BULETINUL Universităţii Petrol – Gaze din Ploieşti	Vol. LX No. 4B/2008	215 - 218	Seria Tehnică

Ecological Compounds Used as Corrosion Inhibitors in Field Waters

Maria Moraru, Alexandra Şchiopescu, Ileana Cameniță

Universitatea Petrol – Gaze din Ploieşti, B-dul Bucureşti nr. 39, Ploieşti, România
email: imcamenita@yahoo.com

Abstract

This paper presents the experimental researches of corrosion phenomena in field waters and relates to the protection of steels surface using ecological compound (Na-lignosulphonate) as corrosion inhibitor.

The corrosion rate of steels in field water inhibited by Na-lignosulphonate was determined by conventional weight loss measurements.

Keywords: *corrosion, ecological inhibitor, field water*

Introduction

The studies carried out have shown that the field water produce the metallic surface deterioration.

It is known the soluble salts confer a strong corrosive character [1 - 3].

The oxygen solved from these waters increases also the corrosion processes.

Inhibition of corrosion of steels in aqueous solutions has been achieved by many classes of organic compounds.

It has been known that the interaction of these compounds with the metal surface leads to the formation of a protective film and that corrosion rate decreases as film thickness increases [4].

Tested inhibitor is Na-lignosulphonate (LGS), selected as nontoxic and ecologically acceptable.

Na-lignosulphonate (LGS) was chosen for its surface active properties, emphasized by its structure, which contains hydrophile groups linked with lignin hydrophobe groups. The adsorption process affects both the anodic and cathodic reaction [5].

Corrosion and its control were evaluated from weight loss measurements.

Experimental details

The behavior of steels in field aerated waters at different temperatures has been analyzed.

The waters composition has been reported (table 1).

Table 1. Chemical composition of field waters

Field water	pH	Chemical composition				
		Na^+ (K^+) (g/l)	Ca^{2+} (g/l)	Mg^{2+} (g/l)	Fe^{2+} (mg/l)	Cl^- (g/l)
A	6,80	26,2	1,48	0,97	1,35	45,8
B	6,65	31,7	1,72	1,16	1,44	55,7

The steel specimens (table 2) are polished by sand paper, degreased by ethanol and acetone, dried, weighed and placed in tested solutions.

Table 2. Chemical composition of steels (%), Fe balance

Steel	Chemical composition (%)						
42 Mo Cr 11	C	Si	Mn	S	P	Cr	Ni
	0,39	0,29	0,77	0,008	0,020	0,88	0,21
	Cu	Mo	V	Ti	Al	As	Sn
	0,30	0,165	0,06	0,0010	0,022	0,014	0,020
OL 52	C	Si	Mn	S	P	Cr	Ni
	0,14	0,29	1,42	0,010	0,014	0,03	0,03
	Cu	Mo	V	Ti	Al	As	Sn
	0,04	0,015	0,06	0,0017	0,027	0,003	0,009

The influence of temperature was examined between 20 – 60^{o}C.

After 24, 48, 96, 168 and 336 hours, the specimens were cleaned, degreased, dried and weighed.

Tested inhibitor is Na-lignosulphonate, selected as nontoxic and ecologically acceptable. Optimal concentration of LGS has been determined.

Results and discussions

The average corrosion rates of steels in field waters as o function of exposure time have been reported (fig. 1-2).

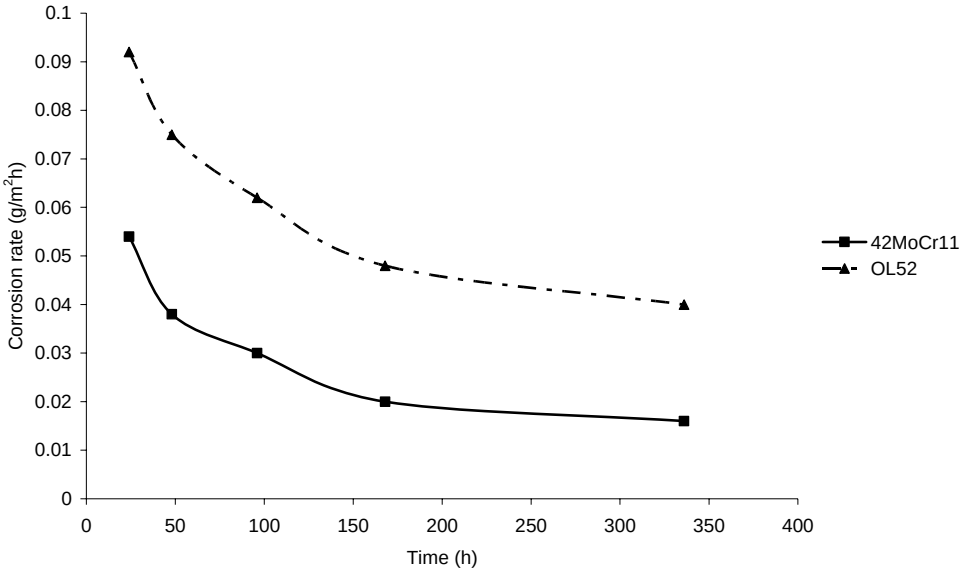

Fig. 1. Variation of the corrosion rate with time exposure for steel samples immersed in field water A

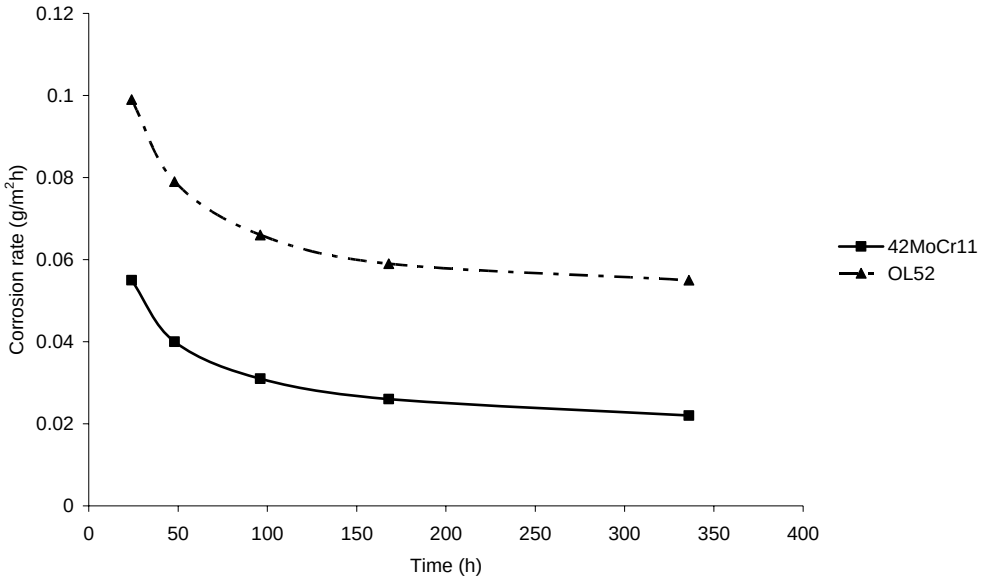

Fig. 2. Variation of the corrosion rate with time exposure for steel samples immersed in field water B

Influence of temperature on corrosion rate is related in table 3

Table 3. Influence of temperature on corrosion rate

Field water	T (°C)	42 Mo Cr 11		OL 52	
		K_g (g/m²h)	P (mm/year)	K_g (g/m²h)	P (mm/year)
A	20	0,038	0,043	0.075	0,084
	40	0,060	0,067	0,098	0,110
	60	0,075	0,084	0,112	0,125
B	20	0,040	0,045	0.079	0,089
	40	0,063	0,070	0,106	0,119
	60	0,080	0,090	0,122	0,137

Optimal concetration of Na-lignosulphonate have been determinated (table 4-5).

Table 4. Corrosion rate of steel samples in field water A, in presence of LGS (t = 20°C, time = 168 h)

LGS (ppm)	42 Mo Cr 11		OL 52	
	K_g (g/m²h)	I. E. (%)	K_g (g/m²h)	I. E. (%)
-	0,021	-	0,048	-
50	0,018	14,2	0,040	16,6
500	0,014	33,3	0,030	37,5
1000	0,007	66,6	0,016	66,6
2000	0,005	76,1	0,012	75,0
3000	0,004	80,9	0,011	77,0

Table 5. Corrosion rate of steel samples in field water B, in presence of LGS (t = 20°C, time = 168 h)

LGS (ppm)	42 Mo Cr 11		OL 52	
	K_g (g/m^2h)	E.I. (%)	K_g (g/m^2h)	E.I. (%)
-	0,024	-	0,059	-
50	0,020	16,6	0,049	16,9
500	0,017	29,1	0,039	33,9
1000	0,009	62,5	0,019	67,8
2000	0,007	70,8	0,016	72,8
3000	0,006	75,8	0,014	76,2

Conclusions

Tests made on 42 Mo Cr 11 and OL 52 steels corrosion processes in field waters demonstrate important rates of corrosive processes.

The results showed that Na-lignosulphonate is a good ecological inhibitor for the steel corrosion in field waters. Optimal concentration of LGS is 2000 ppm. Increasing inhibitor concentrations do not provide any further substantial improvements.

The data obtained confirm suggestion that a dense oriented protective layer is formed on the metal surface.

The results obtained on the inhibiting effects may be most generally ascribed to adsorption phenomena.

References

1. Brânzoi I.V., Brânzoi F., Pilan L., *Caracteristici generale privind coroziunea şi protecţia anticorosivă a metalelor în diverse medii*, Ed. Printech, 2006
2. Dumitrescu V., Moraru M., Cameniţă I., Brânzoi I.V., Şchiopescu A., *Cinetica coroziunii oţelurilor în ape de zăcământ,* Revista de Chimie, vol. 59, nr. 4, p. 428, 2008
3. Cameniţă I., Şchiopescu A., Moraru M., Brânzoi I.V., Brânzoi F., *Protecţia anticorosivă a oţelurilor în ape de zăcământ,* Revista de Chimie, vol. 58, nr. 12, p. 1316, 2007
4. Badea T., Popa M.V., Nicola M., *Ştiinţa şi ingineria coroziunii*, Ed. Academiei Române, Buc., 2002
5. Lahodny-Sarc O., Gotic I., Levacic E., 9 - SEIC, Ann. Univ. Ferrara, N. S., Sez. V, Suppl. N. 11, p. 93, 2000

Compuşi ecologici utilizaţi ca inhibitori de coroziune în apele de zăcământ

Rezumat

Lucrarea prezintă cercetări experimentale ale fenomenelor de coroziune în ape de zăcământ şi respectiv protecţia anticorosivă a suprafeţei oţelurilor folosind ca inhibitor de coroziune un compus ecologic (Na-lignosulfonat).

Viteza de coroziune a oţelurilor în ape de zăcământ cu inhibitor Na-lignosulfonat a fost determinată prin măsurători gravimetrice.