MODIFIED MINERAL SORBENTS FOR WASTE WATER TREATMENT

[1] J. K. Zokirbekov
[1] B. A. Aliev
[1] E. A. Egamberdiev
[1] Tashkent State Technical University named after Islam Karimov

ABSTRACT

The information presented in this work is of great practical importance. With its help, the production process of sorbents for wastewater treatment becomes easier and does not require a lot of time, thereby helping the ecological development of the Republic of Uzbekistan. The experiments carried out during this work allow us to open the prospects of using natural clay materials, thiourea and polyethylenimine for efficient and convenient treatment of waste water of industrial enterprises.

Keywords: *metallurgy, mechanical engineering, metal, waste water, copper, cadmium, lead, mercury, zinc, ion.*

Introduction. From the literature, we found that bentonite clays are promising sorbents for heavy metal ions. The study of physicochemical and textural properties of sorbents is relevant, as it allows to obtain detailed information about the effect of the modifier on the sorption activity of bentonite clay.

Local bentonite clay (Uzbekistan, Navoi region) was studied in the work. The choice of the studied material deposit is due to the fact that the quarries have already been built, and there is a road nearby that allows the extraction of clay raw materials without preliminary preparatory work and economic costs. As modifiers: polymer-polyethyleneimine (PEI) and thiourea (T) were used because they form stable chelate complexes with a number of metals and are non-toxic.

In this study, E-clay bentonite was used for research, its properties are detailed in Table 1. Based on the data in Table 1, we can conclude that bentonite is practically a monomineral raw material, and it contains about 90-95% montmorillonite.

Table –1

Properties of "Navoi" bentonite

№	Characteristics	Indicators
1	Fraction (mm)	0,08
2	Montmorillonite (%)	91-97
3	Moisture Content (%)	13
4	Sand (%)	1-3
5	Swelling index (at 2g)	25

Physico-chemical and textural characteristics of modified sorbents and original bentonite clay are presented in Table 2.

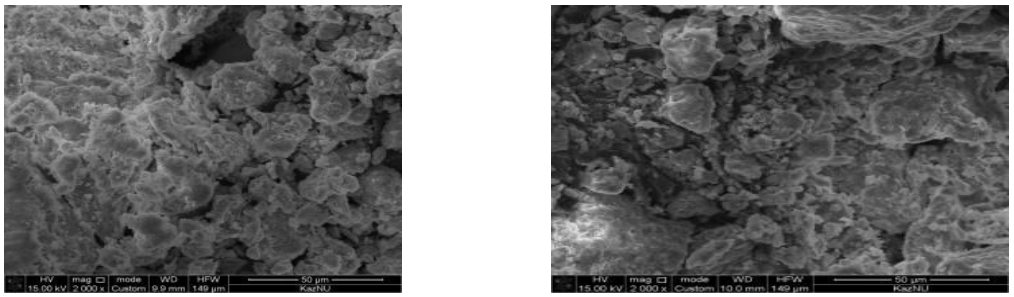
Table –2

Physico-chemical properties of bentonite clay and modified sorbents: (BG+PEI), (BG+T)

Characteristics	БГ	БГ+ПЭИ	БГ+Т
Humidity, %	8,645	4,705	4,525
Ash content, %	6,465	25,325	19,536
Surface area, m^2/g	2,892	26,598	14,235
Total pore volume of acetone, cm^3/g	29,055	18,355	12,855
Adsorption activity with iodine, %	30,675	36,78	20,32
Total volume of pores in water, cm^3/g	3,295	1,125	3,102
Specific volume of pores, cm^3/g	0,001	0,014	0,005

Based on the data presented in Table 2, modification of original bentonite clay significantly increases properties such as ash content, specific surface area, iodine adsorption activity, and specific pore size. Therefore, it can be concluded that the modification of bentonite with polyethenimine and thiourea leads to the predominance of meso- and micropores in the structure of the sorbent, thereby increasing the adsorption activity for heavy metal ions.

The morphology and composition of the surface of the sorbents are shown in the SEM data presented in Figures 1a and 1b.



a) b)

Figure-1. Initial photomicrograph of bentonite clay (a) and modified polyethyleneimine

As can be seen from the images, the original bentonite clay has a denser structure than the bentonite clay modified with polyethyleneimine. It is assumed that the polymer particles are introduced into the interlayer voids of the bentonite, which increases the pore size and creates a head to fill them with TM ions.

References

1. E.Egamberdiev, S. Turabdjanov, D. Mirzaeva, Kh. Khaydullaev, U. Sharipova, A. Shokhakimova, and O. Bakhtiyorov.: Effect of chitosan substance on the mechanical properties of paper obtained on the basis of flax cellulose. E3S Web of Conferences 371, 01045 (2023) https://doi.org/10.1051/e3sconf/202337101045
2. Egamberdiev E.; Ergashev Y.; Turabdjanov S.; Abdumavlyanova M.; Makhkamov A.; Rashidov, Sh.; Karimov, Sh.: Effect of chitosan on the surface properties of cellulose-based paper obtained from the flax plant. E3S Web of Conferences 371, 01010 (2023) https://doi.org/10.1051/e3sconf/202337101010
3. Ergashev Y.; Egamberdiev E.; Mirkhodjaeva D.; Akmalova G.; Umarova M.; Kholdarov R.: Obtaining a filter material used in gas and air purification. E3S Web of Conferences 371, 01012 (2023) https://doi.org/10.1051/e3sconf/202337101012
4. Igamqulova N.; Mengliev, Sh.; Egamberdiev E.: Reduction of waste disposed to the environment through recycling of unused methyldiethanolamine. E3S Web of Conferences 371, 01049 (2023) https://doi.org/10.1051/e3sconf/202337101049
5. Arslanov, Sh.; Turabdjanov S.; Azimova, Sh.; Azimov D.; Sultankhojaeva N.; Egamberdiev E.: Physico-chemical properties and research of acids contained in oils of Uzbekistan. E3S Web E3S Web of Conferences, 2023, 371, 01021, DOI 10.1051/e3sconf/202337101021
6. Egamberdiev E.; Turabdjanov S.; Akmalova G.; Mukhtarova N.; Ayubova I.; Mirzakhmedova M.; Rakhmonberdiev G.: Obtaining paper from composition of different fibers and its analysis. E3S Web of Conferences, 2023, 371, 01004, DOI 10.1051/e3sconf/202337101004
7. Ergashev Y.; Egamberdiev E.; Turabdzhanov S.; Akmalova G.; Isanova R.; Rashidov R.; Sobitov O.: Obtaining filter material from natural fiber composition and areas of its use. E3S Web of Conferences, 2023, 371, 01047, DOI 10.1051/e3sconf/202337101047
8. Egamberdiev E.; Makhkamov A.; Rakhimjonov B.; Khusanov D.; Akmalova G.; Mirzakhmedova M.; Rahmonberdiev G. Effectiveness of cleaning of sunflower oil with filter material made from composition of organic and inorganic fibers. 3rd International Conference on Energetics, Civil and Agricultural Engineering, ICECAE 2022Virtual, Online13 October 2022до 16 October 2022Код 187394, DOI 10.1088/1755-1315/1142/1/012050
9. Egamberdiev E.; Akmalova G.; Rahmonberdiev G. Obtaining paper products from cellulose-containing plants and researching its field of application. 3rd International Conference on Energetics, Civil and Agricultural Engineering, ICECAE 2022Virtual, Online13 October 2022до 16 October 2022Код 187394, DOI 10.1088/1755-1315/1142/1/012054