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Wastewater Treatment By Sorption-Coagulation-Flocculation Method In Silkwinding Industry

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ABSTRACT

In this work, experiments were carried out on the use of an adsorbent from local mineral raw materials of bentonite of the Navbakhor field in complex combination with coagulants, aluminium sulfate, polyacrylamide and sodium bisulfite.The chemical composition of the composition for wastewater treatment has been developed.The mechanism of formation of poorly water-soluble iron and aluminium oxy-hydrates, which are sorbed on the flocculent surface, is revealed.It has been established that the greatest effect (while the efficiency of treatment in terms of COD reaches 38-65%, in terms of colour intensity - 82-95%) of wastewater treatment of silk-winding industries when using aluminium sulfate as a coagulant is achieved in the range of pH values from 6.5 up to 8.

KEYWORDS: adsorbent-bentonite, kaolin, efficiency, suspended substances, polyacrylamide, coagulant-aluminiumsulphate ($Al_2(SO_4)_3$,coagulant-sodium hydrosulphite ($NaHSO_3$) purification by intensity,bivalent iron sulphate - $FeSO_4 \cdot 7H_2O$,iron chloride - $FeCl_3 \cdot 6H_2O$.

ABBREVIATION:

PAA – Polyacrylamide;
COD - chemical oxygen demand;
BOD - Biochemical oxygen demand;
MPC - maximum permissible concentration;
SEC - sorption exchange capacity;

PVA - Polyvinyl alcohol;
CMC - Carboxymethyl-cellulose;

INTRODUCTION

At present, in the world, an increase in the gross domestic product based on the expansion of commodity production requires more intensive use of natural resources, including water resources, and their involvement in the system of economic activity.The analysis of the results of scientific research carried out in the field of inorganic chemistry in the world in recent years is of particular importance because among the compounds with specific properties, there is an increase in the number of drugs used in wastewater treatment, are of great importance [1].

One of the important issues in the modern world is the study of the targeted synthesis of various promising substances and the creation of active preparations, on the basis of which effective wastewater treatment is carried out.In particular, the development of the composition of new components using fine inorganic chemical methods and on the basis of which wastewater treatment is actively developing at industrial enterprises.Among the substances obtained, great importance is attached to the creation of coagulants, adsorbents and flocculants with highly effective properties [2].The widespread use of mineral coagulants for water purification is determined by several factors [3]:

- High coagulating ability and adsorption capacity of hydrolysis products of mineral coagulants;
- The ability to form insoluble compounds with several organic and inorganic substances;
- Availability and low cost of mineral coagulates.

The disadvantages of mineral coagulants include large doses and amounts of the formed difficult to dehydrate sludge, the need to adjust the pH of the water being purified, secondary water pollution with sulphates, chlorides, aluminium or iron ions, and a decrease in purification efficiency at low water temperatures.To improve the quality of purified water during its processing with mineral coagulants, high-molecular flocculants are usually used, which allow to enlarge coagulated impurities, increase the effect of water clarification, reduce doses of mineral coagulant and, accordingly, secondary water pollution, increase the stability and reliability of treatment facilities at peak loads and low temperatures [4-6].

MATERIALSANDMETHODS

One of the most widespread methods of wastewater treatment in textile industries is to clean it by using coagulants.In the practice of wastewater treatment, the following mineral coagulants are used:aluminium sulfate$Al_2(SO_4)_3 \cdot 18H_2O$, bivalent iron sulphate - $FeSO_4 \cdot 7H_2O$, iron chloride - $FeCl_3 \cdot 6H_2O$[27].The main process of coagulation treatment of industrial wastewater is hetero-coagulation-the interaction of colloidal and fine particles of wastewater with aggregates, formed when coagulants are introduced into the wastewater.

When aluminium salts are used as coagulants, as a result of hydrolysis, aluminium oxyhydrates, which are poorly soluble in water, are formed, which sorb suspended, finely dispersed and colloidal substances on the flocculent surface and, under favourable hydrodynamic conditions, settle to the bottom of the settling tank, forming sediment.

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When aluminium salts are used as coagulants, hydrolysis results in the formation of slightly water-soluble aluminium oxyhydrates, which sorb suspended, fine-dispersed and colloidal substances on the floccular surface and, under favourable hydrodynamic conditions, settle to the bottom of the sump, forming sediment.For the first time, the scientific and practical possibilities of the processes of using mixed ingredients consisting of Navbakhor bentonite, aluminium sulfate, sodium hydrosulfite and polyacrylamide (PAA) as adsorbents, coagulants and flocculants for wastewater treatment have been revealed [10-15].The method for purifying wastewater from organic dyes and other impurities is as follows: an adsorbent of a certain weighed amount is introduced into the measured volume of wastewater and mixed for 3-5 minutes, then the coagulants are mixed again for 10-15 minutes.The resulting suspension settles for 20-30 minutes.The degree of discolouration was determined using a photometric colourimeter (FEC)-LF-72M. For each water sample, the necessary light filter and cuvette with a thickness of 10 mm were selected. Distilled water was used as a comparative solution.The main process of coagulation treatment of industrial wastewater is hetero-coagulation – the interaction of colloidal and fine particles of wastewater with aggregates formed when coagulants are introduced into the wastewater [16-17].In the process of studying the efficiency of wastewater treatment of paint and finishing production, depending on the doses of mineral coagulants, it was determined that the optimal doses for aluminium sulfate are 0.75-1.0 g/l and for sodium bisulfite – 0.375-0.75 g/l (counting for the anhydrous salt product), while the cleaning efficiency in terms of COD reaches 38-65%, in terms of colour intensity – 82-95%. The regularities of the efficiency of wastewater treatment in paint-and-food production depending on the dose of PAA have been studied, its optimal doses have been determined, which amounted to 0.25-0.5 g/l, while the value of the COD in wastewater is reduced 43-51ae by 90-95%.Optimal doses of both PAA and 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 cleaning effect in terms of colour intensity and COD [7-26].

RESULTS AND DISCICCION

As a result of the study of the kinetics of removing contaminants from wastewater, it was established that when using chemical reagents in optimal ratios, the greatest degree of purification is achieved: in terms of the intensity of painting, 80-95e%, in terms of the intensity of the coating, 80-95e%, in terms of intensity, 80-95e.In the process of research, the effectiveness of wastewater treatment from the dose of added sorbent was studied.The quantitative measurement of the clarified water composition was carried out from samples after the secondary settling tank in terms of COD, BOD_5, the concentration of sulphates, chlorides and phosphates.Comparison of the results of sorption (1), sorption-coagulation (2) and sorption-coagulation-flocculation (3) purification are shown in Fig. 1 (a-c).

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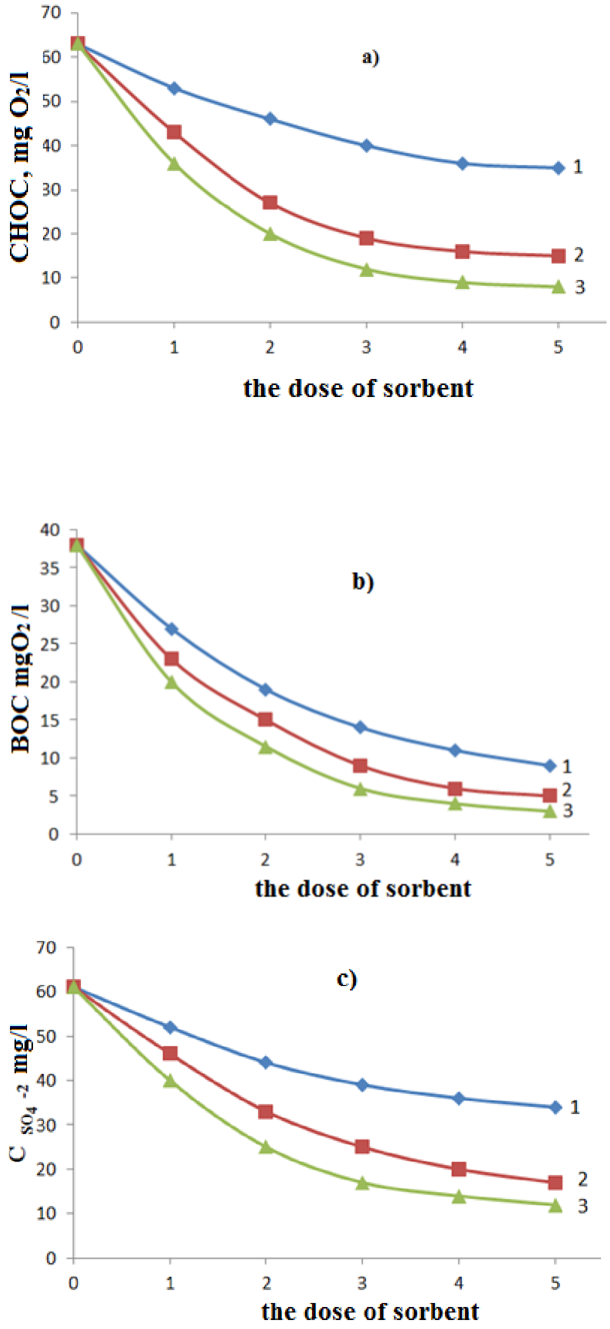

a) COD;
b) BOD;
c) $C_{SO4}2-$ 1-Sorption; 2-Sorption-coagulation; 3-Sorption-coagulation-flocculation cleaning.

Figure: 1. Changes in the quality indicators of treated water.

The parameter values were determined every hour during the first 2 hours and after 6 hours from the beginning of the experiment.The process of sorption-coagulation-flocculation (3) purification is realized in the first 2 hours of contact of sorption with wastewater, and then the values of the parameters change insignificantly [28].A sharp decrease in the concentration of

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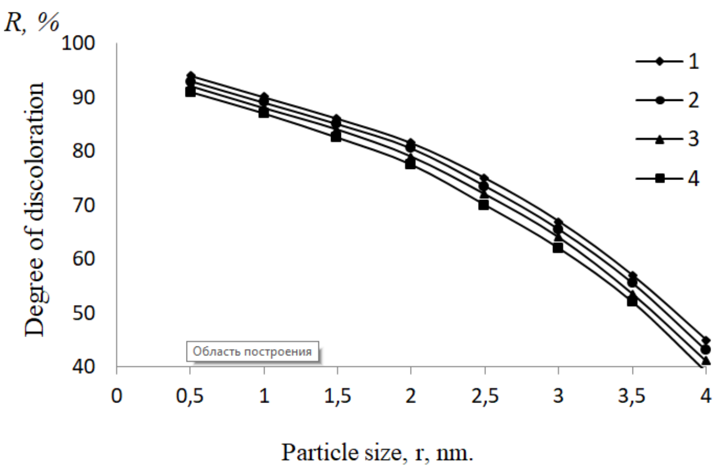
organic impurities in wastewater for the first time indicates the occurrence of physical sorption.The further gradual decline is due to biological oxidation. The kinetic curve of the change in the COD index shows that in the first 2 hours of contact with wastewater, the sorption-coagulation cleaning proceeds with maximum intensity, which is associated with the sorption of bio resistant components by the sorbent.Intensive cleaning in terms of BOD; during the first two hours, it is replaced by a smoother one, since a biofilm is formed during complex cleaning.Effective purification from sulphate ion occurs due to the more complete and rapid removal of organic impurities, the presence of solid porous mineral material and a change in the pH value towards a slightly alkaline medium, which affects intensive growth.It is known that an increase in the flow velocity of more than 2.0 m/s leads to a significant increase in the consumption of electricity with an inadequate increase in the permeability of the adsorbent [26].

Therefore, for the adsorbent of the BKA-500 type, studies were carried out to study the effect of the size of the adsorbent particles on the bleaching efficiency at a wastewater flow rate in the area from 0.5 to 2.0 m/s.Dependences of the degree of discolouration on the size of particles at a specific value of the flow rate of wastewater, according to the developed object-oriented programming environment DELPHI 5.0., Take the form [29].These dependencies with the approximation levels are clearly shown in Fig. 2.



1 -υ = 0,5 м/с, $y = -363{,}1x^2 + 123{,}6x + 84{,}8$;

2 -υ= 1,0 м/с, $y = -374{,}2x^2 + 115{,}9x + 85{,}6$;

3 -υ = 1,5 м/с, $y = -415{,}9x^2 + 131{,}4x + 83{,}1$;

4 - υ= 2,0 м/с, $y = -392{,}9x^2 + 116{,}7x + 83{,}01$.

Figure: 2. Influence of the size of particles on the degree of bleaching of wastewater at the following values of the flow rate over the adsorbent type BKA-500.

Since the velocity value in the range from 0.5 to 2.0 m/s has almost the same effect on the bleaching efficiency of the BKA-500 adsorbent (Fig. 2.), in further studies, the flow rate over the adsorbents was assumed to be 1.0 m/s.Studies of the selectivity of the adsorbent for discolouration and removal of surfactants from the particle size for textile factory wastewater with the maximum content of anionic and nonionic surfactants were carried out at the following constant values: pH = 7.3-7.5; T = 27-30°C and V= 1.0 m/s.

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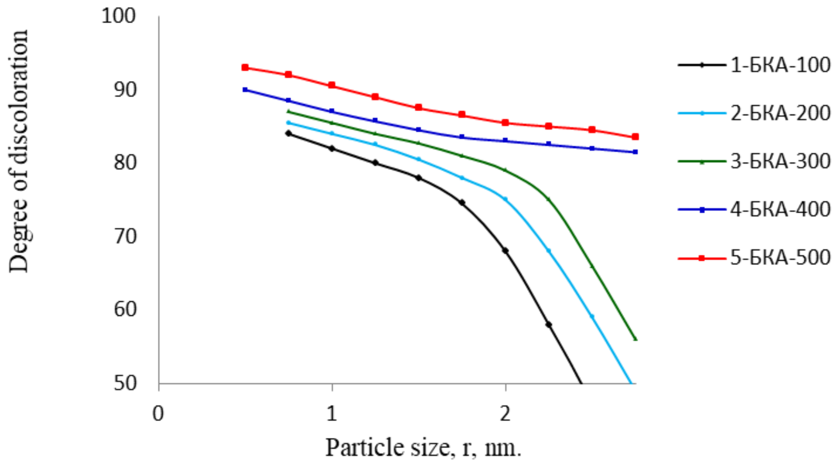

Fig. 3.Effect of particle size on the degree of wastewater discolouration for the 1st stream on adsorbents.

From Fig.3. It can be seen that 87% of discolouration is achieved when using the adsorbent BKA - 400, regardless of the particle size.

CONCLUSION

For fine-porous adsorbents (BKA-100 and BKA-200), the bleaching efficiency also practically does not depend on the particle size and fluctuates in the range from 93 to 97%.In this case, the maximum efficiency is provided with a particle size of 0.05 to 0.8 nm.For the adsorption of the BKA-300 and BKA-500 brands, the optimal particle size is limited to 0.3 nm, and for the adsorbent of the BKA-500 brand - to 0.7 nm.Analysing the current state of the methods of wastewater purification from the above-mentioned impurities, it is necessary to note their variability, while maintaining the urgency of optimizing the existing ones and searching for new economic methods of purifying and creating efficiencies.

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REFERENCES

1. MolokanovD.A. An integrated approach to wastewater treatment. Ecology of production. 2011 (5): 79-81.
2. Antsiferov A.V, Filenkov V.M. Improving the degree of wastewater treatment of industrial enterprises at biological treatment plants. *Bulletin of SGASU. Urban planning and architecture*. 2014 (2): 42-8.
3. Mamitova A.D, Atakhanova R.A. Wastewater treatment for dyeing and finishing plants. Water treatment. 2017 (12): 16-8.

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Received 15 December 2020; Accepted 05 January 2021.

4. Yakovlev S.V., Voronov Yu.V. Water disposal and wastewater treatment. Textbook for universities, Moscow. ASV, 2004: 704.
5. Turovsky IS. Sewage sludge treatment. Stroyizdat; 1988.
6. Henze M, Armoes P. La-Cour-Jansen J., Arvan E. Wastewater treatment. Tra. from English. Moscow. Mir, 2006: 480.
7. Getmantsev SV, Nechaev IA, Gandurina LV. Treatment of industrial wastewater with coagulants and flocculants. Moscow.2008: 272.
8. Alekseev E.V. Physical and chemical wastewater treatment. Tutorial. Moscow. Publishing House of the Association of Building Universities, 2007: 248.
9. Voronov YV, Yakovlev SV. Water disposal and wastewater treatment: textbook. for universities (direction "Construction"). 4th ed., Add. and revised Moscow.*ASV: Publishing house MGSU*. 2006.
10. Serpokrylov NS. Ecology of wastewater treatment by physical and chemical methods. Moscow. ASV, 2009: 262.
11. Lepesh GV, Gritsay EI, Khotulev VA. Study of the essence of the electrochemical process as a technological component of water purification. Technical and technological problems of the service. 2013 (2 (24)).
12. Sadova SF, Krivtsova GE, Konovalova MV. Environmental problems of finishing production. Textbook. for universities / Ed. SF Sadovaya. M .: RIO MGTU. 2002; 284: 2.
13. Mamontova A.A. Features of coagulation wastewater treatment of textile enterprises. *Chemistry and technology of water*. 1990.12 (8): 738-740.
14. Patent. 2029736 Russia. Method of wastewater purification from dyes and surfactants. Alekseev E.V., LaskovYu.M. IISS. No. 5048012/26, Appl. 04/27/92., Publ. 02/27/95.
15. Kiselev AM. Environmental aspects of textile finishing processes. Russian chemical journal. 2002; 46 (1): 20.
16. Ilyin VI. An effective method for wastewater treatment in textile enterprises. Textile industry. 2004 (5): 50-1.
17. Kvachenkova E.V, Simionkova E.Y. Application of polyacrylamide flocculants for purification of wastewater of petrochemical enterprises. In.Innovations and perspectives of modern science. Natural Sciences 2018 (pp. 136-138).
18. Sosnina N.A., Terekhova E.L. Application of polyelectrolyte flocculants for fast treatment of multicomponent wastewater. *Chemical Technology*. Moscow, 2003. (11): 43-47.
19. Aimurzaeva L.G., Safaev M.A., Mirzarakhimov M.S. Investigation of a method for cleaning wastewater from textile industries from dyes. *Uzbek. chem. journ.*, Tashkent. 2006. (3): 12-15.
20. Aimurzaeva L.G., Agzamkhodzhaev A.A., Safaev M.M., Mirzarakhimov M.S. Reagent method for cleaning dyed textile waste. Composite materials. Tashkent. 2008. (2): 38-42.
21. Kalitsun V.N. LaskovYu.M. VornovYu.V. Alekseev E.V. Laboratory workshop on sewerage and wastewater treatment. Tutorial. 3rd ed., Moscow. Stroyizdat, 2000: 272.
22. Gudkov A.G. Mechanical wastewater treatment: textbook. allowance. Vologda: VoGTU, 2003: 152.
23. Ryabchikov, B.E. (2004). Modern methods of water preparation for industrial and domestic use. Moscow. *DeLiprint*, 2004: 328.
24. Fayzullaev, N. I., &Bobomurodova, S. Y. (2020). Laws of Catalytic Aromatization Reaction of C1-C4-Carbohydrates and Texture Characteristics of Catalysts. *International Journal of Psychosocial Rehabilitation*, *24*(04), 1475.
25. АмоноваM.M. Effective wastewater treatment methods. Proceedings. Book #1. Dedicated to the 96th Anniversary of the National leader of Azerbaijan, Heydar Aliyev. III international scientific conference of young researchers. Baku Engineering University. 2019: 536-538.

26. Amonova M.M., Ravshanov K.A., Karshieva D.R. Testing of Navbahor bentonite as an adsorbent for wastewater treatment. International scientific and practical conference "Innovative solutions to engineering and technological problems of modern production." BukharaEngineering - TechnologicalInstitute. 2019: 59-61.
27. Amonova, M. M., Sultanova, D. B., Umurov, F. F., &HayrullayevCh, K. (2020). Improvementofwastewater treatment sorption-coagulation-flocculation method. *European Journal of Molecular & Clinical Medicine*, *7*(8), 1599-1604.
28. Amonova M.M, Ravshanov K.A.Polymeric composition for purification of wastewater from various impurities in the textile industry. Journal of chemistry and chemical technology. Moscow. 2019. 62(10): 147-153.
29. Amonova M.M., Ravshanov K.A., Amonov M.R. Izuchenie doz koaguljantov pri ochistki stochnyh vod tekstil'nogo proizvodstva. [Study of the doses of coagulants in the treatment of waste water from textile production] Universum: himija i biologija. 2019. 6(60): 47-49. [In Russian]