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ADSORPTION OF SILICA GEL ADSORBENTS WITH WATER VAPOR

Annotation. This article presents the methods of obtaining silica gel adsorbents and their industrial use. The methods of recovery of adsorbents produced after purification from heavy metals in wastewater are shown in laboratory conditions and in industry. Water vapor adsorption isotherms of regenerated silica gel adsorbents were measured in a sensitive quartz spiral apparatus of Mac-Behn.

Key words: silica gel, adsorbent, Mc-Ben, π-complex, silicic acid.

In order to study the adsorption properties of silica gel adsorbents, the sorption properties with polar molecules were studied.

It is important to study the structural porosity and adsorption parameters of silica gel adsorbents when conducting experiments and determining the mechanisms of surface properties. Adsorption of obtained silica gel adsorbents with polar molecule water vapor was studied[1].

For this purpose, as a research object, silica gel adsorbents used in the territory of our Republic were activated by initial and thermal (100; 130; 160; 180ºC) for 3.5-4.0 hours. Adsorption of the obtained adsorbents with water vapor was studied.

Water vapor adsorption isotherms of silica gel adsorbents were measured in McBean's sensitive quartz spiral device [2]. Before measuring the adsorption of water molecules in the sample, the system was vacuumed until the residual pressure was 1.33x10-3Pa, heated for 8 hours, and then adsorption isotherms were obtained.

The water obtained as adsorbate was purified and dried under vacuum conditions before being used for sorption, and its vapor pressure was first frozen and then heated until its vapor pressure was equal to the vapor pressure data

given in the tables for pure water [3]. The resulting adsorption isotherms are presented in Figure 1.

Picture 1

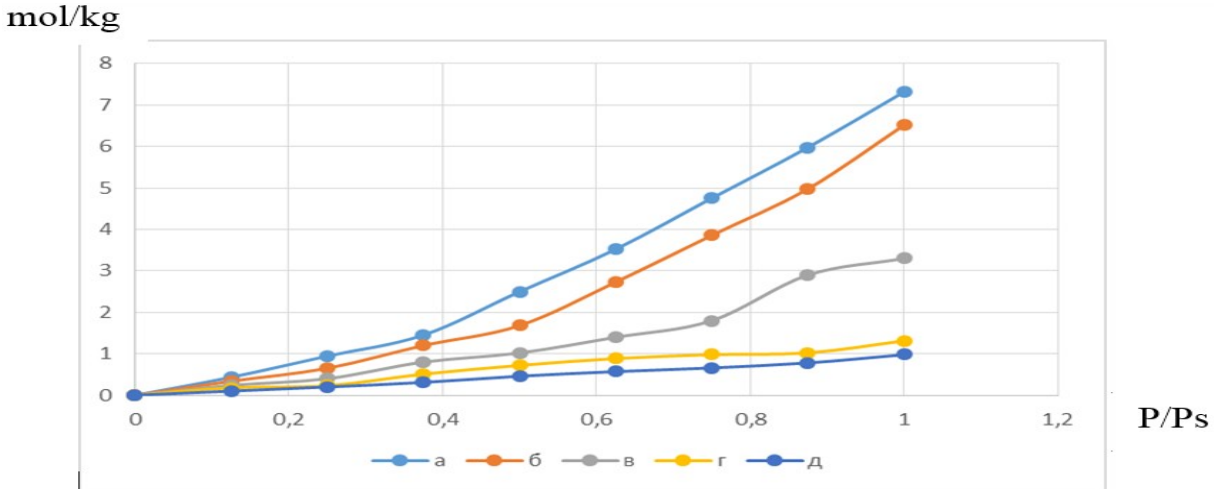

Figure 1. Adsorption isotherms of silica gel adsorbents with water vapor. a - initial ºC, b - 100 ºC, v - 130 ºC, g -160 ºC, d - 180 ºC

From the adsorption isotherms, we can see that water vapor adsorption on adsorbents decreases with increasing temperature. One of the main reasons for this can be explained by the decrease of polar functional, i.e., OH- groups in the adsorbent as the temperature increases[4].

In the studied systems, at low relative pressures (P/Ps=0.1-0.2), it is possible to see that the adsorption isotherms are steep as a result of the large absorption of water vapor. The adsorption isotherms of these samples with water vapor were found to belong to type I of the classification of adsorption isotherms proposed by Brunauer. The adsorbents that form the I-type isotherm are microporous adsorbents. This type of isotherms is characterized by the fact that they form an almost right angle to the P/Ps=1 axis as a result of a sharp rise[5].

It can be seen from the water vapor adsorption isotherms of all adsorbents studied above (at 100, 130, 160, and 180 ºC) that adsorption decreases with increasing temperature during the activation process of silica gel adsorbents

obtained at all specific relative pressures (p/ps). It was found that the highest adsorption amount belongs to the adsorbent sample activated at 100 °C.

Based on the isotherms of water vapor adsorption on silica gel adsorbents, the monolayer capacity am, saturation volume Vs (or adsorption as) and their relative surfaces S were calculated from the important indicators of adsorbents. The obtained results are presented in Table 1.

Table 1

Structural and sorption parameters of silica gel adsorbents for water vapor adsorption

Sample	**Single floor capacity, a_m, mol/kg**	**Comparison surface, $S \cdot 10^{-3}$, m^2/kg**	**Saturation adsorption a_s, mol/kg**
silica gel adsorbents	3,2	582	7,46
100^{0}C	2,8	521	6,62
130^{0}C	1,3	252	3,32
160^{0}C	0,6	116	1,32
180^{0}C	0,5	108	1,05

In such conditions, as a result of the release of various gases and resins contained in the restoration, additional pores are opened in the layers of silica gel adsorbent. Compared to the received adsorbents, it was found that the structure - sorption indicators for the sample activated at 100 ^{0}C are higher than other adsorbents. At 180 ^{0}C, it was found that the specific surface area (S) increased by 5 times and the saturation volume (as) by 6 times.

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