

described here, they indicate that the effect is too small at all concentrations to permit a study of this question, at least at low frequencies. The frequency at which the assumed maximum (B in Fig. 1) occurs is not known. If it can be located and if the effect there is appreciably larger than at 1000 cycles, a study of the change of the effect with concentration might contribute definite evidence concerning dissociation.

The accuracy of the absolute conductivities given above is of the order of 0.05%, which is probably about that of the measurements of Kohlrausch. That true conductivities of great accuracy are not often required is probably responsible for the fact that the experiments of Kohlrausch with potassium chloride, and other standard solutions, have not been repeated, introducing the more recent refinements of technique. The desirability of such a repetition has nevertheless been suggested by several authors. It seems in order to point out in this connection that if such a work is undertaken it should, for the sake of added definiteness, be paralleled with direct current measurements made with the high precision of which they are capable.

Summary.

In this paper it is suggested that the conductivity of solutions of electrolytes should be smaller at zero frequency than at any frequency in a certain range (of unknown limit) immediately above zero. Various measurements made to test this idea are described. It is concluded that the difference between direct current conductivities and those at 1000 cycles does not exceed 0.02–0.03% in the cases studied, but is in the expected direction. Incidentally, the conductivity of N potassium chloride at 25° given by Kohlrausch is confirmed, within 0.1%, by the measurements made here.

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NOTE.

The Use of Potassium Hydrogen Phthalate as a Standard in Alkalimetry.—In 2 recent papers Professor Hendrixson has shown the advantage of potassium hydrogen phthalate as a standard in alkalimetry.¹ Since this substance has been in use in my laboratory for 15 years (I advocated its use as a standard first in a paper read before the New York Section of the American Chemical Society, on January 8, 1904, and later in a published article in 1915,² it is gratifying even at this late date to have its merits recognized.

¹ THIS JOURNAL, 37, 2352 (1915) and 42, 724 (1920). In the former my original paper is referred to, but in the latter, undoubtedly by an oversight, this has not been done. Patten, Johnson and Mains (*ibid.*, 40, 1156 (1918)) quote almost verbatim from my article without acknowledgment.

² *J. Ind. Eng. Chem.*, 7, 29 (1915.)

However, for the benefit of any who are using, or may consider using this substance, I would call attention to an advisable precaution in its preparation. A saturated solution of the acid phthalate on chilling will deposit crystals of a more acid salt, having the formula, $2\text{KHC}_8\text{H}_4\text{O}_4 \cdot \text{C}_8\text{H}_6\text{O}_4$. These crystals are in the form of prismatic needles, easily distinguished under the microscope from the 6-sided orthorhombic plates of the salt, $\text{KHC}_8\text{H}_4\text{O}_4$. A contamination of the acid phthalate with this "triphthalate" would be fatal for its use as a standard, but the formation of the latter can be entirely avoided by crystallization at temperatures above 20° .

The writer hopes soon to present the results of a detailed chemical and crystallographic study of the acid phthalates, which has proved interesting in various ways.

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[CONTRIBUTION FROM THE CHEMICAL LABORATORY OF BROWN UNIVERSITY.]

THE ACTION OF ACETIC ANHYDRIDE ON ALPHA NAPHTHYL PROPIOLIC ACID.¹

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Introduction.

Over twenty years ago, Michael and Bucher² found that phenyl propiolic acid, when treated with acetic anhydride, yields α -phenyl-naphthalene-2,3-dicarboxylic anhydride. This compound was unexpected, and its identity was unknown for almost 2 years. In a previous research³ they found that acetic anhydride reacts with acetylene dicarboxylic acid to form the anhydride of acetoxy-maleic acid; and on treating this anhydride with water, they obtained oxalacetic acid. If acetic anhydride would act on phenyl propiolic acid in an analogous manner, the anhydride of β -acetoxy-cinnamic acid would be formed, and this compound, on treatment with water, would yield β -hydroxy-cinnamic acid.

Their explanation of the unexpected formation of the α -phenyl-naphthalene derivative may be best explained by the following formulas.

¹ This is an abstract of a thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Brown University by the holder of the Morgan Edwards Fellowship founded by the Philadelphia Alumni of Brown University. The investigation was conducted in the Chemical Laboratory of Brown University at the suggestion and under the personal direction of Professor John E. Bucher. The author wishes to express his gratitude to Doctor William Williams Keen, President of the Philadelphia Alumni, for his constant and helpful interest and encouragement.

² Michael and Bucher, *Am. Chem. J.*, **20**, 89 (1898).

³ *Ber.*, **28**, 2511 (1895).