

SORPTION OF GASES BY SILICA GEL.

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In the preceeding paper of the author⁽¹⁾ the measurement of sorption amounts and velocities of ammonia by silicic acid minerals were described. In the present paper the results of measurements are reported on silica gel prepared in vitro.

The silica gel has been prepared in the following manner. Fifty grams of pure sodium silicate from Merck was dissolved in 320 grams of water obtaining a solution of specific gravity 1.10. The solution was mixed with 300 c.c. of 3 normal sulphuric acid and the gel allowed to set. It was then washed with water thoroughly to remove the sodium and sulphate ions. The gel was dried by allowing a long time in an open vessel at the room temperature.

The dry gel thus prepared was dehydrated by evacuating and heating. The dehydrated substance was put in the measuring apparatus of sorption. The preparation of gases, the apparatus and the method of measurements were already described in the former papers.⁽²⁾ The experiments were conducted at 25°C. and under about one atmospheric pressure of gas.

Sorption of Ammonia. The silica gel was dehydrated by evacuating and heating to 300°C. for 30 minutes. By this treatment, 0.6852 gr. of air dry gel gave 0.3668 gr. of dehydrated substance. The amount of water evaporated is, therefore, 46.47 %. The velocity and the amount of sorption of ammonia by this dehydrated silica have been measured. The results are given in Table 1.

In this table, the first column indicates the time in minutes after the contact of gel to ammonia, the second the pressure of ammonia, and the third the volume of ammonia sorbed at 25°C. by 1 gr. of the dehydrated gel in c.c. reduced at 0°C. and 760 mm. pressure. The gel, thus, sorbed about 46 c.c. of ammonia at 25°C. and under 1 atmosphere.

(1) Sameshima, this Bulletin, **6** (1931), 165.

(2) Sameshima, this Bulletin, **2** (1927), 2; **4** (1929), 97; **5** (1930), 173.

Table 1. Sorption of NH_3 by Silica Gel.

Time in min.	Pressure of gas in mm.	Vol. of NH_3 (N.T.P.) sorbed at 25°C. by 1 gr. of gel in c.c.
0.5	762.5	29.00
1	762.5	35.14
2	762.5	40.19
5	762.5	43.29
10	762.4	43.64
20	762.3	43.96
185	760.8	44.64
1470	756.6	45.26
7315	761.3	45.87
17370	752.8	46.01
33225	750.3	46.26
77760	746.9	46.53

Now the gel was made to desorb the ammonia by pumping the gas and heating to 150°C. Then the second measurement has been done on this desorbed gel. The results are shown in Table 2.

Table 2. Second Sorption of NH_3 by Silica Gel.

Time in min.	Pressure of gas in mm.	Vol. of NH_3 (N.T.P.) sorbed at 25°C. by 1 gr. of gel in c.c.
0.5	759.2	29.93
1.17	759.2	37.30
2	759.2	41.11
4	759.2	42.94
6	759.2	43.20
10	759.2	43.39
15	759.2	43.52
30	759.2	43.76
50	759.2	43.96
135	758.7	44.27
280	758.9	44.48
1585	757.8	45.02
11520	765.6	45.85

Sorption of Carbon Dioxide. The velocity and amount of sorption of carbon dioxide by the dehydrated silica gel have been measured. The results are given in Table 3.

Table 3. Sorption of CO₂ by Silica Gel.

Time in min.	Pressure of gas in mm.	Vol. of CO ₂ (N.T.P.) sorbed at 25°C. by 1 gr. of gel in c.c.
0.5	754.7	4.66
1	754.7	5.03
2	754.7	5.38
5	754.7	5.56
10	754.7	5.66
60	754.4	5.82
255	753.7	5.93
1380	753.6	6.08
2995	756.5	6.16
11490	759.4	6.27
34550	761.6	6.34
82050	761.7	6.40

Sorption of Ethylene. The results of measurement on ethylene by dehydrated gel are shown in Table 4.

Table 4. Sorption of C₂H₄ by Silica Gel.

Time in min.	Pressure of gas in mm.	Vol. of C ₂ H ₄ (N.T.P.) sorbed at 25°C. by 1 gr. of gel in c.c.
0.5	758.8	3.81
1	758.8	3.98
2	758.8	4.12
4	758.7	4.20
9	758.6	4.22
40	758.4	4.26
305	757.9	4.29
1490	760.4	4.34
3080	764.4	4.37
17580	760.0	4.43
31930	760.0	4.47
60750	760.0	4.48
99600	760.0	4.50

The theoretical discussion on the velocity of sorption will be done in the next communication.

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