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PROBLEMS OF BIOLOGICAL TREATMENT OF DOMESTIC WASTEWATER FROM OIL AND GAS PRODUCING ENTERPRISES AND THE POSSIBILITIES OF THEIR SYSTEMATIC USE

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ABSTRACT. This article analyzes the composition of domestic wastewater leaving the oil and gas industry. According to the results obtained, domestic wastewater from oil and gas industry enterprises is seasonal in nature, and the levels of chemical pollution exceed the established standard indicators. The chemical and physico-chemical processes of the main treatment processes were found to be fully functional, but there were still problems with the biological treatment process. In particular, it was noted that the indicator of pollution with phosphates in household waste water is 5.66 mg/l, which is 2.26 times more than the established norm, the indicator of pollution with chlorides is 651.74 mg/l, water is polluted 1.86 times more than the established standard indicator. In addition, indicators of pollution with sulfates, nitrates and nitrites were determined, and it was noted that they are above the norm. This article discusses the possibilities of using high-algae water in the treatment of domestic wastewater in oil and gas production enterprises, and the problems of systematic monitoring of existing technical regulatory indicators. Furthermore, the information about higher algae, is given microalgae and macrophytes used in domestic wastewater treatment. The article provides recommendations on improving the technology of using biological methods in the treatment of polluting chemicals contained in domestic waste

water in oil and gas production enterprises, as well as detailed information on the ways of using macrophytes and their importance.

KEY WORDS: *Chemical components of wastewater, Domestic wastewater, Biological wastewater treatment, oil and gas producing enterprises, macrophytes.*

INTRODUCTION. One of the global environmental problems is the increasing level of large-scale pollution of the environment through wastewater. As a result of uncontrolled discharge of waste water contaminated with various toxic substances into the environment, the pressure of negative consequences is increasing not only on the natural environment, but also directly on human health. This problem is not limited to our country. Therefore, as the production capacity of production enterprises in various sectors of the economy increases, the contamination of wastewater with various toxic elements increases, and expand the pressure of its impact on the environment . One of the most important tasks of prevention of water shortage and effective use of water in Uzbekistan is the fundamental renewal of the water use system in industrial enterprises and the implementation of advanced technologies for the use of wastewater. Oil and gas production enterprises can be noted as one of the sectors that generate a large amount of wastewater worldwide, and at the same time emit a large amount of pollution sources into the wastewater.

Therefore, Shortan Oil and Gas Production Department company was selected as the main industrial object of our research. Two type of Wastewater arises from the Shortan Oil and Gas Production Department which divided into industrial and domestic wastewater. Moreover to treat chemical and physical wastewater treatment, biological treatment has also been introduced at the enterprise, where are used eichhornia and pistia algae. However, although chemical, physico-chemical methods are fully effective in cleaning various chemical components polluting wastewater at this enterprise, the fact that insufficient attention is paid to biological cleaning processes should be a cause for concern. In particular, incomplete implementation of the technological process of biological treatment in the aeration tank is a problematic situation that arises at all production enterprises. In this situation, it has very dangerous impacts on the health of people and livestock using these waters[Shu Zhang et al., 2021; Nirmala et al., 2023].

Therefore, it is advisable to constantly monitor household wastewater at oil and gas industry enterprises and improve this technology. In the modern highly industrialized era, one of the most important tasks is to regularly monitor the composition of industrial wastewater leaving oil and gas production enterprises and ensure that the chemical parameters of the water comply with regulatory requirements.

LITERATURE REVIEW. It is known from scientific sources and statistical data that industrial wastewater leaving production enterprises has a strong negative impact not only on nature, but also directly on human health, as it contains various toxic chemical compounds, oil and petroleum products, various organic compounds. high level [Khan et al., 2022.].

As a result of the release of industrial wastewater contaminated with various chemical compounds into the environment without sufficient treatment, it causes the process of eutrophication in nature. As a result, it has a strong negative effect on the ecosystem of zooplanktons and phytoplanktons in water bodies, and as a result of the overabundance of biogenic elements in water bodies, various pathogenic microorganisms (bacteria: *E.coli* O157:H7, *Legionella pneumonia, Helicobacter pylori, Vibrio cholera, Campylobacter, Yersinia, Salmonella*) in water bodies, *Cyanobacter,*

Leptosporosis), viruses: *Hepatitis viruses, Adenoviruses, Enchoviruses*), parasites: Giardia lamblia, Cryptosporidium, Acanthamoeba) [Akpor and Muchie, 2011] and lead to the increase of algae (*Cyanophyceae, Chlorophyceae, Bacillariophyceae, Chrysophyceae-Heterokontophyta*) [Kristiansen, 2009; Bag et al., 2019].

The negative effects of domestic wastewater contaminated with various chemical compounds cause serious damage to the environment, especially in cities and urbanized areas. For example, nitrogen (N) discharged into sewers is usually discharged into rivers, and nitrogen entering rivers dramatically changes the water ecosystem in downstream streams, causing the process of eutrophication in water, that is, a sharp increase in nutrients (biogenic elements) [Hobbie et al., 2017, Hu et al., 2018]. In addition, this situation, i.e., water pollution with excess nitrogen sources, leads to changes in the amount of ammonia (NH^{4+}) and nitrate (NO^{3-}) in water and their ratios [Anisfeld et al., 2007], which in turn affects zooplankton and phytoplankton living in water. has a negative impact on living [Howarth et al., 2011].

Some physiological indicators of aquatic plants, including the activity of the reductase enzyme in plants or the amount of nutrients (nutrients), can be determined to determine the sources of excess nitrogen entering rivers or river beds with wastewater [Dailer et al., 2010, Schubert et al., 2013].

Absorption of nitrogenous compounds (NH^{4+}, NO^{3-}) in a wetland system in an aquatic environment, usually in a swampy state, their semi-submerged growth in water (Emerging aquatic plants: *Vallisneria, Hydrilla, Potamogeton, Najas, Eichornia carasippes, Morning Glory, Craninium natans and Vossia, Phraetophytes, Colocarpus, Daubergia, Alternathera sessilus, Pancicum prolferum, Scipus, Hygrorisa aristat, Alisma aguatica*), floating plants: *Anacharis (Egeria densa), Duckweed (Lemna major), Java moss (Vesicleria dubyana), Hornwort (Ceratophyllum demersum), Amazonian frog (Limnobium laevigatum), Dwarf water lettuce (Pistia stratiotes), Water sprite (Ceratopteris thalicotoides), Cabomba (Cobomba caroliniana), Water spangles (Salvinia minima), Water wisteria (Hygrophila difformis), Pennyworth (Centella asiatica), Rotala indica, mosquito fern (Azolla filiculoides), Ludwigia repens, crystal floater (Riccia fluitans), red-rooted float (Phyllanthus fluitans), pearl mussel (Hemianthus Micranthemoides), Christmas moss (Vesicleria Montagnei) and submersible plants: Myriophyllum spicatum L., Potamogeton Crispus L., Myriophyllum sibiricum Kom., Myriophyllum aquaticum (Vell) Verdc., Rhynchospora corymbosa*) assimilation occurs due to nitrification and volatilization of ammonia [Yimeng Qu et al., 2023]. Normally, plants absorb nitrogen for their growth and use it actively in the process of assimilation, where nitrogen has a great influence on the productivity and species composition of ecosystems [Chang Li et al., 2024]. In addition, aquatic plants utilize nitrogen through uptake, assimilation and transport, in which mainly three forms of nitrogen, namely nitrate ions, urea ions and ammonium ions are taken up by plants, resulting in increased nitrate reductase activity in plants [Masclaux-Daubresse et al., 2010, Guo et al., 2022, Hu et al., 2018].

In addition, microalgae used to control the amount of N in wastewater include *Cyanophyceae* (blue-green algae, *Aphanothece, Chroococcidiopsis, Dermocarpa, Gloeocapsa, Myxosarcina, Pleurocapsa, Synechococcus, Xenococcus, Anabaena, Anabaenopsis, Aulosira, Calothrix, Camptylonema, Chlorogloea, Chlorogloeopsis, Cylindrospermum, Fischerella, Gloeotrichia, Haplosiphon, Mastigocladus, Nodularia, Nostoc, Nostochopsis, Rivularia, Scytonema,*

Scytonematopsis, Stigonema, Tolypothrix, Westiella, Westiellopsis, Lyngbya, Microcoleus chthonoplastes, Myxosarcina, Oscillatoria, Plectonema boryanum, Pseudoanabaena, Schizothrix, Trichodesmium), *Chlorophyceae* (green algae *Prasinophytes, Trebouxiophyceae, Chlorophyceae, Ulvophyceae, Charophytes*), *Bacillariophyceae* (diatoms, *Centrobacillariophyceae, Pennatibacillariophyceae, Chromista, Prymnesiophyta, Silicoflagellata, Chaetoceros, Navicula, Nitzschia, Phaeodactylum, Skeletonema, Thalassiosira*) and *Chrysophyceae* - (golden-brown microalgae, golden algae, also known as Heterokontophyta, *Ochromonas malhamensis, Ochromonas tuberculatus, Poterioochromonas, Chrysamoeba, Chromulina, Chrysococcus, Ochromonas, Chrysothecopsis, Uroglena, Dinobryon, Chrysocapsa, Sphaeridiothrix, Mallomonas, Gloeochrysis, Chrysoclonium, Synura*) is also of great importance [Kristiansen, 2009].

The use of Cyanophyceae – Cyanobacteria – blue-green algae in controlling the amount of chemical compounds polluting wastewater is very common [Bag et al., 2019, Zahra et al., 2020], and based on new information obtained from modern molecular genetic studies, cyanobacteria are now also cyanoprokaryotes. is called [Anand et al., 2019].

The purpose of research. It includes a seasonal study of the chemical composition of domestic wastewater from oil and gas industry enterprises and an analysis of the biological basis for solving existing problems.

RESEARCH METHODOLOGY.

The source of research: Wastewater where is coming out of the oil and gas production enterprise.

Methods for determination of main chemical elements in wastewater:

To determine the concentration of phosphorus in wastewater, a colorimetric method was used according to the formulas [WRF, 2015]:

$$PO_4^{3-} + 12MoO_4^{2-} + 27H^+ \rightarrow H_3PO_4(MoO_3)_{12} + 12H_2O$$

The acid is then reduced to phosphomolybdenum blue. The reduction converts some of the molybdenum(VI) to molybdenum(V) [Barrows et al. 1985, Worsfold et al. 2005].

$H_3PO_4\ (Mo(VI)O_3)_{12} \rightarrow H_7PO_4(Mo(V)O_3)_4(Mo(VI)O_3)_8$ [Smith, 2015].

Determination of chloride in water was performed using an automatic titration method (Thermo Scientific Orion START-TB2) [ISO 2927, 2017].

Quantitative methods were used to determine sulfate ions in the aquatic environment [Anechiţei., 2019].

Nitrates in water containing nitrites were determined using a UV-visible spectrophotometer [Sandu et al., 2014, Karlsson et al., 1995].

Also, the automated colorimetry method and the UV-visible spectrophotometry method were used to determine nitrate-nitrite nitrogen [Drolc and Vrtovšek, 2010; Patton and Kryskalla, 2011].

Controlling the composition of treated demostic wastewater. Oil products are monitored once a day. The effluent must not be in water: COD is checked once a week, standard indicator is 15.0 mg/l; floating particles are monitored daily, the standard indicator is 15.0 mg/l; the amount of dry residue is checked daily, the standard amount is 1000 mg/l; pH is monitored daily, the standard indicator is pH-6.5-8.5; BOD - is monitored once a month, standard indicator is 3.0 mg/l; Iron element is checked once a day, standard indicator is 0.05 mg/l; Hydrogen sulfide (H_2S) is monitored once a day, standard indicator is 0.05 mg/l.

Technological processes of domestic wastewater treatment. The wastewater treatment facility is intended for the treatment of wastewater from the gas pretreatment

plant, the main facility, the finished product processing plant, and the tank. In the treatment plant, there are two devices for the mechanical treatment of industrial wastewater, and for the treatment of domestic wastewater, there is a biological treatment device. The enterprise's biological wastewater treatment device was put into operation in 1985. The design capacity of the biological wastewater treatment device of the enterprise is 400 m^3 per night.

Devices for biological treatment of domestic wastewater. There are reception chamber is a ditch-shaped pool made of reinforced concrete, with a metal mesh. The metal net serves to catch all kinds of granular particles. CU-200/1,2 (Compact unit) is a compact device made of metal, consisting of 3 units (Aerotank, softener, water storage tank), designed for biological treatment of domestic wastewater.

Contact pool (contact reservoir) that is intended for neutralization (cleaning) of treated wastewater. Leachate ponds are rectangular concrete ponds designed for natural drying of activated sludge. UAP that means upper aquatic plants Algae treatment ponds are concrete ponds designed to treat wastewater using natural algae growth. Biological evaporation ponds are concrete ponds designed for natural evaporation of wastewater.

Technological process of the device for the biological treatment of household wastewater. Domestic waste water from vacant buildings and temporary shelters is treated biologically in the sewage treatment plant. Domestic wastewater enters the receiving chamber of the biological treatment device at the sewage treatment facility, and various granular (calcium) particles are caught through the metal net installed in the chamber. The waste water passed through the metal mesh in the receiving chamber is sent to the CU-200 water treatment device. KU-200 device consists of three parts: Aerotank - mixer; Sump – septic tank; Sludge storage tank - collection chamber of activated sludge.

The process of the aerotank compartment: Domestic wastewater entering the aerotank of CU-200 is subjected to biological treatment with the help of *Eichhornia*, *Pistia* and activated sludge. Eichhornia, Pistia flowers and activated sludges are fed with organic waste in the waste water, and it increases the level of purity of the waste water. The degree of purification of wastewater with the help of *Eichorni*a, *Pisti*a and activated sludge is constantly analyzed in the ecology laboratory of our company. There are four air ducts in the aerotank, through which air is constantly supplied with a pressure of 50-80 kRa. Air promotes the development of Eichhornia, Pistia and activated sludges. In order to constantly update the aerotank with active sludges, active sludges are transferred from the activated sludge collection pool by airlift method (through special pipelines). Due to the mixing of active substances with organic waste in wastewater, the oxidation process takes place and turns into inorganic substances. Wastewater from the aerotank and the activated sludge in it pass through the barrier through a special channel (pourer) and fall into the clarifier. In order to maintain the normal life activity of activated sludges, biogenic elements such as ammonium nitrate or sodium tripolyphosphate are added to the wastewater before the aerotank. Lack of biogenic elements slows down the process of biochemical oxidation of organic substances. The lack of ammonium nitrate for a long time will cause the active years to harden without slowing down the oxidation process. The lack of sodium tripolyphosphate in wastewater leads to the growth of filamentous bacteria in active waters, which results in slow sedimentation. At the same time, the growth of activated sludges and the oxidation of organic substances slow down. Under the influence of microorganism mineralizers (activated sludges), the minerality of organic matter increases, or the process of

biochemical oxidation occurs, which takes place in the following two stages: - first stage, carbonic compounds are oxidized as a result of oxidation of carbonic acid and water. Compounds with a chemical reagent are oxidized in two phases, first to nitrite, then to nitrate. - the second stage is the oxidation of nitrogenous organic compounds, and the last stage is nitrification. The presence of nitrates in the wastewater is one of the main parameters that indicate that the wastewater is sufficiently purified. The oxidizing capacity of the aeration part of the compact device was calculated to be 270 g/m^3 during one night and day with BOD-5 at concentration of activated sludge is 3.5-4.0 g/1. The period of separation of wastewater in the aeration part (aerator) of the compact device is equal to one night, equal to 1.5 hours of the maximum flow consumption passing through the settling and stopping part. Saturated active sludge is periodically (once in 1-4 months) discharged from the aeration part to the mud flat. For this purpose, a special metal pipe is installed under the device, and it is possible to completely empty the device through the slide installed on this pipe.

Process in the compartment of septic tank. Domestic wastewater treated in the aeration tank passes through special holes to the settling pond. Here, the wastewater is settled, and the settled wastewater is sent to the contact pool through special metal channels.

Process in the compartment collection of activated sludge. There are two air supply pipes in the activated sludge collection chamber, which are used to transfer air to the active oil aeration tank by airlift method. Air is constantly supplied to protect the activated sludges from destruction.

The mission of muddy area. In the aerotank, the active sludge saturated with microorganisms contained in household wastewater is poured into the sludge pad through Ø159 mm pipes and dried there. The dried compost is taken out to the garbage collection area. Muddy areas are intended for drying the saturated active sludge produced in the compact unit during biological treatment. The calculated capacity of the mud area is designed to dry 5-6 m^3 of mud per year on 1 m^2 area.

The mission of the contact pool. The domestic wastewater settled in the clarifier is fed to the contact pool. The contact pool is also constantly aerated. Here, domestic wastewater is neutralized by chlorination and pumped to UAP ponds or evaporation ponds.

Preparation of domestic wastewater for the addition of a biological treatment device. Preparation for connection after disassembly and repair of the device. After dismantling and repairing the device, it is connected according to the order of the chief engineer in the following sequence:

- as a result of the external inspection, the structure of the building, i.e., entrance-exit ditches, aeration pipes, readiness and grounding of electrical equipment, walls of the building, and shutters are checked.

- it is ensured that there are no foreign objects in the household wastewater receiving basin, aeration tank, clarifier, activated sludge collector, and SPS (Sewage pumping station) wastewater receiving basins.

- it is ensured that the compressors work at the norm. For this, the compressor is turned on for a short time.

- valves in the contact pool network, exit ditches and aeration tanks are closed.

- The water supply system in the perforated pipe in the aeration part of the CU-200 is opened. The engineer on duty is notified that the equipment is ready to be put into operation.

Preparing the device for operation. Preparing the device for operation is carried out in the same sequence as when connecting the network. All containers of the network are filled with water for testing and the filled containers are observed overnight. However, if water leaks from somewhere, the water is

poured and the leaking place is closed. At the same time, the installation of water spillages is checked and adjusted the level. Airlift operation is checked. Airways are tested for tightness with air. Holes, cracks, and similar air leaks are eliminated. After washing with water, the water is poured and the sewer network is also flushed.

Commissioning of a domestic wastewater biological treatment plant. Commissioning of a domestic wastewater biological treatment plant for the first time. When the domestic wastewater treatment plant is put into operation for the first time, the active element is prepared. These can be done in several ways: - at first, starting from taking clean water into the air tank, after filling the perforated pipes with water up to 50 - 80 cm, the compressor is added to the work to open air to the perforated pipes. - air is alternately sent to the perforated pipes in small amounts. - after the water comes out of the perforated pipe beams, the valves on these beams are closed and is checked the air distribution along the aeration tank. -The aerotank is filled up to the water level. - air consumption per square meter of the aerotank is increased to 9-10 m^3 per hour. - According to BOD, wastewater with a concentration of 100-150 mg/l is pumped through an aero tank. This concentration is achieved by adding drinking water or low-contamination wastewater to the wastewater. - the process of increasing active years in the air tank, the aeration process is carried out for 2-3 days and nights during the working period without removing water from the air tank. - depending on the production capacity of the active year, the aeration tank is transferred from the work flow to the oil flow. The aeration period is gradually reduced to the calculated amount. The active year is collected, and in this case adaptation to the composition of wastewater is achieved. At this time, the sewage pipes to CU-200 will be opened. - according to the meeting of the activated sludges in the search engines, an erlift will be put into operation to drive the activated sludges in the aerotank. - after sufficient actives are collected in the air tank, an airlift is added to drive the actives to the actives collection unit. - in order to switch from non-flowing oil to full working oil, the purified water is opened into the water tank and its filling is started. - depending on the filling of the activated sludge collection compartment, air is supplied to the perforated pipes and its operation is regulated.

Putting the device into operation after cleaning and repair. Starting from cleaning and repairing the device is carried out in the sequence mentioned above. In this case, activated sludges are used in mud fields.

Resuming work after a short period of suspension. The cover of the inlet pipe to the domestic wastewater receiving trench is opened. After the aeratank is filled with wastewater to the standard working level, the water level in the clarifiers is monitored until it overflows into the collection ditches. Then, the start-up and stoppage of the erlift is carried out according to the manual. The drain valve in the mixing tank is opened to disinfect the treated wastewater. An airlift will be put into operation for dumping active sludge into the aero tank and the active sludge collection pool. The holes in the aeration part and mixing vessel of CU-200 regulate the amount of air in the pipe.

Unloading and stopping the biological treatment of domestic wastewater. Discharge and shutdown of the biological wastewater treatment plant is carried out only on the instructions of the engineer on duty. Stopping is done in the following sequence:

- sewage is stopped by closing the inlet pipe to the intake trench;

-as soon as the overflow of water into the collection ditches stops, the drain pipes in the CU-200 are opened and emptied.

- waste water collected in the clarifier is pumped to the air tank with the help of an airlift. The remaining wastewater is sucked up with the help of the unit.

- the accumulated turbidity is washed with clean water and driven into the aerotank with the help of an airlift. The air supply to the airlift is stopped.

- after emptying the air tank, air supply to the perforated pipes is stopped. - the aerotank is washed with clean water.

- muddy water falls into the pond.

- the wastewater from the contact pond is pumped to the UAP (overwater weed).

- notifies the engineer on duty that the device is stopped and released and records this in the time log.

Stop the device for a short time. The pipe for receiving domestic wastewater is closed. The aerotank part of CU-200 and the part given to the mixing vessel will be reduced by 50%. As much as possible is removed from the dryer with the help of an airlift. The air supply pipe to the airlift is closed. The supply of chlorine will be stopped in the contact pool. The outlet pipe of treated wastewater from CU-200 is closed.

RESEARCH FINDINGS AND DISCUSSIONS.

Our research focused on determining the initial composition of wastewater where is leaving from oil and gas production enterprises. During the research, it was noted that the chemical composition of treated industrial and domestic wastewater is seasonally variable leaving the "Oil and Gas Production" enterpris is selected as an object.

In order to describe the exact level of the problem, monitoring of the required chemical composition and physical and biochemical parameters of purified household and drinking water leaving the water treatment plant during the period of active operation of the enterprise was carried out for nine months.

The amount of phosphates in wastewater leaving the enterprise was conditionally studied in three decks; it was noted that the total pollution index has seasonal changes and does not show a specific indicator. Therefore, a database has been formed on the amount of phosphates in domestic wastewater leaving the enterprise, weekly data on technological regulations, weekly data on the monthly section and monthly data on the ten-day (three months) section. The results obtained are shown in **Figure 1**.

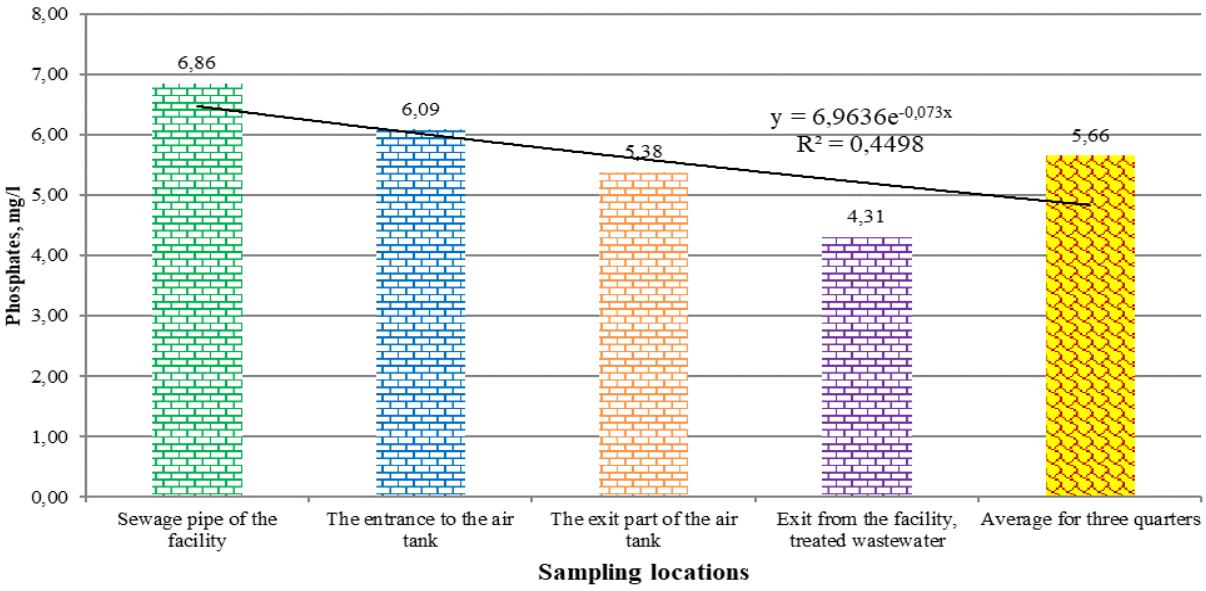


Figure 1. Average indicators of annual phosphate pollution of domestic wastewater.

When the average values of the obtained data in three decades are calculated based on logarithmic calculations, the amount of phosphates in the waste water taken from the wastewater lifting pipe of the facility is on average 6.86 mg/l, the waste water taken from the entrance to the aeration tank is on average 6.09 mg/l, the waste water from the outlet of the aero tank is on average 5.38 mg/l, purified wastewater from the facility was found to be contaminated with phosphates in the amount of 4.31 mg/l. Therefore, it was determined that the average phosphate pollution index in the three decades was 5.66 mg/l. Comparing this indicator with the normative indicators, it was found that the wastewater coming out of the enterprise is polluted 2.26 times more than the standard. Therefore, according to the obtained results, it was noted that additional control of the amount of phosphates is desirable. The study also sought to determine the amount of chlorides escaping from the company's facilities over an annual period of decades. During the comparative analysis of the results obtained, it was noted that the amount of chlorides in wastewater leaving the enterprise is seasonal and does not have a specific indicator.

For this reason, weekly data on the amount of chlorides in the waste water coming out of the enterprise, monthly data on the basis of weekly data, monthly data on the basis of decades (three months) were collected and their average indicators were determined (Figure 2.).

After a comparative analysis of the obtained results and the average indicators for three decades were calculated based on logarithmic calculations, the amount of chlorides in the waste water taken from the waste water lifting pipe of the facility was 778.93 mg/l on average, the waste water taken from the entrance to the aero tank was 708.64 mg/l on average, the exit from the aero tank was 708.64 mg/l it was found that the waste water in the part is contaminated with chlorides in the amount of 607.58 mg/l on average, and the treated waste water coming out of the facility is 511.82 mg/l. Therefore, it was determined that the average chloride pollution index in the three decades was 651.74 mg/l. Comparing this indicator with the normative indicators, it was found that the wastewater coming out of the enterprise is polluted 1.86 times more than the standard. For this reason, it was concluded that it is necessary to further control the amount of chlorides in the waste water coming out of the enterprise and to implement measures to ensure further purification of this pollution.

The studies also monitored the amount of sulfates, which are one of the main pollutants in household wastewater. Based on the results obtained, it was noted that the amount of sulfates in domestic wastewater exceeds standard values. In particular, in the first ten days of observations, it was noted that the amount of sulfates in samples taken from the facility's sewer pipe was 835.11 mg/ml, which is 2.38 times higher than the standard value.

During the comparative analysis of the results obtained, it was noted that the amount of sulfates in wastewater leaving the enterprise is seasonal and does not have a specific indicator. For this reason, weekly data on the amount of sulfates in the wastewater coming out of the enterprise, monthly data on the basis of weekly data, monthly data on the basis of decades (three months), and their average values were determined (Figure 3.).

After a comparative analysis of the obtained results and the average values for three decades were calculated based on logarithmic calculations, the average amount of sulfates in the wastewater from the sewage lifting pipe of the facility was 804.67 mg/l, the wastewater from the entrance to the aerotank was 709.72 mg/l on average, the exit from the aerotank it was noted that the waste water in the part was polluted with sulfates in the amount of 622.30 mg/l on average, and

the purified waste water coming out of the facility was 520.64 mg/l.

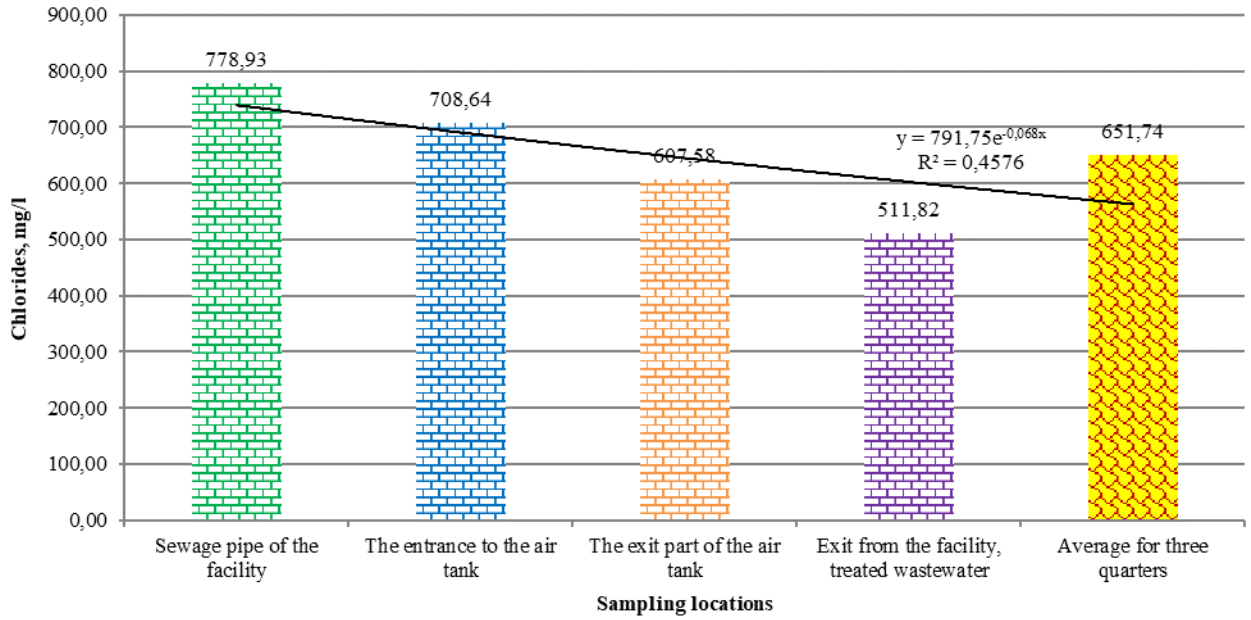


Figure 2. Average indicators of annual chloride contamination of domestic wastewater

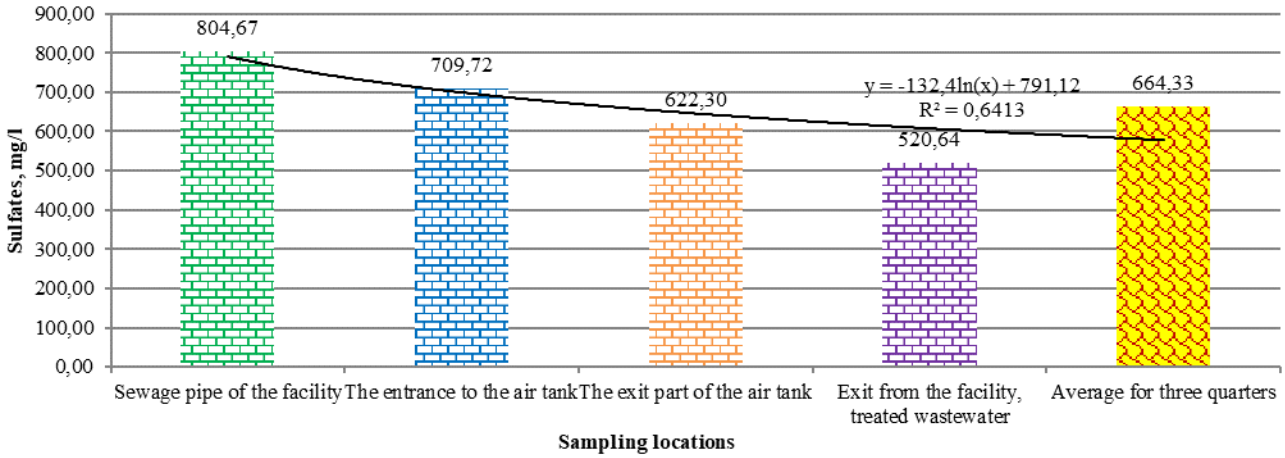


Figure 3. Average indicators of annual sulfate pollution of domestic wastewater

Therefore, it was determined that the average sulfate pollution index in the three decades was 664.33 mg/l. When comparing this indicator with the normative indicators, it was found that the wastewater coming out of the enterprise is polluted 1.9 times more than the established norm. Thus, it was concluded that additional control of the amount of sulfate in the wastewater leaving the plant and the creation of opportunities for further treatment of these contaminants was necessary.

In further studies, the amount of nitrates and nitrites in domestic waste water coming out of the enterprise was studied. According to the obtained results, it was found that the amount of nitrates in the samples taken from the waste water lifting pipe of the facility in

the first decade was 648.16 mg/l, and the amount of nitrites was 23.61 mg/l. When comparing the results obtained, it was noted that the amount of nitrates and nitrites in wastewater leaving the enterprise is seasonal and does not have a specific indicator. For this reason, weekly data on nitrates and nitrites content of wastewater coming out of the enterprise, monthly data on the basis of weekly data, monthly data on the basis of decades (three months) were collected and their average indicators were determined (Figure 4-5).

After a comparative analysis of the obtained results and the average values for three decades were calculated based on logarithmic calculations, the amount of nitrates in the waste water taken from the waste water lifting pipe of the facility was on average 716.29 mg/l, the waste water taken from the entrance to the aero tank was 655.66 mg/l on average, the exit from the aero tank it was noted that wastewater from the construction site was contaminated with nitrates at an average of 584.30 mg/l, and treated wastewater from the facility at 531.62 mg/l. Therefore, it was determined that the average nitrate pollution index in the three decades was 621.97 mg/l (Figure 4.).

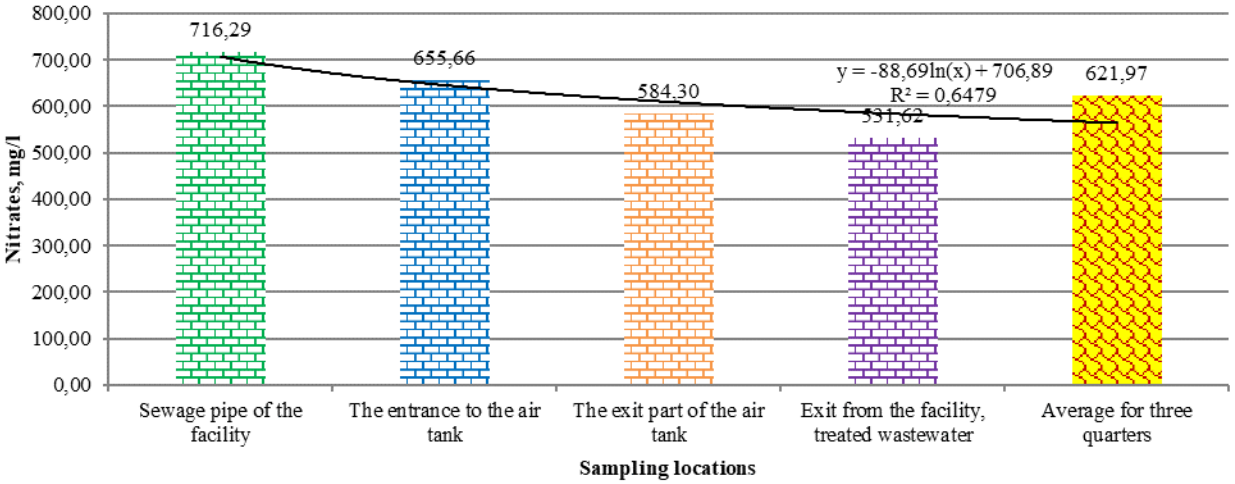


Figure 4. Average indicators of annual nitrate pollution of domestic wastewater

Comparing this indicator with the normative indicators, it was found that the wastewater coming out of the enterprise (531.62 mg/l) is polluted 11.8 times more than the standard. After a comparative analysis of the results obtained for the determination of nitrites, and when the average indicators for three decades were calculated based on logarithmic calculations, the average amount of nitrites in the wastewater from the wastewater lifting pipe of the facility was 21.07 mg/l, and the average amount of nitrites in the wastewater from the entrance to the aerotank was 17.35 mg/l. , it was found that the effluent from the aerotank is contaminated with nitrites at an average of 15.39 mg/l, and the treated effluent from the facility at 11.56 mg/l. Therefore, it was determined that the average nitrite pollution index in the three decades was 16.36 mg/l (Figure 5).

Comparing this indicator with the normative indicators, it was found that the wastewater coming out of the enterprise (16.36 mg/l) is 5.0 times more polluted than the standard. Thus, it was concluded that it was necessary to further control the amount of nitrates and nitrites in the wastewater leaving the plant, as well as to find ways to further purify these contaminants and put them into operation as quickly as possible.

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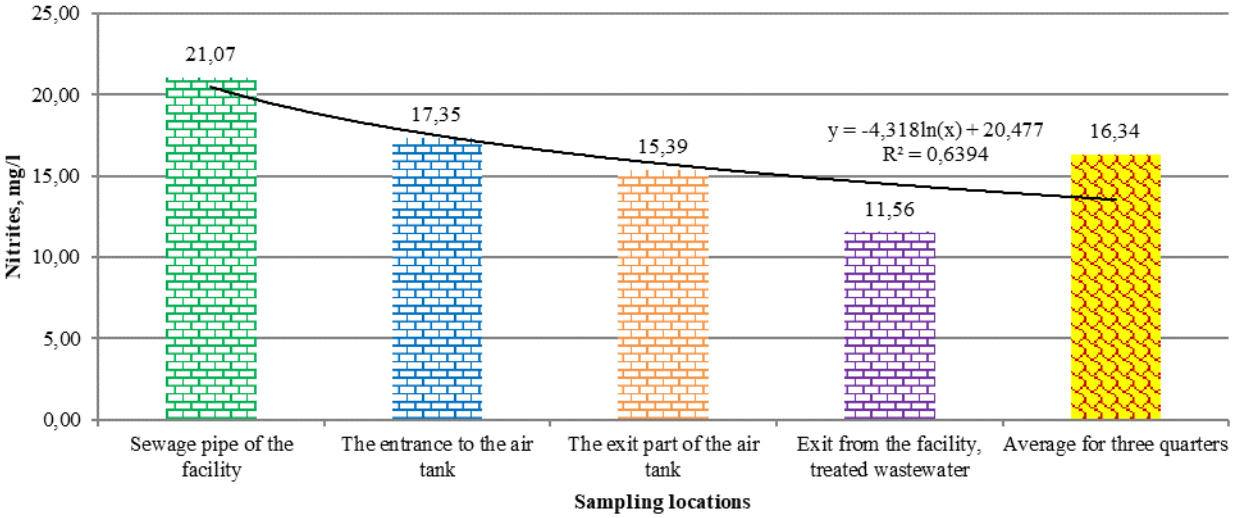


Figure 5. Average indicators of annual nitrite contamination of domestic wastewater

CONCLUSION. After chemical, physico-chemical and biological (aerotank and activated sludge) treatment of domestic wastewater, algae (macrophyte)-based treatment is introduced at all production enterprises as part of biological treatment, and in this process it is aimed at implementing systematic monitoring of processes is advisable. Including biological treatment based on higher algae (macrophytes) in almost all production enterprises (oil refineries, oil and gas production enterprises, chemical production enterprises, tanneries, oil production enterprises, etc.), although the process continues, but the systematic use of macrophytes based clear regulatory indicators and have not been established technical regulatory documents. If the issue of monitoring on the basis of the technical and regulatory documents regulating this process is resolved positively, it would be possible to optimize the level of contamination of the waste water released into the environment with various chemical substances.

When using biological treatment technology in the process of treating domestic wastewater at oil and gas production enterprises, it is advisable to pay attention to the following:

First, to provide biological treatment technology used in the treatment of domestic wastewater in oil and gas production enterprises with special technical normative control regulations;

Secondly, periodic monitoring of biological treatment processes (aeration tank, activated sludge, flood) at these enterprises on the basis of specially developed and controlled technical regulations;

Thirdly, by starting the production of secondary products during the treatment of waste water from these enterprises with the help of macrophytes, the organization of the process will bring added value benefits to the enterprise.

In particular, by organizing bioremediation treatment of secondary wastewater, the process of its purification from various chemical compounds and substances, as well as setting up the production of secondary products (obtaining biomass of microalgae and macrophytes), products that are extremely important for various industries. economy, including food proteins, carbohydrates, lipids, protein-vitamin complexes for industry, pigments, chlorophylls, carotenoids, biocolors, food additives containing ω-3, ω-6, ω-9, bioplastics, β-carotene for the pharmaceutical industry, immunostimulants, cardioprotectors, antaxants, glycerin, anti-inflammatory and

anti-obesity agents, agricultural biofertilizers, feeds and additives, biofuels for bioenergy (biodiesel, methane, hydrogen, liquid hydrocarbons) and can be obtained cosmetics

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