SUMMARY.

1. The vapor tension of the reaction mixture in the assay of Spirit of Ethyl Nitrite has been determined.

2. Results on the argentimetric and gasometric methods have been compared.

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A TOXICOLOGICAL INVESTIGATION OF PHENOL AND IODINE.*

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Few of the modern poisons are as easily accessible to the public as phenol and iodine, owing to their widespread use as household disinfectants and germicides. In the last few years they have been very near the top of the list of poisons causing death in the United States and England.

Toxicologists are therefore many times called upon to examine chemically viscera containing one or the other of these drugs. Methods for analysis of both chemicals are well worked out but there are still certain questions pertinent to toxicology which should have further attention. They are the effect of the common tissue preservants on the recoverable amount of the drugs; the probable rate of disappearance of the specific poison in a preserved or decomposing cadaver; the possibility of organic combinations with the tissue rendering the lethal material, in the case of phenol, not amenable to the ordinary analytical technics; and in the case of iodine the possibility of a shorter method for its determination which is sufficiently accurate for chemico-legal work.

To make the necessary quantitative observations which would in a broad way answer these questions furnish thereby certain standard or comparative data for medico-legal cases, a series of specimens of organic material in contact with known quantities of phenol or iodine and one or no preservative were set up. The procedure for this part of the work was that used in similar previous investigations of other poisons.[1]

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[1] The plan was to subject the poisons as nearly as possible to all of the conditions they might encounter in a body after death. Some of the specimens to be made up for analysis were to be preserved with the common tissue preservatives, including embalmer's cavity fluid, and others left unpreserved and allowed to undergo natural putrefaction. Therefore, using stomachs from freshly killed sheep as carriers for the drugs, a series of 4-ounce wide-mouthed bottles were set up, each containing a weighed amount of minced stomach together with a known quantity of one poison and one or no preservative. All bottles were stoppered and sealed with paraffin. In all, enough specimens were arranged so that there were three complete sets of bottles containing the poison in contact with one or no preservative. This permitted during the period of the investigation three quantitative determinations of the poison under every condition considered.

Phenol.—The phenol content of the specimens containing that poison was determined according to the assay method of the United States Pharmacopœia. This is a thoroughly accurate volumetric procedure in which the phenol is transformed into the tribrom compound, the excess bromine taken up by potassium iodide solution, and the liberated iodine titrated with sodium thiosulphate. The results of the analyses are set forth in Table I.

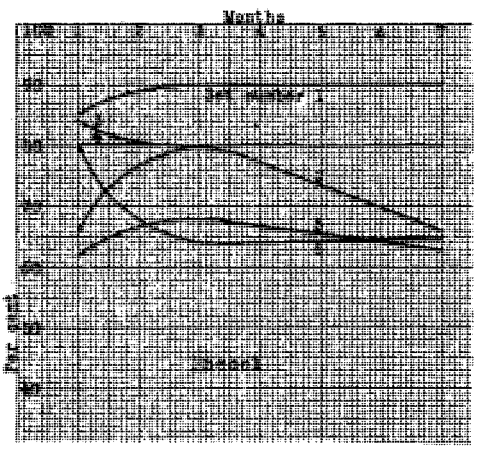

Fig. 1.—Phenol.

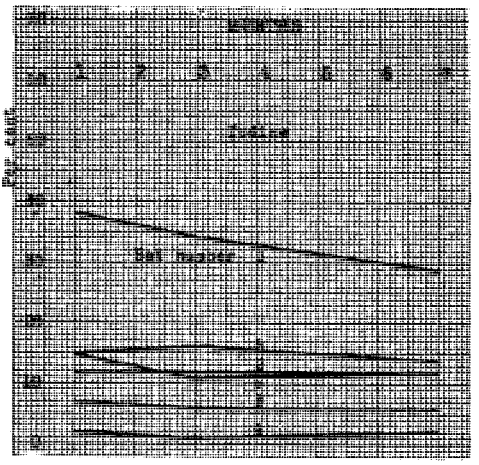

Fig. 2.—Iodine.

TABLE I.—PHENOL.

Set number: Preservative: % found in:	1 Alcohol.	1 HCHO.	3 $HgCl_2$.	4 As_2O_3.	5 Cav. Fld.	6 Unpreserved.
1	85	66	84	80	62	80
2	90	80	80	80	68	64
3	90	67	80	80	63	65

1. Per cent recovered at the end of one month.
2. Per cent recovered at the end of three months.
3. Per cent recovered at the end of seven months.

The data indicates that alcohol is by far the best preservative for samples of viscera containing phenol. A specimen tightly sealed and preserved in alcohol should yield 85 per cent of the acid present in the tissue at the time of death, if analyzed within a year. Bichloride of mercury and arsenous acid cut the decomposition of the poison to approximately half of what it would be in the unpreserved tissue. The two formaldehyde solutions apparently have no effect in the preservation of the phenol contained in the organs. The amount of acid re-

The preservatives used were alcohol, a ten per cent solution of formaldehyde, a one per cent solution of mercuric chloride, a saturated solution of arsenic trioxide, and embalmer's cavity fluid.[1]

[1] The formula for the cavity fluid is approximately as follows:

Absolute alcohol	(Volume)	35.00 per cent
Methyl alcohol	(Volume)	14.70 per cent
Glycerin	(Volume)	2.00 per cent
Ethereal constituents	(Volume)	4.00 per cent
Water and other constituents	(Volume)	44.30 per cent

covered at the end of seven months' contact with them was almost identical with that obtained from the unpreserved tissues (1).

There is some question concerning the formation of phenol within the body during putrefaction. Baumann (2) and Maclawin (3), working independently, have demonstrated the production of some phenol. The amount is so small, however, that it has no toxicological significance.

Iodine.—The increased use of iodine compounds in recent years has brought with it greatly improved methods for determining the element. These procedures will indicate accurately a milligram or less of iodine. They generally begin with fusion of the organic matter in a nickel or platinum crucible and follow through a time-consuming and extended manipulation. Toxicologists now go through these extensive processes to determine the total iodine present. The question arises: is that necessary? Iodine found in quantity in a body is indicative of poisoning, intentional or otherwise. The layman, unfamiliar with the potency of the drug, almost invariably administers a larger quantity than is needed to produce death. This means, that, in cases of iodine poisoning, there will practically always be an amount of the element present that far exceeds the normal content in the tissues. Because of that, the possibility arises that it would usually be necessary only to thoroughly extract the viscera with potassium iodide water and to titrate the resulting extract directly with sodium thiosulfate. The time and technic for the analysis would be lessened materially.

To establish this it was necessary to discover just what per cent of the ingested iodine would combine with the tissue in such a way that it could not be extracted and titrated directly. Preservatives introduce other questions, such as their own combination with the drug and as their probable action in rendering the tissue ineffective as a combining agent to remove the iodine. If the content of free iodine in the organs has a tendency to diminish steadily with age, such a method might be satisfactory provided the organs were analyzed immediately after death, but would fail if the analysis was not conducted until a few weeks later.

To answer these questions the tissue containing the poison was extracted with potassium iodide water until no more iodine was removed. This extract was then titrated for the free element. The results of the determinations are expressed in Table II.

TABLE II.—IODINE.

Set number: Preservative: % found in:	1 Alcohol.	2 HCHO.	3 $HgCl_2$.	4 As_2O_3.	5 Cav. Fld.	6 Unpreserved.
1	38	12	7	2	15	15
2	34	12	6	1	16	11
3	29	12	7	2	14	12

1. Per cent recovered at the end of one month.
2. Per cent recovered at the end of three months.
3. Per cent recovered at the end of seven months.

The results of the analyses show that any loss of iodine through organic or inorganic combination with tissue or preservative, except in the case of tissue preserved with alcohol, occurs immediately. It always includes the major portion of the iodine ingested. Time is no element in the disappearance if the organs are kept sealed to prevent volatilization of the halogen. The content of free element re-

mains constant after the first decrease. Arsenic trioxide and mercuric bichloride are poor preserving agents to employ as they immediately react with the iodine until one or the other is completely used up. Alcohol is the best preservant, with cavity fluid and the 10 per cent formaldehyde solution second and third, respectively. The tissue alone will return as much iodine as that preserved in either of the formaldehyde solutions and, as iodine inhibits putrefaction, if nothing else were available but these two agents it would probably be better to leave the material unpreserved.

It is evident that the toxicologist, by making the preliminary examination as proposed, would be able to tell immediately within 10–15 per cent the quantity of free iodine present in the body at the time of death.

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A COMPREHENSIVE STUDY OF THE PREPARATION OF COLLOIDAL SILVER IODIDE AND A REPORT OF ITS BACTERIOCIDAL AND BACTERIOSTATIC VALUE.*

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It has long been felt desirable to obtain a non-irritating, non-staining germicidal colloidal silver compound to supplant the mild silver-protein compounds which have objectionable staining properties and to supplant the strong silver-protein compounds which produce irritation as well as stains. In fact, colloidal silver halides to which germicidal activity is ascribed have been marketed for some years as germicides. This laboratory has throughout several years conducted a study of colloidal silver iodide made by a great variety of methods. These methods can be indicated briefly as follows:

I Double decompositions.
- *A*. $AgCl + KI \rightleftharpoons AgI + KCl$
- *B*. Ag proteinate $+ KI \rightleftharpoons AgI +$ K proteinate
- *C*. Ag soap $+ KI \rightleftharpoons AgI +$ K soap
- *D*. $Ag_2O\text{-}(H_2O)_4 + KI \rightleftharpoons AgI + KOH$

II Oxidation and reduction.
- *A*. $Ag^\circ + I^\circ \rightleftharpoons AgI$

III Decomposition of double salt.

A. $KAgI_2 \rightleftharpoons KI - AgI$

With each method a very thorough study was made of the effect of varying the conditions during every step in the method on the colloidality and germicidal behavior of the silver iodide.

These conditions themselves seem endless in variability, and no attempt will be made to discuss them all, but it might be pointed out that significantly different effects are obtainable by altering the (1) kind of protective protein, (2) the degree of hydrolysis of this protein, (3) p_H of the protein during the several

* Scientific Section, A. PH. A., Miami meeting, 1931.