

# **THE SYNERGISM OF IFHANGAS INHIBITOR AND DEEMULSIFIERS ACTION ON THE STEEL CORROSION AND THE OIL SEPARATION FROM WATER.**

**Assoc. Prof. Dr. K. M. ALIEVA**

The Institute of Chemistry and Chemical Technology of NAS of Kyrgys Republic

**Assoc. Prof. Dr. J. T. AKMATOVA**

Kyrgyz National State University, Faculty of Chemical Technology, Bishkek, Kyrgyz Republic.

**Dr. L.V. FROLOVA**

Kyrgyz National State University, Faculty of Chemical Technology, Bishkek, Kyrgyz Republic.

The irrigation of extracted oil is being subjected to the considerable rise as the deposit locations exploration term increases. This is especially noticeable on the JSU «Kyrgyzneft" ( a water content in oil goods corresponds to the International standards and does not exceed 1%).

In the system of extraction, collection, initial preparation and production transportation the oil separation is carried out, by this the technological equipment is subjected to the corrosion destruction due to high mineralization (about 2% of salts) and dissolved corrosion-aggressive gases, so the active  $HS^{-1}$ ,  $S^{-2}$  and  $CO_3^{2-}$  ions are contained together with chloride-ions. It should be noted that the aggressivity of hydrogen sulfide is stipulated not by the common corrosion, but first of all by the Hydrogen pick up and the metal fragility, because  $HS$  is a promoter of hydrogen reduction.

In conditions of water deficit the sewage are repeatedly used after long settle and filtration from mechanic admixtures. The other peculiarity of transporting production is the emulsion stability as a result of irrigation, hydrodynamic regime and mechanic admixtures, which stabilize the oil-water system. The JSU uses the oil-soluble deemulsifier *D4411* - the blockcopolymer of polyethyleneglicole with molecular weight 2500 - 3000 - and in the last time - *Progalit* for separation. The deemulsified action of reagents was studied, but there isn't any unambiguosity in their using, because the verification of their technological peculiarities details are necessary. It is well-known that even small change of viscosity and specific weight of liquid, transported in the pipeline may lead to increase of oil extraction energocapacity as a result of hydrodynamic resistance increase.

The polyfunctionality of deemulsifiers and especially their antagonism to other reagents of technological cycle, particularly to the metal corrosion inhibitors is of great interest.

It is known that inhibition as a protection method in oil industry is the most effective and this method's dignity is in possibility of its use without changes in existing technology. The most of using inhibitors are the industrial waste, which are a mixture with one or more active components their composition and properties depending on obtaining way and basic product raw material quality. A universal inhibitor *IFHANGAS* [1.] takes the special place among the inhibitors, as it stops the corrosion and prevents steel Hydrogen pick up in hydrogen sulfide containing media at the same time possessing with high technologicality. The mechanism of its protection action is investigated sufficiently completely, but the joint use with deemulsifier - the antagonism or synergism- is not studied enough both by separation and inhibition.

The corrosion action of reagents is estimated by the known [2] method of corrosion rate defining ( $\text{g/m}^2\text{^}$ ) and the penetration value (mm/year) of steel plated specimens (St.3) in a model medium (1% solution of *NaCl*).

The electrochemical researches were carried out on the potentiostate P5827M according to [3] in the presence of inhibitors *IFHANGAS* and deemulsifiers (in 0,25 ; 50 ; 75 ; 100 mg/1 concentrations).

The deemulgating ability was determined according to [4].

Deemulgators *D4411* and *Progalit* were proposed for researches by the JSU «Kyrgysneft» (they have got a quality certificate of state-marker) ; *IFHANGAS* inhibitors corresponds to the standard ; *NaCl* of «Ch.P.» mark was used in experiment.

The physico-chemical properties of model medium in the presence of reagents were previously studied. It was established , that medium pH changes inconsiderably and remains within limits 5,4-5,85 ; the specific weight increases

from 0,9971 (background *NaCl*) till 1,0027g/sm<sup>3</sup> (in the presence of *Progalit* and *IFHANGAS*) ; the medium viscosity remains constant one (0,9039-0,9098 santipuases) ; the medium electroconductivity changes also inconsiderably .

As it is shown in the table 1 , the most rapid settle aqueous phase is carrying out in 1800 seconds in the presence of 50 mg/l of deemulsifier D4411, the volume of separated water is five times more than at natural settle (compare

49 and 182,6 ml).

№	Time of settling, s	The volume of separated water							
		Background <i>Nad</i>		<i>IFHANGAS</i>		<i>D4411</i>		<i>IFHANGAS</i> + <i>D4411</i>	
		V, ml	%	V, ml	%	V, ml	%	V, ml	%
1	1800	49,0	22,3	65,6	29,8	182,6	82,9	188,6	85,7
2	3600	49,6	22,5	65,6	29,8	206,6	93,89	208,0	94,5
3	7200	49,6	22,5	65,6	29,8	206,6	93,9	220,0	100
4	10800	50,0	23,0	66,6	0,3	220,0	100	220,0	100

Table. 1.

The *D4411* (50 mg/l) deemulsifier and *IFHANGAS* inhibitor (50 mg/l) influence on oil-water emulsion destruction. The solution volume - 220 ml ( $\rho = 1,0027 \text{ g/sm}^3$ ), oil's amount -20 g, emulgation time - 900 sec at  $\omega = 60 \text{ rot/min}$ ,  $T = 293 \pm 2 \text{ }^\circ\text{K}$ .

The *IFHANGAS* inhibitor use does not practically change the *D4411* deemulgation rate: the inhibitor only slightly increases (for 30%) the natural ( 23%) water separation from oil its joint presence with *D4411* is not accompanied by *IFHANGAS* antagonism to oil separation process . Unlike to *D4411 Progalit* pocesses much higher deemulsifying effect: at 30 mg/l content (almost in 2 times less than *D4411*) the complete -157,0 ml or 99,%- separation of aqueous phase takes place in 300 sec as disolvan separates on 82,8% only in 1800 sec .

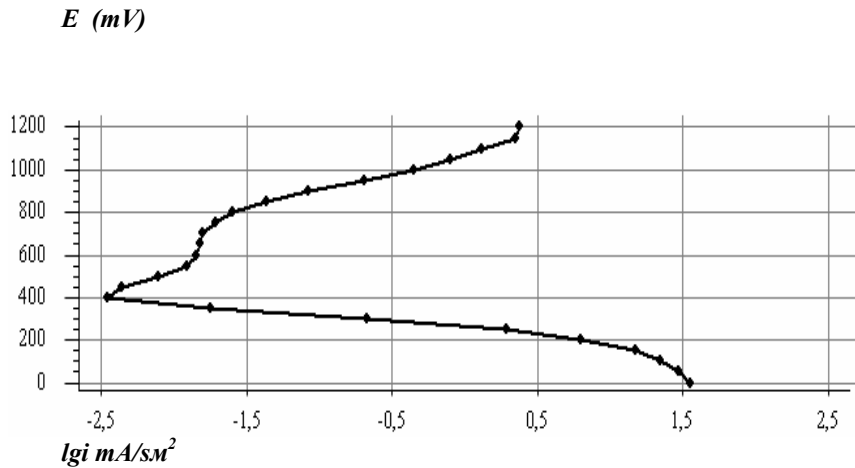
The *IFHANGAS* inhibitors use (30 mg/l) at joint content with *Progalit* doesn't influence on deemulsifying process of oil-water system. Water volume - 157,0 ml -

separates in first 300 seconds. While in the presence of *D4411* and inhibitor of separation takes place only in 2 hours .

The corrosional behavior of steel in the presence of these reagents changes as follows: the small quantity of *D4411* (10 mg/l) decreases corrosion from 0,1455 to 0,0902 g/m<sup>2</sup>-hour (from 0,1601 till 0,100 mm/year), reaching its maximum (0,1391 mm/year ) at 50 mg/l. At concentration *D4411* 100 mg/l corrosion rate become commensurable with the rate established at 10 mg/l. The *Progalit* deemulsifier doesn't increase steel dissolving, it in some extent inhibits the process , in unmixed medium the corrosion inhibition rate ( $\gamma$ ) being equal to 1,45 it increases by mixing till 2,09.

The obtained data contradict to confirmation about corrosion acceleration in the presence of deemulsifiers - SAS because of their washing effect. The inhibitors action is not much ( $Z = 46,4\%$ ). The joint presence of inhibitor both with *Progalit* and *D4411* and, does not actually change the corrosion rate .

The steel corrosional behavior in investigated conditions is in good agreement with the results of electrochemical studies (fig. 1, a, b, c). As it is seen from figure, the permanent potential of steel corrosion in 1% solution *NaCl* is equal to -400 mV (that strictly corresponds to known data [5] and with reagents addition it inconsiderably displaces to the cathode region (fig.1, b: -420 mV) – *D4411* and to the anode region (fig. 1, c -300 mV) - *Progalit*.



*fig. 1,a*

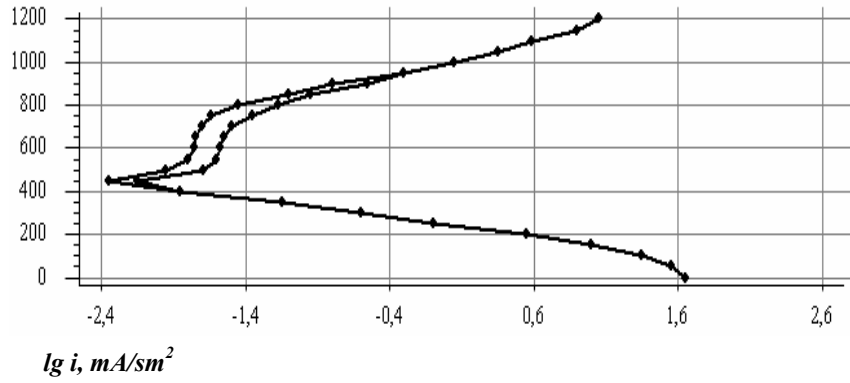
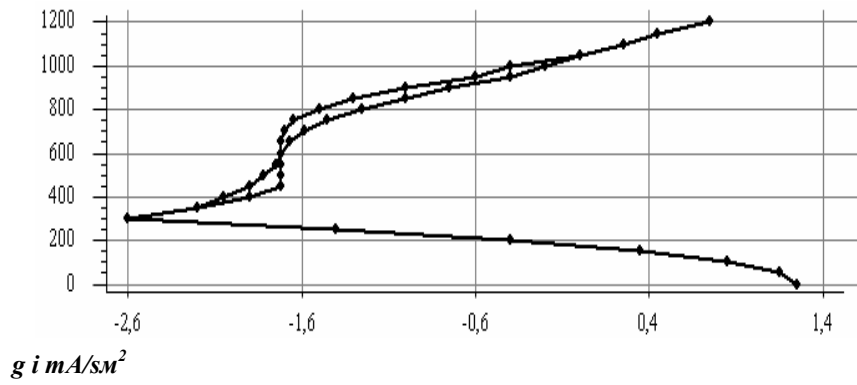
$E$  (mV)*fig.1, b* $E$  (mV)*fig.1, c*

Fig.1. The polarization curves, received on steel (St.3) in unmixed 1% solution  $NaCl$  ( $a'$ ) at 100 mg/1 *D4411* ( fig. 1, *b*) and 100 mg/1 *Progalit* (fig. 1, *c*).

With the polarization growth (see at  $E = -250$  mV) the deemulsifiers decrease the anode current density more than for order (fig.1, *b*, *c*) and inconsiderably decrease the current densities of cathode depolarization (see at  $E = -600$  mV, fig. *b*, *c*). On the cathode curves (fig.1, *b*, *c*) hysteresis is observed. The Hysteresis interesting peculiarity at all *Progalit* concentrations is the stable hysteresis «inversion» at -600 mV. It should be noted that hysteresis potentials region 1 part ( $-450 \div -600$  mV) and 2 part ( $-600 \div -1000$  mV) in the *Progalit* presence is more negative than in the case of *D4411* ( $-400 \div -850$  mV). This displacement is probably conditioned by the high effective  $+\delta$  - charge on *Progalit* adsorption reaction centre. It may be supposed that the reason of observed hysteresis inversion is in existing of two adsorption reaction centres : 2 part (

$-600 \div -850$  mV) corresponds to the adsorption of *Progalit* molecule adsorption reaction centre. It is effective charge is more positive than 1 part, exhibiting active absorption at more positive potentials of electrode surface ( $-450 \div -600$  mV). This fact allows to suppose that *Progalit* - high molecular SAS (surface active substance) is ampholyte.

If in *Progalit* case the inverse hysteresis is observed, in the presence of *D4411* the square of hysteresis loop is wider, compare it at ( $E = -700$  mV and 100 mg/1 deemulsifiers content:

a) *D4411*:  $i_k -1,43 \div -1,71$  mA/sm<sup>2</sup>,

b) *Progalit*:  $i_k -1,46 \div -1,6$  mA/sm<sup>2</sup>, as thicker adsorption layer is formed. But the proof of SAS adsorption influence on steel corrosion should be studied by the analyses of potential -capacity ( $C - C(E)$ ) and potential - surface energy ( $\sigma - \sigma(E)$ ) dependences.

In the presence of *Progalit* and *IFHANGAS* inhibitor the cathode process is accompanied with the normal hysteresis.

Conclusions: The highest oil separation is provided by the *Progalit*. The joint presence of *IFHANGAS* inhibitor and *Progalit* exerts evident synergism of action, which nature is caused by many factors, the main among them being, probably, peculiarities of compounds absorption both on hard surface, and on the oil - water division surface.

**REFERENCES**

1. Rosenfeld I.L., Frolova L.V., Minenko E.M. // Zashita metallov. 1982, v. 18, № 2, p. 169 -173.

2. GOST 9.506-87.ECLK.C. The Inhibitors of metal corrosion in water-oil environments. M.: Standart Publishing. 1988.

3. Freiman L.M., Makarov V.A., Bryksin I. E. The Potentiostatic method in corrosional tests and electrochemical protection. L.:Chimia, 1972, p.239.

4. RD-39-30-898-93. Kuibyshev. Giprovestok-neft; 1984.

5. Rosenfeld I.L. The Inhibitors of the corrosion. M.: Chimia, 1979, p.350.