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Analysis of long distance dosing in Honggang water injection gathering and transportation system

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Abstract

In view of the Honggang district water gathering and transferring system, serious corrosion and scaling problems, to block water quality testing, bacteria and corrosion rate, through the different distance conveying unit scale corrosion factors and corrosion environment, sample analysis, determine the old red hills, water gathering and transferring system, main control factors of corrosion and scaling bacteria corrosion and carry out effective governance.

Keywords

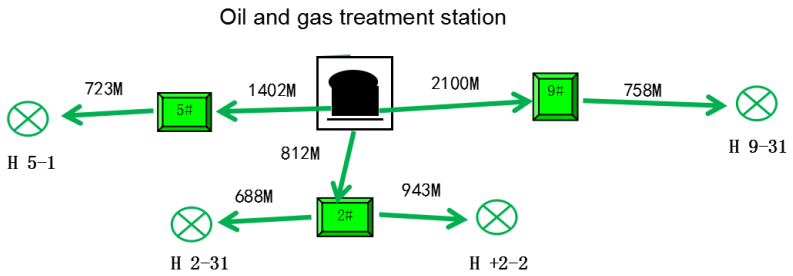
Corrosion scaling; Main control factors; Bacterial corrosion.

1. Overview of the study area

At present, the corrosion of Honggang water injection system is mainly reflected in the serious corrosion of water injection Wells in the old area, which belongs to the area of one oil and gas treatment station. At present, there are 375 water injection Wells with the displacement of 750m3/h. The filtration process adopts pressure oil removal + double filter material filtration. The following figure shows the one-station filtration process of oil and gas treatment:

2. Water injection system block selection

The exemption period of Honggang district is 520 days, of which corrosion repair accounts for 21%, scaling repair accounts for 24%; The first oil and gas treatment station in this block is the main research work, and 7 water injection Wells and water injection Wells with different gathering and transportation distances from the first oil and gas treatment station in Honggang are selected as monitoring points.



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3. Analysis of main controlling factors of corrosive fluid and corrosion scaling

3.1. Analysis of corrosion influencing factors

The content of calcium and magnesium ions in the old area is 56-76mg/ L, sulfate ions are 130-2612mg/ L, and total salinity is 6807-15956mg/ L, which belongs to moderately corrosive water [1].

SRB bacteria exceeded serious, bacterial corrosion is obvious.

The sewage samples from the first oil and gas station were seriously pitted, and the appearance of the samples was consistent with the characteristics of SRB bacterial corrosion. Bacterial corrosion accounted for a large proportion, and there was also aggressive CO_2 corrosion [2].

Table 1 Bacterial content evaluation of samples from different nodes of one oil and gas treatment station

Description	Oil and gas treatment station 1	Oil and gas treatment station 1	2#Water injection room	5#Water injection room	9#Water injection room
	No dosed after 2nd filtration	After filling the inlet of the water injection pump	After the water distributor is dosed	5#coming water all the time	9#running water all the time
Na	4281.28	4402.88	4573.29	7882.50	2803.96
Ca	0.00	0.00	0.00	11.75	0.00
Mg	69.83	76.30	68.52	48.38	56.58
Kalium	117.82	113.29	120.02	177.75	84.63
CI	5704.95	5865.12	6088.77	2213.73	2543.53
Sulfation	130.16	131.61	137.41	2612.93	329.74
Carbonate	0.00	0.00	0.00	0.00	0.00
HCO	1323.22	1382.71	1370.81	3009.20	989.44
Degree of	11627.26	11971.92	12358.82	15956.23	6807.88
SRB	4500.0	4.0	25.0	950.0	950.0

3.2. Analysis of corrosion and scaling products

Through the follow-up investigation of 4 injection Wells on site, it can be seen that the oil well corrosion is mainly local corrosion (poreetching), and the wellbore surface has serious local and mesa corrosion characteristics, with corrosion scaling products and serious corrosion under scale [3].

There are many influencing factors of corrosion and scaling in injection Wells. Qualitative analysis of scale samples is needed to find out the main factors of corrosion and scaling, so as to achieve better results. Scale samples are taken from four injection Wells in this block and analyzed by XRD diffraction instrument [4], and the results are shown in Table 2.

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Table 2 Analysis of main control factors of corrosion in block

Well No.	$CaCO_3$ (%)	Fe_2O_3 (%)	$FeCO_3$ (%)	FeO (%)	FeS (%)	SiO_2 (%)
Well 2-3	23.04	0	12.02	5.49	57.93	1.52
Red +2-2	6.16	3.92	60.7	2.92	26.3	0
Red 5-1	2.26	3.6	14.65	0	77.86	1.62
Red 9-31	3.55	0	6.86	0	69.31	20.27

It can be seen from the analysis results that the scale components are mainly composed of FeCO3 and FeS, and the proportion of FeS is larger. Bacterial corrosion is the main controlling factor for the corrosion and scaling of water injection Wells in this block [5].

4. Evaluation and control of anti-corrosion dosing

4.1. Reagent evaluation experiment

Corrosion rate is calculated mainly by measuring the change before and after the test piece to calculate the material loss of the test piece so as to achieve the purpose of measuring the corrosion rate [6].For metal specimens with fixed geometric size, the relationship between corrosion rate and external size is shown in the following formula.

$$F=C\times\triangle G/S\times t\times\rho$$

Where: F -- corrosion rate (mm/a); △G -- Difference of quality before and after test (G); S -- sample surface area (cm2); T -- Corrosion time (h); ρ -- material density (g/cm3); C -- Conversion factor (8.76×104).

5 liters of water samples from 4 field water injection Wells were taken, and a certain amount of water samples were respectively put into a small stopper bottle, and fungicides were added, and the medium with different concentrations of 50ppm and 100ppm was prepared. The medium was incubated at 37.3 for 4 h at a constant temperature, and 1 mL of the medium with different concentrations was taken out with a sterilized syringe. Add it into the bacterial bottle (Beijing Huaxing Chemical Reagent Factory), dilute it step by step, and do the experiment with blank water sample at the same time for comparative determination. Experimental results show that the bactericidal effect on produced water with low SRB bacteria is better than that of produced water with high SRB bacteria. According to Q/SY 49-2010 "technical requirements for bactericidal agents for oilfield use", when the SRB content is more than 1000 /mL, the bactericidal rate is greater than 99% when the drug concentration is 100mg/L. When the SRB content is less than 1000 PCS /mL, the dosage is 50mg/L.

Experimental results are shown in the following table:

Table 3 Evaluation of bactericide sterilization

Serial No.	Sample source	Fungicide concentration	Reading		Sterilizing rate	Mean corrosion rate (mm/a)
			Index	CFU/mL		
1	Red 2-3	0	330	25		0.055
2	Red 2-3	Fungicide 50ppm	0	0	100%	0.055
3	Red 2-3	Fungicide 100ppm	0	0	100%	0.054
4	Red +2-2	0	311*10	75		0.053
5	Red +2-2	Fungicide 50ppm	302	6.5	91%	0.054

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6	Red +2-2	Fungicide 100ppm	0	0	100%	0.050
7	Red 5-1	0	321*102	1500		0.091
8	Red 5-1	Fungicide 50ppm	220	2.0	99%	0.077
9	Red 5-1	Fungicide 100ppm	0	0	100%	0.071
10	Red 9-31	0	330*102	2500		0.132
11	Red 9-31	Fungicide 50ppm	220	25	99%	0.088
12	Red 9-31	Fungicide 100ppm	0	0	100%	0.075

4.2. Long-distance gathering relay dosing experiment

With fungicide as the test agent, relay dosing test points and sampling points were set up between water injection # 5 and # 9 of the gathering and transportation system, and the applicability evaluation experiment of long-distance gathering and transportation relay dosing with fungicide concentration of 100ppm was conducted. The evaluation results are shown in the table below.

Table 4 Fungicide performance evaluation at different dosing sites

Sampling spot	Sample No.	Germ (piece/ml)	Mean corrosion rate(mm/a)
5#water injection room	305	0	0.063
	313	4.5	
	355	0	
9#water injection room	336	0.9	0.071
	312	0	
	329	7.5	

According to the above data, it can be concluded that for the same agent, the utilization rate of the agent at the distal end is greatly reduced due to different dosing locations. Therefore, it is more economical and reasonable to set dosing points at different dosing locations considering economic benefits.

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