APPLICATION OF THE COPPER-ZINC COUPLE TO THE ESTIMATION OF NITRATES IN WATER.

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SOME time ago I had occasion to consider the most readily available methods of estimating nitrates in the process of water analysis.

Crum's method by reduction to nitric oxide was found most satisfactory for regular use in the laboratory; but we were also in need of a handy method applicable in circumstances where few of the appliances of an analytical laboratory were accessible.

In the *Journal of the Chemical Society*, vol. xxxix, page 100, Mr. Whiteley Williams describes a process of reducing the nitric acid to ammonia by a copper-zinc couple, and nesslerising a few cubic centimetres of the water so treated.

On endeavouring to repeat Mr. Williams' experiment, only inaccurate results were obtained. After trying various modifications of the method, I came to the conclusion that the following are the conditions of greatest accuracy.

1. The nitric acid should only be present in small quantity—best not more than 10 or 12 grains per gallon. Waters containing more than this should be proportionately diluted with distilled water.

2. The couple is most active in slightly acid solutions. I find it best to acidify with oxalic acid, which has the advantages both of precipitating the lime, and of forming an insoluble compound with the zinc.

The method of procedure is as follows:—The couple is made by immersion of clean zinc foil in a 3 per cent. solution of copper sulphate for 10–15 minutes. It is then gently washed, and about 1 square decimetre placed in a wide-mouthed stoppered bottle of 300–400 c.c. capacity. About 0.5 gramme of oxalic acid is added, and the bottle filled with the water to be analysed. The reduction may then safely be assumed to take place in the cold in 24 hours. But if the bottle be heated in a water-bath to 55°–60° C. the reduction will be found to be completed in $1\frac{1}{2}$ to 2 hours.

From 2 to 10 c.c. of the water are now carefully withdrawn in a graduated pipette, made up to 50 c.c. in the Nessler glass with ammonia-free water, and nesslerised in the usual way.

The use of oxalic acid enables the temperature to be raised to 60° C. without loss of ammonia, and the reduction is then completed rapidly. The oxalic acid used must of course be free from ammonia and nitric acid.

Attempts were made to use granulated zinc instead of zinc foil for making the couple; but the couple so obtained was weaker and more uncertain in its action.

The following are the results of the experiments made. When not otherwise stated, I worked upon dilute solutions of potassium nitrate of known strength; but in the case of natural waters the figures obtained are compared with determinations by Crum's method.

As the work was with a view to water analysis, the results are stated in grains per gallon of nitric acid (N_2O_5).

In the first seven experiments, granulated zinc was employed for making the couple, and the quantity of oxalic acid varied from 1 to 2 grams.

	N ₂ O ₅ present.	N ₂ O ₅ found.	Remarks.
1.	7.00	7.22	2 hours at 50° C.
2.	3.50	4.17	2 hours at 50° C.
3.	14.00	13.90	20 hours in cold.
4.	4.08 (Crum)	(a) 3.89 (b) 4.17	2 hours at 60° C. 24 hours in cold.
5.	3.03 (Crum)	3.00	2 hours at 60° C.
6.	5.00	4.72	24 hours in cold.
7.	10.00	7.78	24 hours in cold.

After this, zinc foil was employed.

8.	7.00	6.95	2 hours at 60°.
9.	4.20	3.90	48 hours in cold.
10.	5.00	5.28	18 hours in cold.
11.	1.00	.95	20 hours in cold.
12.	62.26 (Crum)	43.86	40 hours in cold.
13.	62.26 ,,	61.31	The water was diluted to 10 times its original volume, then stood on couple 20 hours in cold.
14.	17.90 (Crum)	15.56	40 hours in cold.
15.	1.40	1.44	2 hours at 55°—60° C.
16.	4.20	4.17	2 hours at 55°—60° C.
17.	5.18 (Crum)	5.45	1½ hours at 60° C.
18.	1.44 (Crum)	1.44	1½ hours at 60° C.
19.	5.97 (Crum)	6.20	1½ hours at 60° C.

In experiments 8 to 14 the quantity of oxalic acid varied from 0.5 to 1.0 gram ; and in the last 5 experiments it was 0.5 gram.

In conclusion, I wish to record my obligations to Dr. Graham, in whose laboratory these experiments were made.

MILK ANALYSIS IN BOSTON, U.S.A.

In connection with extracts from Dr. Bell's new book on Milk Analysis, &c., printed on another page, the following analyses made during one year, by the Analyst of Boston, will, no doubt, be of interest to our readers, as showing the standard adopted in that city.

MILK ANALYSES MADE DURING THE YEAR.

No	Gravity.	Cream per cent.	Total solids.	Fatty matter	Solids not fat.	Water.	Per cent. of water added.
1	1.028	1½	9.20	0.42	8.78	90.80	15
2	"	3½	7.85	0.98	6.87	92.15	35
3	"	5	10.50	1.45	9.05	89.50	20
4	"	8	12.80	2.15	10.65	87.20	
5	"	2	7.42	0.58	6.84	92.58	40
6	"	4.5	11.15	1.46	9.69	88.85	15
7	"	4	9.50	1.32	8.18	90.50	25
8	"	4.5	11.20	1.68	9.52	88.80	15
9	"	7	10.98	2.15	8.83	89.02	15
10	"	5	10.25	1.65	8.60	89.75	20
11	"	7	11.15	2.15	9.00	88.85	15
12	"	7.5	13.70	2.18	11.52	86.30	pure.
13	"	6	10.25	1.92	8.33	89.75	20
14	"	4	10.87	1.80	9.07	89.13	16
15	"	5	10.40	1.58	8.82	89.60	20
16	"	7	10.60	1.95	8.65	89.40	20
17	"	9	10.45	2.65	7.80	89.55	20
18	"	6.5	10.40	1.82	8.58	89.60	20
19	"	7	11.05	2.19	8.86	88.95	15

FOOD ADULTERATION IN FRANCE.

The following Analyses were made at the Paris Municipal Chemical Laboratory, during the month of June, 1883 :—

Nature of the Samples Analysed.	Good.	Passable.	Bad.		Totals.
			Not Injurious.	Injurious.	
Wines	71	.. 57	.. 412	.. 13	.. 553
Vinegars	1	.. 3	.. 1	.. —	.. 5
Beers	16	.. —	.. 2	.. 3	.. 21
Ciders	—	.. 1	.. 5	.. —	.. 6
Alcohols and Liqueurs	—	.. 2	.. —	.. 12	.. 14
Syrups.....	1	.. —	.. —	.. —	.. 1
Waters	15	.. 3	.. 2	.. 21	.. 41
Milks	44	.. 173	.. 197	.. —	.. 414
Malt.....	—	.. —	.. —	.. —	.. —
Butters	15	.. —	.. 2	.. —	.. 17
Oils	3	.. 1	.. 4	.. —	.. 8
Flours	5	.. —	.. 8	.. —	.. 13
Dough, Bread.....	1	.. 1	.. —	.. 1	.. 3
Sweetmeats.....	—	.. —	.. —	.. 1	.. 1
Meats	—	.. —	.. 1	.. —	.. 1
Preserves.....	3	.. —	.. —	.. 2	.. 5
Salt, Pepper	5	.. —	.. 13	.. —	.. 18
Chicory, Coffee, Tea..	—	.. 2	.. —	.. —	.. 2
Chocolates	1	.. —	.. 7	.. —	.. 8
Honeys	—	.. —	.. —	.. —	.. —
Confitures	—	.. —	.. —	.. —	.. —
Colouring Materials ..	2	.. 2	.. —	.. 5	.. 9
Toys	—	.. —	.. —	.. 7	.. 7
Coloured Papers	—	.. —	.. —	.. —	.. —
Tins.....	2	.. —	.. 1	.. —	.. 3
Spices	8	.. —	.. —	.. —	.. 8
Pharmaceutical Pro- ducts	—	.. —	.. —	.. —	.. —
Perfumery	5	.. —	.. —	.. —	.. 5
Various	22	.. 2	.. 8	.. 11	.. 43
TOTAL....	220	247	663	76	1,206