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Treatment of Sewage Water of Electrical Production on Recycled Filters

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ABSTRACT: The article presents the results of laboratory research on wastewater treatment of galvanic production carried out on the model of a filter plant. A high and stable retarding ability of the alluvial layer of filter perlite was established in a constant speed mode. The possibility and feasibility of using filter perlite of the Tashkent plant “Stroyperlit” for wastewater treatment of galvanic production as a filling material are shown.

KEY WORDS: Galvanic production, wastewater, deep cleaning, particulate matter, particulate filters, precoat filters filters, filter element, experiment planning, filtering mode, cleaning efficiency.

I. INTRODUCTION

One of the important aspects of the economic policy of the Republic of Uzbekistan is the task of comprehensively improving the technical level of production in mechanical engineering and metalworking and improving the quality of their products. The development of these sectors, which are large water consumers, is inconceivable without improving their water management systems. The currently observed continuous increase in fresh water consumption for the technological needs of enterprises and the increase in the number of waste water discharged to natural reservoirs or to urban sewage facilities are explained by the still widespread use of direct-flow water supply systems and the imperfection of industrial wastewater treatment technology that makes it difficult to reuse these waters.

II. MATERIAL AND METHODS

One of the sources of origin of a large amount of wastewater from engineering and metalworking enterprises, reaching 15-40% of the total runoff, is production associated with electroplating, chemical and electrochemical processing of metals and washing of metal products. Discharges of wastewater from galvanic production containing cyanide compounds, salts of iron, hexavalent chromium and heavy metals, acids, alkalis and harmful organic compounds into natural bodies of water make the water unsuitable for use in drinking water, can cause irreparable damage to the fisheries of these bodies of water , and upon admission to sewage treatment plants disrupt the biological treatment processes. As a rule, wastewater treatment of galvanic production is carried out separately, depending on the nature and origin of the dissolved contaminants present in them by treatment with precipitating reagents. Gutters of galvanic production contain a large number of heavy metal ions hazardous to human health and the environment. Their additional purification in order to return to production will make it possible to create recycling water supply systems and closed water use systems at a number of enterprises, which are the most effective means of protecting water bodies from pollution and rational use of water.

Therefore, the search for rational methods of preliminary deep cleaning of wastes from mechanical impurities before their final purification is of great importance. A disadvantage of widely used cleaning methods (sedimentation, clarification in a suspended layer, flotation and separation of particles in hydrocyclones) is a significant amount of mechanical particles in treated water (up to 10-20 g / m^3, and sometimes up to 50 g / m^3), which usually requires when reusing such water, additional deep mechanical or mechanical reagent clarification on filters of various designs. Currently, both in the Republic of Uzbekistan and abroad, filtering on non-pressure and pressure filters with granular loading is most often used to clean liquids with a limited content of dispersed impurities. Along with such advantages as the simplicity of the device and the principle of operation, these filters have significant disadvantages. The latter

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include the need to build large-sized buildings to accommodate installations, the large size of the filters themselves; the need for large tanks for storing wash water; installation of special washing pumps and, finally, the creation of an additional large-scale complex for the purification of spent washing water, the volume of which in normal operating conditions ranges from 8 to 15% of the total volume of treated water.

III. SIMULATION & RESULTS

In addition, when treating washing water of filters with granular loading, it is necessary to create complex devices for thickening and compacting sludge from the settled washing water, characterized by a relatively low concentration of solid phase. Therefore, for the post-treatment of industrial effluents with a relatively low content of mechanical impurities, it may be appropriate to use reclaimed filters (filters with auxiliary filtering materials), which, due to the design features and operating principle, have a higher throughput and occupy significantly smaller areas. In addition, the use of alluvial filters reduces the flow rate of wash water to 0.2-1.0% of the total capacity of the installation and creates the possibility of obtaining sludge with a very high degree of compaction, which cannot be achieved on other devices. Inlet filters provide a stable degree of clarification of water from the moment the filter is turned on and until the end of the filter cycle, the duration of which is limited by the permissible pressure drop across the filter. The wastewater treatment process using in-line filtration consists of three operations:-application of an auxiliary filter layer;-filtration of wastewater;-regeneration of the filter layer of the element.

The formation of an alluvial filter layer is an extremely important stage, in which a suspension of a certain concentration is gradually introduced into the filter apparatus using a pump and uniformly layered on the filter element. The use of cylindrical filtering elements in alluvial filters allows the most complete use of the volume of the apparatus. So, for example, in a pre-filter with a diameter of 2.0 m, the filtering surface is 70-100 m^2. At filtering speeds of 2-3 m / h, the productivity of such a filter is 140-300 m^3 / h, which is 5-10 times higher than the performance of a bulk mechanical filter of the same diameter [1].

At the Namangan Construction Engineering Institute, research was conducted on the efficiency of the alluvial filter when cleaning the industrial wastewater of the galvanic shop of the Joint-Stock Company - AO "NAMANGANMASH" in the city of Namangan on an experimental installation, the diagram of which is shown in Fig. 1. The filter consists of a vertical cylindrical body with a diameter of-150 mm, a height of-650 mm with a conical bottom made of organic glass. A cartridge filter element with a diameter of -50 mm, a height of -290 mm and a filtering surface s = 0.0455 m^2 is placed inside the housing. To simulate the composition of the initial wastewater, a complex iron-containing reagent was introduced into tap water, which was a mixture of sulfates of ferrous and ferric iron in the ratio Fe^3 +: Fe^2 + = 2: 1. The pH value (9.5-11) necessary for the formation of dispersed particles of iron hydroxide in the experiments was supported by the addition of alkali (NaOH, KOH) according to the readings of the pH meter. As an auxiliary material, filter perlite of the UzPerlit Company in the city of Tashkent was used.

IV. METHODOLOGY

Filter perlite is a product obtained from expanded perlite as a result of mechanical and thermal processing of perlite ore. Due to the fact that filter perlite is environmentally friendly, absolutely non-toxic, insoluble and not subject to chemical influences, it has found its application in various industries as a special and additional material for filtering liquids and suspensions. Perlite filtering powder is used as an auxiliary filtering material for the formation of an alluvial layer on modern filters during the filtration of various suspensions: process oils in metallurgical plants; petroleum products, lubricants; solutions in chemical plants; antibiotics; vegetable oils; sewage and drinking water; sugar juices and syrups; beer wine fruit juices, etc. The research program was compiled using the method of planning experiments on the Greco-Latin square [3].

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V. EXPERIMENTAL RESULTS

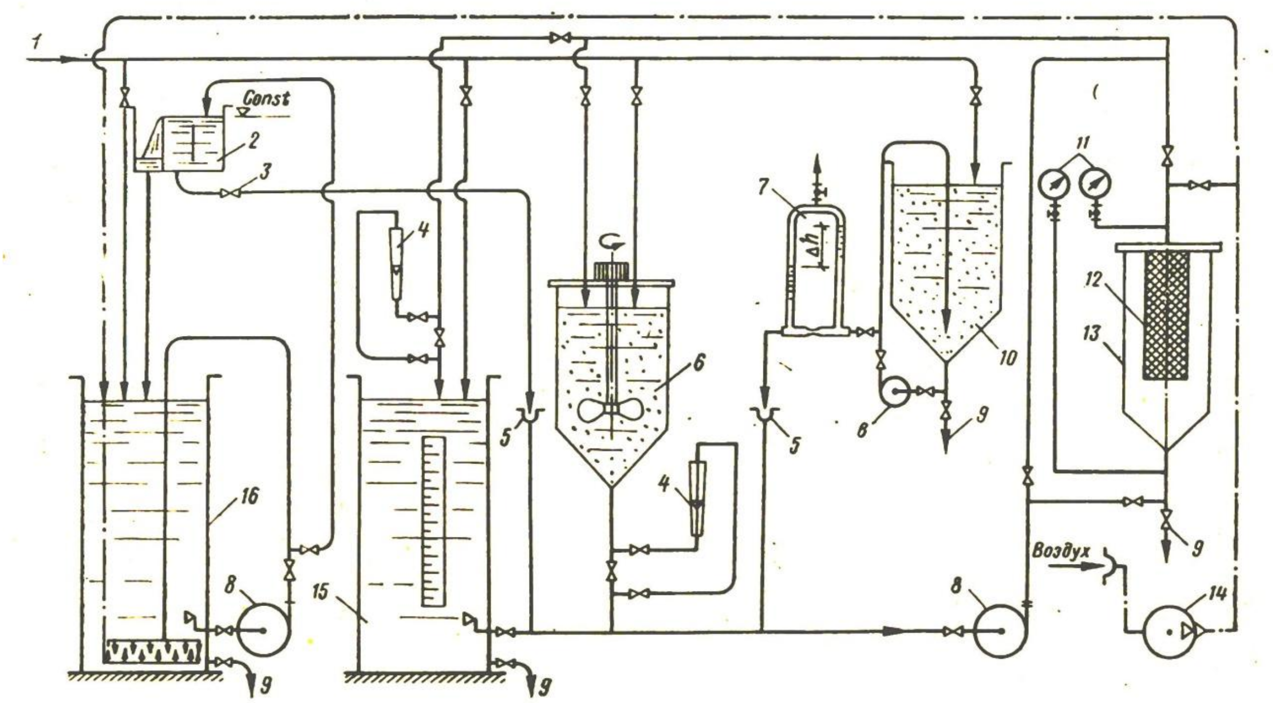

Fig. 1. Experimental setup: 1-water from city water supply; 2-dosing tank of constant level; 3-way valve; 4-rotameter; 5-receiving funnel; 6-tank with a mixer for preparing a suspension of auxiliary filtering material and washing the primary layer; 7-glass differential pressure meter dispenser; 8-pump; 9-discharge into the sewer; 10-tank with a mixer for the preparation and supply of a suspension-additive of auxiliary filtering material; 11-manometer; 12 filter element; 13-body precoat filter; 14-compressor; 15-dimensional leachate tank; 16-tank for the preparation of source water.

PrimaryFactorLevels
Table 1

PrimaryFactorLevels P	**The content of suspended solids in the source water Mo, g / m^3**	**VFM consumption for the primary layer M vfm, g / m^3**	**Additive Suspension Concentration $M^{II}_{вфм}$, g/m^3**	**Filtering speed v, m / h**
1	15	500	5	2
2	30	1000	10	3
3	45	1500	15	4
4	60	2000	20	5

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The results of experimental studies
Tab. 2.

Turbidity of the source water Mo, g / m^3	Consumption VFM M^I, g / m^3	Suspension concentration M^{II}vfm, g / m^3	Filtration rateν, m / h	Turbidity of the filtrate M^I, g / m^3	Cleaning effect E,%	Filter Cycle Durationτ, h
15	500	5	2,0	1,5	90,5	9,3
30	2000	20	3,0	2,4	92,5	4,5
45	1000	10	4,0	3,6	92,5	2,5
60	1500	15	5,0	3,6	94,0	1,4
15	1000	15,0	3,0	1,8	87,6	8,1
30	1500	10,0	3	2,7	90,5	4,2
45	500	20,0	3	3,6	92,4	3,5
60	2000	5,0	3	4,8	91,6	2,4
15	1500	20	4,0	1,35	90,9	6,8
30	1000	5	4,0	1,8	93,8	3,7
45	2000	15	4,0	4,95	89,1	2,8
60	500	10	4,0	4,2	93,3	2,1
15	2000	10,0	5	1,2	91,9	4,5
30	500	15,0	5	2,4	91,6	3,1
45	1500	5,0	5	4,05	91,4	1,9
60	1000	20,0	5	4,8	92,3	1,8

VI.CONCLUSION AND FUTURE WORK

The following were selected as independent primary factors:• suspended solids content in the initial water-Mo, g / m^3;• filtration rate-ν, m / h;• consumption of auxiliary filtering material-M^I, g / m^3;• concentration of the suspension of the dosed additive-M^{II}vfm, g / m^3.• Dependent factors were:• clarification effect on suspended substances-E osv, %;• filter cycle time-τ, h The color Ts of the source and purified water and the dirt capacity of the filter were also determined. The values of the primary factors were determined in accordance with the data on the content of suspended solids in the source water at different periods of the year and according to the results of trial experiments (Table 1).The experiments were carried out in the filtering mode at a constant speed. As can be seen from the table. 2, the effect of clarification at different contents of suspended solids in the source water was quite stable and high (about 90%). Analysis of individual samples showed a decrease in color by 50-60% (up to 12-20 degrees.). When using filter perlite, the duration of application of the primary layer was 7–12 min, and the maximum pressure loss was 0.15–0.25 M Pa. The use of an inlet filter reduces the cost of the after-treatment of industrial wastewater by reducing the area for filtration facilities and reducing (up to 1.0% of the total capacity) water consumption for washing the filters. Thus, studies have established the feasibility and feasibility of using galvanic production for the treatment of industrial wastewater by the method of alluvial filtration using auxiliary filter materials.

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