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BIOCORROSION OF OILFIELD PIPELINES AND ITS PATHOGENS.

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Abstract. A bank of microorganisms - main agents of oilfield pipelines and equipment biocorrosion - is created. Technical specifications for producing the most promising biocorrosion inhibitors and their application methods in the oil production industry prevent oilfield pipelines biocorrosion.

Keywords: biocorrosion, biocorrosion agents, the microbiology of oil, corrosion inhibitors, the technology of bioinhibitors production.

Introduction. Corrosion of pipelines and oil storage facilities damages the oil and gas industry. Losses from microbial corrosion are estimated in thousands of tons of metal annually [1-4]. The most critical, global problem of oil microbiology at the present stage is creating ways to effectively protect oilfield pipelines from biocorrosion in the hot, sharply continental climate of Uzbekistan. We have established that bacteria cause 70% of biocorrosion, and 23-30% of corrosion is caused by microscopic fungi. Qualitative and quantitative evaluation of the degree of contamination with corrosive bacterial microflora of oilfield equipment is given for Kokdumulak, North Urtabulak, South Urtabulak, Umid and Kuruk. The isolation, study and identification showed that the main biocorrosion agents are sulfatered and heterotrophic bacteria. A bank of microorganisms - the main biocorrosive agents of oilfield pipelines and equipment - has been established. On an unprotected metal surface in the oil products environment in the presence of even a small amount of water and chemical and electrochemical corrosion also develop biocorrosion. Its active development is facilitated by water and components containing nitrogen, sulfur, and oxygen. Along with hydrocarbons, they are used by microflora as a nutrient medium.

The aggressive effect of microflora is manifested in increasing the rate of destruction of the metal, which in this case, is destroyed 2-3 times faster than in electrochemical corrosion. This process is accompanied by a sharp deterioration of metal performance indicators: a decrease in strength, an increase in internal stresses, an increase in the rate of formation of microcracks, deterioration of heat resistance and other electrophysical indicators [4-10].

First, the medium on the water/oil product boundary is inhabited by bacteria invisible to the naked eye. They are not dangerous in themselves and do not destroy metal; however, the life products they release are an active nutrient medium for the development of micromycetes and fungi, which produce aggressive acids, enzymes and other components causing metal destruction.

It is known that biocorrosion is most active on the surface of the metal at a temperature of 6-40 ° C and acidity of 1 to 10.5 pH in the environment of hydrocarbons in the presence of impurities containing water, sulfur, nitrogen, oxygen. During the course of metal biocorrosion in the medium of oil products, the most active are: sulfatered bacteria (multiplied on the border "oil

product/water"), actinomycetes (multiplied in the oil products themselves, using hydrocarbons as a nutrient medium), fungi (multiplied on the surface of the metal in the medium of oil products and form visible mold and persistent bioimulsions that can clog the filter cleaning and cause accidents).

An effective way to combat internal corrosion of means of transport and ensure the safety of both the containers themselves and the quality of light oil products in them is the corrosion protection of the inner metal surfaces of tanks.

For the first time, it has been established that the main agents of aerobic corrosion of oilfield pipelines in the Kokdumulak, Northern Urtabulak, Southern Urtabulak and Kruk oil fields are iron bacteria of anaerobic corrosion-sulphatereducing bacteria referred to the genera Desulfovibrio and Desulfotmaculum: Pseudomonas stutzeri, Pseudomonas putida, Pseudomonas turcosa, Ps. Aeroginoza, Arthrobacter chroococcum, Micrococcus album, Micrococcus sulfurous, Desulfovibrio Vulgaris, Desulfovibrio sp.., Acinetobacter sp., Rhodococcus eruthropolis, Rhodococcus luteus, Rhodococcus terrae and Basillus sp. [10-13].

Technology has been developed to produce new generation biocorrosion inhibitors (biocides) based on acetylene compounds produced on an industrial scale in Navoiazot JSC. Bactericidal and bacteriostatic activity of hexine-3-diola-2.5 and 1-phenyl-3-methylbutin-1-ola-3 anticorrosive preparations for sulfate bacteria has been determined as a result of a study of their action on life activity [14-16].

The structure, physico-chemical and quantum-chemical characteristics of synthesized preparations were determined, and mathematical modeling of the process of their preparation was given.

Technical specifications for producing the most promising biocorrosion inhibitors and their application methods in the oil industry to prevent oilfield pipelines biocorrosion have been developed.

As a result of studying the effect of inhibitors on the vital activity of bacteria - the main agents of oilfield pipelines biocorrosion - their "bacteriostatic" and "bactericidal" activity in minimum concentrations were established [14-18].

Preliminary studies have shown the effectiveness and good use of synthesized compounds as antimicrobial preparations. The preparation completely destroyed bacteria of Rhodococcus and Pseudomonas genera, causing biocorrosion of metal surfaces of the equipment. The researches have shown efficiency and prospects of use of the selected preparations as antimicrobial inhibitors of biocorrosion: 1-phenyl-3-methylbutin-ola-3 and 1-phenyl-3-methylpentin-1-ola-3, which in concentrations of 50 and 100 mg/l destroyed bacteria of genus Pseudomonas turcosa, Desulfovibrio, Rhodococcus, Arthrobacter and others, causing corrosion of metal surfaces of oilfield equipment and pipelines.

In our opinion, microzonal settling of oil pipelines and equipment surfaces with alkanotrophic bacteria leads to significant pH change and destruction of metal pipelines surface layer. Especially aggressive in this direction are aerobic alkanotrophic bacteria.

Many years of observations have shown that the most significant factor causing intensive corrosion of the metal surface of pipelines is the growing content of ground water in the products of wells (oil from wells ¹ 47, 86, 103, and others went under high pressure together with ground water).

The study of sulfatered bacteria activity of these anticorrosive agents determined their bactericidal and bacteriostatic activity.

Thus, a new generation of biocides, two of which, namely, were synthesized for the first time: 1-phenyl-3-methylbutin-1-ol-3 and 1-phenyl-3-methylpentin-1-ol-3 proved to be the most effective and promising biocides in the fight against microbial corrosion.

The following conclusions can be drawn from the results of the studies:

1) The cause of biocorrosion in oilfield pipelines of Uzbekneftegaz enterprises was studied for the first time;

2) The taxa of bacteria of different physiological groups at the five families, eight births and sixteen species were described. The replenishment of microbial collections with cultures that use oil hydrocarbons as the only source of carbon is essential for the development of new biotechnologies;

3) among synthesized new generation inhibitors based on acetylene compounds hexine-3-diol-2.5 and 1-phenyl-3-methylbutin-1-ol-3 proved to be effective and promising in combating bacterial corrosion of oilfield equipment and oil storage facilities;

4) quantum-chemical and molecular-dynamic calculations of aromatic acetylene alcohols and their vinyl esters were performed, mathematical modeling of vinyling was studied;

5) pilot batches of 1-phenyl-3-methylbutin-1-ola-3 and its vinyl ether were developed at pilot plant of Navoiazot JSC;

6) technological regulations for production of 1-phenyl-3-methylbutin-1-ola-3 have been developed.

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