3. The acids studied, citric, tartaric and oxalic, lower the surface tension of water, so that hydrolysis in such salts would tend to lower the surface tension.

4. Salts of the same acid, for the most part, show a marked agreement in their values for the surface tension at the same temperatures; but there are decided exceptions even to this generalization.

5. The surface tension of a solution of two salts, one of which raises the surface tension and the other lowers it, is an additive property of the two separate solutions—provided no chemical reaction takes place between them and the values for the two are not very far removed from the value for water. If one of the solutes causes a much larger effect than the other, the value for the mixture lies closer to the one with the greater effect.

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NOTES.

A Method for Electrolytic Heating and Regulation of Thermostats.—Of the many methods suggested for heating thermostats, electrical heating by resistance wires has gradually displaced the other methods because of the cleanliness, safety and little attention necessary. Electrical heating has been accomplished principally by coils of resistance wire or by incandescent bulbs of the ordinary kind, or of special design, placed within the bath. If the coils are well insulated, there is a lag in the transmission of the heat. Bare wires usually corrode, unless of platinum, and this is too expensive to be available in the average laboratory. Also, some particular place in the bath must be reserved for the bulbs or coils. The ideal heater would be one which heated all parts of the bath simultaneously and which was free from lag. Such heating is most closely realized by dipping electrodes into an electrolyte, thus utilizing the resistance of the bath itself and making it the heating circuit.

L. Ehrman[1] has tried an electrical method for heating, in which he used the liquid (dilute sulfuric acid) in the bath for the resistance, and passed the current between two platinum points sealed in glass tubes. He states that he obtained good results for twenty hours.

Without a previous knowledge of Ehrman's work, the authors made use of copper plates—later replaced by graphite plates—in aqueous solution with the 110 volt alternating current. Sheets of copper, 8 cm. square and 6.5 cm. apart, in series with a relay interrupter, were first tried in a 17 liter thermostat at 40°. The relay *a b*, was a modified telegraph pony relay of 20 ohms resistance, which served to make and break the heating circuit as the temperature of the bath fluctuated. Relays with metal con-

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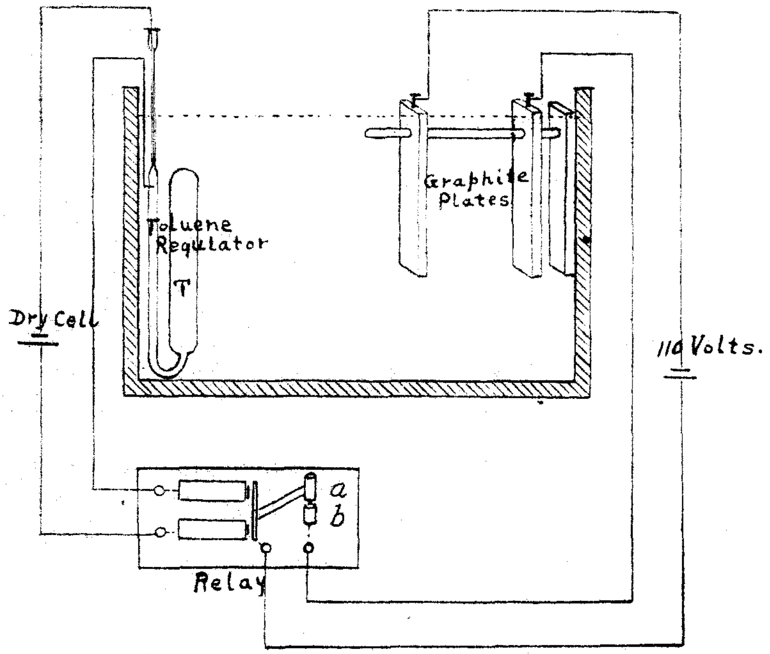
[1] *Bull. assoc. chim. sucr. dist.*, 26, 272.

tacts are not satisfactory for higher currents because they become heated, the contacts stick together, and the metals erode rapidly. Mercury is unsatisfactory because of spattering and rapid volatilization. The metal contacts of the relay were, therefore, replaced by carbon pencil contacts, 1 to 2 cm. in diameter. One carbon pencil was attached to the armature and the other fixed to the base. The relay coils were connected in series with a mercury toluene regulator T, in which nickel wire was used to make contact with the mercury. A single dry cell served to operate the relay.



The results obtained with the copper electrodes were very satisfactory. Some of the copper, however, dissolved, for the water in the bath assumed a green color; but after a day's use at 40° the plates lost only a little in weight. Still, as time went on they became more corroded. Graphite plates were then substituted for the copper ones, and no further trouble was experienced when either the alternating or direct current was employed. The carbon electrodes were 1 cm. thick and of two sizes, 10 × 10 cm. and 10 × 20 cm. They were fastened to wooden supports in such a way that the distance between the plates could easily be varied. These electrodes were used in two baths of widely differing capacities.

A general idea of the size of the electrodes, and the distance between them, necessary to maintain the desired temperature for baths having a fair thermal insulation, can be obtained from the following data: The distances given here are those experimentally found to meet the ordinary conditions of the laboratory (temperature of the laboratory, about 20°). The variation of temperature given in Column VI represents the extreme temperature fluctuation observed during a period of several days. In no case was the liquid directly between the heating electrodes observed to vary more than in any other portion of the bath. For the electrolyte, tap water and solutions of sodium sulfate were used. During the experiments vigorous stirring was found essential to good regulation.

WITH ALTERNATING CURRENT 110 VOLTS.

Temperature of bath.	Size of bath. Liters.	Size of electrode Cm.	Specific conductance at bath.	Distance apart of electrodes. Cm.	Variation of temp.
30°	17	10 × 10	0.00044	13.0	0.005°
40°	17	10 × 10	0.00044	6.5	0.010°
70°	17	10 × 10	0.00044	3.5	0.025°
30°	310	10 × 20	0.00044	5.0	0.005°
WITH DIRECT CURRENT 110 VOLTS.					
30°	17	10 × 10	0.00044	13.0	0.005°
70°	310	10 × 20	0.00044	3.5	0.025°

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Oxidation of Arsenious and Antimonious Oxides.—In a short paper entitled "Oxidation of Arsenious and Antimonious Oxides," published in THIS JOURNAL, **33**, 1762 (1911), the author, J. Bishop Tingle, states that, in the course of some work having for its object the preparation of certain new organic arsenic and antimony compounds, he dissolved particular organic compounds in dilute alcohol, added arsenious acid or antimonious oxide and boiled the mixture for a number of hours under a reflux condenser. At the end of a definit time he found the arsenious acid (when that compound was used) was converted into arsenic acid. Further, he states that "the presence of organic compounds other than alcohol appeared to exert little if any effect on the results." He then describes the following experiment: "Arsenious oxide (0.5 gram) after being boiled during 26 hours with 95% alcohol (3 cc.) and water (5 cc.) was found to have been converted completely into arsenic acid. Similar results were obtained with antimonious oxide."

Having reason to doubt the accuracy of this work, I carefully repeated this experiment several times using a carefully prepared standard solution of iodine to determin the amount of arsenious acid. In all my determinations the amount of this acid at the end of each experiment corresponded with the amount taken for the same, showing that no appreciable transformation into arsenic acid had taken place. This, of course, is quite contrary to the results stated to have been obtained by Tingle.

If Tingle is correct, antimonious oxide also should be converted into the higher oxide under the conditions mentioned by him. I made a number of determinations using very pure antimonious oxide and found no evidence of the conversion into the higher oxide.

Further, several experiments were made using different proportions of the acids, alcohol and water but always with the same result.

PERCY EDGERTON.

[CONTRIBUTION FROM THE CHEMICAL LABORATORY OF THE OHIO STATE UNIVERSITY.]

THE EXISTENCE OF MANDELIC ALDEHYDE IN AQUEOUS SOLUTION.

BY WILLIAM LLOYD EVANS AND CHARLES RAYMOND PARKINSON.

Received September 17, 1913.

In a recent report[1] from this laboratory, on the "Preparation and the Oxidation of Styrolene Alcohol," it was stated that the authors of the present paper were engaged in an attempt to synthesize mandelic aldehyde. We were anxious to know whether this compound was capable of existence, under the conditions employed in the studies with styrolene alcohol, *viz.*, at ordinary temperature and pressure, and in the presence of water.

The only other previously recorded attempt to isolate this substance was that of Nef.[2] He prepared mandelic aldehyde acetate by the interaction of α-bromphenylacetaldehyde and silver acetate in absolute ether. He then attempted to hydrolyze the product thus obtained at 100°, and found that the reaction products were benzoyl carbinol and acetic acid:

$$(a)\ C_6H_5.CHOCOCH_3.CHO + HOH \longrightarrow C_6H_5.CHOH.CHO + CH_3.COOH.$$

$$(b)\ C_6H_5.CHOH.CHO \longrightarrow C_6H_5.CO.CH_2OH.$$

In a similar study, Nef[3] found that acetol and acetic acid were formed by the hydrolysis, at 100°, of lactic aldehyde acetate, which had in turn been prepared by the action of α-iodopropionic aldehyde and silver acetate in absolute ether.

Subsequently, Wohl and Lange[4] prepared lactic aldehyde at ordinary temperature. They prepared diethoxyacetic acid by the interaction of dichloroacetic acid and sodium ethylate. This product was condensed with piperidine, and on treatment of the piperidide thus formed with methyl magnesium iodide, by Grignard's general method, they obtained the acetal of pyruvic aldehyde. By reduction, the acetal of lactic aldehyde was obtained, which, in turn, was hydrolyzed with 0.1 *N* sulfuric acid. By this latter reaction the free aldehyde was prepared. It is therefore clear, that lactic aldehyde is incapable of existence in water at 100°,

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[1] THIS JOURNAL, **35**, 54.

[2] *Ann.*, **335**, 268.

[3] *Ibid.*, **335**, 266.

[4] *Ber.*, **41**, 3612.