Calculating these for the ratio $ZrOCl_2.3H_2O : ZrO_2$, taking H = 1.008, O = 16, and Cl = 35.45. we have the following:

Maximum ratio······	53.055	Atomic weight······	91.12
Mean " ······	52.986	" " ······	90.78
Minimum " ······	52.951	" " ······	90.61

The atomic weight as determined by Bailey is 90.65. The mean value given in Clarke's Recalculation is 90.40. I purpose repeating the determinations with the oxychloride, with such modifications as have occurred to me since the completion of the above work.

UNIVERSITY OF NORTH CAROLINA.

THE SURFACE-TENSIONS OF AQUEOUS SOLUTIONS OF OXALIC, TARTARIC, AND CITRIC ACIDS.

BY C. E. LINEBARGER.

Received January 5, 1898.

IN the determination of the surface-tensions of the solutions of citric, oxalic, and tartaric acids, the apparatus described in a previous number of this Journal[1] was employed. The "apparatus constant" was ascertained directly before and after a series of determinations, Ramsay and Shields'[2] data for water being taken as the standard; the variation, when there was one, which seldom happened, affected only the decimal places after the second. At least five readings of the adjustment of the tubes were made for every solution, and their average taken. The specific gravity of the solutions were determined to one or two figures in the fourth decimal place and were referred to water at temperature of its maximum density.

The thermometer had been tested by the Physikalische Reichsanstalt, at Berlin, and found to be without appreciable error in the neighborhood of 20°.

The acids were the purest obtainable and were recrystallized once or twice.

The solutions were prepared by dissolving the solid acids so as to form almost saturated solutions, and then diluting this stock solution ; their surface-tensions were measured very soon after they were made up, although it was found that that phys-

---

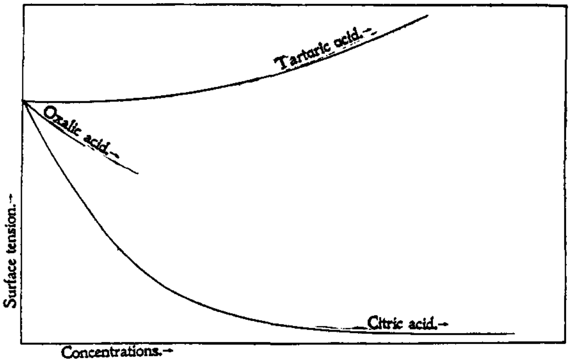
[1] This Journal, 18, 514.

[2] *Ztschr. phys. Chem.*, 12, 471. Surface-tension for water at 15° was taken to be 71.27 dynes per cm.

ical property did not alter with time, provided the solutions were hindered from evaporation; enough solutions to clearly determine the curve for each acid were investigated.

The percentage composition of the solutions were taken from the tables of specific gravities prepared by Gerlach.

The following tables contain the data which are represented graphically in Fig. 1; the curve for oxalic acid is raised a little so as to make its origin coincide with the origin of the other curves; this slight shift has no appreciable influence on the shape of the curve.



SURFACE-TENSION OF OXALIC ACID SOLUTIONS AT 17.5°.

Per cent. acid.	Apparatus constant.	Specific gravity referred to water at 4°.	Distance between ends of tubes.	Surface-tension in dynes per cm.
1.53	1.275	1.0087	54.15	70.65
2.91	1.275	1.0152	53.71	70.55
4.33	1.275	1.0243	53.21	70.34
9.13	1.275	1.0323	52.25	69.85

SURFACE-TENSION OF TARTARIC ACID SOLUTIONS AT 15°.

18.18	1.278	1.0870	50.57	71.44
33.33	1.278	1.1866	46.75	72.11
50.05	1.278	1.2699	44.23	73.39
53.32	1.278	1.2913	43.74	73.86

SURFACE-TENSION OF CITRIC ACID SOLUTIONS AT 15°.

6.12	1.268	1.0223	52.70	69.35
8.03	1.268	1.0313	51.89	68.91
18.05	1.268	1.0708	47.97	66.27
29.96	1.268	1.1243	45.07	65.46
31.11	1.268	1.1301	44.72	65.41
43.52	1.268	1.1865	42.34	65.17
58.00	1.268	1.2656	39.62	65.19
64.53	1.268	1.2990	38.55	65.18
65.08	1.268	1.3011	38.50	65.19

The curves are quite different in trend. Oxalic and citric acids diminish in surface-tension as the concentration increases; the limited solubility of oxalic acid does not permit of an extended comparison of the two acids, however. A curious fact about the curve for citric acid is its being rectilinear and parallel to the x-axis at concentrations varying between thirty-five and sixty-five per cent.; within this range the surface-tensions of the solutions are independent of their concentrations.

The curve for tartaric acid gradually rises, becoming steeper and steeper as the concentration increases. For moderate concentrations it is approximately straight, which, for that matter, is the case with the other two acids also.

The reasons for the peculiarities of these curves are probably to be sought in the possible molecular polymerization and undoubted electrolytic dissociation of the acids in aqueous solution; very complicated relationships are presented, which in the absence of other physical data on the subject, it would now be unprofitable to attempt to unravel.

SODIUM PEROXIDE IN QUANTITATIVE ANALYSIS.[1]

BY C. GLASER.

Received January 5, 1898.

W. HEMPEL[2] and J. Clark[3] first proposed to use sodium peroxide in quantitative analysis. Hempel employed it for the oxidation of chromium, manganese, tungsten, and tin, and subsequent determination by known means; he also mentions that sulphur is completely oxidized to trioxide. He further recommends the reagent for the decomposition of zinc-blende and galena.

J. Clark recommends it for the estimation of sulphur, arsenic, and chromium, also for the separation of manganese from zinc, nickel, and cobalt. He states[4] that the action of sodium peroxide on coke and coal is too violent for analytical purposes. T. Spüller and S. Kalman[5] use it on ferrochrome, chrome steel,

[1] A review of various propositions made since 1892.

[2] *Ztschr. anorg. Chem.*, *1892*, 3, 193-194.

[3] *J. Chem. Soc.*, *1893*, 1079.

[4] *Ibid*, 63, 1079.

[5] *Chem. Ztg.*, 17, 18.