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Synthesis of a New Composition of Sorbents Based on Local Raw Materials and Study of Their Sorption Properties

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ABSTRACT: The article presents information on the synthesis of a new composition of sorbents based on local raw materials and the study of their sorption properties. We know that the efficiency of wastewater treatment based on activated carbon can reach 80% depending on the level of water pollution, but an efficiency of 95% can be achieved by modifying activated carbon with activated bentonite. In our studies, the studies were carried out on modified sorbents.

KEYWORDS: sorbent, activated, carbon, bentonite, wastewater, modification, industry.

I.INTRODUCTION

Currently, the need for wastewater treatment in the chemical and metallurgical industries is increasing due to the development and use of sorbents based on various materials. Attention is paid to the creation of highly efficient resource-saving sorbents based on local materials for industrial wastewater treatment, their use in the chemical and metallurgical industries.

Today, the development of sorbents with high selectivity, low cost, high sorption capacity and high physical and mechanical properties, as well as a long service life, is relevant in the world.

A number of scientific and practical results have been achieved in the republic in the production of ion-exchange sorbents with a feature of complex formation based on local raw materials. We have also conducted several studies in this regard and achieved certain results.

II. SIGNIFICANCE OF THE SYSTEM

The article presents information on the synthesis of a new composition of sorbents based on local raw materials and the study of their sorption properties. The study of methodology is explained in section III, section IV covers the experimental results of the study, and section V discusses the future study and conclusion.

III. METHODOLOGY

Bentonite is sampled for research purposes. Separated bentonite samples were finely ground using a laboratory grinder (Retsch RM 200), passed through a 0.1 mm sieve to separate large sand and rock fragments and crushed debris samples. Then 250 g was taken in a 5-liter container, distilled water was added to it and left for 8 hours. In this case, the bentonite was crushed under the influence of water, and the resulting suspension was thoroughly mixed. The suspension was cleaned of various water-insoluble additives that fell to the bottom. After this process was repeated three times, the bentonite suspension was separated from the water using a centrifuge (brand H1650K). After that, it was first dried at room temperature to 30% humidity, and then dried in a drying oven (brand PE-4610) at 105℃ for 2 hours. Samples were milled in sizes of 1.5-2 nm and 2-4 nm [1].

Bentonite 20% aqueous suspension. Polyhydroxyaluminum bentonite-PGAM-1 and PGAM-2 samples were mixed with 0.03 N aluminum chloride solution and heated in the temperature range of 150-500°C, KFAM sample was obtained by activating with 15% sulfuric acid at 100°C for 4 hours [2].

Activated charcoal. Coal adsorbents were prepared by thermally activating Aylant tree stem of a certain size for 1.5 hours in a pyrolysis device designed for laboratory conditions in an airless environment at 300, 400, 500, 600, 700, 800°C. The resulting coal adsorbents were conventionally named Aylant. Aylant wood is a microporous product with a high amount of carbon stored as a result of pyrolysis. The composition and structure of these coals depends on the pyrolysis temperature and the activation method. In most cases, pyrolysis is carried out at 450-550°C, and as a result, a

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high-molecular product in an amorphous state is formed. Charcoal has mainly aliphatic and aromatic structure. Contains 80-92% S, 4-5% N, 5.0-15% N, O and 1-3% inorganic compounds (elements such as K, Na, Ca, Mg, Si, Al, Fe mainly in the form of carbonates and oxides) occurs.

IV. EXPERIMENTAL RESULTS

In order to determine the value of the static exchange capacity of the sorbent obtained by activating bentonite and ailanthus wood chips, a study was conducted in a 0.1 N NaOH solution. In this case, a sample of bentonite was mixed with wood chips in the ratio of 1:0.5; 1:0.6; 1:0.7; 1:0.8; 1:0.9; The dispersion level was crushed to 0.1 mm using a grinder, adding in a mass ratio of 1:1, 1:1.1 and heated for 2 hours at a temperature of 300°C in airless conditions. After that, samples of carbon-mineral sorbent were collected for 10 minutes by activation with water vapor at a temperature of 750-800 °C and conventionally BA-1 (1:0.5), BA-2 (1:0.6), BA-3 (1:0.7), BA-4 (1:0.8), BA-5 (1:0.9), BA-6 (1:1) and BA-7 (1:1.1). The value of their static exchange capacity was determined using a 0.1 N NaOH solution. The results obtained are presented in Figure 1.

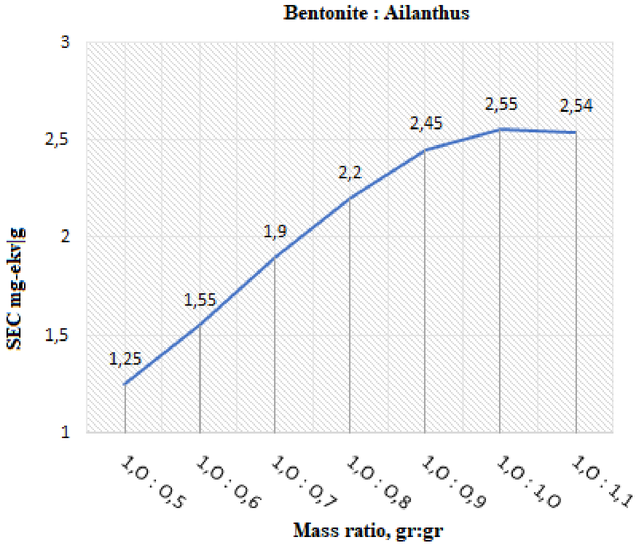

Figure 1. Dependence of the value of static exchange capacity on 0.1 n NaOH solution on the mass ratio of bentonite and ailant tree shavings.

From the obtained results, we can see from Figure 1 that the value of the static exchange capacity of BA-6 brand sorbent activated by adding sorbents of wood shavings to the bentonite sample in a 1:1 mass ratio is high, 2.55 mg-eq/g.

The physicochemical properties of synthesized sorbents were studied using GOST 10898.1–84. Along with the study of their physico-chemical properties, another important parameter, their physico-mechanical properties, was studied.

These properties include moisture content, specific volume, bulk, and fractional composition in the bulk state. During the research, the moisture content and specific volume of the sorbents below were also studied.

To do this, the bag with hermetically closing mouth is dried in an empty drying cabinet for 1 hour. Cool in a desiccator for 45 minutes before using. 3.5 ± 0.5 grams of sorbent was weighed on an analytical scale with an accuracy of 0.0002 g to the dried baguette, and until it reached a constant weight for 6 hours with the mouth open. Since the KPS-6 sorbent is heat resistant, it was 100 ± 100 according to the requirements of paragraph 4.1 of GOST 10898.1–84 It was dried in a drying cabinet at a temperature of 5 °C. Before weighing the sample, it was dried in a desiccator containing hygroscopic calcium chloride pellets for 45 minutes. The moisture content of the sorbent (W, %) was calculated according to the following formula.

$$W\% = \frac{m_1 - m_2}{m_1} \cdot 100\%$$

here:

m_1 - sorbent mass before drying, g;

m_2 - sorbent mass after drying, g.

Calculate:

m_1 – 11,452 g;

m_2 – 6.125 g;

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$$W_1\%=\frac{11,452-6,125}{11,452}\cdot 100\% = 46,5\%$$

m_1– 11,465 г;

m_2– 6,148 г;

$$W_2\%=\frac{11,465-6,148}{11,465}\cdot 100\% = 46,38\%$$

m_1– 11,449 г;

m_2– 6,141 г;

$$W_3\%=\frac{11,448-6,141}{11,501}\cdot 100\% = 46,34\%$$

$$W_{ўрта}\%=\frac{W_1+W_2+W_3}{3}\cdot 100\% = \frac{46,5+46,38+46,34}{3}\cdot 100\% = 46,4\%$$

$W_{ўрта}\%=46,4\%$

In addition, ACZET MB 120 SERIES moisture balance (USA) device was used to determine the moisture content of sorbents. The moisture content of the sorbent in this device was found to be 46.1%. From the results of both studies, it was found that the moisture value of the sorbent is almost close to each other.

V. CONCLUSION AND FUTURE WORK

Local raw materials were selected. The sorbents were synthesized to obtain The static exchange rate of BA-6 obtained in 0.1 N NaOH solution was determined.

The static exchange capacity of BA-6 mixed with bentonite at a ratio of 1:1 by weight is higher than that of BA-1, BA-2, BA-3, BA-5, BA-7 sorbents at lower and higher weight-to-mass ratios. it turned out that the static exchange capacity is low. In addition, the ion exchange capacity of composite polymer sorbents was determined.

Elemental content of reactive functional groups was also determined by the method of elemental analysis of sorbents. Moisture level and properties of sorbents were also determined.

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