ОСОБЕННОСТИ КОМПЛЕКСНОЙ ОЧИСТКИ СТОЧНЫХ ВОД ТЕКСТИЛЬНЫХ ПРЕДПРИЯТИЙ

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АННОТАЦИЯ

Исследование посвящено изучению адсорбционных характеристик различных типов композиционных коадсорбентов-коагулянтов-флокулянтов в сочетании с полиалюминия хлоридом (оксихлоридом алюминия) с органическим полимером.

Было изучено влияние этих коагулянтов флокулянтов на снижение мутности растворов, а также исследованы характеристики процесса когезии и коагуляции. На основании полученных экспериментальных данных обсуждены характер и механизм когезии и коагуляции для различных типов композиционных коагулянтов-флокулянтов.

Установлено, что изотерма адсорбции катионных композиционных коагулянтов-флокулянтов соответствует закону адсорбции Ленгмюра и характеризуется параметрами адсорбции монослоя, что повышает их способность к нейтрализации электрического заряда. Анионные композиционные коагулянты-флокулянты повышают адсорбционную способность и способность к образованию мостиковых связей с помощью органических полимеров, демонстрируя при этом свойства, характерные для многослойной адсорбции.

Ключевые слова: очистка, композиция, сточные воды, эффективность, адсорбент, каолин, бентонит, концентрация, коагулянт-алюминий сульфат ($Al_2(SO_4)_3$, натрий гидросульфит ($NaHSO_3$), флокулянт полиакриламид-ПАА, состав, электрофлотация.

FEATURES OF COMPLEX PURIFICATION OF WASTE WATER OF TEXTILE ENTERPRISES

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ANNOTATION

The study is devoted to the study of the adsorption characteristics of various types of composite coadsorbents-coagulants-flocculants in combination with polyaluminium chloride (aluminum oxychloride) with an organic polymer.

The effect of these coagulants, flocculants on reducing the turbidity of solutions was studied, as well as the characteristics of the cohesion and coagulation process. On the basis of the obtained experimental data, the character and mechanism of cohesion and coagulation for various types of composite coagulants-flocculants are discussed.
It has been established that the adsorption isotherm of cationic composite coagulants-flocculants corresponds to the Langmuir law of adsorption and is characterized by the adsorption parameters of a monolayer, which increases their ability to neutralize an electric charge. Anionic composite coagulants-flocculants increase the adsorption capacity and the ability to form bridging bonds with organic polymers, while exhibiting properties characteristic of multilayer adsorption.

Keywords: purification, composition, waste water, efficiency, adsorbent, kaolin, bentonite, concentration, coagulyant-aluminum sulfate-($Al_2(SO_4)_3$), sodium hydrosulfite-($NaHSO_3$), flocculant polyacrylamide-PAA, composition, electroflotation.

Waste water from the textile industry is the main source of environmental pollution, as well as the spread of various diseases and epidemics. Therefore, it is very important that all waste water is purposefully discharged, and the main thing is to clean it in order to eliminate all the negative consequences of the waste water in order to use it as an acceptable method for waste water production and create an effective waste water treatment. The release of synthetic dyes leads to the formation of contaminated waste water, a characteristic feature of which is intensely negative for the environment.

Dyeing water in water, in addition to the negative influence on its acidic mode, helps to suppress the process of self-purification due to changes in the amount of light The content in wastewater of colorants, oxidants, reagents, PAS leads to death in water of the organisms that inhabit them, and changes in organic light. Therefore, various methods of wastewater purification are used, including filtration, coagulation, flocculation, electric regulation, electric flotation and electrochemistry to reduce the flow of water.

It is known that textile production is the main consumer of a large amount of water - for the production of 1 kg of fabric, about 100-200 kg of water is consumed. Wastewater from textile production contains suspended solids, unfixed dyes, compounds of heavy metals, surfactants, harmful organic compounds, etc. as basic pollutants. Therefore, purification of wastewater from these pollutants is an important task of protecting the environment and ecology at enterprises. Analyzing the current state of methods for treating wastewater from dyes, it should be noted their diversity, while the relevance and prospects of optimizing existing and searching for new treatment methods, as well as the creation of new highly effective and economically rational technologies for neutralizing wastewater from dyes and other pollutants. The existing wastewater treatment methods can be divided into mechanical, chemical, physical-chemical and biological. In the case when they are used together, then the method of purification and disposal of wastewater is called combined [1-2].

In addition, contaminated waste water is also cleaned with the help of ultrasound, ozone, ion exchange resins and high pressure. However, these methods have certain disadvantages in particular, the complexity of implementation.

It should be noted that the combined method is most often used in many industrial wastewater treatment technological schemes to reduce the content of unfixed dyes after washing suspended dispersed particles and removing a number of pollutants, and its efficiency largely depends on the type and composition. All chemical reagents used that play the role of a sorbent, coagulant and flocculant must meet the following requirements: have high intrinsic ability, chemical and thermal stability, high porosity, good adhesion and coagulation and flocculating properties in relation to removed contaminants. In addition, they should also be easily regenerated and relatively low in cost [3].

Taking into account the foregoing, we carried out experiments to identify the effectiveness of the developed composition in the treatment of wastewater from textile production. Bentonite was chosen as a sorbent, aluminum sulfate and sodium bisulfite as a coagulant, and PAA as a flocculant.

From the literature it is known that during the adsorption there is a concentration of molecules of absorbing substance on the surface of the sorbent under the action of the power of the power. The force field of the surface is formed as a result of the presence of solid phase molecules in the boundary molecules, unlike intraphase molecules of greater free energy. As a result of this, boundary molecules attract molecules from the contacting phase.

With this condition, it is possible to distinguish three types of intermolecular interaction:

1) interaction between sorbet molecules and water;
2) between the molecules of sorbent and the extracted substance;
3) between the molecules of the extracted substance and water.

The difference in the energies of these three processes is the energy with which the substance extracted from the solution is retained on the surface of the sorbent. Adsorption process is reversible, i.e. The sorbed substance can be passed from the adsorbent back into the solution.

Table 1.Composition and concentration of waste water pollution by textiles of the first and second flow

Indicators	Concentration, mg/l	
	First flow	Second flow
pH	9	8,5
Suspended substances	300-400	250-300
Surfactant	70	40
Total alkalinity, мg-eq/l	9,6	8,2
Dry residue	120	900
Chlorides	51	43
Sulfates	350	280
BOD full., мg O_2/l	321	276
COD, мg O_2/l	400	350
Phosphorus (in terms of P_2O_5)	14,5	11,7
Ion ammonia	6,7	5,3
Transparency by font, cm	2	3

The speed of sorption and desorption processes depends on the concentration of the substance on the surface of the adsorbent and in solution.

With the aim of identifying the optimal concentration of coagulants and flocculants in the process of wastewater treatment, we studied in different concentrations of chemical optimizations.

According to the efficiency charts of wastewater treatment, the percentage of water-separated products is reduced depending on the dose of PAA %, color intensity by 90-95%. Optimal doses of both PAA, as well as mineral coagulants ($Al_2(SO_4)_3$: 0.75-1.0 g / l, $NaHSO_3$: 0.375-0.75 g / l) give practically the same effect of cleaning the strength and intensity [6-8].

In this way, the use of the above-mentioned reagents can provide a fairly high degree of cleaning in terms of the intensity of the paint, suspended substances and other debris.

In this section, we carried out experiments on the use of an adsorbent from mineral raw materials of bentonite of the Navbakhor deposit in complex combination with coagulants, aluminum sulfate, polyacrylamide and sodium bisulfite

On the basis of the obtained data, the graphs of the dependence of the effectiveness of the decrease in the intensity of the dyeing in the presence of coagulants and from the dose of bentonite were plotted.

It can be seen from the obtained graphs that the efficiency of wastewater treatment, only on the concrete is not sufficient. Therefore, it is necessary to enter into the system simultaneously with the adsorbent and coagulant.

As expected, Navbakhor bentonite in combination with aluminum sulfate, PAA and sodium bisulfate provides only a high degree of bleaching and bleaching. With the aim of identifying the nature of coagulants on the effectiveness of reducing the intensity of paint when varying the concentration of bentonite from 1 to 7 g / l, we introduced PAA, $Al_2(SO_4)_3$, $NaHSO_3$ in it; 0.25;0.75; 0.375 g / l. From the data obtained, it can be seen that the degree of wastewater purification with adsorbent in the presence of coagulants is significantly higher (84-95%) than only with bentonite (70-72%). Moreover, the decrease in the efficiency of coloring in the adsorbent-PAA system reaches a maximum value of 93-95% at a polyacrylamide concentration of 0.25 g / l, and in the adsorbent-sodium hydrosulfite system and adsorbent aluminum sulfate, respectively, is 84-86% and 87-95% [9-12].

Further research is aimed at studying the illumination of waste water from dyes, PAWs and other admixtures of coagulants, depending on the quality of the flavor 3-4, from which it can be seen that the degree of decrease in the intensity of staining increases with an increase in the number of bentonite, PAA, $Al_2(SO_4)_3$, $NaHSO_3$ and reaches a maximum value of 91.0% for 4-5% , 25-0.5 g / l for PAA, 0.75-1.0 g / l for aluminum sulfate and 0.375-0.75 g / l for sodium bisulfite [13-14].

Especially it should be noted that the maximum degree of wastewater treatment is observed in the system of bentonite – PAA – $Al_2(SO_4)_3$– $NaHSO_3$ with a ratio of 1:0,05:0,15:0,075 91-95% of the composition.

In addition, it is noted that a good cleaning of the high-dispersed turbidity and various as present in the waste water is observed on the bentonite.

One of the methods of intensification of the separation of phases after the chlorination of metal hydroxides and their saturation with particles or molecules of pollutants is the dispersion of fluids.

A decrease in the solubility of the surfactants and dyes with the help of water-soluble polyelectrolytes also helps to increase the efficiency of wastewater treatment.

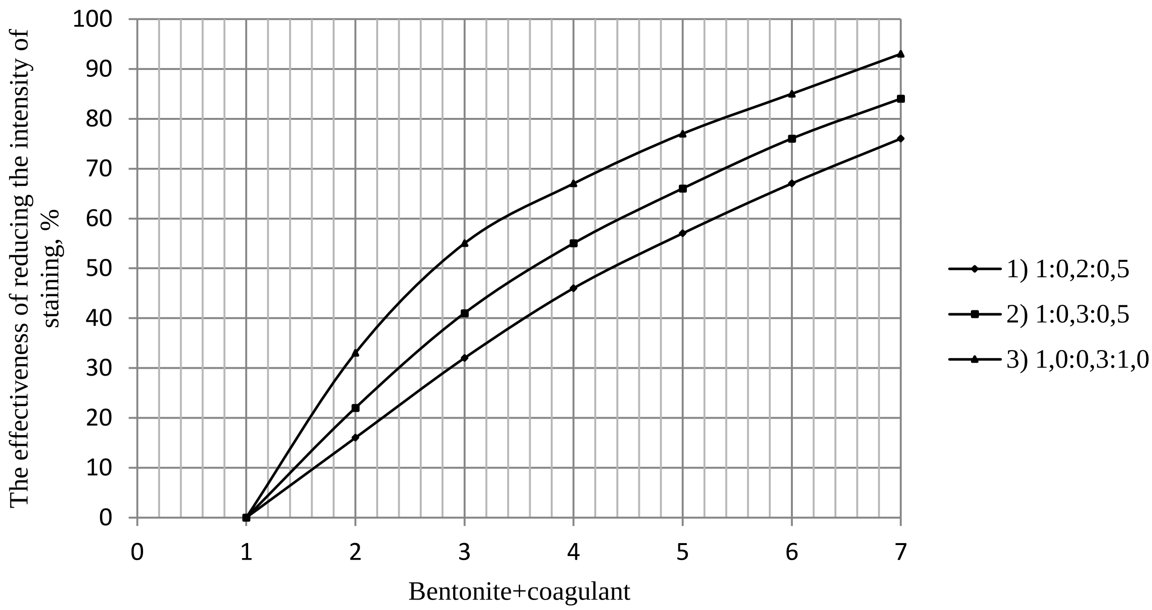

Fig. 1. - Change the intensity of staining from the dose of bentonite and coagulants at different ratios. Coagulant ratio: $Al_2(SO_4)_3$: PAA: $NaHSO_3$

Then, experiments were carried out to identify the duration of filtration with average and maximum input concentrations of suspended substances of waste water enterprises with a high frequency of consumption.

It should be noted that the duration of filtering for each series of tests was taken the same (1 and 3 hours) and was able to identify other constructive and technical parameters.

From the data obtained, it can be said that at average concentrations of suspended substances, the duration for wastewater from enterprises of the cotton industry is taken 1.5-2 hours, and at maximum initial concentrations, the duration of the inter-regeneration period increases to 3 hours.

In parallel with the technological and design parameters that ensure the maximum efficiency for the retention of suspended substances, analyzes were also carried out to reduce such indicators as COD, BOD full, non-ionic and anionic surfactants, the results of which are shown in Tables 3 and 4.

In accordance with the results given in the table. 3 and 4, the average efficiency of wastewater treatment of the first and second streams by COD, BOD 40-41% and 18-19%, respectively.

From the data obtained, it is seen that when using drilled bentonite with a fraction of 0.80-1.06 mm, it also provides a fairly high efficiency in maintaining the suspension. So, at its initial values of the order of 20 mg / l, the average indicator reaches up to 93.5%, and at maximum and minimum initial concentrations - 90.8% and 94.6% of the content. Therefore, the drilled bentonite can be recommended for deep purification of waste water from the cotton industry [15-16].

Table 3. Indicators of deep purification of waste water of the 1st stream at QMF

Main indicators	Waste water from the dyeing and printing workshops after cleaning in a tunnel sump					
	Min-max value		E, %	Average		E, %
	Before cleaning	After cleaning		Before cleaning	After cleaning	
Cleaning intensity per unit	1:45- 1:60	1:30-1:60	9-12	1:55	1:30	10
Suspended substances, mg/l	17-44	4-8	82,7-93,8	39	3,0	92,3
COD, mg/l	190-310	120-187	29,0-31,0	261,0	174,0	33
BOD p., mg O2/l	80-158	52-90	36,0-41,9	130	70,0	46
Surfactant, mg/l: pH	9,0-20,0 6,7-7,7	6,5-17,0	16,0-21,2	13	4,0	69

When observing the optimal design and technical parameters, high values of the efficiency of deep cleaning are provided according to the following indicators: 91.0-94.6% - weighted on COD - 30.0-34.1%; on BOD - 39.1-42.3% and on SAV - 69-75% confirm the desirability of using the developed systems for cleaning industrial waste.

The highest efficiency for the retention of suspended solids on a bentonite composition for wastewater from enterprises of the cotton industry is achieved at a filtration rate of 6-8 m / h, while the optimal filtration duration, depending on the initial concentration of suspended solids concentration, ranges from 1.5 to 3 hours.

Table 4 Indicators for deep cleaning of mixed waste from the 2nd stream

Main indicators	Flow from the 2nd stream after cleaning in tunnels					
	Min-max values		E, %	Average values		E, %
	Before cleaning	After cleaning		Before cleaning	After cleaning	
Intensity of cleaning by dev.	1:7-1:8	1:4-1:7	8-12	1:7	1:6	10
Suspended substances, mg/l	12-18	2,5-4	83-92	17	1,2	93
COD, mg/l	170-203	83-120	29,6-32,7	170	110	35
BODp., mg O_2/l	65-110	41-73	39,2-41,3	80	51	36
Surfactant, mg/l: pH	5,2-15,0 7,1-7,4	4,0-8,0	19,0-24,5	12 7,25	3,0	75

Thus, on the basis of the above studies on the treatment of wastewater from the dyeing and finishing shop on adsorbents obtained from local mineral raw materials of Navbakhor bentonite with subsequent coagulation with aluminum sulfate, PAA and sodium bisulfate, they showed the possibility of using this effective method of removing coloring organic substances, surfactants from water and other impurities.

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