The Equilibrium in the System Consisting of Potassium Sulphate, Potassium Nitrate and Water at 25·0°.

By

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H. Euler[1] determined the composition of solutions saturated both with potassium sulphate and potassium nitrate at 15°, 20° and 25°. A. Massink[2] studied the equilibrium of this ternary system at 35°, and found that only KNO_3 and K_2SO_4 exist as solid phases.

Now, the equilibrium of this system at 25° was studied, as knowledge of it became necessary in the course of another investigation, and the results are given in this article.

The two potassium salts were of the Pharm. Jp. They were thrice recrystallised. A mixture of the two salts in a certain proportion was put in an Erlenmeyer flask of about 30 cc. capacity, some ordinary distilled water was added, and the flask, well stoppered, was made to rotate in a thermostat at 25° for a few days. When equilibrium was attained, the solution was drawn off with a pipette through purified cotton, and the residue was centrifuged promptly to remove as much as possible of the mother liquor. They were analysed separately.

The potassium was determined as potassium sulphate. The sulphate radical was determined as barium sulphate, after the removal of nitric acid. The nitrate radical and water were found by calculation.

The experimental results are represented in Table 1, the composition of solutions and of residues mixed with some mother liquor being given in gram percentages.

1 Zs. physik. Chem., **49**, 313 (1904).

2 *Ibid.*, **92**, 353 (1918).

Table 1.

No.	Solution			Residue		
	Potassium sulphate	Potassium nitrate	Water	Potassium sulphate	Potassium nitrate	Water
1	10.70	0.00	89.30	100.00	0.00	0.00
2	8.12	5.84	86.04	91.18	1.83	6.99
3	5.89	14.52	79.59	97.47	0.47	2.06
4	3.98	25.33	70.69	81.12	13.05	5.83
5	3.84	25.49	70.67	12.43	85.07	2.50
6	3.99	25.30	70.71	4.28	90.22	5.50
7	4.00	25.38	70.62	1.43	94.05	4.52
8	3.00	25.91	71.09	0.06	92.54	7.40
9	1.64	27.33	71.03	0.00	97.94	2.06
10	0.00	27.64	72.36	0.00	100.00	0.00

In Table 2, some numerical data now found are compared with those given in the literature.

Table 2.

Grams salts in 100 grams water				Author
Saturated with potass. sulphate	Saturated with potass. nitrate	Saturated with both salts		
		K_2SO_4	KNO_3	
12.04	37.3	—	—	Average of several authors[1]
—	38.448	—	—	Armstrong and Eyre.[1]
—	—	3.94	25.49	Euler.[2]
11.98	38.19	3.95	25.37	The author.

When the composition of the solutions and of the residues is recalculated to be represented by the following formura:

$$100mH_2O.xK_2SO_4.\ (100-x)\ (KNO_3)_2$$

Table 3 is obtained.

1 Seidell's Solubilities of Inorganic and Organic Compounds. 2d. ed. (1919).

2 *Loc. cit.*

Table 3.

No.	Solution		Residue		Solid phase
	x	*m*	*x*	*m*	
1	100.00	80.72	100.00	0.00	K_2SO_4
2	61.76	63.28	98.34	0.71	„
3	32.00	41.84	99.58	0.20	„
4	15.42	26.49	87.82	0.61	$K_2SO_4+KNO_3$
5	14.89	26.49	14.50	0.28	„
6	15.47	26.52	5.22	0.65	„
7	15.45	26.41	1.74	0.53	„
8	11.85	27.15	0.07	0.90	KNO_3
9	6.49	27.28	0.00	0.24	„
10	0.00	29.39	0.00	0.00	„

Fig. 1 is drawn from the data in Table 3. As Massink[1] found at 35°, the solid phases existing at 25° are K_2SO_4 and KNO_3 only.

1 *Loc. cit.*

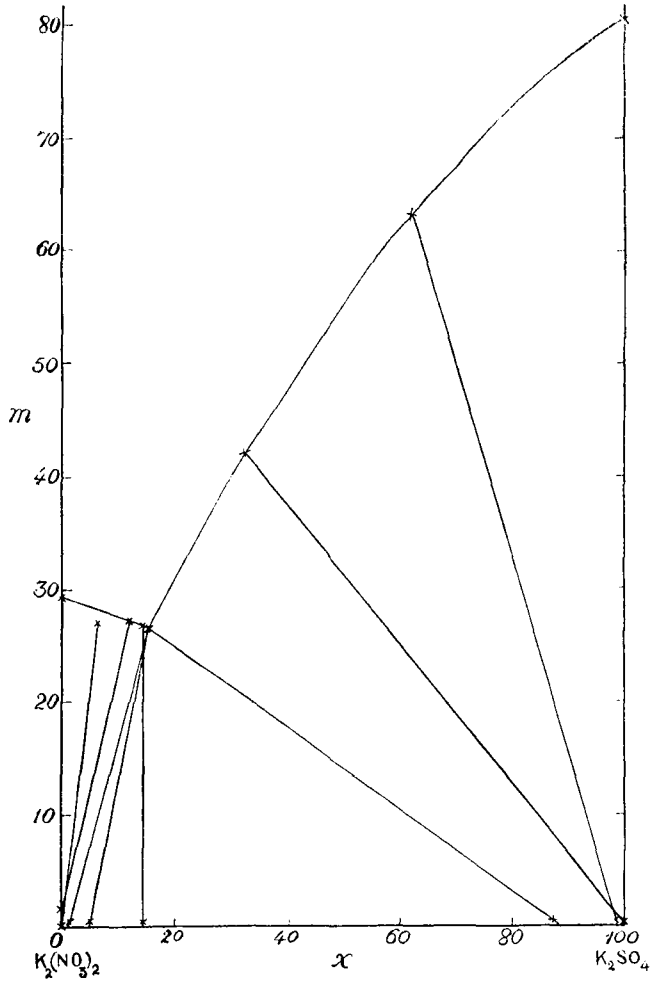

Fig. 1.