

## IODINE TINCTURES, WATER-SOLUBLE.\*

BY TORALD SOLLMANN.<sup>1</sup>

Water-soluble tincture of iodine, devoid of potassium or sodium iodide, have been widely advertised as superior to the U. S. P. tincture, under the claim that potassium iodide "produces a localized irritation." It is, of course, highly improbable that potassium iodide should be more irritant than the hydriodic acid that is present in these preparations; in fact, a substance would need to be a fairly powerful irritant to modify the irritation of the free iodine to a noticeable degree. However, it appeared advisable to subject the claim to direct tests, using the secret "Burnham's Iodine" and "Surgodine," and comparing them with analogous non-secret preparations, as well as with the official tinctures. The results of the physiologic tests, which are reported elsewhere, confirmed that the claims of superiority are untenable. However, the formulas that were devised for the non-secret preparations may have some pharmaceutic interest.

*Effect of Hydriodic Acid on the Solubility of Iodine.*—Preliminary assays of Burnham's Iodine and of Surgodine showed that they contain from 2.2 to 3.2 percent of free iodine, and a variable amount of combined iodine in a volatile form, chiefly hydriodic acid (1.2 to 2.6 percent). It is quite probable that the hydriodic acid is not added as such, but is formed in secret processes of preparing these mixtures. In any case, however, it seemed probable that it represents the solvent agent, and it was therefore planned to add it directly to the alcoholic iodine solutions.

The specimen of concentrated hydriodic acid was obtained from the Central Scientific Company, Chicago, and marked Specific Gravity 1.70. It assayed 0.95 Gm. of HI per Cc.

Increasing quantities of this acid were added to 7 percent and to 3 percent alcoholic solutions of iodine, until the mixtures could be poured into water without turbidity. 100 Cc. of the 7 percent iodine required 1 Cc. of the HI (specific gravity 1.7); 100 Cc. of 3 percent iodine required 0.1 Cc. of the HI (specific gravity 1.7).

It is noteworthy that the more dilute solutions of iodine require an even smaller ratio of hydriodic acid. Furthermore, the 7 percent solution, when made up with the minimum of HI, is not miscible in all proportions. It is therefore safer to increase the hydriodic acid.

I therefore used the two following formulas, which I found miscible with water in all proportions tried; in fact forming clearer solutions than Burnham's or Surgodine:

<i>Tinctura Iodii Hydriodica.</i>	7%.	3%.
Iodine.....	7 Gm.	3 Gm.
Hydriodic Acid, sp. gr. 1.7.....	2.2 Cc.	1 Cc.
Distilled Water.....	5 Cc.	
Alcohol, q. s.....	100 Cc.	100 Cc.

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<sup>1</sup> From the Department of Pharmacology of the Medical School of Western Reserve University, Cleveland.

The 3 percent solution is practically the equivalent of the secret products and seems to be identical with Surgodine.

*Other Solvents.*—A few attempts were made with other substances that suggested themselves during the course of the work. They were unsuccessful, but may be briefly recorded.

*Ethyl Iodide.*—This is a good solvent for iodine, but is insoluble in water. For instance, a mixture of 1 volume of 3 percent alcoholic iodine solution and 2 volumes of ethyl iodide, when poured into water, separates into two layers, of which the watery layer is colorless.

*Glycerin.*—This mixes freely with 7 percent alcoholic iodine, but the iodine precipitates on the addition of water, even when large quantities of glycerin are used.

*Lactic Acid.*—Concentrated lactic acid mixes freely with 7 percent alcoholic iodine, but precipitates on dilution with water. A fairly high concentration of the acid is required to maintain solution.

*Analytic Results.*—The various preparations were examined for *free iodine* by titration with thiosulphate by the U. S. P. method, using 5 Cc. of the 7 percent preparations and 10 Cc. of the 3 percent solutions. The *acidity* was determined in this with N/10 NaOH. The *total iodine* was liberated by nitrite and acid, extracted with chloroform, and titrated with thiosulphate.

The assays were carried out by Miss J. R. Collacott.

The results are shown in Table I.

TABLE I.—ANALYSES OF IODINE PREPARATIONS (GM. PER 100 Cc.).

Nature of the preparation.	Free iodine.	Acidity as HI.	Total iodine.	Combined iodine (inclusive of HI).
Burnham's soluble iodine.....	2.2-2.8	1.4	5.5	2.7
Surgodine.....	3.0	1.2	4.7	1.7
7% Hydriodic tincture.....	5.7	2.1	7.8	2.1
Iodine	7 Gm.			
Hydriodic acid (1.7)	2.2 Cc.			
Distilled water	5 Cc.			
Alcohol q. s.	100 Cc.			
3% Hydriodic tincture.....	3.1-3.2	0.8-1.0	4.0-4.2	0.8-1.1
Iodine	3 Gm.			
Hydriodic acid (1.7)	1 Cc.			
Alcohol q. s.	100 Cc.			

#### CONCLUSIONS.

The paper presents formulas for water-miscible *Hydriodic Tinctures of Iodine*, containing 7 percent and 3 percent of free iodine.

These are comparable to the secret "soluble iodines."

None of these, however, present any material therapeutic advantage over the U. S. P. tincture, or the simple alcoholic iodine solutions, in their respective fields.