

2. The structure of 3-nitro-4-hydroxy-5-iodo-benzoic acid has been definitely established.

3. The preparation of 3-nitro-4-hydroxy-5-iodo-phenyl carbinol is described.

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[CONTRIBUTION FROM THE DEPARTMENT OF CHEMISTRY, WASHINGTON UNIVERSITY.]  
**THE SOLUBILITY OF PHTHALIC ACID IN WATER AND SODIUM  
SULFATE SOLUTIONS.**

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The purpose in undertaking this work was to determine the solubility of phthalic acid in water and in sodium sulfate solutions of different concentrations at different temperatures, because the literature records but few facts concerning the solubility of phthalic acid. Vaubel<sup>1</sup> gives the solubility of phthalic acid in water at 14° as 0.54 g. per 100 g. of solution. Graebe<sup>2</sup> gives its solubility at 99° as 18 g. per 100 g. of solution. In the preparation of phthalic acid it is often set free by treating its sodium salt with sulfuric acid and it was for this reason that its solubility was determined in sodium sulfate solutions. These solutions were made up to be 10 and 15% by weight.

The purity of the phthalic acid used was from 99.95%, with 0.02% ash, to 100%. No attempt was made to purify the acid further. It was supplied by the Monsanto Chemical Works. Pure anhydrous sodium sulfate was used. All solutions were prepared with water from which the carbon dioxide had been removed.

#### Experimental.

The method followed was somewhat similar to that of Walton and Judd.<sup>3</sup> The acid was put into 175 × 55 mm. heavy-wall glass tubes with the water or sodium sulfate solutions and agitated until equilibrium was attained. The tubes were immersed in a constant temperature water-bath which was controlled by a mercury-column regulator. At 25° a standardized thermometer reading from the -10° to +32° and graduated in 0.02° was used. For the higher temperatures a thermometer reading from -10° to +100° and graduated in 0.1° was used. The bath was kept constant to ±0.02°.

When equilibrium was reached the undissolved acid was allowed to settle and the saturated solution was drawn through an asbestos filter into a weighing tube (Fig. 1). Above 55° the solution was blown over into the weighing tube to prevent vaporization under the reduced pressure. The delivery tube was steam-jacketed to prevent crystallization of the acid in the tube (Fig. 2).

<sup>1</sup> Vaubel, *J. prakt. Chem.*, (2) **52**, 72 (1895); **59**, 30 (1899).

<sup>2</sup> Graebe, *Ann.*, **238**, 321 (1887).

<sup>3</sup> Walton and Judd, *THIS JOURNAL*, **33**, 1036 (1911).

The weighing tubes containing the solutions were allowed ample time to come to room temperature before being weighed. The saturated solution was then carefully washed into beakers and titrated against standard sodium hydroxide solution, using phenolphthalein as an indicator.

The necessary time for equilibrium was arrived at by taking samples every hour. A number of determinations showed that 6 hours at least was required for equilibrium to be established between the solid and its solutions. The results in each case recorded be-

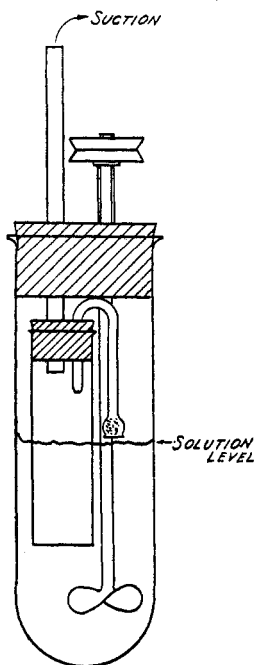


Fig. 1.

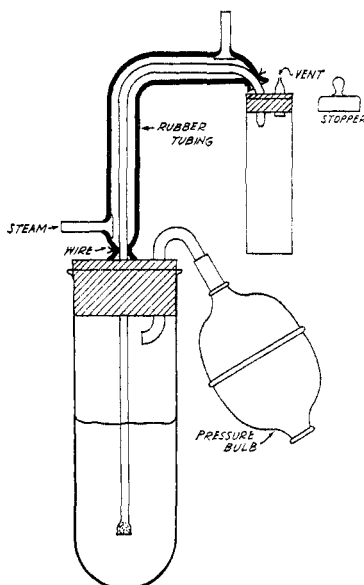


Fig. 2.

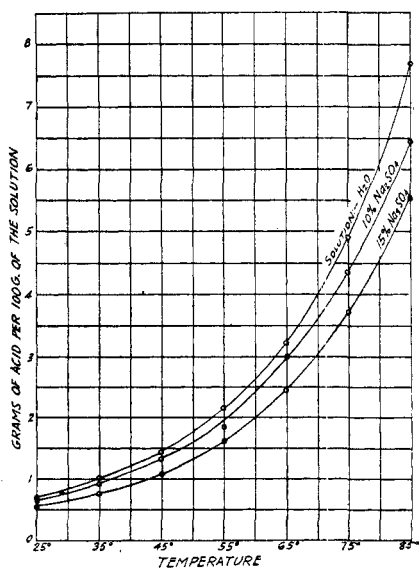


Fig. 3.

low are the average of several obtained by approaching the equilibrium both from undersaturation and from supersaturation. Considerable difficulty was experienced in getting the sodium sulfate solutions to yield concordant results.

It will be noticed that the solubility of the phthalic acid decreases with increased concentration of the sodium sulfate. More marked divergence of the solubility is noticed between the 10% and the 15% salt solutions than between the water and the 10% solutions. There is also great increase in solubility of the acid with rise in temperature. These facts can be readily seen by referring to Fig. 3.

## GRAMS OF PHTHALIC ACID PER 100 G. OF THE SATURATED SOLUTION.

Temp. ° C.	Water.	10% Na <sub>2</sub> SO <sub>4</sub> .	15% Na <sub>2</sub> SO <sub>4</sub> .
25	0.7014	0.6440	0.5272
35	1.0125	0.9338	0.7575
45	1.446	1.341	1.080
55	2.168	1.858	1.639
65	3.246	3.018	2.455
75	4.926	4.373	3.748
85	7.687	6.461	5.533

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## NEW BOOKS.

**Applied Colloid Chemistry, General Theory.** By WILDER D. BANCROFT, Professor of Physical Chemistry at Cornell University. International Chemical Series, H. P. Talbot, Ph.D., Consulting Editor. McGraw-Hill Book Company, Inc., New York, 370 Seventh Avenue. London. 6 and 8 Bouverie Street, E. C., 4, 1921. VIII + 345 pp., 14 × 21 cm. Price, \$3.

This book is just like Bancroft. It is not merely a walking encyclopedia of matters relevant to colloids. It is more. It is a romping enthusiast's collection of about every detail of the universe which, according to "Sir Wilder's" quick acting imagination, could be related, even temporarily, to the subject. Therefore, we are not surprised to read that a knowledge of colloid chemistry is essential to anybody who really wishes to understand about bricks, pharmacy, candles, leather, crayons, roads, coke, zinc, beer, butter, comets, wireless, physiology, and actually 47 other equally closely related subjects. But why did he omit farming and the movies? Even the starry heavens have colloidal properties, and psychology is a pure colloid subject. Colloids ought to be of interest to physicists, too, which he overlooked.

The title, "Applied Colloid Chemistry," in this case does not mean so much a study of technical processes or manufactures based on colloids, as it means all the known, miscellaneous recorded phenomena of Nature to which some part of the principles found in colloid reactions might apply.

Over a third of the book is on adsorption. About every separate item in the literature of this subject is represented by a word or two, so that the reader is led from fact to fancy at bewildering speed. He may fail to anticipate the frequent warnings, such as "the whole matter is up in the air at present," "the experiment should be repeated," "it is not clear why this should be so," "this cannot be true, because \* \* \*," "this seems improbable," "this can hardly be so," "this does not follow at all." In other words, he has left exposed a lot of scientific work still to be done.

He writes just as interestingly, rapidly, and suggestively as he talks. Who but he would have seen, under Adsorption, the possibility of using