can state that $E_0$ and $Q$ are linearly dependent (see Fig. 1). The calculation of the parameters of these dependencies, obtained for 120 samples of AC by the method of least squares, led to the equations:

$$\text{For } \text{Kr } E_0 = 4.1Q - 68.7 \text{ kJ/mole} \quad (3)$$

$$\text{For } \text{CF}_4 E_0 = 2.5Q - 39.4 \text{ N/mole.} \quad (4)$$

**CONCLUSIONS**

1. Heats of adsorption of Kr and CF$_4$ on activated carbons, characterized by different micropore structure, were studied by the gas-impulse method over a relatively wide temperature range.

2. A correlational dependence in the form of $E_0 = aQ + b$ ($a$ and $b$ are empirical coefficients) has been established between the heat of adsorption of the chromatographed gases and the specific energy of adsorption, calculated from the adsorption isotherm using benzene as the adsorbate.

**LITERATURE CITED**


**STUDY OF THE ADSORPTION PROPERTIES OF SORBENTS BY THE GAS-PULSE METHOD**

2. **DETERMINATION OF THE LIMITING VOLUME OF ADSORPTION SPACE**


We showed in [1] that one of the micropore-structure parameters of activated carbons (AC) which enters into the adsorption-isotherm equation in the theory of the volumetric filling of micropores (TVFM) is the characteristic adsorption energy $E_0$, which can be determined by using the correlation between $E_0$ and the heat of adsorption of the gas Q as obtained by the gas-pulse method. The relationship of the second parameter, the limiting adsorbed volume $W_0$, with the characteristics obtained by the gas-pulse method, the adsorbed monolayer volume $V_m$ and the heat of adsorption of the gas Q, stems from the following assumptions.

The adsorption isotherm described by the equation from [2] is:

$$a = \frac{W_0}{v^*}\exp\left[\frac{-A}{BE_0}\right] \quad (1)$$

TABLE 1. Properties of Activated Carbons

<table>
<thead>
<tr>
<th>Adsorbent</th>
<th>Micropore structure parameters</th>
<th>Monolayer adsorption vol. at 298°K, Vm, cm³/g</th>
<th>Heat of adsorption, Q, kJ/mole</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eo, kJ/mole</td>
<td>Wo, cm³/g</td>
<td>Kr</td>
</tr>
<tr>
<td>AU-1</td>
<td>19.3</td>
<td>0.262</td>
<td>31.9</td>
</tr>
<tr>
<td>AU-2</td>
<td>19.6</td>
<td>0.310</td>
<td>37.9</td>
</tr>
<tr>
<td>AU-3</td>
<td>20.2</td>
<td>0.380</td>
<td>34.7</td>
</tr>
<tr>
<td>AU-4</td>
<td>21.5</td>
<td>0.351</td>
<td>34.6</td>
</tr>
<tr>
<td>AU-5</td>
<td>21.8</td>
<td>0.438</td>
<td>64.5</td>
</tr>
<tr>
<td>AU-6</td>
<td>25.4</td>
<td>0.364</td>
<td>63.0</td>
</tr>
<tr>
<td>AU-7</td>
<td>26.5</td>
<td>0.316</td>
<td>66.2</td>
</tr>
<tr>
<td>AU-8</td>
<td>31.0</td>
<td>0.440</td>
<td>144.0</td>
</tr>
</tbody>
</table>

where \(a\) is the equilibrium amount of adsorption, mole/g; \(v^*\) is the molar volume of the adsorbate, cm³/mole; 
\(A = RT \ln \left( f_s / p \right)\) is the differential molar work of adsorption, J/mole·K; \(f_s\) is the fugacity of the saturated vapor, Pa; \(\beta\) is the coefficient of similarity, approximated closely by the Henry equation in regions of low filling [3], as follows:

\[
a = kp
\]

(2)

where \(p\) is the equilibrium pressure in Pa.

It was shown in [3] that the coefficient \(k\) is expressed by parameters of adsorption equation (1) as follows:

\[
k = \frac{W_0}{v^*/f_s} \exp \left( \frac{\beta E_0}{2RT} \right)
\]

(3)

The Henry coefficient can be determined from the data of a gas-chromatographic test under conditions which ensure the attainment of adsorption equilibrium [1].

According to equilibrium chromatography theory [4], the relationship between the Henry coefficient and the adsorbed monolayer volume is given by the equation

\[
K = \frac{V_m}{RT}
\]

(4)

Substituting Eq. (4) in Eq. (3) and solving for \(W_0\), we obtain

\[
W_0 = \frac{V_m v^*/f_s}{RT} \exp \left[ - \left( \frac{\beta E_0}{2RT} \right) \right]
\]

(5)

When we have determined \(E_0\) by the method in [1], we can, in principle, calculate \(W_0\) from the values of \(V_m\). However, the process is very difficult and we cannot determine \(W_0\) with sufficient accuracy; above the critical temperature, the values of \(f_s\) and \(v^*\) lose their physical meaning and can be considered only as conditional parameters which cannot be determined by any single method [5]. At the same time, Eq. (5) allows us to draw the conclusion that when \(E_0\) is constant, a change in \(V_m\) is proportional to a change in \(W_0\). From Eq. (5) when \(T\) is constant, we can write in general form

\[
W_0 = k_1 V_m \exp (- k_2 E_0^x)
\]

(6)

Values are given for \(V_m\) in AC in [4, 6-11], but only in [10] has an attempt been made to study the change in \(V_m\) as a function of \(W_0\). The objective of the experiment was to find statistically dependable values of the coefficients \(k_1\) and \(k_2\) which relate the parameter \(W_0\) to the properties \(V_m\) and \(Q\) obtained by the gas-pulse method.

**EXPERIMENTAL**

Eight AC specimens were studied, prepared under laboratory and plant conditions. Table 1 shows the pore-structure characteristics of the AC, calculated from standard vapor adsorption isotherms of benzene for \(T = 293^\circ K\) [12] and the following parameters determined by the gas-pulse method: monolayer adsorption volume \(V_m\) for Kr and CF₄ at 298°K and the heat of adsorption \(Q\) of these gases between 298 and 373°K. The method of measuring \(V_m\) and \(Q\) is given in [1].