RESEARCHES 0F THE INHIBITING PROPERTIES OF WATER AND ORGANIC EXTRACTS OF OIL SLIMES

ИССЛЕДОВАНИЕ ИНГИБИРУЮЩИХ СВОЙСТВ ВОДНЫХ И ОРГАНИЧЕСКИХ ВЫТЯЖЕК НЕФТЕШЛАМОВ.

Cand. of tech. science Assoc. prof. Chkhaidze D., Dr. of tech. science, Full prof. Megrelishvili Z., Academy doct. Assist. prof. Loria M.
Shota Rustaveli State University, Batumi, Georgia

Abstract: *Considered are inhibitor properties of the tank oil slime. Physical and chemical characteristics of oil and oil slime are given. Given are the data of tests on corrosive stability in atmospheric conditions and by accelerated anticorrosive method. It is shown that the aqueous and organic extract of the tank oil slime has obviously marked inhibitor properties that allow to recommend them for producing anticorrosive paint and varnish coatings.*
***KEYWORDS**: OIL, SLIME, INHIBITORY QUALITIES, PAINT COATINGS.*

1. Introduction

In many enterprises of oil and gas industry the oil slime is multitonnage waste. A great amount of oil waste of various type and structure [1.2] is formed after the production, transportation and refining of oil and gas. Only according to the data of gas branch of "Gasprom" the oily waste constitute about 10.0 thousand tone in 2000 where the share of liquid waste is 70 % and paste like and hard ones – 30 %. The amount of formed waste in some enterprises varies from 578 tone a year to 2510 tone a year [3]. In spite of the variety of existing oil slime they could be divided into three general groups according to the conditions of their forming [1] :

-ground (formed as a result of the oil products spillage on the soil during industrial operations and emergency);

-benthonic (formed at subsidence of petrol floods at the bottom of the water reservoir);

-reservoir type (formed during the storage and transportation of oil products in tanks of various constructions)

The refining of such slimes for utilization generally provides the extraction of oil fraction [2] on the use of oil slime for slime concrete production in highway engineering [4]. All types of oily waste contain substances having inhibiting properties against corrosion. The research of slimes for using them in the production of corrosion-resistant paint coatings or for the improvement of their quality will allow to expand the material base of paint coatings products production and will assist the protection of environment.

2. The goal of the research.

To determine physical and chemical characteristics of tank oil slime of Batumi Oil Terminal and to define inhibitory quality of aqueous and organic extracts with the purpose of their use in a production and for the improvement of quality for corrosion-resistant paint coatings (aqueous, half oily, oily prime coating and enamel)

3. Object and research methods.

Tanks used during the processing and storage of oil products in course of time require scraping as the sedimentation (oil slime) appears at the bottom and on the walls reducing the actual space of a tank and affecting the quality of oil products. Systematic scraping of tanks is done at least once a year depending on the types of oil products. But in some cases the scrapping can be done earlier than the prescribed period because of changing the filled-in oil products in the tank or preparing the tank for systematic or extra repairing works. According to the results of most researches in scrapped oil slimes the oil products, water and mechanical impurities (particles of sand clay and corrosion etc.) relation vary in wide limits: carbons make up 5-9 %, water - 1-52 %, hard impurities - 068-65 %. Because of it, their physical and chemical indexes also vary in wide limits. The oil slime density varies in the limits of 830-1700 kg/m^3, the freezing point from 3^o C to +80^o C. The flash point is over the range from 35 to 120^o C. At ingress of water into oil products the true emulsion as water-oil is formed. The stabilization of this emulsion happens at the expense of natural stabilizers. In most cases the main part of tank slimes is made up of liquid-viscous products with a high content of organic substances, water and some additives of mechanical impurities [1].

Today Batumi Oil Terminal transfer oil from Azerbaijan (Azerilight Crude Oil) and Kazakhstan (Kumkol Crude Oil, Tengiz Grude Oil). In table 1 physical and chemical data of three types of crude oil determined for 6 months of 2011 year are given. The analyses have been carried out in Batumi Laboratory of Georgian branch C B(Intertek Cateb Brett) according to the standards of ASTM [5].

Table 1. Physical and chemical indexes of crude oil

Crude oil	Density at 20 ^{o}C, kg/m3	Water content, %	Mechanical impurities, %	Freezing point, ^{o}C	Sulphur content
Tengiz Grude Oil	790,3	0,05	0,009	-33,0	0,517
Azerilight Crude Oil	846,0	0,18	0,010	-9,0	0,143
Kumkol Crude Oil	827,0	0,27	0,022	+18,0	0,158

At the same period carried were the analyses of oil slime from the storage located on the terminal territory where the tank oil slime from above mentioned types of oil is collected The amount of accumulated slime of 200…2500 tone is the danger for environment. The accumulated oil slime is viscous mass of dark brown colour, with a density 933,1 kg/m^3 at 80^{o}C, water content 13,3 %, freezing point +3,0^o C ,mechanical impurities 0,443 % and sulphur structure 0,257 %.

For the definition of the possibilities for using such slime for the production of corrosion- resistant paint coatings the research of inhibitor quality of the given TOS is carried out. For this purpose the water extract TOS was prepared. (100 gr. of oil slime was being boiled in 1 litre of water for one hour)

After freezing the water extract was filtrated and used for performing accelerated corrosion - resistant tests [6]. For comparison the corrosive inhibitor "Malkor" (technical condition 2415-004-56478541-06) and distilled water were used. Corrosion of the plates was valued visually according to the size of the corroded surface of the plates.

The organic extract of the oil slime was got by the extraction of TOS (tank oil slime) with organic solvent (toluene, xylol). The weight 100 gr of TOS was taken and 1 L. of organic solvent was added. The mixture was allowed for 24 hours. The produced extract in various proportions was added into the known paint varnish enamel ГФ-927 (ТУ 6-10-662-95).

The samples covered with enamel were tested for corrosion-resistant both in atmospheric conditions and by accelerated corrosion-resistant method in 3 % sodium chloride solution. As an example the steel plates of mark CT 08 (steel 08) and size 100 x 150 mm were used. The plates were covered both by clean enamel ГФ-927 and enamel with added various amount of organic extract of TOS. The relationship for paint varnish compositions are given in table 2.

Table 2. *Paint varnish composition structure*

#	Enamel ГФ-927 mas. %	Organic extract TOS, mas. %
1	100	-
2	98,0	2
3	95,0	5
4	93,0	7
5	90,0	10

The duration of the test in atmospheric condition lasted 24 months but by the accelerated method - 60 days. Corrosive damage was defined according to the changes of mass of the samples (ГОСТ 17322-71).

4. Result and discussion

The received data given in figure 1 show that the water extract of TOS has obvious inhibitory quality against corrosion. From the researches [7] done earlier, the qualities of TOS could be used for the production and for the improvement of anticorrosive qualities of paint coatings.

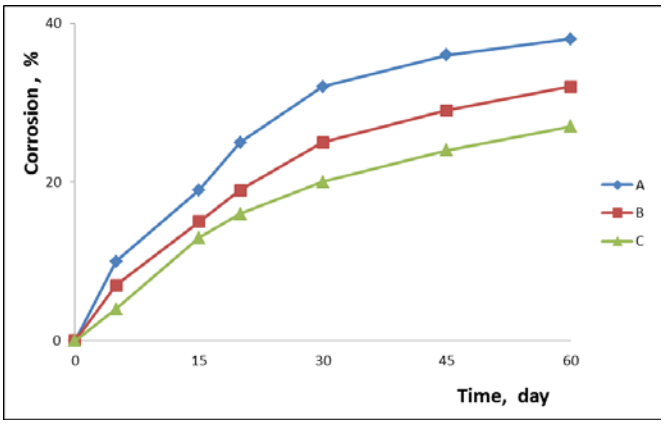

Fig.1 *The corrosion resistance of steel CT 08 (st.08) in distilled water (A), water extract of tank, slime (B) and in the solution of inhibitor corrosion (C).*

In oil refineries the waste is formed after contact cleaning of transformer oil by synthetic aluminosilicate adsorbent-adsorbent oil slime (AOS). It is the product of adsorbent regeneration caught by wet scrubbers.

The AOS consists of 90-94 % aluminosilicate and 5-8 % of petroleum coke consisting of the mix of high condensate aromatic hydrocarbon and naphthenes. Carried out was the work on researching AOS and on its base the technology for the production of anticorrosive ground compositions and underpaints [7] was developed. The inhibitory quality of water extract AOS is given in figure 2. In table 3 the developed ground compositions on the base of adsorbed oil slime are provided but in table 4, accordingly, the results of anticorrosive tests are provided. It is obvious from the tables that composition IV has the best corrosion-resistant qualities. The received primers with the use of AOS have improved characteristics in comparison with similar paint varnish materials [7].

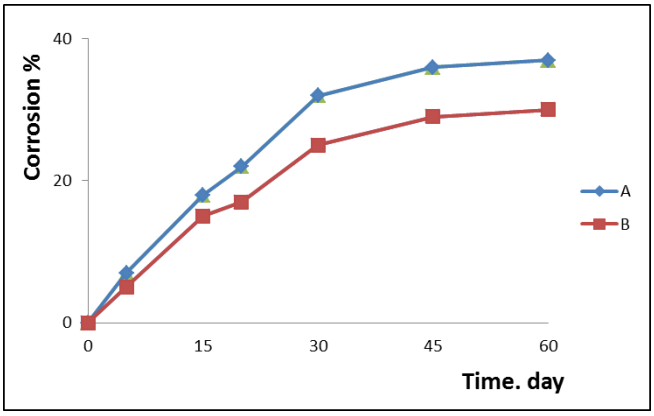

Fig.2 *Corrosion resistance of the steel G 08 (st.08) in distilled water (A) and in water extract of adsorbed oil slime (B).*

Table 3. *The structure of water-soluble primer on the base of dispersive polyvinylacetate (DPVA) [7]*

Primer components	Structure of components mas.%				
	I	II	III	IV	V
DPVA	25,0	20,0	15,0	10,0	5,0
AOS (adsorbed oil slime)	40,0	45,0	50,0	55,0	60,0
ZPS (zine phosphate slime)	4,0	4,5	5,0	5,5	6,0
SAS (surface active substances)	0,4	0,4	0,4	0,4	0,4
5 %-carboxyl methyl cellulose	2,0	2,0	2,0	2,0	2,0
Water	28,6	28,1	27,6	27,1	26,6

Table 4. *Data of anticorrosive tests of primer structure on the base of DPVA in 3 %. sodium chloride solution [7]*

#	Primer structure according to table 2	Share of steel surface under paint coating covered with corrosion after testing, %
1	Structure I	30,0
2	Structure II	20,0
3	Structure III	15,0
4	Structure IV	5,0
5	Structure V	12,0

The received results on corrosion resistance of paint-varnish compositions on the base of organic extract of TOS are given in table 5.

Table 5. *The data of tests on corrosion resistance in atmospheric condition and by accelerated corrosion-resistant method.*

#	Paint coatings structure table 1	Tests in atmospheric conditions	Tests by accelerated corrosion-resistant method
1	I structure	0,025	0,088
2	II structure	0,022	0,079
3	III structure	0,010	0,067
4	IV structure	0,015	0,075
5	V structure	0,018	0,080

Proceeding from the given data (tab 5) the paint coatings with the organic extract of TOS show the best anticorrosive qualities in all cases. The most effective structure is structure III.

5. Conclusion

Given researches show that the water and organic extracts of tank oil slime have obvious inhibitory qualities that allow to recommend them for using during the production of anticorrosive paint coatings. It not only serves the purposes of environmental protection but also allows to expand the material base of paint coatings production.

References

1. What is oil slime.26.09.2010 http/www.piligrim.selec.ru/news.php?act=news_id&news_id=6 (Russian);
2. Anchugova E.M,. Markarova M.K., Shemelinina T.H.. Efficiency and ecological aspects of using solutions of superficially active agents for dividing phases of mechanical impurities and oil from oil slimes. In the book “Izvestia” of Samara Scientific Centre of Russian Academi of Science, v.11, #1(2), 2009-pp 209-207 (Russian);
3. Problems of placement and utilization of waste in gas industry. “Materials of scientific and technical council ltd. “Gazprom”,Orenburg, 6-9 June 2001 Volume 1 and 2 (Russian)
4. Patent RF RU 2150546 C1, Slimeconcret/ T.I. Shein, S.F. Korenkova, O.M. Klimenkov,pub.06.10.2000, (Russian);
5. ASTM : D.5002, D 4928, D 4807, D 5853, D 4294
6. I.L. Rozenfeld, F.I. Rubinshtein, K.A. Zhigalova. Protection of metals from corrosion by paint coatings. M, “Khimia”,1986-p.222.(Russian);
7. D.T. Chkaidze, Z.N. Megrelishvili, M.D. Loria. Studying of inhibiting properties of tank oil slime for developing