

## FOWLER'S SOLUTION.\*

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In looking over the reports of the various Health Boards, we find that there is hardly any pharmaceutical preparation which has oftener been found to be below standard than Fowler's Solution.

It is generally accepted that in Fowler's Solution frequently the arsenic in the arsenous state is oxidized to arsenic in the arsenic state, and that the discrepancies found by the various Health Boards are chiefly due to such an oxidation, inasmuch as, according to the U. S. P assay process, only the arsenic in the arsenous state is estimated.

In 1908, A. B. Lyons<sup>1</sup> reported on a series of experiments which were carried out in order to find at what rate this oxidation takes place. Lyons arrives at the conclusion that products which are slightly acid are not so prone to oxidation as those which are alkaline and especially those which contain alkali carbonates or alkali hydroxides.

Anticipating complaints in regard to Fowler's Solution, we thought it advisable to take up this subject again in order to find at what rate the oxidation of the arsenite takes place. This was done by estimating both the arsenous acid and the total arsenic.

A sample of Fowler's Solution was prepared strictly according to the U. S. P. This sample assayed 1.016 percent  $As_2O_3$  at the time of manufacture. One quart of the solution was kept in an amber cork-stoppered bottle on a shelf under ordinary conditions, while another part of the sample was filled into one-ounce flint glass cork-stoppered bottles. The samples were assayed at intervals of one month by the following process:

The arsenous acid was estimated in the regular way with iodine. In order to save material we tried to utilize the final solution, which, after oxidation with iodine, contained all the arsenic in the arsenic state by applying to it Lukenow's method.<sup>2</sup> This was done by adding to the solution 3 Gm. of potassium iodide and 20 Cc. of concentrated hydrochloric acid, allowing the mixture to stand for 10 to 15 minutes and then titrating the separated iodine with thiosulphate in the

Month.	Large bottle.		Month.	Small bottle.	
	Direct.	Total.		Direct.	Total.
March.....	1.016%	1.023%	March.....	...	...
April.....	1.010%	1.010%	April.....	1.016%	1.019%
May.....	1.011%	1.018%	May.....	1.014%	1.021%
June.....	1.01%	1.015%	June.....	1.020%	1.015%
July.....	0.994%	1.030%	July.....	0.985%	1.021%
August.....	0.992%	1.024%	August.....	0.984%	1.025%
September.....	0.990%	1.032%	September.....	0.99%	1.02%
October.....	0.992%	1.038%	October.....	1.03%	1.044%
November.....	0.990%	1.04%	November.....	0.985%	1.04%
December.....	0.987%	1.04%	December.....	1.025%	1.04%
May.....	0.984%	...			
June.....	0.992%	1.04%	June.....	1.03%	1.04%

\* Read before Scientific Section, A. Ph. A., Atlantic City meeting, 1916.

<sup>1</sup> Proceedings A. Ph. A., 1908, p. 901.<sup>2</sup> *Apoth. Zeit.*, 1910, p. 122.

Assay at date of manufacture $As_2O_3$ .	Reassayed after months.	$As_2O_3$ .	Total arsenic. A. O. A. C. method.	Total arsenic. Chapin's modifications.
1.05	30	1.02	1.07	1.04
1.02	29	0.992	1.03	1.07
1.07	28	1.099	1.15	1.14
1.09	26	1.03	1.11	1.13
1.04	26	0.997	1.08	1.06
1.02	25	0.92	1.02	1.03
1.04	24	0.953	1.02	0.987
1.05	22	1.00	1.05	1.05
1.05	22	1.00	1.11	1.09
1.04	21	0.99	1.05	1.11
1.02	19	1.03	1.04	1.08
1.03	18	1.04	1.11	1.09
1.05	17	1.05	1.1	1.06
1.04	16	1.03	1.09	1.09
1.03	16	0.94	1.0	1.0
1.01	14	0.96	1.05	1.055
1.04	12	0.95	1.08	1.03
1.04	12	1.02	1.07	1.04
1.03	11	0.97	1.03	1.03
1.02	9	1.02	1.09	1.09
1.01	8	1.05	1.09	..
1.03	6	1.0	1.06	1.02
1.04	5	1.02	1.05	1.07
1.0	4	0.93	0.97	0.95
1.02	3	1.02	1.06	1.09
1.03	1	1.01	1.02	1.03

regular way. For reasons, so far unknown, this method did not work properly. The end point, when using starch solution as indicator, was very uncertain and a distinct blue color could not be obtained.

We therefore applied a method which is recommended for estimating the total arsenic in London purple. This method, a modification of Heywood's method,<sup>1</sup> is published in a slightly modified form in *Bulletin 107, Official and Provisional Methods of Analysis of the Association of Official Agricultural Chemists*. We have modified this method in the following way: 5 Gm. (exactly weighed) of Fowler Solution were mixed with 20 Cc. of concentrated hydrochloric acid; 45 Cc. of water and 2 to 3 Gm. of potassium iodide and the mixture were heated on a water bath for about one-half hour. After cooling, the iodine which had separated was discharged by sodium thiosulphate solution, the contents of the flask were then poured onto an excess of sodium bicarbonate and after well diluting with water (about 600 Cc. liquid in all) the arsenous acid was titrated in the usual way. Quite recently, Chapin<sup>2</sup> pointed out that when eliminating the iodine, formed in the reduction process, by thiosulphate solution no distinct color change in the titration of the arsenous acid could be obtained. He therefore recommends replacing thiosulphate solution by a weak (0.5 percent) sodium sulphite solution. We have applied this method also but have found that nothing is gained by this modification.

The experiments were made in duplicate and from the results referred to be-

<sup>1</sup> *Journ. Am. Chem. Soc.*, 1900, p. 800.

<sup>2</sup> *Ibid.*, 1916, p. 625.

low it can be seen that the degree of accuracy is not all that could be desired. In addition to the above named sample which was especially prepared for this examination we also examined samples of Fowler's Solution from our Control Department which were at the time of re-examination from a few weeks to three years old. The results obtained were as follows:

Judging from the above results, it is evident that the arsenous acid in Fowler's Solution is oxidized only to a very slight degree when the solution has been properly prepared and has been kept under ordinary conditions. It was very gratifying to note that the solution which was kept in a large bottle and from which, each month a certain amount was taken out for examination (thus giving about the same conditions under which the stock bottle of Fowler's Solution is kept in a drug store, that is, increasing the amount of air gradually), did not deteriorate as rapidly as might be expected. In regard to the color of the various solutions after being kept for various lengths of time, it might be stated that the color varied from a red to a very pale pink. In other words, in some of the solutions the color of the tincture of lavender had been destroyed completely. That, however, the decoloration of the tincture of lavender is in no way indicative of an oxidation of the arsenous acid is evident by the above results.

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#### REFINING OILS WITH PERMANGANATE OF POTASH.

Since pale-colored oils are considered of better quality than dark or muddy ones, a special process of refining is employed for olive, linseed, poppy, fish, and other oils. According to *Por Esos Mundos* (Madrid) this is as follows: A kilogram of permanganate of potash (2.2 lbs.) in the form of small crystals is dissolved in 10 liters of water. This solution, of a deep purple color, is mixed gradually with 30 kilos of the oil to be refined and stirred repeatedly as smoothly as possible during a period of two days. At the end of this time there are added 20 liters of water and 5 liters of commercial hydrochloric acid at 20 to 22 degrees Baumé and it is stirred again energetically. Several days later the acidulated water is carefully decanted. To remove all trace of the acid it is treated with clear, warm water and as a final operation is passed through a charcoal filter.

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#### FORMULA FOR AMBRINE.

T. Whitmore Peck of Birmingham, England, contributes the following to the *Pharmaceutical Journal* as the formula for Ambrine:

Resorcinol.....	1 percent
Oil Eucalyptus.....	2 percent
Olive Oil.....	5 percent
Hard Paraffin.....	67 percent
Soft Paraffin.....	25 percent