and report on other methods which they had employed; also information was requested relative to the experience of the assayists.

In discussing the subject with Dr. Hanzlik in Boston, he had been informed that Dr. Hanzlik would publish the results he had obtained in several kindred clinical cases compared with the "pigeon emesis" method.

W. H. Zeigler stated that he had studied one of the assays and he was looking forward with interest to the clinical reports.

E. Fullerton Cook referred to the efforts being made to establish international standards. He stated that there will be an International Secretariat on Pharmacopœias under the auspices of the League of Nations where every nation may obtain definite standards.

James C. Munch stated that he had quite a lengthy discussion with bio-assayists of Canada while in Boston. They have been using "International Standard" leaf and obtained quite uniform results. They pointed out to him that it was necessary to specify in greater detail the method of preparing the test solution because slight variations in technic will give results varying from 25 to 100 per cent.

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p_H STUDIES OF NEOARSPHENAMINE.*

BY RALPH B. SMITH, A. E. JURIST AND W. G. CHRISTIANSEN.

Work done in this laboratory by Jurist and Christiansen[1] indicated that it would be desirable to determine the p_H of neoarsphenamine solutions, since the very rough results obtainable with indicators had given considerable evidence that the stability of the product was related to the p_H of its solution. Furthermore the p_H could be used to indicate the presence of free acid because both sodium formaldehyde sulphoxylate and 3,3′-diamino-4,4′ dihydroxyarsenobenzene-*N*-methylene-sodium-sulphinate have a p_H of more than 8.0. Williams and Swett[2] state that they have determined the p_H of solutions of a number of commercial neoarsphenamines but give no details as to the method employed. Elvove and Clark[3] and Hunter and Patrick[4] have investigated the p_H of arsphenamine solutions with the hydrogen electrode and found that true and reproducible values could be obtained and it was found in our Laboratory that the method of Elvove and Clark could be adapted to neoarsphenamine.

In this investigation a bubbling type of electrode was used with a saturated half cell of the type described by Clark and Cohn.[5] The electrodes were prepared according to the method of Elvove and Clark[3] by first plating them with a thin layer of bright gold and then with a thin layer of palladium black. Electrodes of both the coil and point type were used but as far as could be noted there was no difference between the behavior of the two types; in all cases a fresh pair of electrodes was used for each determination.

The general method was to put 13.5 cc. of double distilled water which had been cooled under nitrogen into the electrode vessel, place two electrodes in position and pass hydrogen through the bubbling tubes for about fifteen minutes,

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* Scientific Section, A. PH. A., Portland meeting, 1928.

[1] *J. A. C. S.*, 50 (1928), 191.

[2] "Proc. Soc. Expt. Biol. Med.," 19 (1922), 266.

[3] Hygienic Laboratory—Bulletin No. 135.

[4] *J. Lab. & Clin. Med.*, 10 (1925), 343.

[5] "Public Health Reports," 38 (1923), 933.

so as to saturate the electrodes and the water. At the end of this time the electrodes and their bubbling tubes were raised about two cms. above the surface of the water, the electrode vessel removed without stopping the hydrogen flow and 2.7 Gm. of neoarsphenamine sprinkled on top of the water. The tube was now put back into position and the neoarsphenamine allowed to dissolve. It was found that in most cases the powder would dissolve without stirring but where this was necessary it was accomplished by a small stirring rod passed through the hydrogen outlet. When the neoarsphenamine powder comes in contact with the electrode surface it increases the time necessary for the electrode to come to equilibrium and also increases its tendency to poison, however, the method of manipulation just described prevents this from happening. As soon as all the neoarsphenamine was dissolved, the electrodes and their bubbling tubes were lowered into the solution and the whole apparatus lowered into the constant temperature bath. The neoarsphenamine solution was protected against the entrance of air by trapping the exit hydrogen through about one cm. of water. The effect of hydrogen on the solution both in the presence and absence of the electrodes was studied by means of the iodine titration method, thus measuring any possible change in reducing power due to oxidation, and it was found that the protection of the solution by hydrogen was equal to or better than that afforded by nitrogen which is usually assumed to completely protect these solutions. The following table gives one set of results obtained in comparing the protection to the solution by hydrogen and nitrogen as determined by drawing a sample equivalent to 0.10 Gm. from the solution under examination and titrating with $N/10$ iodine.

PROTECTION OF NEOARSPHENAMINE SOLUTIONS BY INERT GAS.

Time.	$N/10$ iodine used.		Per cent loss.	
	Sample under H_2, cc.	Sample under N_2, cc.	Under H_2.	Under N_2.
0 hrs.	17.08	16.80	0.0	0.0
4	16.83	16.27	0.2	0.42
$22^1/_2$	16.38	15.26	0.56	1.23

This table shows that the loss under H_2 in four hours is within the limit of experimental error.

It was found in most cases that the electrodes came to equilibrium with each other and remained constant within one or two millivolts in 15–30 minutes. The electrodes were then watched for about 30 minutes longer. They generally remained constant within two millivolts during this period or dropped off slightly. In all determinations the highest electrode reading was taken in calculating the p_H. This value was used because it was found that this point was generally reproducible within 0.05 of a p_H unit by different operators and at widely separated times. It should be noted in connection with the above that neoarsphenamine solutions appear to be on the border line of solutions which poison electrodes and those which do not and a number of experimental samples have been tested which poison the electrode so badly that no reliable readings could be obtained. This was more frequently noticed in samples having a p_H below 7.5. Electrodes used in neoarsphenamine solutions have, however, been repeatedly checked against $N/20$ potassium acid phthalate and in all cases where otherwise satisfactory readings have been obtained, the phthalate check usually gave readings within

2–3 millivolts of the correct value. It should be remembered, however, that where a voltage of 0.481 was not obtained these same electrodes had usually started to show a drop from their high value in the neoarsphenamine solution; this is another reason for using the highest potential registered by the electrode in the neoarsphenamine solution when calculating the p_H. A rapid drop after a brief maximum was considered as a strong indication of poisoning and that at the maximum voltage the electrode had not reached true equilibrium.

The experimental results given in the following tables are divided into three groups. The first table gives a series of determinations in duplicate intended primarily to show how closely it is possible to check duplicate determinations on different types of neoarsphenamine. It further shows the effect of dilution on the p_H.

TABLE A.—CHECK DETERMINATIONS OF p_H ON DIFFERENT TYPES OF NEOARSPHENAMINE.

Sample no.	p_H 20% sol.	p_H 4.5% sol.	Electrode voltage in voltage in $N/20$ phthalate.
A	6.99	7.30	Not tested
	6.98	7.25	0.447
	6.94	..	Poisoned on dilution
B	6.32	6.62	0.476
	6.31	6.65	0.480
C	7.87	8.14	0.480
	7.83	7.96	0.480
D	8.32	8.41	0.480
	8.32	8.46	0.481
E	8.66	8.82	0.480
	8.67	8.77	0.480

These results show that the maximum variation, with one exception, is 0.05 p_H units which is within the limits of experimental error with this type of material. On dilution from 20% solution to 4.5% the p_H has shown an increase of from 0.09 units to 0.34 units in the results given but increases as high as 0.45 units have been observed. One commercial sample has been found which, when diluted from 10% to 2.5%, decreases in p_H from 8.50 to 8.39. We have no evidence to explain this dilution change but two apparent explanations are either a change in the colloidal state of the solution or a depolymerization of the dissolved arsenical.

The results given in the following, Table B, show that the p_H on dilution rises steadily from a concentration of 40% neoarsphenamine to 0.1%.

TABLE B.

Concentration by weight, %.	p_H.
40	7.60
20	7.73
10	7.78
2.5	7.88
0.5	8.50
0.1	8.62

These results indicate that the effect of dilution is in the same direction over a very wide range of concentration.

Tables C and D give a series of determinations on experimental and market neoarsphenamines showing the wide range of p_H covered by these products.

Table C.—Values Obtained with Different Types of Experimental Neoarsphenamines.

Class.	p_H in 20% sol.
A	8.01–8.74
B	6.31–6.99
C	7.62–7.87
D	6.62
E	8.04
F	6.74
G	7.01
H	6.99
I	7.97

Table D.—p_H of Market Brands of Neoarsphenamine.

Sample no.	p_H in 20% sol.
A	5.78
B-1	8.30
B-2	8.07
C	8.48
D	8.20

The results show a range of 6.31 to 8.74 for the experimental preparations and 5.80 to 8.48 for the market samples.

SUMMARY.

1. The method of Elvove and Clark for the determination of the p_H of solutions has been successfully applied to neoarsphenamine.

2. The range of p_H for different types of experimental and commercial neoarsphenamine is shown.

3. The effect of dilution on the p_H of neoarsphenamine solutions is indicated and two possible explanations are suggested.

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MEDICINAL WOOD TAR CREOSOTE: I. METHOXYL CONTENT AS A CRITERION OF THE COMPOSITION OF CREOSOTE.*

BY DARRELL V. SICKMAN[1] AND ROBERT P. FISCHELIS.

Wood tar has been used for one purpose or another since the dawn of recorded history. The Egyptians used it to preserve their mummies and the preservative action of "wood smoke" has been made use of in various industries, from the earliest times to the present day. Reichenbach (1), in 1832, determined that the antiseptic properties of wood tar resided in the alkali-soluble portion of this crude material and he named this particular fraction "Kreosot."

For a long time creosote was confused with phenol (2) which was discovered as a constituent of coal tar by Runge, in 1834. Early investigators considered creosote to be a chemically homogeneous substance and tried the effect of oxidizing agents, chlorine, metallic potassium, sulphur, etc., upon it. However, these experiments shed very little light upon the constitution of creosote.

That creosote is not identical with phenol was first shown by von Gorup-Besanez (3) in 1841. In 1858, Hlasiwetz (4) established the fact that creosote contains guaiacol and creosol, which was later confirmed by Müller (5). An account of all work done on creosote up to 1867 is given in an interesting article by

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* Scientific Section, A. Ph. A., Rapid City meeting, 1929.

[1] Maltbie Chemical Company Research Fellow, Princeton University, 1928–29.