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Texture and Sorption Characteristics of Modified Bentonite Made by Ash-Gel and Together Equipment

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ANNOTATION
The paper presents the results of the study of the texture and sorption characteristics of the sorbent based on the Bentonite clay of the Navbachorsky field, modified by aluminum and iron. It is shown that almost all textural and adsorption characteristics of BG as a result of modification improved markedly. The specific surface area of the original BG obtained by the BET method (Brunauer, Emmeta, Teller. It is established that the sorption process of bichromate ions is described by the monomolecular theory of lungmuir, which is characterized by the presence of active centers on the sorbent surface.

The relevance of the development is determined by the increasing interest in creating new environmentally friendly sorbents of natural aluminosilicates. However, a deterrent to the wide use of bentonites for gas purification is the lack of effective granulation technologies, since clay minerals are subject to gas and aqueous media dispersion effect. Methods and materials: To substantiate the possibility of using the developed technology of the granule-laying of bentonite, as well as the obtained sample samples in the water treatment process, the granules have studied the mineralogical composition by the method of x-ray phase analysis, analyzed the specific surface, porosity (pore volume, pore distribution by radius) by the method Sorption and capillary condensation of gases, their chemical and mechanical resistance are determined. After the study of physical properties, the sorption capacity of the samples against non-ferrous and muddy solutions was evaluated.

Results: Detailed analysis of the physical and chemical properties of the developed sorbents showed that the developed sorbents comply with the requirements of GOST and are effective for use, both as an independent filtering material and component in water purification systems.
Keywords: sorbents, bentonite granules, sorption tank, gas cleaning

Introduction

The study of zeolites is devoted to many works. Zeolites are microporous substances with a regular crystalline structure and a controlled pore size, not exceeding 2 nm [1-4]. Zeolithic frames are grilles consisting of tetrahedral T-atoms (T=Si, Al etc.) connected by oxygen atoms.Ordinary "building blocks" of zeolite frameworks from 3-, 4-, 5-6 membrane rings (n-domestic). Each N-membrane ring consists of NT-atoms concluded in the ring from oxygen atoms, and, therefore, actually has 2natoms; Thus, the 6-membered ring has a total of 12 atoms. The structures are ordered so that they form large rings, which represent molecular pores - in 8-, 10-12-membered, although structures with 9-, 14-, 18-membered rings are also known. Zeolites containing 8-, 10-12-membered rings are better known as microporous, medium-affinity and coarse. On microporous zeolites, n-paraffins are sorbed, analarge branching-and-steaphins. On

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medium-road zeolites, sorption of some not strongly branched paraffins is possible [5]. In the way, zeolites are part of a large class of materials called "molecular sieves" and used for the separation of mixtures of various molecular structures. More than 200 species of synthetic zeolites of different structural types are known. [6-7]. However, the industry produces no more than 10% of all known structures [8], and only 5 structural types are actually used as catalysts.

It is known [9-12] that some clay materials are quite active in a natural state, but most of them are advisable to activate the chemical or thermal method to increase and regulate their porous structure, changes in the chemical nature of the surface. Various methods for modifying natural materials lead to the preparation of sorbents with specific sorption properties to a wide range of inorganic and organic substances [13-17]. The modification of various materials of heat treatment is the most simple and effective way that does not require additional reagents and complex hardware. The materials obtained are characterized by elevated sorption properties in relation to corrosion inorganic and organic substances. Among natural minerals, special attention is paid to zeolite, which is associated with its widespread and economic feasibility of technological use [18-21]. The heating of natural zeolites up to 700^0 C increases the specific surface area and improve the sorption properties [22].

The features of the conditions for the formation of natural aluminosilicates determine their polyfunctionality and the absence of a narrow selective sorption capacity [23], which provides them with one of the first places to use in various industries, including construction [24-26]. Thus, the use of dry building mixtures in the construction industry is an effective way to improve the quality of construction work and leads to a significant decrease in labor costs. Currently, due to the high profitability of the use of dry construction mixtures, much attention is paid to the development of new effective compositions of dry building mixtures with advanced functional capabilities in order to increase the performance characteristics and expanding the field of their use. In aluminosilicates, due to the characteristics of the structure, chemical and mineralogical compositions, they occupy a special place Calcium and sodium bentonites. Minerals of the smektites group have a layered structure: structure type (2: 1). Two layers are represented by tetrahedry-calcium-acidic nets, one layer - octahedral grid, in the center there may be aluminum atoms, jelly or magnesium, which causes the special properties of bentonite clay sorption, binders, colloid-chemical [27-28]. The annual global production volume of bentonite clay is about 10 million tons, from which up to 80% is involved in the construction industry [29].

PRACTICAL PART

The following sectors were used from Navbahorbentonite[30-35] as modified samples:

- modified by the "Zol-gel" method with polyadisiocytes in aluminum and iron (III);

- modified aluminum, iron (III) and zirconia (IV) polytococcolism through the "sinking" method;

- ground dough (mixture) is obtained through the method of extrusion and incineration at a temperature of 550^0 C, granulated sorbents of natural bentonite;

- obtained by means of a solid packaging method and are burned at a temperature of 550^0 C, sorbine granulation based on natural bentonite.

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The acquisition of modified sorbents by means of the "Drilling together" method. The bentonite modification was also carried out zirconi (IV) a mixture of individual polytoxica (III) or aluminum cations) and this polyaroscience. The ratio of aqueous suspension of bentonite (solid and liquid phases 1:10, aqueous extract 1:10.) added to them:

- amount of iron (III) or aluminum cation 1; 2; 3; four; five; 10 mmol [ME^{3+}] / G organized bentonite;

- the amount of zirconia (IV) 1; 2; 3; four; five; 10 mmol [ME^{3+}] / G organized bentonite;

- The amount of iron (III) or the amount of aluminum cation is 2.5 or 5 mmol [ME^{3+}] cations, while the zirconi (IV) cation is 2.5 or 5 mmol [ME^{3+}] / g of bentonite, respectively.

Then for 3 minutes ultrasound with frequency. After adding 0.5 M solution of sodium hydroxide, kzipenses was added ([OH^-]/[M^{n+}] = 2.23) and the room temperature was deteriorated at room temperature. The resulting midionith was devoted to the liquid phase in the form of a vacuum pump, chloride - and (or (or) sulfate - and (or (or) sulfate-ion, washed with decent water until a negative reaction was observed and not dried at temperatures at temperatures at 80^0 C. Then some samples were granulated through the mud "mixture" of extrusion, or dubious legal proceedings, and 550^0 C gave 550^0 C.

Consent to samples of a granulated sorbent. Glacier "The mixture" of the formation of the granule was introduced through the dirt. To implement this method, a press and molds with a matrix and Punz were made. The size of the matrix consists of a power of 100 ml (1 mm), 100 ml of hollow cylinders. Puanson squeezes another "UGRA" diameter through the tool (hole), when the sorts are formed with a similar cylinder similar to the minimal vessels. Extralded and borrowed above were the furnace at a temperature of 550^0 C. Then "Ugra" was crushed on the mill and sleeves in the seat. The target fraction is a paragraph of 1-2 mm.

Sieior Quivative analysis of the content of the element is carried out in the spectrometer through the method of fundamental parameters of EDX-720 (Shimadzu, Japan).The spectrometer is based on measuring the intensity of fluorentgenic radiation into detected atoms under the influence of X-ray influence. In the field spectrometer, the semiconductor detector torn by liquid nitrogen is used to record the emission quad bike.

X-ray analysis of the cobalt anode receiver (Co-K_α) using DRONE-4 X-ray diffractometry. 1999 International Data Operation Center for Diffractogram Analysis The PDF-2 database was used.

Nit-Tempered AD nitrogen parameters identified in qantachrome Nova (USA), porous nitrogen structure.

Each sample was degassed under vacuum at 250 ° C for 20 minutes before each measurement. The Brunauer-Emmett-Tyler (BET) method was used to determine the specific surface area of solid samples. This method uses the BET equation:

$$\frac{1}{W \cdot (\frac{P_0}{P} - 1)} = \frac{1}{W_m \cdot C} + \frac{C - 1}{W_m \cdot C} \cdot \frac{P}{P_0}$$

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Where W is the mass of gas adsorbed $\frac{P}{P_o}$ at relative pressure;

W_m- the mass of the adsorbed substance forming a monolayer covering the entire surface;

C - is the BET constant corresponding to the adsorption energy on the first adsorbed layer, and its value is an indicator of the magnitude of the adsorbent / adsorbate interaction.

The Barrett-Pushner-Halena (BJH) method was used to determine the pore volume and pore sizes. The initial data for calculations was used 0.967-0.4 R0 pressure from 0.967-0.4 R_0 pressure.

Determination of the granulometric composition of samples

The particle size distribution was determined by the laser disk method in the particle particle diaposer particles of SALD-2220 particles. Adsorbing experimental methods

Quantitative analysis of the crew element was carried out on the spectrometer through the EDX-720 method (Shidadzu, Japan).

According to the average values of equilibrium concentrations (at least five parallel measurements), the size of the adsursion is calculated in accordance with the following formula:

$G=(C_{begin.}–C_{balance})\cdot V/m$

G - sorbent adsorbant, mg / g;

C_{begin}- Deltal ion concentration, mg / l;

$C_{balance}$- is the concentration of ions, mg / l;

V - research size, ml;

M - is a sorbent mass obtained for analysis,g.

The entire currency is part of Isotherm in Langmur (L type). The processes between solid gas and solid body are described through the theory of adsorbing Lengmur. An isothermia element of insorbury theory based on adoling perception is the following version of the following (2.3) when using solutions:

$$G= G_{\infty} \cdot \frac{K \cdot C}{(1+ K \cdot C)}$$

Where K is an adbnium balance, air-conditioning adsorbing energy;

C-balance constant, mg / l;

G_{∞}- protection of unlimited adsorbion sizes (monocata capacity), mg /g.

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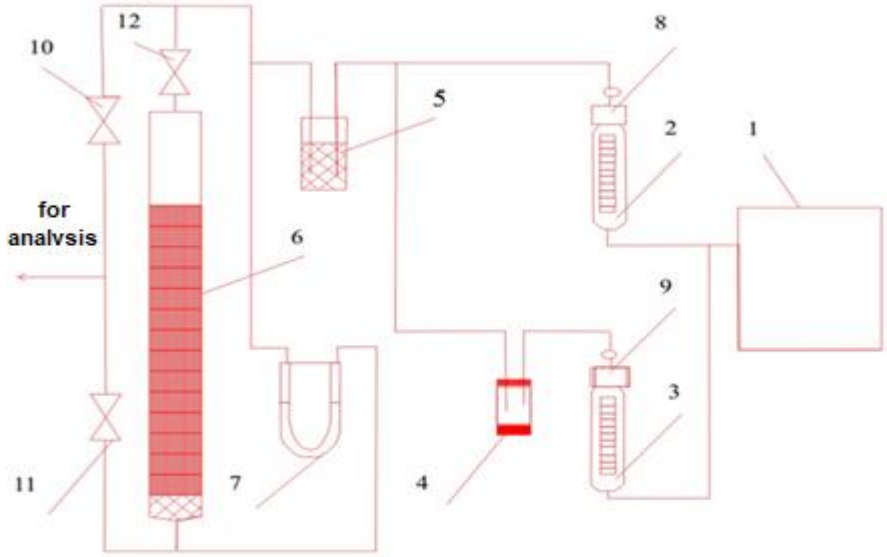

Fig.1. Installation for studying dynamic adsorption processes: 1 -port; 2, 3-rotameter; 4-saturator; 5-tank with a nozzle for mixing gas streams; 6-Pharmaceutical with the absorber; 7-difmaneometer; 8, 9-evenil; 10,11,12 –kran.

Experimental results and discussion

The results of thermogravimetry (Fig. 2) confirmed that the main minerals belonging to the clay under study are: Ca-montmorillonite, calcite and quartz.

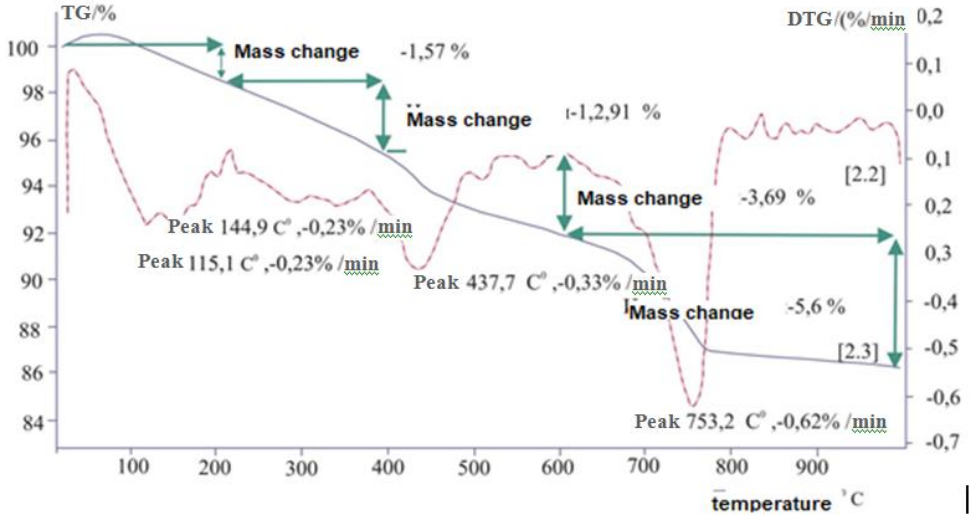

Figure 2. Mailramogram from a sample of dense bentonite

Bentonites are not considered real materials, as well as the main phase monmorillonite, mixed with different minerals, depending on production mining. Analysis of the X-ray phase took place for bentonites to determine mineralogical content. Figure 3 depicts x-ray different in an inert argon atmosphere at 550.

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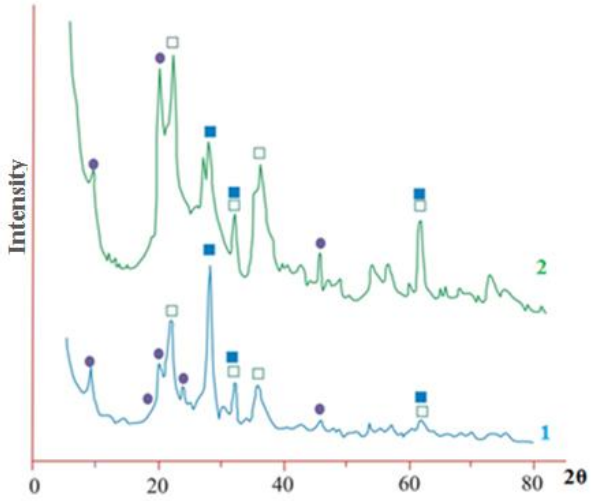

Figure 3 Rairegic bentonite diffraction (2) burned in the atmosphere of the inert argon of natural bentonite (1), as well as 550^0 C 550^0 C X-ray analysis of natural objects confirms the availability of monmuntylloillonite, a-crybalititis and plagioclase.

Most porers for both baductors are observed in the 2 nmsfield or more, indicating that these materials are considered to be mediogenous materials. However, the 2nd sample stores a large number of pores with a large number of 1.5-8.0 nmsand the size of 8.0 nm than 8.0 nm. This explains the upper 2 surface surfaces of the 2nd sample surface.

The sorbents of the IQ spectral analysis are investigated. IQ spectrons are expressed in Figure 4 ..

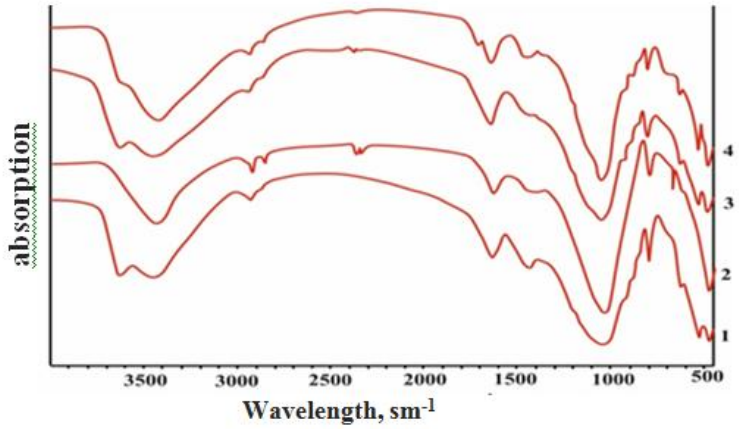

Figure 4 IQ spectrum for natural bentonite and its samples based on the FE- and AL-modifier .

As can be seen from Figure 4, it is typical for a state and minor change in the relative intensity of peaks for all samples. There is a whole set of characteristic lines for the montiorillonite structure in the IQ speakers of bentonite in bentonite and modified bentonite, and the two main areas are separated. The first field is associated with 2000-3000 cm cations - 1 cations, as well as in groups of valence vibrations are lines through hydrogen gardens. The second area of 1400-400 cm - 1 is in lines specific to the silicate structure.

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Bechkomat-ion was used as a tested anion to explore the capabilities of the adsorbnt modified sorbent. The first bentonite data on the biomate and adsorbing kinetaions are shown in Figure 5.

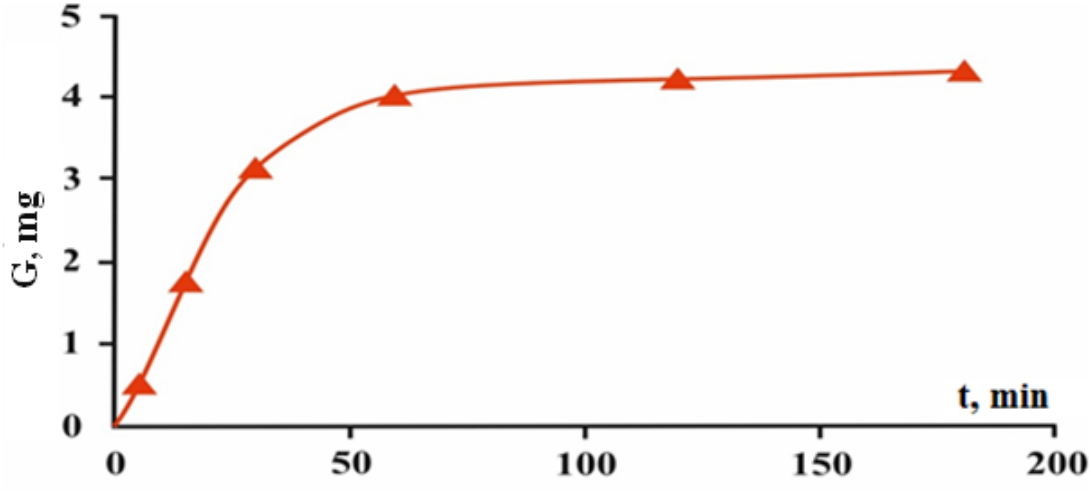

Figure 5 In the neutral environment kinetic kitty biromat-ions bihromat-ions adstbusion.

As we can see from the picture, the first saturation of bentonite begins once a hour about fertilizer, but an experiment for a sustainable balance in the sorbent system is charming at least two hours. Consequently, the installation of adbnation balance was 2 hours, describing the adsorption isotin.

Figures 6-8 in the references that are studied in a neutral environment, bihromat ions are listed by adsorbing isotheras.

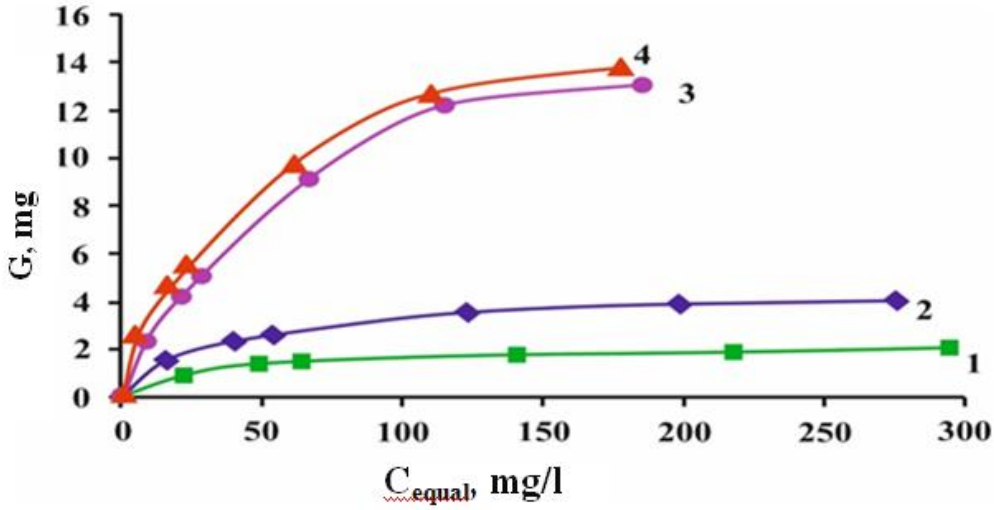

Figure 6 adsorbing isoffin neutral engineer: Modified bentonite with aluminum and iron (III) polyadications through the sample and the "Hell-gel" method; 2nd sample - "bonding" Method modified with aluminum and iron (III) politidine; 3-shaped qualifying "dough" (mixed) through the method of extrusion and combustion at a temperature of 550, granulated sorbents based on natural bentonite; The 4th sample was obtained through the witsarm wrap method and burn at a temperature of 550, granulation sorbents of natural bentonite

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Figure 7 adsorbing isoff in neutral engineer: Modified bentonite with polyadiscations of aluminum and iron (III) through the sample and the "Zolo-gel" method; 2nd sample - "bonding" Method modified with aluminum and iron (III) politidine; 3 Sample "Dough" was obtained through the extrusion method and burnt at a temperature of 550, granulation of natural bentonite based sorbents based on natural bentonite

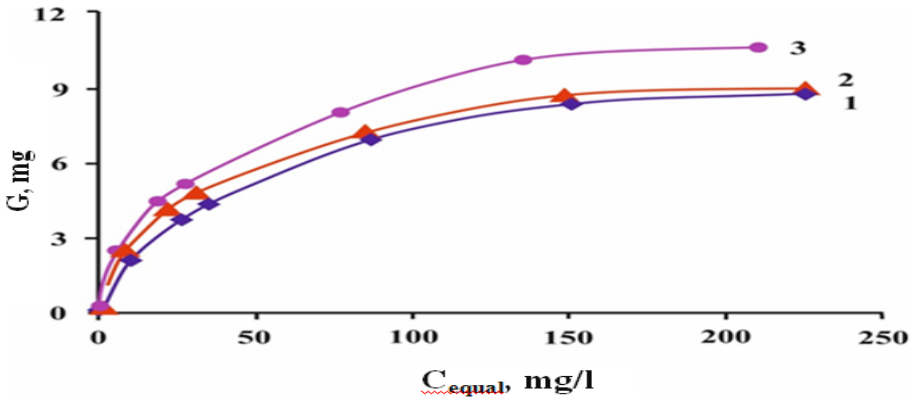

Figure 8 adsorbing isoff in neutral engineer: Modified bentonite with aluminum and iron (III) polyadications through the sample and the "Zolo-gel" method; 2nd sample - "bonding" Method modified with aluminum and iron (III) politidine; 3 Sample "Dough" was obtained through the extrusion method and burnt at a temperature of 550, granulation of natural bentonite based sorbents based on natural bentonite

In accordance with the equation of the lengmuur equation, the coordinates obtained allow processing materials on reverse coordinates, allow you to determine the value of the maximum adjustment capacity of advertising.

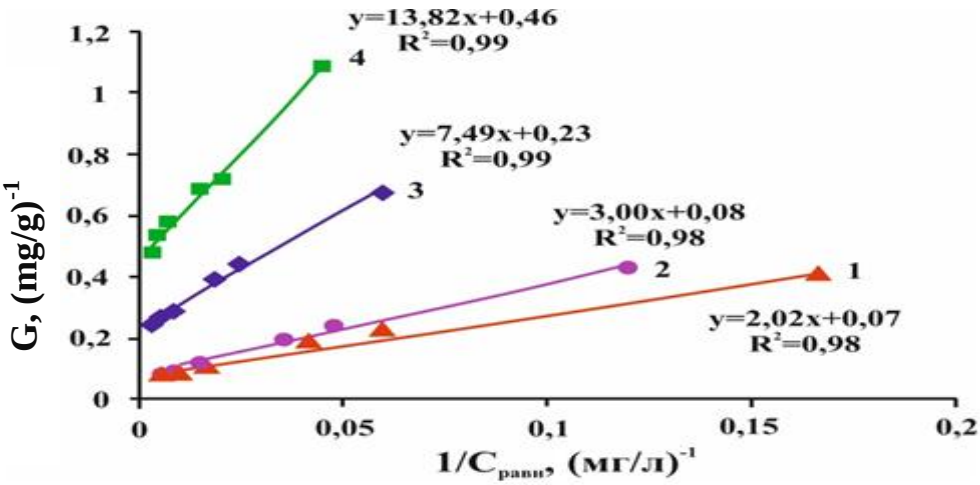

Figure 9. adsorbing isoffin neutral engineer: Modified bentonite with aluminum and iron (III) polyadiscations through the sample and the "Zolo-gel" method; 2nd sample - "bonding" Method modified with aluminum and iron (III) politidine; 3-shaped qualifying "dough" (mixed) through the method of extrusion and combustion at a temperature of 550, granulated sorbents based on natural bentonite; The 4th sample was obtained through the witsarm wrap method and burn at a temperature of 550, granulation sorbents of natural bentonite

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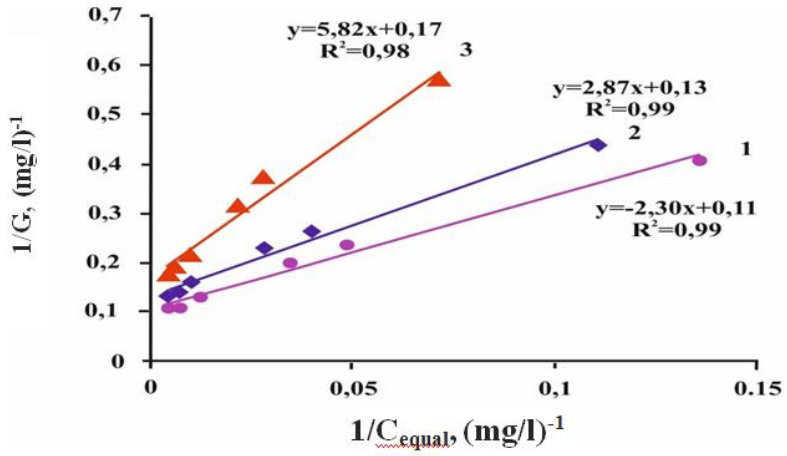

Figure 10. Adsorbing isoff in a neutral engineer: Modified bentonite with polyadiscations of aluminum and iron (III) through the sample and the "Zolo-gel" method; 2nd sample - "bonding" Method modified with aluminum and iron (III) politidine; 3 sample "Dough" was obtained through the extrusion method and burnt at a temperature of 550, granulation of natural bentonite based sorbents based on natural bentonite

It depends on the production of bentonite with aluminum and iron (III) aluminum and iron (III) aluminines (iii) the optimal number of modifiers is 5 [i +] mmol / g of bentonite. Further increase in the number of components that change the number of components leads to a relatively decrease in the value of the adsorption capacity. High-temperature burns lead to a decrease in the active surface of adsorption.

It should also be noted that the value of the maximum adsorption tank for atomicual sorbents exceeds the sorbents of the specific surface surface. Adsorring se-modified adsorbates Equipment and an increase in the Bentonite facility indicates the effectiveness of the modification of the modification of bentonite sorbents.

CONCLUSION

1. The physical properties of sorbents that were changed by the "zol-gel" method were studied by the "zero-gel" method 1 1. 1. The physical properties of sorbents, which were changed by the "ZOL gel" method and its "zolo-gel" method . The modification of the natural bentonite shows that their chemical composition, structural and adsorption properties.

2. Modified bentonite-based sorbents is 1.5-4.0 nm of pores are small, and fine. The modifying component, which is included in the value of sorbents, depends on the amount of aluminum or iron (III) polytoxides. The seats of the researchers adsorb them were studied against the biomat-ions. It is assumed that Lengmur Essers in the form of isotherm. Sorbents, including sorbents, from modified sorbents and biomates are indicated by higher adsorption than a natural bentonite.

3. In this paper, a sorbent based on bentonite clay Navbahor field was synthesized for the first time. Sam and Bat showed that as a result of modifying, texture and sorption characteristics of bentonite clay are significantly improved. The impact of the amount of modifier, the initial concentration of salt, the time of contact of the reagents to the adsorption of ions was established. Langmuir isotherm describes the sorption process better than the Freundlich

isotherm, which indicates the formation of a monomolecular sorption layer. Moreover, the degree of extraction of bichromate ions of the modified clay reaches (99.0 ± 1.0)%. The results indicate that this composite material is a highly efficient adsorbent. This modification method, thanks to simple preparation stages, allows to obtain sorbents with low cost, which is certainly beneficial from the point of view of chemical and economical use of bentonite clays. Consequently, the obtained sorbent can be used to clean wastewater at the industrial level.

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