that the deviations from the calculated value are in entire accord with predictions made upon the basis of the internal pressures and polarities of the substances involved.

BERKELEY, CALIFORNIA.

[CONTRIBUTION FROM THE CHEMICAL LABORATORY OF THE UNIVERSITY OF CALIFORNIA.]

SOLUBILITIES OF ANTHRACENE, ANTHRAQUINONE, PARA-BROMOBENZENE, PHENANTHRENE AND IODINE IN VARIOUS SOLVENTS.

BY JOEL H. HILDEBRAND, E. T. ELLEFSON AND C. W. BEEBE.

Received August 13, 1917.

In working upon the theory of solubility one is struck by the fact that nearly all of the determinations of solubility to be found in the literature have been made with aqueous solutions, or at least with solutions in other more or less polar solvents like alcohol. Since solutions of this type introduce complications due to association and ionization, it is desirable to have solubility data for relatively non-polar substances, whose solutions are much simpler. The following determinations were made with this end in view, the solutes chosen being those whose heats of fusion are known, for the purpose described in the following paper:

An accuracy of 1% was considered quite sufficient for our purpose, and the various factors involved were controlled to the corresponding degree. The solutes used were from a commercial source and in most cases were not further purified. The solvents were dried and carefully distilled; the portion used distilled between narrow limits.

The solid and liquid, in each case, was sealed in a tube about 2 cm. in diameter and 8 cm. long, provided with a stem several centimeters long bent at an angle with the axis of the tube. These tubes were rotated in a thermostat at 25° for one or more days, until equilibrium was attained. Except in the case of the iodine solutions the analysis was made by evaporating the solvent from a weighed portion of the solution and weighing the solid residue of solute. The vessels in which this evaporation was carried out were flat-bottomed bulbs of about 20 cc. capacity, provided with two open tubes, the bore of one of which was large enough to admit the stem of the tubes described above, which we will call the shaking tubes. The transfer of the saturated solution from these tubes to the evaporating bulbs was effected as follows: The tube was detached from the shaking device in the thermostat and held so that only the stem projected above the water in the thermostat. This stem was then opened with a file and inserted into one of the openings of the evaporating tube. A portion of the saturated solution was poured into the latter which was quickly stoppered for weighing. The angle which the stem made with

the tube allowed the solution to be poured out without disturbing the solid in the lower end.

The solution having been weighed, the solvent was evaporated on a water bath, and the solid residue weighed. The iodine in solution was determined by titration with sodium thiosulfate instead of by evaporation.

The results are summarized in the following table:

SOLUBILITIES AT 25°.

In g. per 100 g. of Solute.

	Anthracene.[1]	Anthra-quinone.	*p*-Bromo-benzene.	Phenanthrene.	Iodine.
Alcohol	0.326	0.439	10.3	4.91	....
	0.330	0.430	10.4	4.90	....
		0.436			
	0.328	0.441	10.35	4.91	
		0.437			
Benzene	1.88	...	83.8	58.7	....
	1.87	...	83.8	60.2	....
	1.83	...			
	1.84		83.8	59.5	
	1.86				
Carbon disulfide	2.55	...	89.9	80.3	....
	2.61	...	90.0	80.2	....
	2.58		90.0	80.3	
Carbon tetrachloride	0.733	...	36.3	26.0	....
	0.731	...	36.8	26.5	....
	0.732		36.6	26.3	
Ether	1.44	0.098	71.3	43.0	....
	1.39	0.112	71.2	42.8	....
		0.101			
	1.42	0.103	71.3	42.9	
		0.104			
Hexane	0.38	...	26.0	9.14	1.30
	0.36	...	25.8	9.16	1.34
	0.37		25.9	9.15	1.32

[1] Versmann, *Jahresber. Chem.*, **1874**, 423, gives the following solubilities of anthracene at 15°: in ether, 1.175; in carbon disulfide, 1.478; in benzene, 1.661. Tyrer, *J. Chem. Soc.*, **97**, 1778 (1910), gives its solubility in benzene at intervals of 10° including the following: at 20°, 1.43; at 30°, 2.03. By graphic interpolation from his data the value 1.70 is obtained for 25°.

BERKELEY, CALIFORNIA.