

SOME SOLUBILITY MEASUREMENTS

BY STEWART J. LLOYD

The solubility determinations recorded in the following note were made incidentally in the course of other work and are given here to prevent unnecessary labor on the part of those who may need such data. Trustworthy solubility measurements are none too common, especially those in non-aqueous solvents, as has recently been remarked by Hildebrand.¹ Interest in what, for lack of a better name, may be called the theory of solubility, has recently revived also,² and the more data made accessible to those working on the subject the more rapidly will essential relationships be established.

These substances whose solubilities in various solvents were examined comprise sulphur dioxide, aluminium chloride, barium chloride, and benzoic acid.

The sulphur dioxide determinations were made by bubbling the gas through the solvent in question until equilibrium was reached. It was found that a steady quiet stream of SO₂ suitable for this work could be made most easily by running concentrated sulphuric acid and a saturated aqueous solution of sodium bisulphite into a Wolff bottle from separate dropping funnels. The Wolff bottle may be freed from spent solution without admitting air to it by inserting in the third hole a glass tube reaching to the bottom of the bottle and bent over at right angles outside the bottle. Closing the stop-cock in the delivery tube forces out the liquid without trouble. The sulphur dioxide was dried by passing it through two sulphuric acid wash bottles, and a tube of phosphorus pentoxide.

The solvent in each case was contained in a long graduated

¹ Jour. Am. Chem. Soc., **39**, 2301 (1917).

² Hildebrand: Jour. Am. Chem. Soc., **38**, 1452 (1916); Tyrer: Jour. Phys. Chem., **16**, 68 (1912); Langmuir: Jour. Am. Chem. Soc., **39**, 1848 (1917); Harkins: Ibid., **39**, 541 (1917).

tube of small diameter immersed in a thermostat. When saturation was attained the volume of liquid in the tube was read, the contents of the latter rapidly immersed in a large volume of water, and thoroughly mixed with it. Enough solvent was usually taken to give a final volume of about 5 cc. The sulphur dioxide was then titrated with iodine and the solubility expressed in grams per liter of solution.

In some cases saturation is not reached as rapidly as might be expected. Entire exclusion of air is very necessary, and much time is saved by first passing the gas through a tube of the solvent maintained at a much higher temperature than that of the thermostat. In every case saturation was reached from both sides, from a higher and a lower temperature.

The organic liquids employed were distilled, dried over calcium chloride and redistilled just before using. The barometer reading remained between 756 and 760 mm throughout the measurements.

Sulphur dioxide; grams per liter

Temp.	Benzol	Nitrobenzol	Toluol	<i>o</i> -Nitrotoluol	Acetic anhydride
—5	—	—	—	—	196
0	—	—	—	—	148
5	—	—	—	—	136
10	—	—	—	—	122
15	—	311.4	—	290.8	114
20	—	267.4	217.5	236.0	106
25	—	227.9	170.4	192.2	99
30	127.5	190.0	124.4	160.7	90
40	82.9	132.0	93.6	118.5	—
50	60.3	98.7	77.2	87.0	—
60	34.0	78.6	54.7	68.8	—

The specific gravity of the saturated acetic anhydride solution at zero is 1.22.

The solubility of freshly prepared anhydrous aluminium chloride in pure chloroform and carbon tetrachloride was measured in the course of some work on Friedel and Craft's

reaction. The chloride was prepared by passing dry hydrochloric acid gas over heated aluminium strips, and was distilled directly into the tube where its solubility was to be measured. Volhard's method was used for analysis.

Aluminium chloride; grams per liter

Temp.	Carbon tetrachloride	Chloroform
-15	—	0.65
0	—	1.00
4	0.74	—
14	0.22	—
20	0.15	—
25	—	0.72
34	0.06	—

Some work on the partition coefficients of radium chloride rendered necessary a determination of the solubility of anhydrous barium chloride in nitrobenzol. Mohr's method of analysis was employed.

Barium chloride; grams per liter

Temp.	Nitrobenzol
20	0.167
50	0.33
100	0.40

A study of the electrolytic decomposition of benzoic acid in ethyl acetate involved the determination of its solubility in that solvent.

Benzoic acid; grams per liter

Temp.	Ethyl acetate
-6.5	8.0
21.5	37.7
75	95.7

University of Alabama
Dept. of Chemistry
and Metallurgy