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EFFECT OF BENTONITE ON BENZENE VAPOR ADSORPTION IN ORDER TO DETERMINE THE ACTIVATION CONDITIONS OF LOG BENTONITE

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Abstract: In the article, the adsorption properties of benzene vapor by adsorbents derived from Logon bentonite, activated through various thermal and chemical methods, were analyzed. The study highlights that chemical activation significantly enhances the adsorption capacity of Logon bentonite (LB-1). The comparison between untreated bentonite and chemically activated forms reveals improved benzene vapor adsorption in the chemically treated bentonite, indicating that the activation process has a substantial impact on the material's adsorption efficiency.

Keywords: Betonies, water vapor, adsorbent, absorbate, adsorption, monomolecular layer, isothermal monolayer capacity, specific surface area.

Introduction. Uzbekistan possesses abundant reserves of natural mineral raw materials, including clays with significant potential for industrial applications. The modification of secondary raw materials, such as natural clays, with carbon-retaining substances presents an opportunity to enhance their adsorption properties. By studying the adsorption characteristics and determining the optimal activation conditions, these modified clays can be employed in purifying heavy metal ions and surface-active substances from various industries.The targeted use of adsorbents based on modified natural clay minerals and oil waste depends largely on their surface properties and structural sorption parameters. Key factors include the surface geometry, crystal chemical structure, the number and nature of active centers, functional groups, and ion exchange capacity. A comprehensive understanding of these properties is essential for determining the potential applications of mineral sorbents.Fergana Valley bentonites, particularly from Logon and Shorsuv, are rich in montmorillonite and exhibit high ion exchange properties, primarily due to the presence of alkaline metal ions. Unlike other types of bentonites, these contain fewer colored metal oxides and salts, making them highly effective as adsorbents. To further enhance their capabilities, a two-way hybrid adsorbent can be developed by modifying these bentonites with gossypol resin. The next step is to study their structural sorption properties to better understand their performance in industrial applications.

Method and materials. Adsorption isotherms of vapors of gases and liquids on different adsorbents are studied in a high-vacuum Mc-Ben-Bakra balance. A scheme of a high-vacuum Mc-Ben-Bakra apparatus for adsorption research is shown in Figure 3.1.

The device is equipped with a quartz coil with high sensitivity. The sensitivity of the device is 1.78-10-3 kg/m. The benzene vapor adsorption device is equipped with quartz coils and adsorbent containers, glass calonna (special cups). During laboratory work, the temperature of the adsorption column (tube) containing modified adsorbent samples is kept at 20 °C with an accuracy of 0.1 °C in a water thermostat. Mc-Ben-Bakra structure and principle of operation, the main working parts are composed as follows - from the adsorbent samples under study are weighed on an analytical balance with an accuracy of 1 g in cups), quartz spring adsorption columns (equipped with cups, - forvacuum pump (VN - 461M brand), -diffusion pump (creates a vacuum until the residual pressure in the system is 1.33 • 10-3 Pa.) it is provided with a screw, the system pressure is controlled by a thermovacuum meter (VIT-2 brand) and a trap (functioning to trap various gases and water vapors in the system with liquid nitrogen), U-shaped manometers, ampoules containing adsorbates, and taps for separating the parts of the device are placed.

Diffusion pump, forvacuum pumps in adsorption device 1-10-5 mm.s.s. creates a vacuum until The pressure difference in U-shaped monometers is measured using a V-630 type cathometer, and the accuracy of the cathometer is 0.05 mm. Prepared samples are crushed in a mortar to a powder state, after mixing thoroughly, 1 g is taken out on a scale. Placed in a cup, the pressure in the system is stabilized by vacuum for 6-8 hours.

In our country, the adsorption of organic substances on natural mineral compounds (bentonites) [1; P. 247-256], in addition to the adsorption of organic and inorganic substances on synthetic zeolites [2; 182-193b] scientific research works were carried out. The effect of log bentonite and its activation on the adsorption of organic matter under the conditions of activation has not been fully studied. Nowadays, local bentonites are cleaned and activated and used as various absorbing substances. Bentonite samples have high adsorption properties due to the high content of montmorillonite, which determines the absorption properties. Local bentonites are widely used in production, cosmetology, medicine, and food industries due to their high content. Bentonite has a high ability to adsorb non-polar substances. This feature indicates increased hydrophilicity. High absorption of water can clog pores and prevent absorption of harmful substances as a result of water saturation. For this purpose, it is necessary to conduct a fundamental study of the adsorption of vapors of organic substances on adsorbents modified by various methods. Adsorbents were obtained by thermally and chemically activating Logon bentonite. Adsorption of benzene vapor on the obtained adsorbents was studied. [2; C. 20-25].

Study of the effect of adsorption on log bentonite activation conditions

Benzene, which was absorbed into the samples, was purified under vacuum before use in the sorption. Then it was dried, its vapor pressure was adjusted to the standard conditions for pure benzene by first freezing and then heating until its vapor pressure was equal to that of pure benzene, and its dissolved gases were released and its adsorptions were studied. Adsorbents (LB-1, LB-2, LB-3) with thermal (200, 300, 400) processing, chemical activation; activated in acidic (0.1 N HCl) and alkaline (0.1 N NaOH) media (LBK, LBI) and adsorbent were obtained.

The adsorption of non-polar benzene vapors on modified bentonites was studied. [3; C. 45-49]

Results and discussions. Benzene adsorption on LBI and LBK (activated in alkaline and acid conditions) adsorbents compared to LB-1, LB-2, LB-3, adsorption is very low in the initial states of adsorption, and cations located between the adsorbent layers (with Na+ [Al13O(OH) 24(H2O)12]7+) and depends on electronic nature and interactions of benzene molecule. The amount of adsorption at high specific relative pressures (R/Rs=0.3) It can be seen from the adsorption isotherms that the amount of adsorption in LBI and LBK increases sharply (Fig. 1). [4; C 376-379 b]

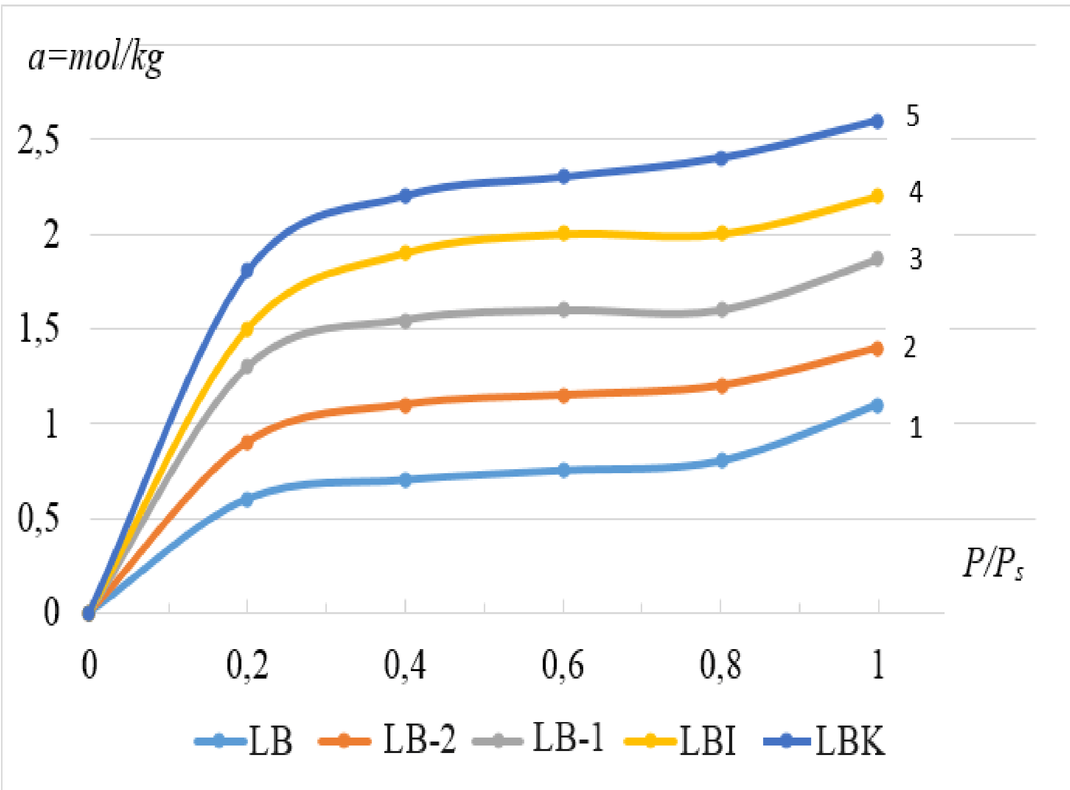

Figure 1. Activated LBI, LBK, LB-3, LB-2,LB-1, benzene vapor adsorption isotherm on bentonites.

The structure-sorption parameters of the modified adsorbents were determined using the equation of the reference surface (BET) theory. In this case, if the values on the ordinate and abscissa axis are given, the isotherms will be straight line coordinates. [5; C.28-30].

The relative surface of adsorbents is calculated based on the following formulas:

S = am·NO· ω_0 (3.1)

where S is specific surface area (m2/g);

am-monomolecular layer (mol/kg);

NA-avagadro number;

ω- surface occupied by one molecule (nm2)

In adsorbents, the structure is determined from the adsorption parameters using the equations of the specific surface area (S) (BET) theory. If P/Ps values are given on the ordinate and abscissa axes, straight line coordinates will be obtained.

Based on the isotherms of benzene vapor adsorption in modified adsorbents, the monolayer capacity am, the relative surface area S, the saturation volume Vs (or adsorption as) were calculated from the important parameters of the adsorbents (Table 1).

Table 1. At different temperaturesstructure - sorption indicators, indicators of benzene vapor adsorption of modified bentonites obtained by thermal treatment.

No	Adsorbent samples	Single floor capacity indicator a_m, mol/kg	A unit of reference surface S·10-3, m2/kg	Adsorption saturation as, mol/kg
1	LB	0.18	40	1.13
2	LB-2	0.53	149	1.40
3	LB-1	0.68	164	1.87
4	LBI	0.76	175	2.20
5	LBK	0.83	198	2.60

From the table, the specific surface index (S) for all adsorbents is: 40· in LB103 m2/kg, 149·103 m2/kg in LB-2, 164· in LB-1103 m2/kg is 175·103 m2/kg in LBI and 198·103 m2/kg in LBK, as well as adsorption saturation (as): 1.13 mol/kg in LB, 1.40 mol/kg in LB-2, LB-1 was found to be 1.86 mol/kg, LBI 2.2 mol/kg, and LBK 2.60 mol/kg. So, comparing the adsorption of benzene vapor against Log'on bentonite (LB-1) as a result of chemical activation, it can be seen that it leads to an increase in adsorption to 1.14-2.20 in LBI and 1.14-2.60 in LBK.

Conclusion. Acid activation of log bentonite can allow cleaning of inter-pore inclusions resulting in significant reduction of iron oxide, magnesium and alkaline-earth metals and increased adsorption properties. A decrease in the amount of these substances leads to an increase in the amount of tetrahedral silicon oxide in the bentonite crystal lattice as a result of the release of polar and non-polar substances in the form of surfactants.

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