

On the Solubility of Lead Acetate in Water.

By

Yukichi Osaka and Reijiro Hara.

(Received January 15, 1917.)

When lead acetate is dissolved in water, the solution is not clear owing to its hydrolysis, and any systematic determination of its solubility is not to be found in literature. The Landolt-Börnstein's *Tabellen* gives no data for it, in A. Seidelle's *Solubilities of Inorganic and Organic Substances*¹ a single datum for 25° is given, as 50 grams in 100 grams water, while in the *Tables annuelles de Constantes et Données numériques de Chimie, de Physique et de Technologie*² it is reported as 72.5 instead of 50.

Led by these facts, we have undertaken to study the solubility of lead acetate in water. We have not determined its actual solubility, but estimated its solubility in pure water if no hydrolysis had taken place, by extrapolation from its solubilities in dilute solution of acetic acid.

Commercially pure lead acetate was twice recrystallised, and the final product was found to be pure to 99.96 per cent. by analytical determination of its lead. As solvents, 0.10, 0.05, and 0.025 normal acetic acid were used. The experiments were carried out in the following way.

The solvent was put in a small Erlenmeyer flask which was well steamed, an excess of lead acetate was added and the well-stoppered flask was made to rotate in a thermostat for two days and nights, then it was allowed to stand still. When the residue had subsided, a portion of the solution was transferred to a weighed bottle by a warmed pipette with a tube filled with some refined cotton wool, attached to its end, and the bottle was weighed again. The sample taken out was diluted to 100 cc., and 20 cc. of the diluted solution

¹ p. 162.

² 2, 462: from Hyg. Lab. U. S. Publ. Health and Mar.-Hosp. Serv., Bull., 67, 91.

was used for a single analysis. In a few cases the original solutions were directly subjected to analysis. The lead was determined as the sulphate in the usual way.

The method of calculation may be best illustrated by an example.

The original solution taken for analysis in grams	1.1083	
Lead in it	0.2452	
Lead acetate $((C_2H_3O_2)_2Pb)$ corresponding to it	0.3849	
Water of crystallisation originally contained in the acetate dissolved	0.0644	
Solvent in the sample taken	0.6590	
Acetic acid in it	0.0040	
Water in it	0.6550	
Total water in the sample	0.7194	
Percentage composition of the sample	{ lead acetate	34.73
	{ water	64.91
	{ acetic acid	0.36
Percentage composition, excluding acetic acid	{ lead acetate	34.86
	{ water	65.14
Lead acetate in 100 grams water	53.52	

The results calculated in this way are given in the following table :

Normality of acetic acid used as solvent.	No.	Sample analysed.	Lead found.	Percentage composition of the sample.			Lead acetate in 100 grms of water.
				$(C_2H_3O_2)_2Pb$	$C_2H_4O_2$	H_2O	
Temperature : 25.0°							
0.10	1	1.1083	0.2452	34.73	64.91	0.36	53.52
	2	0.5272	0.1162	34.69	64.95	0.36	53.49
	3	0.8241	0.1823	34.73	64.92	0.35	53.48
	4	1.1022	0.2440	34.75	64.90	0.35	53.54
							53.51
0.05	1	0.6555	0.1462	35.01	64.81	0.18	54.02
	2	0.6755	0.1506	34.98	64.83	0.19	53.97
	3	0.7124	0.1585	34.92	64.88	0.20	53.90
	4	0.7579	0.1686	34.93	64.90	0.17	53.81
							53.92
0.025	1	0.3884	0.0869	35.11	64.82	0.070	54.17
	2	0.3884	0.0809	35.11	64.82	0.070	54.17
							54.17

Normality of acetic acid used as solvent.	No.	Sample analysed	Lead found.	Percentage composition of the sample.			Lead acetate in 100 gm. of water.
				$(C_2H_3O_2)_2Pb$	$C_2H_4O_2$	H_2O	
Temperature : 35·0°							
0·10	1	0·8921	0·2635	46·34	53·36	0·28	86·88
	2	0·8921	0·2632	46·32	53·40	0·28	86·73
	3	0·5246	0·1549	46·36	53·36	0·29	86·90
	4	0·5246	0·1550	46·38	53·34	0·29	86·95
							86·87
0·05	1	0·5692	0·1689	46·56	53·30	0·14	87·34
	2	0·5692	0·1688	46·54	53·32	0·14	87·24
	3	0·8108	0·2405	46·56	53·31	0·14	87·34
	4	0·8108	0·2406	46·58	53·28	0·14	87·43
							87·34
0·025	1	0·4665	0·1386	46·65	53·29	0·060	87·53
	2	0·4934	0·1467	46·66	53·28	0·060	87·56
							87·55
Temperature : 45·0°							
0·110	1	0·6409	0·2467	60·43	39·40	0·17	153·39
	2	0·6409	0·2466	60·40	39·43	0·17	153·18
	3	0·8235	0·3170	60·43	39·39	0·18	153·40
	4	0·8235	0·3170	60·43	39·39	0·18	153·40
							153·34
0·05	1	0·6263	0·2415	60·56	39·36	0·080	153·87
	2	0·6263	0·2416	60·55	39·37	0·080	153·75
	3	0·9388	0·3620	60·54	39·38	0·085	153·71
	4	0·9388	0·3620	60·54	39·38	0·085	153·71
							153·76
0·025	1	0·5598	0·2162	60·61	39·35	0·04	154·01
	2	0·5772	0·2221	60·61	39·34	0·05	154·05
							154·03

If we represent graphically the solubility of lead acetate as a function of the normalities of acetic acid, it is found that it is linear, and we have extrapolated the solubility of lead acetate in pure water analytically, by the method of the least square, and has obtained the following results :

Temperature.	Solubility of lead acetate in 100 grams water.
25·0°	54·38
35·0	87·77
45·0	154·25

These are naturally the would-be solubility when no hydrolysis would take place.
