THE WATER IN INORGANIC COMPOUNDS. II. THE WATER CONTENT OF ODO ACID CLAY AT VARIOUS TEMPERATURES IN AIR CURRENT OF THE CONSTANT WATER VAPOUR PRESSURE.

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Received April 2nd, 1935. Published August 28th, 1935.

Studies on the water in Odo acid clay have been reported by many investigators.(1) The present writer,(2) too, has often done similar researches, one of which will be briefly described below.

The whole apparatus used in our experiment is shown in Fig. 1. The air current was produced and purified in A, B, C, and D, and, after saturated with the water vapour in the thermostat (Fig. 2), was introduced into the reaction furnace in which the platinum crucible containing the sample was hung as shown in Fig. 1. The weight change of the sample was observed by Honda's thermobalance.(3) The temperatures of the thermostat (T_2), connec-

Table 1.

g (g.)	P mm. Hg	T	P'mm. Hg	p mm. Hg	V (c.c.)	$\frac{V}{\text{Time}}$ c.c./min.	π mm. Hg
0.1151	761.5	291.9	771.0	16.0	2000	3.0	54.5
0.1787	763.0	292.6	773.0	17.0	3000	2.1	56.4
0.1806	759.0	292.6	769.0	17.0	3000	2.3	57.0
0.1198	764.0	291.1	772.0	15.5	2000	2.0	56.5
0.1139	763.5	292.1	773.5	16.5	2000	5.3	54.0
0.1173	762.5	292.1	772.5	16.5	2000	16.7	55.5
0.1170	755.0	292.1	764.5	16.5	2000	13.6	55.4
0.1783	765.0	290.1	773.0	14.5	3000	12.9	55.7
0.1183	756.5	289.1	764.5	13.6	2000	14.1	55.3
0.1782	763.0	291.1	771.0	15.5	3000	13.4	56.1
0.1775	758.5	291.6	768.0	16.0	3000	23.4	55.9
0.1782	763.0	290.6	771.0	15.0	3000	23.4	55.9

(1) *J. Soc. Chem. Ind., Japan*, **32** (1929), 997; *ibid.*, **33** (1930), 69, 304, 1040; *ibid.*, **34** (1931), 680; *J. Chem. Soc. Japan*, **51** (1930), 673, 755.
(2) *J. Chem. Soc. Japan*, **50** (1929), 473; *ibid.*, **54** (1933), 717, 772.
(3) *Kinzoku-no-Kenkyu*, **1** (1924), 542.

tion tube E (T_3), and the furnace (T_4) were strictly conditioned as follows: $T_2 < T_3 < T_4$. To confirm the saturation of the air current with the water vapour, the vapour pressure was calculated by the following formula from the experimental data in Table 1, which were determined at the temperatures: $T_2 = 40°C.$, $T_3 = 55°C.$, $T_4 = 65°C.$: $\pi = \frac{62370\, gPT}{(P'-p)MV + 62370\, gT}$, where π

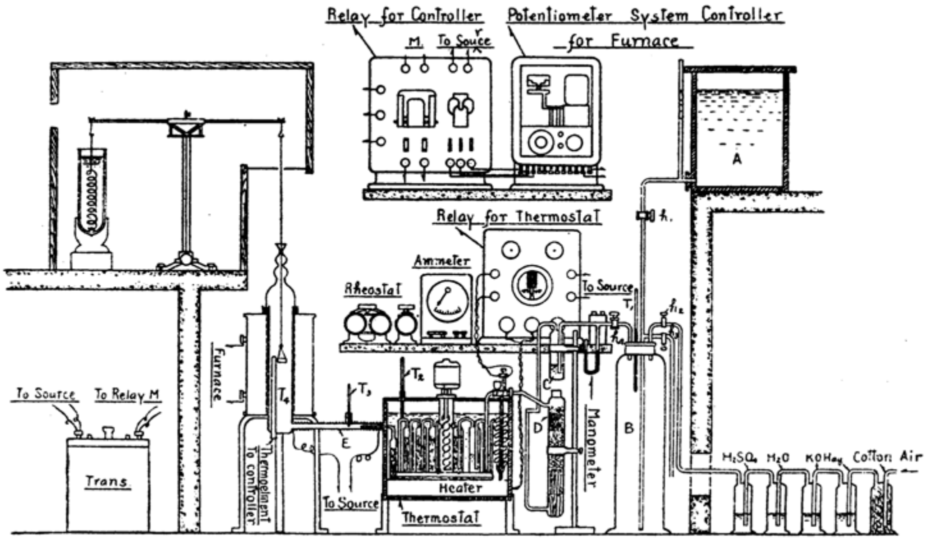

Fig. 1.

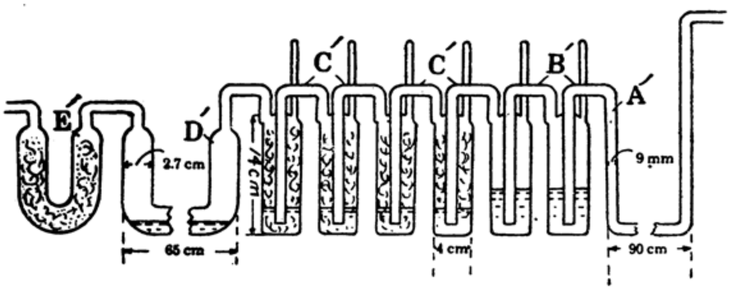

Fig. 2.

is the saturated vapour pressure at 40°C., g weight of the water caught by calcium chloride tubes connected to the furnace, P atmospheric pressure, P' pressure of the introduced air, p saturated vapour pressure at T, T absolute temperature of B in Fig. 1, V volume of the introduced air, and M 18.

Table 1 shows the calculated results, from which it was confirmed that the air current had the saturated vapour pressure at the desired temperature. The experimental results of the dehydration and hydration of Odo acid clay between room temperature and 150°C. are shown in Tables 2–4 and Fig. 3, and those of the dehydration up to 800°C., in Tables 5–7 and Fig. 4.

Table 2.

Dehydration (T_2 = 25°C. 23.8 mm. Hg)			Hydration (T_2 = 25°C. 23.8 mm. Hg)		
T_4 Heating temp. (°C.)	Heating time (hr.)	Weight decrease (%)	T_4 Heating temp. (°C.)	Heating time (hr.)	Weight decrease (%)
35	50	0.80(×)	120	35	11.31
50	30	3.90	100	35	10.25
60	15	6.14	80	40	8.78
80	25	8.46	60	35	6.50
100	15	10.04	50	50	4.39
120	15	11.22	35	60	0.22
150	10	11.40			

Table 3.

Dehydration (T_2 = 40°C. 55.3 mm. Hg)			Hydration (T_2 = 40°C. 55.3 mm. Hg)		
T_4 Heating temp. (°C.)	Heating time (hr.)	Weight decrease (%)	T_4 Heating temp. (°C.)	Heating time (hr.)	Weight decrease (%)
50	50	0.72	120	35	10.68
,,	50	0.14(×)	,,	35	10.51
60	20	4.04	100	35	9.35
,,	30	3.96	,,	34	9.31
80	35	7.16	80	40	7.59
,,	35	6.96	,,	40	7.61
100	35	9.30	60	35	4.76
,,	25	9.16	,,	35	4.76
120	35	10.60	50	45	1.01
,,	35	10.34	,,	45	1.03
150	38	10.84			
,,	40	10.96			

Table 4.

Dehydration ($T_2 = 60°C.$ 149.4 mm. Hg)			Hydration ($T_2 = 60°C.$ 149.4 mm. Hg)		
T_4 Heating temp. (°C.)	Heating time (hr.)	Weight decrease (%)	T_4 Heating temp. (°C.)	Heating time (hr.)	Weight decrease (%)
70	25	1.03(×)	120	70	9.20
,,	35	0.76(×)	,,	90	9.22
80	60	3.24	100	40	9.27
,,	40	3.60	,,	50	7.28
100	20	6.78	80	65	3.62
,,	20	6.52	,,	85	3.81
120	20	8.90	70	70	0.44(×)
,,	40	9.20	,,	90	0.28(×)
150	25	10.11			
,,	25	10.34			

(×) Weight increase in %.

Table 5.

Dehydration (1.5 mm. Hg; Drying bottles ($CaCl_2$, H_2SO_4) instead of thermostat)					
T_4 Heating temp. (°C.)	Heating time (hr.)	Weight decrease (%)	T_4 Heating temp. (°C.)	Heating time (hr.)	Weight decrease (%)
35	30	4.50	150	20	11.68
			200	20	11.95
50	20	6.82	300	20	12.18
,,	24	7.10	,,	20	12.32
60	25	8.52	400	20	12.75
80	32	9.70	500	25	14.15
,,	30	9.59	,,	25	14.05
100	30	10.75	600	20	15.60
120	25	11.54	800	10	15.84
,,	25	11.46	,,	10	15.76

Table 6.

Dehydration ($T_2 = 25°C.$ 23.8 mm. Hg)					
T_4 Heating temp. (°C.)	Heating time (hr.)	Weight decrease (%)	T_4 Heating temp. (°C.)	Heating time (hr.)	Weight decrease (%)
50	20	3.99	400	15	12.66
100	25	10.12	500	15	13.70
150	15	11.37	600	15	15.24
200	15	11.70	800	15	15.58
300	15	12.24			

Table 7.

Dehydration $\left(\begin{matrix} T_2 = 40°C. \\ 55.3 \text{ mm. Hg} \end{matrix}\right)$					
T_4 Heating temp. (°C.)	Heating time (hr.)	Weight decrease (%)	T_4 Heating temp. (°C.)	Heating time (hr.)	Weight decrease (%)
100	20	9.28	400	30	12.39
,,	15	9.31	,,	30	12.51
,,	20	9.11			
150	30	10.78	500	25	13.33
,,	20	10.97	,,	30	13.59
			,,	25	13.23
200	40	11.21	600	25	14.65
,,	30	11.39	,,	25	14.83
,,	35	11.36			
300	45	11.84	800	20	15.36
,,	40	12.03	,,	15	15.34
,,	40	11.90	,,	20	15.45

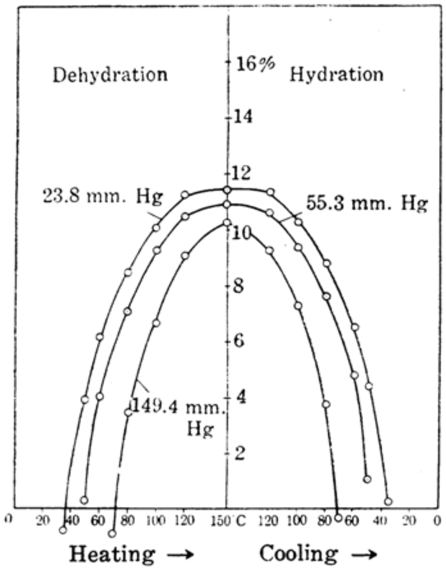

Fig. 3.

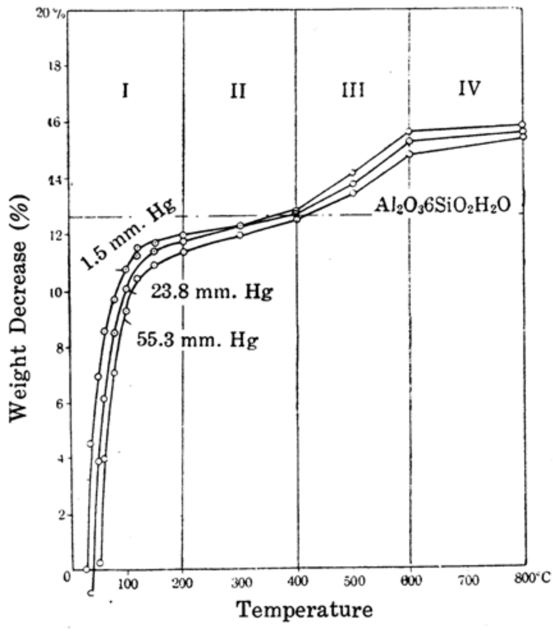

Fig. 4.

From the above investigations, it seems that the following conclusions must be derived : (1) There could not be observed the existence of a polyhydrate. (2) The water evolved on heating up to 300°C. is the adsorbed water and that evolved above 300°C. is the combined water. (3) The amount of the combined water nearly corresponds to one molecule of water, assuming that Odo acid clay has the composition $Al_2O_3 \cdot 6SiO_2$ in the anhydrous state.

In conclusion, the author wishes to express his sincere thanks to Prof. M. Matsui for his invaluable advices and to Prof. N. Sasaki for his kind guidance given throughout this work.

(November 30th, 1933)

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