INDUSTRIAL WASTEWATER RECYCLING SYSTEM

[1]Haydarov Bekzod, [2]Mirsaidov Makhmudjon, [3]Ibodullayeva Gavharoy, [4]Ergasheva Sarvinoz, [5]Bekbotayeva Munira

[1,2] Assistant teachers of the Yangiyer branch of the Tashkent Institute of Chemical Technology
[3]Trainee-teacher of the Yangiyer branch of the Tashkent Institute of Chemical Technology
[4,5] Students of the Yangiyer branch of the Tashkent Institute of Chemical Technology

https://doi.org/10.5281/zenodo.7774926

Abstract. *This article provides information on industrial waste water treatment, treatment of waste water produced during phosphating and galvanizing at the production enterprise operating at "MEXMASH" LLC.*

Keywords: *waste water, "MEXMASh" LLC, phosphating and galvanizing, degreasing, phosphate, zinc, iron, recuperative methods, floating, settling, sedimentation, filtration, centrifugation, adsorption, coagulation, flocculation, flotation, ion- exchange, extraction, neutralization, oxidation, reduction.*

Water plays an important role in the main processes occurring in nature, as well as in human life. In industry, water is used as a raw material and energy source, as a cooling or heating agent, as a solvent, as an extractant, as a means of transporting raw materials and materials, and for a number of other purposes. The total volume of natural water on our planet is 1386 million km^3. More than 97.5% of it is ocean, sea and lake waters. The world's need for fresh water is 3900 billion m^3 per year. [1] About half of this water is not recycled, and the other half becomes waste water. One of the solutions to this problem is the correct use of waste water treatment facilities (method devices) when processing waste water or dumping it into water bodies. Construction of water protection facilities and increasing the capacity of the water reuse system, better protection of water sources from construction or pollution in general, application of a non-polluting system of water use in enterprises, as well as organization of an automated system of management of water management complexes, full use of water resources in our country It is carried out by using them, protecting them from pollution by household and industrial wastes, and organizing the water purification process well. As can be seen from the above, in order to protect the environment and water bodies, it is necessary to thoroughly clean the wastewater before dumping it into the water bodies. In addition, production (industrial) wastewater is considered very toxic and rich in chemical (reagent) elements. For this reason, it is advisable to use a closed system in the processing of waste water of production (industrial) enterprises.[3]

Research results:

There are various methods and components for the treatment of waste water. Based on this existing technology, it is aimed at the treatment of waste water produced during the phosphating and galvanizing process at the production enterprise operating at "MEXMASh" LLC.

At "MEXMASh" LLC, a wastewater treatment technology was selected that meets the standards for discharging wastewater into the sewers of the city of Namangan. Waste water from the phosphating line is directed to treatment. The technological process includes anti-rust coating by phosphating and galvanizing.

Sources of water pollution include phosphates, alkalis and oils, acids, and zinc ions in the waste water produced during these processes. An increase in the level of these types of pollutants,

which cannot be treated in urban wastewater treatment plants, leads to a change in the properties of natural waters and a sharp deterioration of the ecological situation.[2]

Pollution of a limited water basin as a result of industrial development shows the urgency of the problem of natural water protection in Uzbekistan.

Protection of water resources from industrial pollution is carried out in the following directions:

- treatment of wastewater at the enterprise itself in local treatment facilities before disposal into the sewer;
- introduction of return and closed water supply, reuse of purified water;
- consists of using low-waste technology of cleaning.

The composition and classification of the waste water generated during the production process at "MEXMASH" LLC consists of the application of the treatment and processing of the waste water generated during the washing process.

The qualitative and quantitative composition of wastewater is given in **Table 1.**

№	Process name	Number of devices	Bath composition %	The size of the bath is m3	Flow time (water)	Type of cleaning
1	Boiling degreasing	2	35-45	0,822	2-3 week	Drum
2	Harm (travlena)	2	22-28	0,822	2-3 week	Drum
3	Surface activation	1	0,1	0,63	Every day	Drum
4	Phosphating	2	40-50	1,164	in the month	Drum
5	Washing	6		0,63	Every constant	Drum

Quality and quantity composition of wastewater:

Table 2.

№	Process name	Number of devices	Bath composition %	The size of the bath is m3	Flow time (water)
1	Washing	1	0.2	1	Every constant
2	Seasoning	1	1.4	1	in the month
3	Zinc plating	1	9.93	1	Does not drain
4	Washing	1	0.29	1	Every constant

In the production process, phosphating and galvanizing (protecting the surface of metals from corrosion) are carried out. In this process, in order to ensure that chemical compounds with metal do not pass from one bath to another during chemical processing, a cleaning process is carried out with the help of wastewater after each process. In this case, the total consumption of washing water during the washing process is 5-5.5 m3/hour.

Description of chemicals used in the phosphating process

Table 3.

№	Process name	Chemical type	Components	The concentration of the active part. %	pH
1	Seasoning	Trisodium phosphate	Na_3PO_4	50-70	9-12
		Caustic soda	NaOH	18-19	
2	Harm (travlena)	Hydrochloric acid	HCl	31,5	
3	Surface activation	For surface activation	Na_2CO_3	62	8,5-10
			TiO	38	
4	Phosphating	Solution for phosphating	H_3PO_4	37-38	
			HNO_3	18-19	
			ZnO	15-16	
			H_2O	29-30	

The description of the chemicals used in the galvanizing process is given in the table below.

Table 4.

№	Process name	Chemical type	Components	The concentration of the active part. %	pH
1	Washing	Water	H_2O	70	
2	Seasoning	Trisodium phosphate	Na_3PO_4	50-70	9-12
		Caustic soda	NaOH	18-19	
3	Zinc plating	zinc metal	Zn	7-12	5,5-6,0
		Ammonium chloride	NH_4Cl	50-60	
		Zinc chloride	$ZnCl_2$	17-20	
		Tiomachevina	CH_4N_2S	5-7	
4	Washing	Water	H_2O	80-90	

The degreasing recycled phosphate and zinc solution is a complex four-phase colloid-dispersed system containing a degreasing emulsifier, a mechanical lifter (vzvesi) and oils. The initial removal of oils from the surface of the solution to be degreased takes place in the process of degreasing the products according to the non-stop technological scheme. For this, it is advisable to use a device of the type of quencher. Film oils and light water-soluble fractions flow into the discharge sump and then into the oil fraction separator.

According to the information presented in the table, it can be concluded that in the phosphating and galvanizing section of "MEXMASh" LLC, the pollutants of waste water are phosphate, zinc, iron, ions of oils and the concentration of pN, which does not meet the norms of disposal into the sewers and requires preliminary cleaning (Fig. 1).

The waste water generated at the enterprise of "MEXMASh" LLC is divided into two groups:

- concentrated – degreasing, process electrolytes and surface activation;
- washed - formed during washing between operations.

The stability of the operation of the treatment facilities depends to a large extent on the invariability of the composition of the effluents that go to the treatment plant.

A specific feature of wastewater during dehumidification is the high concentration of oils. This complicates the removal of other contaminant components and increases the amount of reagents used and results in the formation of large volumes of precipitates. Therefore, degreasing is desirable to create conditions for maximum removal of floating oils from electrolyte surfaces.

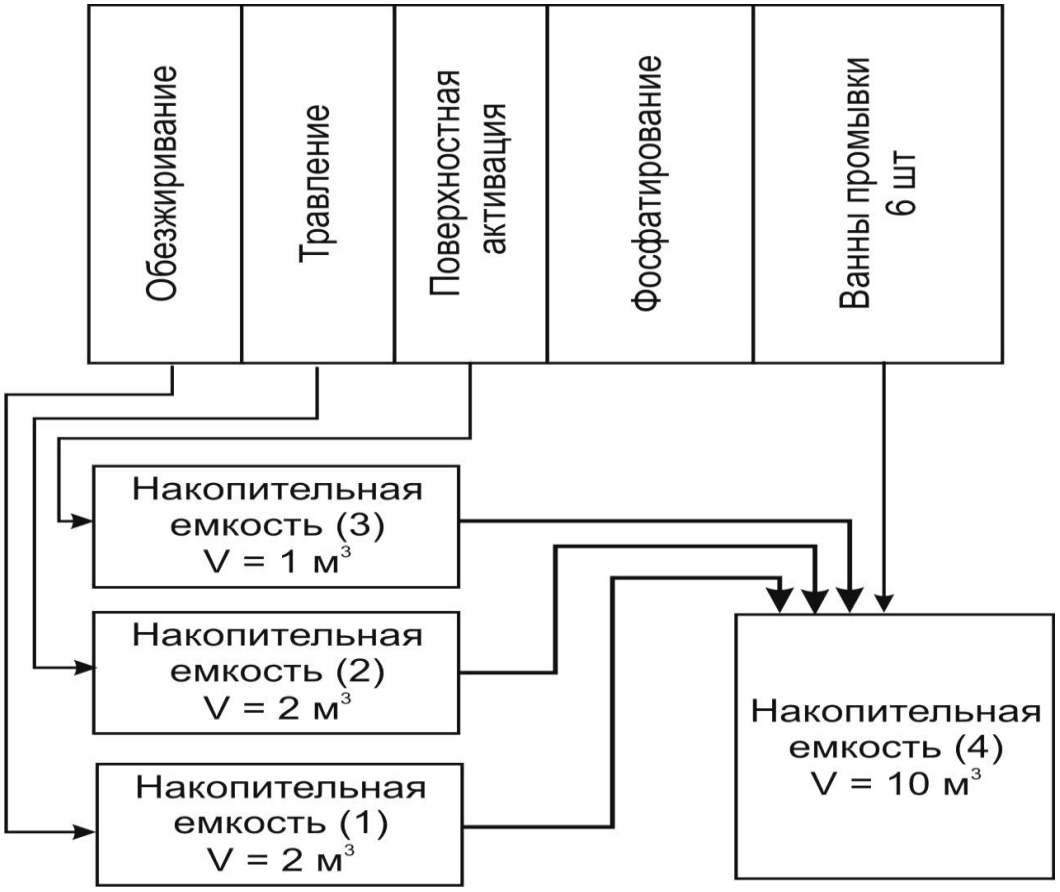

Figure 1. Scheme of the phosphating department at the production enterprise operating at "MEXMASH" LLC.

Electrical properties of water. Water is a weak conductor of electricity. Its specific electrical conductivity at 18°C is 4.41 • 10 x 1/Ohm-cm, and its dielectric constant is 80. The presence of soluble salts in water increases its electrical conductivity. This property of water is directly related to temperature changes.

Discussion:

Industrial wastewater treatment methods are purified again due to solar radiation and fresh water flowing into dirty water. Various bacteria, fungi and algae are active agents in water repurification. If the water is oversaturated with various impurities, various independent or complex methods are used to clean it. In order to create a closed system of water supply, industrial waste water is purified to the required quality of water by mechanical, chemical, physical-chemical, biological and thermal treatment methods, depending on the type of enterprise. In

addition, the mentioned methods are divided into recuperative and destructive methods. Recuperative methods are aimed at extracting all valuable substances from wastewater and then reusing it. In a destructive way, water pollutants are broken down using oxidation or reduction methods. Decomposition products are separated from water in the form of gas or sediment. The selection of cleaning methods is carried out taking into account the following factors:[3]

1) sanitary and technological requirements for purified water, taking into account reuse;

2) amount of wastewater;

3) the amount of energy and material resources necessary for the decontamination process at the enterprise (steam, fuel, compressed air, electricity, reagents, sorbents), as well as the necessary area for cleaning equipment and facilities.

Industrial and domestic wastewater contains suspended particles of water-soluble and insoluble substances. Suspended impurities are solid or liquid and form a dispersed system. According to particle size, dispersed systems are divided into 3 groups:

1) coarsely dispersed (suspension and emulsion) systems with a particle size of more than 0.1 μm;

2) particle size 0.1 μm; colloidal systems with a diameter of up to 1 nm;

3) pure solutions with particles corresponding to the size of individual molecules or ions.

Hydromechanical processes are used to separate suspended particles from the composition of wastewater, and chemical processes are used to separate physicochemical, organic and inorganic solutions for colloidal dispersed systems. The choice of these processes depends on particle size, physicochemical properties, their concentration in water, and wastewater consumption. Therefore, the following methods are used for wastewater treatment:

1. Mechanical (swimming, settling, settling, filtering, centrifuging, etc.).

2. Physico-chemical (adsorption, coagulation, flocculation, flotation, ion-exchange, extraction, etc.).

3. Chemical (neutralization, oxidation, reduction).

4. Biochemical (under aerobic, anaerobic conditions).

5. Thermal (in the presence of high temperature).

These methods, in turn, are divided into different cleaning processes. First of all, a mechanical method is used in wastewater treatment.[4]

Selection and justification of wastewater treatment technology

The analysis of the composition of production wastewater generated during the operation of the equipment in the phosphating and galvanizing line showed that the main pollutants are phosphate, zinc, iron ions and emulsified oils.

Cleaning of the main pollutant - phosphate ion - is carried out using coagulants - aluminum or iron salts, as a result of which insoluble phosphates are formed.

Cleaning from polluting components is carried out on the basis of the following reactions:

$$2PO4^{-3} + 3Fe^{+2} \rightarrow Fe_3(PO4)_2\downarrow;$$

$$PO4^{-3} + Al^{3} \rightarrow AlPO_4\downarrow;$$

The introduction of aluminum or iron ions can be carried out using reagents or by electrochemical melting of metal (Al or Fe) electrodes under the influence of electric current.

However, the high concentration of phosphates, as well as the coating of the surface of the electrodes by pollutants - iron, emulsified oils, indicate that the electrochemical method (electrocoagulation or galvanocoagulation) cannot be used.

The presence of iron ions in the treated electrolytes ensures partial loss of phosphate ions, but the concentration of iron is not sufficient for complete loss of phosphate ions.

One of the ways to effectively eliminate phosphate ions is calcium phosphate, which is formed as a result of adding lime to the treated water.

Cleaning from polluting components is carried out based on the following reaction:

$$2PO_4^{3-} + 3Ca(OH)_2 \rightarrow Ca_3(PO_4)_2\downarrow$$

This reagent is developed on an industrial scale and is much cheaper than metal coagulants. Even in this case, zinc ions are eliminated as a result of the formation of zinc hydroxide and zinc phosphate based on the following reaction:

$$Zn^{+2} + 2OH^- \rightarrow Zn(OH)_2\downarrow;$$

$$2PO_4^{-3} + 3Zn^{+2} \rightarrow Zn_3(PO_4)_2\downarrow;$$

Treatment with milk of lime provides an opportunity to destabilize the emulsified oil, to form an insoluble calcium soap from the free oils, and to ensure the sorption of the oils on the surface of the resulting sediments:

$$NaOOC–(CH_2)_n–COONa + Ca(OH)_2 = (CH_2)_n–(COO)_2Ca\downarrow + 2NaOH$$

A high concentration of phosphate ions in the treated water requires a large amount of lime to be added, which results in a pH concentration in the treated water that is greater than the discharge standards (greater than pH 9). That's why it is suggested to adjust the pH by adding hydrochloric acid.[4]

The resulting sediments can be removed using a dewatering device. Taking into account the large amount of the solid phase in the formed sediments and its filtration properties, it is desirable to implement forced filtration in devices that provide it.[5]

Thus, for the degreasing of wastewater generated at the enterprise of "MEXMASH" LLC, it is recommended to implement it on the basis of effective technology according to the following periodic regime: treatment of the wastewater flow with calcium hydroxide, then removal of sediments and treatment in purified water consists of correcting the pH.

Summary

Nowadays, taking into account the global problems caused by the development of industry, the increase in the number of the world population, climate change, and the uneven distribution of water resources in the world, and the limited amount of water resources, it is very important to deeply process not only industrial, but also other types of wastewater. is counted [1] . Also, it is necessary to switch irrigation systems to the drip mechanism, and in other production processes, it is necessary to switch to a closed, intensive cycle of water circulation. [6]

REFERENCES

1. Wastewater treatment technology, Tashkent "Music" publishing house, 2010. - S. Turobjonov, T. Tursunov, Kh. Pulatov
2. Sewage drainage networks "Cholpon creative house of publishing and printing" Tashkent. 2014– E.S. Buriyev, K.F. Yakubov
3. Fundamentals of industrial waste purification technology "Publication of the National Society of Philosophers of Uzbekistan" Tashkent. 2011– M.N. Musayev
4. The use of Modern Automated Information Systems as the Most Important Mechanism for the use of Water Resources in the Region //Test Engineering and Management. 2020. - Obidovich S. A.

5. The role and place of agro clusters in improving the economic efficiency of water use in the region //Asian Journal of Multidimensional Research (AJMR). - 2018. - Kenjabaev A.T., Sultonov A.O.
6. Some questions of the composition and assessment of the state of industrial gas emissions and their components //Science and Education. - 2020 - Karimovich M.T., Rakhmatullaevich S.S.