benzylmagnesium chloride and mercuric chloride leads to a mixture of mercury dibenzyl and benzylmercuric chloride. Since sodium stannite will convert benzylmercuric chloride to mercury dibenzyl, it is suggested that the product of the Grignard reaction be treated with sodium stannite. This procedure would not only eliminate the difficulty of separating the two mercury compounds, but would increase the yield of the desired mercury dibenzyl.

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# COMMUNICATIONS TO THE EDITOR

## THE RELATION BETWEEN THE ACTIVITY OF THE WATER AND THE POTENTIALS OF THE GLASS ELECTRODE

*Sir:*

In the differential thermodynamic equation recently used to explain the potentials of the glass electrode [M. Dole, THIS JOURNAL, **53,** 4260 (1931)] the correction for possible transference of solvent [see P. B. Taylor, *J. Phys. Chem.,* **31,** 1480 (1927)] was purposely omitted for two reasons. In the first place it was not certain that water could be carried through the glass by ions on the passage of an electrical current, and in the second place the activity of the water was maintained in the actual experiments nearly the same and constant on both sides of the glass membrane; hence if there had been any transfer of water, there would have been no increase or decrease in the free energy of the water as it passed through the glass from one solution to the other and consequently no contribution to the total e. m. f. due to this effect. MacInnes and Belcher [THIS JOURNAL, **53,** 3315 (1931)] have shown that water may be drawn out of the glass, and there have also been recently published [G. Buchböck, *Z. physik. Chem.,* Abt. A, **156,** 232–236 (1931); D. A. MacInnes and D. Belcher, THIS JOURNAL, **53,** 3315 (1931)] data of experiments performed under conditions in which the activity of the water was not maintained constant, but was reduced by the addition of concentrated acids. The observed potentials did not agree with those of the hydrogen–platinum electrode, the resulting error being negative in sign in contrast to the errors of the glass electrode in alkaline solutions which are positive in sign [Dole, *loc. cit.*]. Considering a possible transfer of water, the equation for the glass electrode in acid solutions (where only hydrogen ions are assumed to carry the current across the boundary) becomes

$$E_1 = \frac{RT}{F} \ln \frac{a'_H}{a''_H} + S \frac{RT}{F} \ln \frac{a'_{H_2O}}{a''_{H_2O}} \tag{1}$$

In this equation $a_H$ is the hydrogen ion activity, $S$ is the number of moles of water carried across the boundary by one mole of hydrogen ions and $a_{H_2O}$ is the activity of the water. If the glass electrode acted as a perfect hydrogen electrode, the equation would be

$$E_2 = \frac{RT}{F} \ln \frac{a'_H}{a''_H} \tag{2}$$

Subtracting $E_2$ from $E_1$, an equation for the error of the glass electrode in acid solutions is obtained, namely

$$\Delta E = E_1 - E_2 = S \frac{RT}{F} \ln \frac{a'_{H_2O}}{a''_{H_2O}} \tag{3}$$

If the activity of the water is decreased in solution ('), the error will be negative, as is actually observed (Ref. 4). In order to test equation (3) further experiments have been carried out in alcoholic solutions and in acid solutions of various salts; they will be fully described in a paper to be submitted shortly for publication. At this time it should be emphasized that this apparent connection between the activity of the water and the proper functioning of the glass electrode must be considered by those who are using or hope to use the glass electrode for determining the $P_H$ in non-aqueous solutions.

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RECEIVED FEBRUARY 16, 1932
PUBLISHED MAY 7, 1932

## THE CATALYTIC INFLUENCE OF DRIED CELLULOSE ON THE HYDROLYSIS OF SUCROSE

*Sir:*

The writers have found that the rate of hydrolysis of sucrose in aqueous solution is subject to a many-fold increase in the presence of dried cellulose fiber at elevated temperatures.

The cellulose fiber which was used as a catalyst in these studies was prepared from the purest quantitative filter paper (Whatman number 43). The paper was disintegrated to a pulp by boiling with distilled water. This treatment was repeated five times with fresh supplies of water. The pulp was pressed into a cake on a Büchner funnel and dried in air at atmospheric pressure at 130–135° for eighteen hours. The fiber was pulled apart with tweezers into a fluffy mass. It was reheated at the same temperature for several hours, and placed in a desiccator over a fresh charge of Dehydrite. Ash determinations on this fiber showed no more than 0.10% of non-volatile matter.