TREATMENT OF OILY WASTEWATER

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Annotation

A reagent intensification method has been proposed purification of wastewater from petroleum products at biological treatment plants using a mixture of reagents - aluminum oxychloride (OXA) and water-soluble polyelectrolyte cationic grade VPK-402. The method provides a high degree of wastewater treatment from petroleum products – 86–88%.

Annotatsiya

Biologik tozalash inshootlarida chiqindi suvlarni neft mahsulotlaridan reagentlar aralashmasi - alyuminiy oksixlorid (OXA) va suvda eruvchan polielektrolit kationi VPK-402 yordamida tozalashning reagent intensivlash usuli taklif qilingan. Usul neft mahsulotlaridan oqava suvlarni yuqori darajada tozalashni ta'minlaydi - 86-88%.

Аннотатция

Предложен реагентный метод очистки сточных вод от нефтепродуктов на станциях биологической очистки с использованием смеси реагентов - оксихлорида алюминия (ОКХА) и водорастворимого полиэлектролита катионоактивного марки ВПК-402. Способ обеспечивает высокую степень очистки сточных вод от нефтепродуктов – 86–88%.

Key words: *wastewater; coagulant; oil products; aluminum oxychloride; polluting substances; polyelectrolyte; reagent; floculant.*

In modern conditions of intensive growth of industrial production of one one of the important problems is the protection of the environment, and, in particular, the water basin, from pollution by harmful substances and also rational use of water and mineral resources.

Despite the tightening requirements to the quality of treated water discharged into surface water bodies, state of water objects are not improved. The priority pollutants continue to be petroleum products, surfactants, sulfates and chlorides.

The development of rational technological solutions and the use of new, more effective coagulants and flocculants in order to accelerate the separation of phases of dispersed systems with minimal consumption and cost of reagents are current and important problems to date.

The purpose of this work is to increase the degree of purification of industrial wastewater at biological treatment plants JSC "Caustic" by selecting the optimal combinations of reagents - aluminum oxychloride (OXA) and water-soluble

polyelectrolyte cationic (VPK-402); selection of the method, sequence and optimal dose of introducing the reagent into the technological cycle of wastewater treatment.

Wastewater from the Sterlitamak industrial hub and the city is characterized by: high degree of mineralization, diversity of chemical composition of polluting components, rapid changes in the concentration of pollutants. These waters are sent for treatment to the biological treatment facilities of OJSC Kaustik (BOS). Among wide variety of methods used wastewater treatment biological treatment is relatively cheap, most accessible and sanitary reliable.

Wastewater entering BOS in two streams is generated at enterprises in the chemical, petrochemical and construction industries. In addition, biological treatment facilities process municipal wastewater.

The technological process of wastewater treatment consists of the following stages:

– mechanical treatment of domestic and fecal wastewater;
– neutralization of industrial wastewater;
– adsorption cleaning of industrial wastewater;
– mechanical cleaning of industrial wastewater;
– mixing of mechanically treated household and industrial wastewater;
– biological treatment;
– wastewater disinfection.

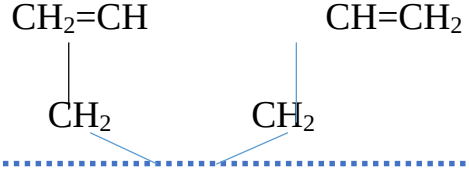
The composition of industrial wastewater entering the biological treatment plant of OJSC "Kaustik" is given in table. 1.

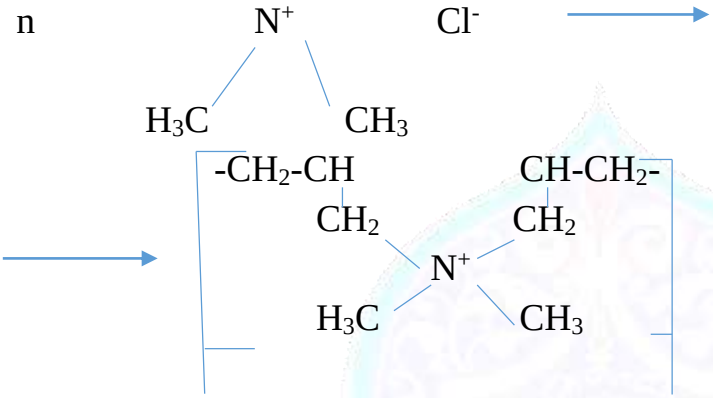
From the table 1 shows that the priority pollutants are petroleum products and chlorides. The content of petroleum products in treated wastewater discharged into the Belaya River does not exceed permissible limits

standards, but there remains a danger of exceeding the maximum permissible concentration for this pollutant.

Increased content of petroleum products in wastewater entering biological treatment can lead to a weakening of the activity of microorganisms, which will have an extremely negative impact on the composition of water going further into the surface reservoir. This is due to the fact that petroleum products are poorly removed from wastewater by biological treatment . The solution to this problem is seen in the removal of petroleum products from wastewater water to the stage of biological treatment, for which is why it is proposed to use a reagent cleaning method.

High molecular weight cationic polyelectrolyte grade VPK-402 is produced at JSC "Kaustik" by polymerization of dimethyldiallylammonium chloride in an aqueous solution.





VPK-402 is used in drinking water treatment, as well as for cleaning industrial wastewater of various origins.

Its empirical formula is (C8H16NCl)n. The concentration of the active substance is from 10 to 40% wt., the molecular weight is from 10 thousand to 1 million. The cationic charge is located on the secondary chain.

1-table

Composition of treated wastewater discharged by the jsc kaustik wwtp into the white river

№	Wastewater quality indicators	Allowable concentration	Actual concentration
1	Hpk	-	34
2	Chloride anion	300,0	450
3	Sulfide ion	0,003	0
4	Ammonium ion	0,50	0,45
5	Phosphates (by phosphorus)	0,2	0,17
6	Chrome 3 valent	0,07	0
7	Chrome 6 valent	0,02	0
8	Mercury	0,00001	0
9	Amines	0	0
10	Phenols	0,001	0
11	Petroleum products	0,05	0,05
Additionally ph		6,5-8,5	6,8

At the treatment facilities of OJSC "Kaustik" VPK-402 is used to accelerate (improvement) of the process of settling fine particles in the streams of primary settling tanks. It is suggested to apply at this stage

Another inorganic coagulant, aluminum oxychloride (OXA), can also be used for purification. It is known that OXA is a highly effective coagulant that does not contain

organic impurities, and can be produced from chemically pure raw materials – 99.9% aluminum chloride, which compares favorably with analogues 4.5 produced in Russia. An important point is the possibility of obtaining aluminum oxychloride from the waste of the existing aluminum chloride production plant, which allows solving the urgent problem of their disposal.

Experimental technique Laboratory experiments were carried out on a device – flocculator brand "PE-8800".

The installation is intended for test coagulation during the treatment of natural and waste waters. To determine the content of petroleum products in treated wastewater, the AN-1 device (petroleum product analyzer) was used, designed to measure mass concentration of petroleum products using IR spectrometry.

The introduction of coagulants was carried out in two ways:

– joint introduction of OXA and VPK-402 into various ratios;

– sequential dosing of coagulants.

When administered separately, the coagulant OXA (1%) was added first, after why intensive stirring was performed at a speed of 250 rpm for 30 minutes, in resulting in the process of hydrolysis reagent and the formation of primary, so-called "microflakes". Then dosed calculated amount of flocculant VPK-402

(0.5%). The resulting mass was also stirred at a speed of 50 rpm for 10 minutes.

The speed was reduced so that the structure of the resulting "microflakes" would not be destroyed during strong stirring.

When administered together, the calculated amount of reagents was mixed, then added to the wastewater and intensive mixing was carried out at a speed of 250 rpm for 30 min.

Then the effluent mixed with the reagents was allowed to settle for 30 minutes. The settled flocculi were visually assessed, and the supernatant layer of the sample was analyzed for the content of petroleum products.

During wastewater treatment, sorption of petroleum products presumably occurs on the surface of flakes formed by OXA, and the further introduction of polyelectrolyte VPK-402 makes it possible to intensify the process cleaning and speed up the process of enlargement and sedimentation of flakes. Therefore, when carrying out experiments changed the amount of dosed OXA at a constant dose dose VPK-402.

Experimental results are presented in table 2.

2-table

Influence of the ratio of sequentially introduced reagents on the degree of wastewater purification from petroleum products

№	Amount of oxa	Amount of VPK	Content of	Content of	Cleaning degree, %

Experience	administered mg/dm^3	administered mg/dm^3	petroleum products before cleaning mg/dm^3	petroleum products after cleaning Mg/dm^3	
Separate input of reagents					
1	4	4	0.075	0.009	88
2	5	4	0.075	0.028	62
3	6	4	0.075	0.033	43
4	8	4	0.075	0.047	42
5	10	4	0.075	0.053	30
Joint input of reagents					
6	4	4	0.075	0.041	45
7	5	4	0.075	0.032	57
8	6	4	0.075	0.015	86
9	8	4	0.075	0.055	26
10	10	4	0.075	0.058	22

The discussion of the results as a result of the experiments, it was determined that the best degree of purification is achieved in experiment No. 1 (Table 2), with separate introduction of reagents. The content of petroleum products in wastewater has been reduced from 0.075 to 0.009, while the degree of purification is 88%. However, from a technological point of view, separate introduction of reagents into wastewater is difficult and requires the installation of additional equipment, which leads to significant economic costs, therefore experiments were conducted on the possibility of jointly introducing a mixture of OXA and VPK-402 reagents, not requiring additional capital costs. Based on the results of joint dosing reagents at different ratios (Table 2) it was found that such a dosage of reagents allows one to achieve a degree of purification comparable to separate ones, but differs in that it requires a slightly higher consumption OXA reagent. The maximum achieved degree of purification was 86%.

From the table 2 it can be seen that the optimal ratio of reagents with sequential introduction is achieved in experiment No. 1, but in order to save costs it is possible to use a joint dosing of reagents at the OXA ratio and MIC equal to 1.5:1, achieving high degree of purification.

The experiments carried out showed that reagent treatment of wastewater using the proposed mixture of reagents is promising in order to achieve maximum permissible standards for pollutants, especially for petroleum products.

It has been established that when cleaning wastewater water with a mixed reagent consisting of OXA and VPK-402, its use before the stage biological treatment allows significantly reduce the concentration of petroleum products, reaching a degree of 86% wastewater purification, in addition, it will reduce the mass of pollutants discharged along with wastewater into surface water, which is an environmentally and economically beneficial measure.

A prerequisite for obtaining a high effect of industrial wastewater treatment is compliance with the optimal hydrodynamic regime of mixing and flocculation when using coagulants and flocculants. The proposed cleaning method allows

dispose of aluminum chloride production waste.

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