ADSORPTION PROPERTIES OF COAL-MINERAL ADSORBENTS BASED ON BENTONITES OF THE NAVBAKHOR DEPOSIT

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Abstract: *the article presents the results of studies of the degrees of hydrophilicity of coal-mineral sorbents based on Navbakhor alkaline bentonite and various activated carbons. The data obtained show the possibility of increasing the amount of sorption of organic substances on bentonite clays by modifying them with coal adsorbents based on wood chinar and Angren brown coal. The creation of adsorbents with the necessary technological properties and a dual nature, which are active in the purification of various technological liquids from organic and inorganic substances, is ecologically and economically beneficial. Therefore, it is considered an urgent task for further scientific research in this direction to create effective adsorbents based on local raw materials of the Republic.*
Keywords: *bentonite, montmorillonite, activation, modification, hydrophilicity, coal.*

АДСОРБЦИОННЫЕ СВОЙСТВА УГЛЕМИНЕРАЛЬНЫХ АДСОРБЕНТОВ НА ОСНОВЕ БЕНТОНИТОВ НАВБАХОРСКОГО МЕСТОРОЖДЕНИЯ

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Аннотация: *в статье приведены результаты исследований степеней гидрофильности углеминеральных сорбентов на основе Навбахорского щелочного бентонита и различных активированных углей. Полученные данные показывают возможность увеличения количества сорбции органических веществ на бентонитовых глинах, путем модификации их угольными адсорбентами на основе дерева чинары и Ангрнеского бурого угля. Создание адсорбентов с необходимыми технологическими свойствами и двойственной природой, активных при очистке различных технологических жидкостей от органических и неорганических веществ, является экологически и экономически выгодным. Поэтому считается актуальной задачей проведение дальнейших научных исследований в данном направлении для создания эффективных адсорбентов на основе местных сырьевых ресурсов Республики.*
Ключевые слова: *бентонит, монтмориллонит, активация, модификация, гидрофильность, уголь.*

Currently, the development of the world industry dictates the consumption of sorbents for use in the technological cycle of production and in the processes of disposal of hazardous waste in this industry.

The variety of both nature and the amount of adsorbed substances in the industrial process and the severity of environmental protection requirements require the creation of highly efficient adsorbents for cleaning gas and liquid emissions from organic and inorganic chemical pollutants.

Bentonite clay is a widely used material in the national economy and is a chemically stable sorbent. The sorbent is not toxic to humans and does not harm the environment. The listed qualities make it possible to distinguish bentonite among similar materials.

However, bentonite clays, being a highly hydrophilic material, have disadvantages in the processes of sorption of non-polar organic substances. Activated carbons as an adsorbent for organic and non-polar substances are indispensable, firmly entrenched in the leadership position.

In connection with the above, the creation of adsorbents with dual characteristics based on bentonite and activated carbons is considered an urgent task, for the solution of which it is necessary to fully study the structural features, as well as the conditions for activation and modification of the original objects of study [1, 2]. The scientific and technical literature contains data on the possibility of creating coal-mineral adsorbents by mixing coal, coal containing raw materials and natural aluminosilicates [3, 4].

Objects and research methods

In our early works, we reported on the creation of coal-mineral adsorbents based on acid-activated Navbakhor alkaline bentonite and activated Angren and charcoal (tree plane), which were conventionally named CMSPTAC-4 and CMSAAC-4 [5]. Studies of the adsorption of non-polar adsorbates have been carried out. benzene and toluene at these facilities.

This paper presents the results of studying the amounts of water vapor adsorption and changes in the degrees of hydrophilicity of the developed coal-mineral adsorbents.

The hydrophilic properties of the adsorbents were determined using a Schottky microcalorimeter. In this case, traditional adsorbents were used as the working fluid, since water and benzene. For experiments, the adsorbent samples were first ground using a ball mill, then sieved through a sieve 0.25 mkm in size, dried at 150 ° C and evacuated using a McBen-Bakra apparatus for 8 hours to a residual pressure of 10-3 Pa.

Results and their discussion

The processes of water vapor adsorption on UMSAU-4 and UMSAUCH-4 coal-mineral sorbents were investigated, the results obtained are shown in Picture-1.

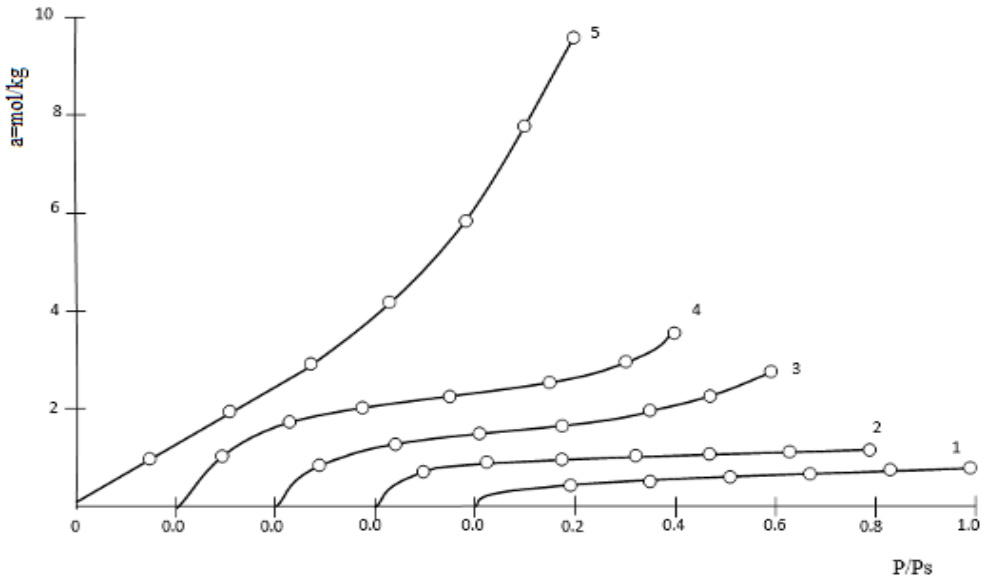

Fig. 1. Isotherms of water vapor adsorption on adsorbents: 1) activated carbon plane tree (ACPT); 2) brown coal (BC-B); 3) coal-mineral sorbent with plane tree activated carbon (CMSPTAC-4); 4) coal-mineral sorbent with activated Angren carbon (CMSAAC-4); 5) acid activated montmorillonite (AAML)

It is known that the rectilinear shape of the isotherm curve of the ACPT adsorbent indicates the chemical nature of the interaction of the adsorbent surface with water vapor. The introduction of coal crystals into montmorillonite results in the hydrophobization of its surface. At low values of relative pressure, a sharp rise in the adsorption isotherm is observed for samples CMSPTAC -4 and CMSAAC-4 and reaches adsorption equilibrium at medium values of relative pressure. However, as the curves of the diagram show, the sorption activity with respect to water vapor decreases in comparison with ACPT by more than 3 times.

The adsorption isotherms were used to calculate the monolayer capacity αm, the saturation volume as, and the specific surface area of the adsorbents S (table 1).

Table 1. Structural sorption properties of adsorbents

Sample	**Monolayer capacity, A_m, mol / kg**	**Specific surface area, S m^2 / g**	**Saturation adsorption, A_s, mol / kg**
AAML	1.22	79.80	10
ACPT	0.52	33.96	0.8
BC-B	0.64	47.70	1.0
CMSPTAC -4	1.20	79.30	2.5
CMSAAC -4	1.15	76.11	3.5

From the data Table 1 that 12% of the total adsorption of water vapor falls on the capacity of the monolayer, which is about 3.5 mol / kg. The CMSPTAC -4 and CMSAAC -4 coal-mineral sorbents based on CFAM have relatively the same specific surface area (S).

The heat of wetting is one of the main indicators for characterizing the hydrophilicity of adsorbents. Therefore, the amount of heat of wetting of the studied objects was investigated. It is known from numerous literature data that at values of heat of wetting β> 1 the sorbent has a hydrophilic surface, on the contrary, at values β <1 it is hydrophobic [6].

Consequently, hydrophobic coal sorbents have phility values β<1, and bentonite clays, respectively, β>1. As established as a result of research, the modification of bentonite clay with carbon adsorbents with subsequent steam activation leads to a decrease in the phility coefficient by 16 times or more. The results of determining the coefficient of phility of coal-mineral adsorbents are given in table 2.

Table 2. Hydrophilic properties of coal-mineral adsorbents

Sample	**Heat of wetting, kDj kg**		**Phility coefficient**
	Water	**Benzol**	
AAML	95,20	26,44	3,60

ACPT	43,14	73,18	0,59
BC-B	28,03	108,78	0,26
CMSPTAC -4	52,27	110.28	0,24
CMSAAC -4	49,53	114.13	0,22

The data obtained show the possibility of increasing the amount of sorption of organic substances on bentonite clays by modifying them with coal adsorbents based on wood chinar and Angren brown coal. The creation of adsorbents with the necessary technological properties and a dual nature, which are active in the purification of various technological liquids from organic and inorganic substances, is ecologically and economically beneficial. Therefore, it is considered an urgent task for further scientific research in this direction to create effective adsorbents based on local raw materials of the Republic.

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