect on the improvement of the anticorrosion work of the injection wells. And if you want to do a good job in anti-corrosion work of water injection wells, you should pay attention to the following two aspects; first, establish a good water injection well inspection work, regularly check the corrosion phenomenon of water injection wells, and ensure that 1-2 inspections per day can be very good. Greatly reduce the corrosion phenomenon. In addition, during the inspection process, attention should also be paid to the maintenance of the pipeline, and the pipeline should be replaced in time for the damage of the pipeline. Secondly, to conduct research on anti-corrosion technology, relevant departments of oil and mines should increase investment in science and technology, personnel and capital for anti-corrosion pipes of injection wells, and well-inspected anti-corrosion technology for injection wells to fundamentally improve the anti-corrosion ability of oil injection wells.
3. Scaling of injection wells in oil production plants

3.1. Causes of scaling in water injection wells of oil production plants
The scaling of oil injection wells in oil production plants is also an important factor affecting the work of oil injection wells in oil production plants. From the fundamental reason, the main reason for the scaling of oil injection wells in oil production plants is due to the corrosion problems of oil injection wells in oil production plants. It will produce a large amount of oxides and other substances, which will cause clogging and scaling. In addition, some scaling may occur during the normal operation of the water injection wells in the oil production plant.

3.2. Anti-scaling and descaling technology of water injection well in oil production plant
At present, the use of anti-scaling and descaling technology for water injection wells in oil production plants mainly includes the following two forms: first, the pipelines that produce corrosive dirt in oil injection wells of oil production plants are replaced, and new types of anti-scaling pipes are replaced. Secondly, the current advanced anti-scaling and descaling agents are used to solve the structural problems of water injection wells in oil production plants. The following is the experimental screening of scale inhibitors for water injection wells of an oil production plant by a factory in S City. Through relevant research, it has been found that w T 304 scale inhibitor is a scale inhibitor with good scale prevention effect. And descaling is of great help. w T-304 anti-scaling agent itself is a non-toxic and harmless substance, and it is easy to merge with water, and its anti-corrosion and anti-scaling effects can meet the relevant national technical standards [3]. In addition, the desulfurization agent is also a preparation that is often used in the descaling technology of water injection wells in oil production plants. The desulfurization agent currently uses H\textsubscript{2}O\textsubscript{2} and KMnO\textsubscript{4}. Compared with KMnO\textsubscript{4}, H\textsubscript{2}O\textsubscript{2} The effect of sulfur removal is more obvious.

4. Conclusion
Oil is an important resource in society at present, and it can be said to be crucial for the development of a country. However, the phenomenon of corrosion and scaling of oil injection wells in oil production plants affects the efficiency of oil extraction and has an impact on the production of petroleum resources. Failure to solve the problem of corrosion and scaling of oil injection wells in oil extraction plants as soon as possible will cause more losses to human exploitation of petroleum resources. The currently used anticorrosion and antifouling technology for water injection wells has yet to be developed. Only by studying more advanced anticorrosion and antifouling technology for water injection wells can the efficiency of oil extraction be improved. It is hoped that this article will be helpful to the development of anti-corrosion and anti-scaling technology for water injection wells in oil production plants.

References
[1] Wei Ning. Research on anti-corrosion and anti-fouling technology of water injection well in oil production plant [J]. Chemical Engineering Management, 2015, 000 (015): 84, 86.
[2] Xiao Ming, Fang Zhengliang, Zhou Jian. Discussion on anti-corrosion and anti-scaling technology of water injection wells in Zhongshi Oilfield [J]. Chemical Industry Management, 2016, 000 (022): 198-198.
[3] Li Jing, Dai Qingxiang, Liao Rugang. Discussion on anti-corrosion and anti-fouling technology in Guangbei Block of Qinghe Oil Production Plant [J]. Journal of Jianghan Petroleum University, 2006 (02): 80-82.