A CASE STUDY OF SELECTION OF CORROSION INHIBITORS FOR WATER SOURCE OF WAHA FIELD

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Abstract:

WAHA oil field is an important oilfield in Libya is operated by WAHA company . In this oil field water is being used for reinjection in reservoir to increase the pressure in the reservoir and hence increase production of crude oil. This water is produced from the water source wells drilled in oil field. Injection water contains dissolved carbon dioxide and hydrogen sulphide and hence it has corrosive characteristic .Moreover the temperature of water is high .A study has been performed to select suitable corrosion inhibitor for inhibition of corrosion .

This paper presents the results of corrosion inhibition studies of water source wells in WAHA field. The concentration of selected corrosion inhibitors has been optimized for economical consideration.

1.Introduction

WAHA oil field is operated by WAHA company and it is the important oil fields in Libya . The unique nature of this oil field is that has no liquid effluents. Whatever water is produced it is again injected to reservoir together with some other water for enhanced oil recovery . WAHA oilfield has about twenty water source wells at W-59 and nine water source wells at N.DEFA . These wells are producing water about 85000 bbl/day . The geological formation of all water source wells are either TAZERBO formation or SARIR formation . The temperature of water from the well of TAZERBO formation was measured as 72.7 C while the temperature of the water fro well of SARIR formation was 98.9 C . The typical analysis of both type of water are given in Table 1 and 2 . Both type of water acid gases water has acidity and becomes corrosive. The acid corrosion in water flood is controlled by addition of chemicals corrosion inhibitors.

A wide variety of inhibitor formations [1,4] is available for corrosion control in water flood and brine disposal system . However most of these inhibitors are produced from only a few types of starting materials. Fatty acid and rosin acids some form of basic nitrogen precursor and ethylene oxide are active ingredient sources .

After transformation into final product the resulting ingredients are usually dissolved in alcohol (often isopropyl alcohol) water solution.

Table 1 : Typical water analysis from a well of TAZERBO formation:

Property	Units	Result
Cations		
Calcium (Ca^{+2})	Mg/L	50.0
Magnesium (Mg^{+2})	Mg/L	13.4
Sodium (Na^+)	Mg/L	1538.8
Anions		
Chloride (Cl^-)	Mg/L	2300.0
Sulphate (SO_4^{-2})	Mg/L	0.0
Carbonate (CO_3^{-2})	Mg/L	0.0
Bicarbonate (HCO_3^-)	Mg/L	457.5
Miscellaneous		
Total hardness	Mg/L as $CaCO_3$	180
Calcium hardness	Mg/L as $CaCO_3$	125
Magnesium hardness	Mg/L as $CaCO_3$	55
Phenolphthalein alkalinity (P Alkalinty)	Mg/L as $CaCO_3$	0
Methyl orange alkalinity (M alkalinity) Ph at 25 C	Mg/L as $CaCO_3$	375
Total dissolved solids (Calculated)	Mg/L	6.59
Conductivity at 25 C°	mhos/cm**μ**	4430 7120
Specific gravity		1.0031
Dissolved Gases (on site)		
Carbon dioxide (CO_2)	ppm	108
Hydrogen sulphide (H_2S)	ppm	4
Oxygen (O_2)	ppm	0

Table 2: Typical water analysis from well of SARIR

Property	Units	Result
Cations		
Calcium (Ca^{+2})	Mg/L	330.0
Magnesium (Mg^{+2})	Mg/L	394.9
Sodium (Na^+)	Mg/L	3585.5
Anions		
Chloride (Cl^-)	Mg/L	6800.0
Sulphate (SO_4^{-2})	Mg/L	620.0
Carbonate (CO_3^{-2})	Mg/L	0.0
Bicarbonate (HCO_3^-)	Mg/L	305
Miscellaneous		
Total hardness	Mg/L as $CaCO_3$	2450

Calcium hardness	Mg/L as $CaCO_3$	825
Magnesium hardness	Mg/L as $CaCO_3$	1625
Phenolphthalein alkalinity (P Alkalinty)	Mg/L as $CaCO_3$	0.0
Methyl orange alkalinity (M alkalinity) Ph at 25 C°	Mg/L as $CaCO_3$	250
Total dissolved solids (Calculated)	Mg/L	6.13
Conductivity at 25 C°	mhos/cmμ	12215 14690.0
Specific gravity		1.0085
Dissolved Gases (on site)		
Carbon dioxide (CO_2)	ppm	96.0
Hydrogen sulphide (H_2S)	ppm	5.5
Oxygen (O_2)	ppm	0

2.CORROSION INHIBITORS STUDIED

In this study tow commercial inhibitors are studied . We have given identification number S1 and S2 for the selected corrosion inhibitors . The description of these corrosion inhibitors are follows:

CORROSION INHIBITOR (S1) :

It is a commercial product . This is a water soluble filming amine corrosion inhibitor containing (morpholine basis and dimer acid) as active materials formulated to give good film persistency in fresh water , sea water and heave brine systems.

CORROSION INHIBITOR (S2):

This is also a commercial product . It is water soluble filming amine corrosion inhibitor it has the similar blend as S1 except does not contain dimer acid.

3.CORROSION INHIBITORS TESTING METHOD

There are different techniques for testing of corrosion inhibitors such as: [2,3]

. Weight Loss Specimens.

. Electrical Resistance Probes.

. Polarization.

. Galvanic Corrosion Probes.

In present study Linear Polarization Resistance Technique (LPR) has been used. This method of evaluating corrosion rates employs galvanic cell the test water being the electrolyte and the two carbon steel rods providing the electrodes. In the (Result) mode the two ranges the electrodes are initially coupled for a period of 14 seconds .This is to allow the coupling polarization current to fall to a small static value . The cell is then polarized to +20 mV for about 15 seconds towards the of this time a reading of the current flowing is

taken. The cell potential is then reversed to – 20 mV for about 15 seconds and another reading of the current flow is taken at the end of time . An average of the two current reading is then calculated . This current is then processed by the meters electronics an displayed as a corrosion rate in Mils Per Year (MPY) . Experimental conditions used are summarized in table 3

Table 3: Experimental conditions used are summarized

Test Temperature	70 C°
Water Phase	Water from water source wells
Gas Phase	CO_2 saturated
Coupon Material	1018 M/S

Both the corrosion inhibitors (S1 and   S2) have been tested at different concentrations ranging 0   to   50 ppm . The results are summarized in Table 4-5 and Fig 1-2.

Table 4: Corrosion inhibition of water source wells(TAZERBO) using S1   and   S2   corrosion inhibitors

Dose	Percent Corrosion Inhibition	
Rate (ppm)	S1	S2
0	0.0	0.0
5	93.03	88.85
10	97.01	92.87
25	98.63	96.31
50	99.20	97.62

Fig.1.Corrosion Inhibition in Water Source Well TAZERBO formation
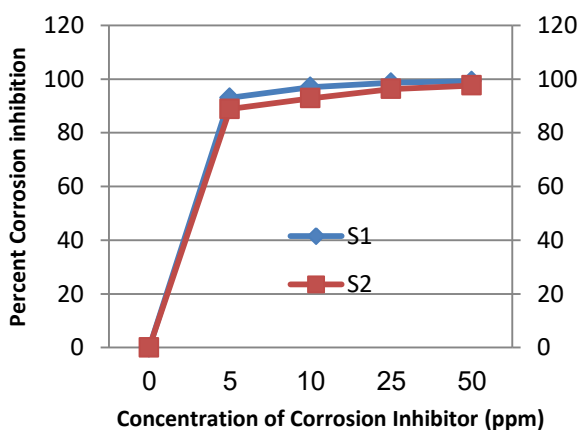
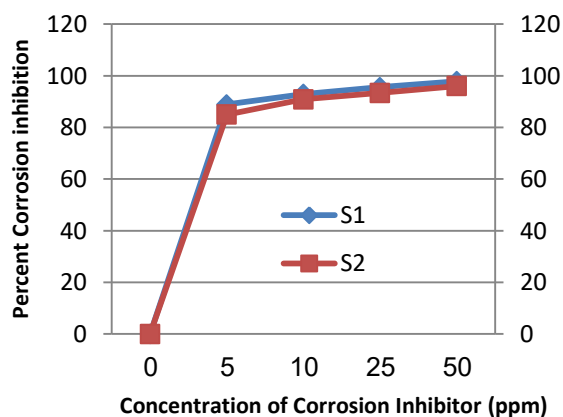Fig .2. Corrosion Inhibition in Water Source Well SARIR formation

Table 5: Corrosion inhibition of water source wells(SARIR)   using S1 and   S2   corrosion inhibitors

Dose	Percent Corrosion Inhibition	
Rate (ppm)	S1	S2
0	0.0	0.0
5	88.89	84.98
10	92.91	90.86
25	95.56	93.38
50	97.88	96.01

CONCLUSION:

- In from the results it is clear that both corrosion inhibitors S1 and S2   showed corrosion inhibition for waters from water source wells of Waha oilfield.
- Bothe corrosion inhibitor S1 performed better compared at the same concentrations of corrosion inhibitor   S2 .
- This is because corrosion inhibitor S1   contains dimer acids but the corrosion inhibitor S2 does not contain dimer acids and other components the same.

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