to examine more completely the interior of a drinking glass, proved quite satisfactory and it was used extensively in this investigation.

The Steril-Ray Cabinet, employing 4 Sterilamps, was tested while in actual operation at a soda fountain. Dry clean glasses showed but slight bacteriological improvement as the result of being exposed in this cabinet. It should be noted that these were already of low bacterial content without being exposed. Wet clean glasses showed a very marked improvement as the result of being exposed. However complete sterilization did not result in every case.

The experimental evidence obtained in this investigation indicates that almost sterile surfaces are produced when clean drinking glasses are irradiated with the ultraviolet light produced by the Sterilamp.

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Determination of Hydrogen Sulfide in Stomach Contents of Experimental Animals.

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The problem of determining the sulfide content of solutions containing reducible or interfering substances presents difficulties. Since hydrogen sulfide is unstable and easily oxidized considerable trouble may be expected in recoving it from solution. Aeration with air, carbon dioxide, or hydrogen as well as distillation procedures have been employed[1, 2, 4, 5] but the completeness of the removal is open to question.

Recently in connection with another investigation it was necessary to determine the hydrogen sulfide concentration in the stomach contents. Due to the nature of the material it was evident that methods based on evolution procedures were the only approach to the problem.

Preliminary experiments with various evolution procedures on pure hydrogen sulfide solutions (1-10 mg per liter) consistently

1 Benade, W., *Mitt. Lab. preuss. geol. Landesenst,* 1933, **19**, 3; Dept. Sci. Ind. Research, *Water Pollution Research,* Summary, current lit. **7**, 318.

2 Buswell, *J. Am. Chem. Soc.,* 1925, **47**, 1381.

3 Gibbs and Clardy, *Ind. and Eng. Chem. Anal. Ed.,* 1940, **12**.

4 Marzahn, W., *Hyg. Rundschau,* 1919, **29**, 557; *Exp. Stat. Record,* **42**, 207.

5 Rudolfs and Baumgartner, *Ind. and Eng. Chem.,* 1932, **24**, 1152.

gave results which varied from 50-90% of theory. Furthermore, the sulfide ion concentration rapidly diminished on standing. Other investigators[2] have reported similar observations, but the possibility of errors of this magnitude has not been generally recognized.

In the determination of the sulfide content of metals and alloys, evolution procedures give excellent results.[6] This is probably due to the presence of nascent hydrogen which reduces any free, sulfite, or thiosulfate sulfur to sulfide ion, thus preventing any oxidation or decomposition of hydrogen sulfide.[7] This suggests that proper reducing conditions in sulfide solutions may permit quantitative removal of hydrogen sulfide.

On the basis of these considerations the following method was developed which may be useful to those confronted with a similar problem.

Apparatus and Procedure. 1. 0.01 N sodium thiosulfate solution containing 1 volume % of amyl alcohol. 2. 12 N hydrochloric acid. 3. Cadmium chloride solution: 10 g of cadmium chloride dissolved in 400 ml of water and diluted with 600 ml of 28% ammonium hydroxide. 4. Starch solution: 2 g of soluble starch dissolved in 250 ml of boiling water and filtered. 5. Caprylic alcohol. 6. 0.01 N iodine solution, 1 ml = 6.8 mg per liter of hydrogen sulfide per 25 ml sample.

In an apparatus similar to one described by Gibbs and Clardy[3] an 8-in. test tube served as the reaction vessel and a 6-in. test tube as the receiver. The thistle tube was equipped with a segment of rubber tubing and a screw clamp to permit the closing of the inlet tube.

The reaction vessel was charged with a 25 ml sample of material, 2-3 g of metallic zinc (S-free) and a drop or two of caprylic alcohol. The absorption tube containing 1 ml of cadmium chloride diluted to 15 ml was then placed in the system. Twenty-five ml of 12 N HCl were added to the reaction vessel, and the inlet tube was closed by means of the screw clamp. To hasten the evolution of hydrogen sulfide, the reaction vessel was warmed at the beginning. After the evolution of hydrogen was complete, the reaction vessel was brought to boiling for a minute or two, the receiver contents acidified and treated with an excess (1-2 ml) of standard iodine solution; back titration was with standard thiosulfate solution measured from a microburet.

[6] A. S. T. M., *Methods of Chemical Analysis of Metals*, 1939, E **30-39**, 23.

[7] Schere and Sweet, *Ind. and Eng. Chem. Anal. Ed.*, 1932, 103.

Results and Discussion. The results of several typical experiments (Table I) show that the quantitative removal of hydrogen sulfide from stomach contents can be attained by the use of nascent hydrogen as the aerating agent. When air was used instead of nascent hydrogen consistent but slightly lower results were obtained. The recovery of added amounts of hydrogen sulfide was always incomplete due probably to oxidation.

When nascent hydrogen is used for aeration of the hydrogen sulfide, other reduced forms of inorganic sulfur must be absent.[7] Pure solutions of cysteine and cystine evolved small amounts of hydrogen sulfide when treated with nascent hydrogen. When cystine, cysteine or methionine was added to stomach contents no additional hydrogen sulfide was obtained (Table I).

TABLE I.
Determination of Hydrogen Sulfide by Aeration with Nascent Hydrogen.

	Stomach contents mg H_2S/liter	Mg added/liter		Total H_2S mg/liter Found	Calc.
I. Recovery experiments	3.7	8.6	H_2S	11.9	12.3
	4.4	8.0	''	12.6	12.4
	5.1	7.8	''	12.9	12.9
II. Effect of organic sulfur on recovery of H_2S		*4,000	cystine	0.6-1.8	
		*4,000	cysteine	0.6-3.0	
	2.7	4,000	cystine	2.7	
	2.7	4,000	cysteine	2.7	
	2.7	4,000	methionine	2.7	
III. Typical analyses of a given sample	3.9				
	3.8				
	3.8				
		Standard H_2S solution (made slightly alkaline) Mg H_2S/L.			
IV. Stability of sulfide solutions	3.0	6.7			
	2.6	1 day later	5.0		
	2.7	2 '' ''	3.3		
	2.1	3 '' ''	2.2		

*With pure solutions the results varied through limits indicated.

The stability of sulfide ion is slightly greater in stomach contents than in pure sulfide solutions; perhaps this might be expected from the nature of materials present.

Summary. A simple method is described for determining hydrogen sulfide in the stomach contents of experimental animals.