THE USE OF SORBENTS BASED ON LOCAL RAW MATERIALS IN THE WATER TREATMENT OF INDUSTRIAL ENTERPRISES

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Abstract. *Problems with water resources began to emerge at the end of the last century, and by today they have reached the level of a global problem. The growth of these problems is caused, on the one hand, by increasing demographic indicators, and on the other hand, by the increasing number of industrial enterprises.*

Keywords: *industrial enterprise, process water, industrial wastewater, mine water, bentonite, coal, sorbent, cation, anion, degree of turbidity.*

Introduction

The role of giant industries in the rapid development of the economy is incomparable. The Republic of Uzbekistan has a strong place among countries with a highly developed mining industry in the world. Each industrial sector consumes several times more water than the population.

Water plays an important role in the performance of a number of tasks for industrial enterprises, it acts as a coolant for certain processes, as a heater and solvent in other processes, as well as for the transportation of substances and materials.

Main part

The total volume of natural water on our planet is 1386 mln. is km^3. More than 97.5% of it is ocean, sea and lake waters. The need for fresh water in the world is 3900 billion per year. is m^3. About half of this figure is not used and returned, and the remaining half becomes wastewater. One of the solutions to this problem is the proper use of wastewater treatment facilities when processing wastewater or dumping it into water bodies.

Due to the development of industry, the types and amount of waste water are increasing rapidly, the pollution of water bodies is becoming more and more widespread and serious, threatening human health and safety. Environmental experts believe that industrial wastewater treatment is more important than municipal wastewater treatment to protect the environment.

Although industrial wastewater treatment began at the end of the 19th century, many experimental studies and production practices have been carried out in the next half century due to the complex composition and variability of industrial wastewater, and there are still some technical problems that have not been fully resolved.

The excess of cations and anions in the technological water produced in factories causes not only the quality of the produced products, but also the unusability of the equipment and devices

in the technology, because the high hardness of the technological water leads to the formation of soot in the technological equipment.

To date, more than 2.8 thousand promising mineral deposits have been identified in Uzbekistan. Year after year, new mines are opened and developed. Due to the opening of new mines, their demand for water consumption is also increasing.

Mines, which are mining enterprises that produce minerals underground, consume 40-100 m^3 of water per day, depending on the area. Due to the high level of turbidity of the process water coming out of the mines, it cannot be used for further processing. Mechanical and sorption treatment of mine waters can reduce water turbidity.

Also, in order to reduce the hardness of technological waters in factories, the amount of toxic substances in them, technological waters should undergo a series of cleaning processes.

Analysis of the obtained results

Large-scale research is being conducted not only in our country, but also on a global scale, to clean technological and waste water of industrial enterprises. In addition to traditional cleaning methods, non-traditional cleaning methods are also being used.

As a result of the conducted research, samples of bentonite and charcoal sorbent in the form of granules were taken and their sorption capacity, strength level, bulk density and other properties were analyzed. In order to increase the porosity of sorbents, several modifying agents were added, and it was found that the sorption capacity of sorbents modified with sodium salts increased.

Based on the derivatographic and infrared spectroscopic analyzes of the obtained raw materials, bentonite and coal, the porosity of the prepared sorbents gave good results. The addition of modifying reagents to the sorbent mass, which burn out during the activation process and cause the formation of additional pores in the sorbent due to their burned-out areas, significantly helped to increase the sorbent's sorption properties.

Below are images of the sorbent sample taken:

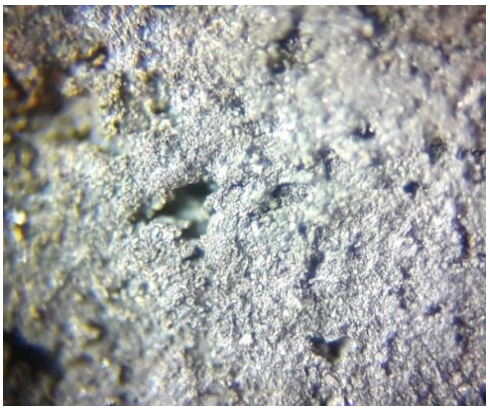
a)  b) 

Figure 1. Bentonite-coal sorbents a) simple; b) Microscope image

sorbent samples taken on the basis of enriched coal in the laboratory of solving water supply problems within the central scientific and research laboratory of Navoi Mining and Metallurgical Combine JSC for GMZ-4 mine water No. 1 and GMZ-3 mine waste water and process water S-100 several experiments were conducted.

The experiment was carried out to check the results of analysis of bentonite-based sorbents with enriched coal powders for the treatment of mine and factory technological waste water.

First, the sorbent samples taken for the experiment were washed and the sorbent mass was measured in three funnels (m1=60 g), mine water was transferred from the sorbent placed in the first funnel, and factory waste water was transferred from the second and third funnels.

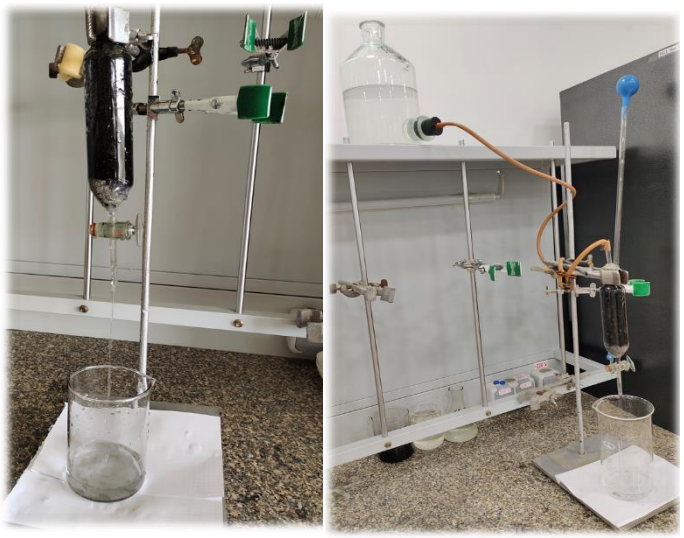


Figure 2. The process of washing bentonite-coal sorbents and industrial waste water treatment with them

In the experiments conducted on GMZ-3 mine industrial wastewater and S-100 process water, water was passed through the sorbent in funnels at a rate of 100 ml/h. The water passed through the sorbent was analyzed in the laboratory.

Analysis results of GMZ-3 mine waste water treated with sorbent

Table 1

№	Ca^{2+} (mg/l)	Mg^{2+} (mg/l)	CN^{-} (mg/l)	Dry residue (mg/l)	Turbidity level	pH
GMZ-3 waste water	350,7	188,48	2,417	7156,4	88,7	7,43
Clear water	260,5	158,08	2,011	7023,6	1,72	8,06

Analysis results of GMZ-3 mine waste water treated with sorbent

Table 2

№	Ca^{2+} (mg/l)	Mg^{2+} (mg/l)	Total hardness (mg eq/l)	Fe (mg/l)	cl^{-} (mg/l)	Alkali (mg/L)	Dry residue (mg/l)
C-100 water	621,2	615,3	81,6	2,06	297,7	5,2	6648
Clear water	268,5	267,5	35,4	1,31	224,6	2,8	3310

The level of turbidity of mine water 1 of the GMZ-4 mine was checked on the HACH 2100 mutnomer apparatus. Due to the high turbidity level of the water, the device showed the symbol "++++", which means that it could not detect the turbidity level because it was higher than the specified standard. The mine water was then passed through filter paper and tested to show a

turbidity of 39.0. It has been found that water flowed at minimum speed can purify water up to 150 ml/hour.

The water passed through the filter paper was passed through a bentonite-charcoal sorbent (150 ml/h) in order to reduce the level of turbidity. The purified water showed a turbidity level of 12.0 when tested in a mutnomer apparatus. At the end of the experiment, the mass of the sorbent was measured again (m_2=74 gr).

The difference between the initially measured mass and the mass measured at the end of the experiment also means that the cleaning process has a good result, that is, the mass has increased due to the fact that the pores in the sorbent are filled with retained substances due to the progress of physical sorption.

According to the obtained results, the degree of turbidity decreased from 39.0 to 12.0, i.e. 3.25 times. Also, calcium (Ca^{2+}) cations, which give the level of hardness in water, also decreased (from 35.07 mg/l to 30.06 mg/l, i.e. 5.1 mg/l).

Summary

Based on the experiments, the presented sorbent samples reduced the turbidity level of mine water up to 3.25 times, as well as the number of water-hardening cations and toxic anions in factory waste and process waters.

After conducting additional studies to clean the water of industrial enterprises from metal ions and other pollutants, it was found that there are prospects for using bentonite-coal sorbents with a porous structure in the form of granules.

REFERENCES

1. D.T.Qodirova, A.O.Abdullayev, M.A.Mirzabuvayev. Ishlab chiqarish korxonalarida hosil bo‘ladigan chiqindi suvlarni tozalash va qayta ishlash usullarini o‘rganish. Science and innovation. №4, 2022. 240-247 b.
2. И.А.Тагаев, М.Ю.Бойхонова. Бентонит-кўмирли сорбент намуналарини маҳаллий хомашёлар асосида олишни ўрганиш. XXI аср-интеллектуал ёшлар асри Республика илмий ва илмий-назарий анжуман. Т.: 24 апрель, 2020 й. 132-133 б.
3. И.А.Тагаев, Л.С.Андрийко, Н.Б.Хужакулов, Б.Р.Вохидов, М.Ю.Бойхонова. Подбор исходного местного сырья и изучение дериватографических показателей для получения сорбентов. Универсум: технические науки. М.:9 (78), 2020. 63-69 с.
4. Tagayev I.A., Andriyko L.S., Muratova M.N., Boyxonova M.Y. Characteristics of new promising bentonite coal sorbents modified by different compounds. Science and Innovation//*ISSN 2409-9066. Sci. innov.* 2021. 17 (3). 87-95 p.
5. А.А.Дидковский. Методы регенерации сорбентов//Современные наукоемкие технологии. М.: 2014. № 5-2. 101-102 с.
6. Смирнов А.Д. Сорбционная очистка воды. М.: «Химия», 1982. 112-125 с.
7. Хужакулов Н.Б., Бойхонова М.Ю. Ангрен қўнғир кўмирининг термик ишлов бериш натижасидаги асосий хусусиятларининг ўзгариши. Кончилик хабарномаси. 3(86). 2021. 68-73 б.
8. Mukhin, V. M. Activated carbons as an important factor in the development of the economy and solving environmental problems. *Chemistry in the interests of sustainable development,* 24(3), 2016. 309-316 in Russian. DOI:10.15372/KhUR20160305.

9. Domracheva V.A., Vescheva E.N. Modification of carbon orbents to improve the efficiency of heavy metals extraction from sewage and technogeneous entities. *Bulletin of Irkutsk State Technical University*, 4, 2010. 134-138.
10. Singh, N. B., Nagpal, G., Agrawal, S. Water purification by using adsorbents. A Review. *Environ. Technol. Innov*., 11, 2018. 187-240. https://doi.org/10.1016/j.eti.2018.05.006.