

A New Micro Portable Quinhydrone Electrode.†

By

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Since the author had enjoyed the privilege of studying under Prof. S. P. L. SÖRENSEN in early 1914, he has been engaged, at different occasions, in the subject of hydrogen ion concentration as noted in the appendix (1-14). It is a great pleasure and honour to have this opportunity to send in a short paper to the jubilee volume for the celebration of the seventieth birthday of Prof. SÖRENSEN although the value of this paper itself is so insignificant.

This paper deals with a new micro-portable quinhydrone electrode which has been devised by the author very recently to meet the demands from various fields of investigation. The description of the electrode is given below.

1) The standard portable cell :

It is constructed on the same principle as the one which was reported previously¹³⁾ and used in the direct p_H determination of soil under its natural state but was slightly modified in its form, as shown in the figure.

The saturated KCl calomel standard cell (C) is enclosed in an ebonite case (E) and its end is plugged and connected to the cork (P) which has been boiled in water and sat. KCl solution previously and its one face is exposed in (D) so that the connection is made with the electrode through (d); the case is provided with the metal spring (S) by which the electrode is held tightly in place.

2) Micro-quinhydrone electrode :

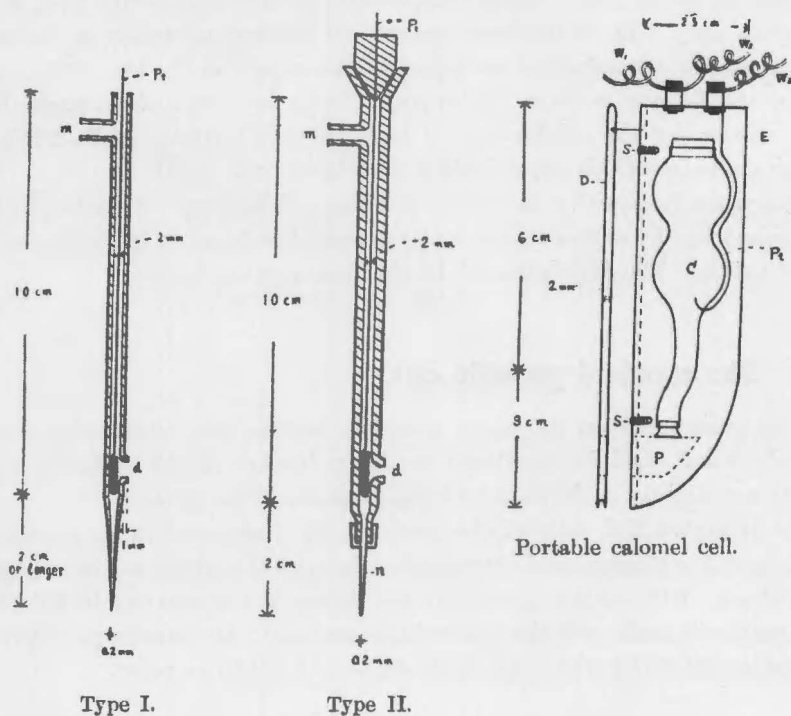
The electrode is made of glass tube of 2 mm. bore, provided with an arm (m) and a short projection (d), and the end is tapered to capillary of any length to suit the purpose as type I while the other type II is provided with a hyperdermic needle of fine bore; in both cases a platinum wire electrode of wound end is provided. The electrode is shown in Fig. 1.

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Determination of pH:

The quinhydrone paste is smeared on the end of pt-wire electrode and inserted in the position as shown in Fig. 1, and the electrode is placed against the ebonite case along the depression (D) so that (d) is pressed against (p) by means of the metal springs. The end of capillary is inserted into the sample so that ordinarily the sample rises in the capillary as far as (d) and comes in contact with the quinhydrone electrode. But if it fails, suction is applied at (m) keeping the other opening closed. If necessary, the pt-wire is moved up and

Figure 1.
Quinhydrone electrode.



down to saturate the sample with quinhydrone. The E.M.F. is determined with any convenient form of potentiometer such as reported by the author¹⁰⁾ by completing the chain through wires, W_1 to the quinhydrone electrode, W_2 and W_3 to the potentiometer.

Results:

The results obtained with the standard buffer solution, checked with the standard K-type equipment, are shown in Table 1.

Table 1.

Buffer solution.	K-type.		ITANO-type (18°C.).	
	π	P_H	π	P_H
=1	0.3882	1.14	0.3870	1.15
=2	0.3348	1.89	0.3420	1.94
=3	0.2318	3.85	0.2310	3.84
=4	0.1732	4.87	0.1720	4.89

As noted in the above table, very close results were obtained by the proposed method.

Discussion :

A small amount of sample i. e. 0.05 cc. or so is sufficient for this method to make the determination quite accurately and quickly under various conditions.

Many electrodes (glass part) can be prepared and sterilized at a time, by which many consecutive samples from one source can be taken under aseptic condition at different intervals. Thus the method has a great significance in microbiological as well as in other works.

Further the electrode is economical and easily manipulated.

Summary.

A new micro-portable quinhydrone electrode by which the determination of hydrogen ion concentration in a small amount of sample 0.05 cc. or so is made accurately and quickly.

Some Papers Published on Hydrogen Ion Concentration.

By ARAO ITANO and his Collaborators.

1. ITANO, A. The Relation of Hydrogen Ion Concentration of Media to the Proteolytic Activity of *Bacillus subtilis*. Bull. 167, Mass. Agr. Exp't Station, 1916.
2. ———. Influence of Temperature and Hydrogen Ion Concentration upon the Spore Cycle of *B. subtilis*. J. Gen. Physiol., 1:4, 1919.
3. ———. Influence of Hydrogen Ion Concentration on *B. botulinus*. Abstract of Bact. 1:5, 1920.
4. ITANO, A. and U. YAMAGATA. Influence of Hydrogen Ion Concentration on Various Types of *Aerobacter*. J. Bact., 8:6, 1923.
5. ITANO, A. Investigation on Billmann's Quinhydrone Electrode. I. Berichte d. Ohara Inst., 3:193-201, 1926.
6. ITANO, A. and K. HOSODA. Table for P_H Values Corresponding to E.M.F. determined in Quinhydrone Electrode Measurements. II. Ibid., 3:204-214, 1926; by different Electrometric Methods. Ibid., 4:199-253, 1929.

7. ITANO, A., S. ARAKAWA and K. HOSODA. Investigation on the Biilmann's Quinhydrone Electrode. III. Further studies on the electrode and agar bridge. *Berichte d. Ohara Inst.*, 3:337-346, 1927.
 8. ITANO, A. A Portable P_H Apparatus with Micro-analytical Electrode and Saturated Calomel Electrode. *Ibid.*, 4:19-26, 1929.
 9. ITANO, A. and S. ARAKAWA. Investigation on the Biilmann's Quinhydrone Electrode. IV. Comparative study of quinhydrone and hydro-quinhydrone electrode. *Ibid.*, 4:255-264, 1929.
 10. ITANO, A. An Improved, Portable P_H Apparatus. *Ibid.*, 4:472-474, 1930.
 11. ———. Investigation on Antimony Electrode for Determination of P_H . I. Standardization of the electrode. *Ibid.*, 4:273-277, 1929.
 12. ITANO, A. and S. ARAKAWA. *Ibid.* II. Determination of P_H of soils. *Ibid.*, 4:383-394, 1930.
 13. ITANO, A. Direct P_H Determination of Soil under its Natural State by Quinhydrone Method. I. Determination of P_H in the Paddy-field Soil. *Ibid.*, 6:587-606, 1935.
 14. ITANO, A. and Y. TSUJI. *Ibid.* II. Description of a New Electrode and its Use. *Ibid.*, 7:215-225, 1936.
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