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METHODS FOR OBTAINING ACTIVATED ADSORBENTS BASED ON OIL INDUSTRY WASTE

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ABSTRACT
The article analyzes the methods of activation of petroleum coke produced by FNKVIZ LLC and the sorption properties of adsorbents activated on the basis of petroleum coke.

Keywords: petroleum coke, coal, adsorbent, alkali, water vapor, water repellent.

Introduction

The results of the analysis of the world literature show that there is not enough information about the production of adsorbents by the activation of natural coal dust, petroleum coke and other carbonaceous materials in pilot works. According to the analysis of the studied literature data, it is possible to conduct research on the production of activated carbon adsorbent from products containing carbon [1].

In the course of the research work, petroleum coke produced by FNKIZ LLC was selected. Due to the high stability of petroleum coke, as a result of its additional processing, adsorbents with the possibility of efficient and fast regeneration can be obtained from it [2].

Activation refers to an increase in the porosity and surface area of carbon storage materials. To increase the porosity of carbon-containing materials, physical, chemical, and physicochemical methods are used [3].

Physical activation consists in removing additional substances from it using various physical methods (centrifugation, flotation and filtration) without changing the composition of the substance.

Acid, alkali and other substances are often used in chemical activation. In this case, the coke is cleaned from various inorganic substances and the coke is activated, resulting in an increase in the porosity and surface area of the coke.

Also, the activation of coals is carried out by heating to 700-8000C using steam or other gases (N2, CO2, Ar). In most cases, SO2 or N2O gases are used for activation in this method. As a result, additional pores are formed due to the excess of amorphous carbon in the coal structure.

To activate the coke, it was first stirred in a mortar and then subjected to pyrolysis at 400°C for 3 hours until gas evolution ceased. Thermally activated adsorbents were obtained by

heating the pyrolyzed sample at 400°C (K-1), 600°C (K-2), and 800°C (K-3) under airless conditions for 4 hours.

According to the analysis of the literature, taking into account that the sorption property of the adsorbent is enhanced by activation with water vapor, the pyrolyzed sample was used to study the effect of water vapor on the adsorbent using a pyrolysis device. at 800°C for 2 hours (kb) was obtained adsorbent.

For chemical activation, the pyrolysis sample was activated in 5%, 10%, 15% HCl solution to obtain adsorbents (KK-1, KK-2, KK-3). In the case of acid activation, acid (5%, 10%, 15%) solutions and pyrolysis coke were added in a ratio of 3/1 and activated at 600°C for 3 hours. The activated mixture was washed with distilled water until pH 7 was reached and dried in an oven [4].

Adsorbents (KI-1, KI-2, KI-3) were obtained by activating a pyrolysis sample in 10%, 15%, and 20% KOH solution for activation in an alkaline medium. For activation in an alkaline medium, acid solutions (10%, 15%, 20%) and pyrolysis coke were added in a ratio of 3/1 and activated at a temperature of 600C for 3 hours. The activated mixture was washed with deionized water to pH 7 and dried in an oven.

The moisture content of carbon adsorbents obtained from residual petroleum coke was determined according to the method developed on the basis of GOST 11014-2001. According to the results obtained, the moisture content of carbon adsorbents obtained at different temperatures (400, 600, 800°C) based on natural coal, petroleum coke and asphaltenes is in the range of 1.7-2.3%. It is known that natural coal and oil products have hydrophobic properties. That is why carbon adsorbents, obtained from petroleum coke, almost do not absorb water molecules, due to which the amount of organic functional groups with hydrophilic properties (-OH, -COOH, etc.) in petroleum coke adsorbents obtained at high temperature is very small.

The level of carbon adsorbent powder obtained from petroleum coke was determined according to the method developed on the basis of GOST 11022-95. The results obtained are presented in Table 2.2.1.

Table 2.2.1 Physical properties of obtained carbon adsorbents

Adsorbent samples	Activation temperature, °C	Technical analysis		
		Humidity content, %,W^A	Ashes content, %, A^s	Product of formation adsorbents (%).
Activated carbon adsorbent obtained from petroleum coke	400	2,2	9,1	49,4
	600	2,0	8,7	45,3
	800	1,8	6,8	38,4
	800 (steam)	1,7	5,6	34,1

The process of adsorption of carbon adsorbents is considered one of the most important indicators, and the strong absorption of adsorbates is one of their important features.

Because after absorption of the adsorbate molecules, the surface tension of the adsorbents decreases due to the location of the adsorbent and adsorbate molecules on the surface of the adsorbent, and, accordingly, their strength decreases, that is, the sorption of adsorbates. For the release of carbon adsorbents from the absorbed systems after use, the necessary technological conditions are important. Therefore, the dependence of adsorbents on the degree of grinding and, moreover, on the stability of their temperature during their extraction was analyzed.

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