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April 21, 1845.—William Thomas Brande, Esq., Vice-President,
in the Chair.

Mr. John Thomas Cooper presented a Galvanic arrangement constructed by the late Dr. Wollaston, consisting of a minute pair of zinc and silver elements, capable of heating to redness a fine platinum wire.

George Philips and George Southby, Esqrs., were elected Members.

The following communications were read :—

A note from Professor Liebig, stating that Dr. Hofmann, in continuing his investigations on coal-gas naphtha during the last summer, had proved that leucol and chinolin were identical.

Professor Bunsen communicated the substance of a paper from M. Genth on the discovery of a large quantity of chemically pure oxide of nickel in the scum which arises in the smelting of copper in certain works in Germany. This oxide of nickel, which amounts to upwards of 13 per cent. in the top skimming, is in a peculiar allotropic condition, being insoluble in acids, and possessing a high specific gravity. It communicates, even in a very minute proportion, great brittleness to the metallic copper and its alloys.

A short notice from Dr. Clark was read to the effect, that as lead is the chief poison ever to be apprehended in water, and as its occurrence is not unfrequent where the water has to be conveyed through much length of leaden pipe, it will probably be satisfactory to the Society to learn, that this poison may be entirely removed by means of an effective filter.

CXLII. *On the Conversion of Cane-sugar into a substance isomeric with Cellulose and Inulin.* By THOMAS TILLEY, Esq., Ph.D., and DOUGLAS MACLAGAN, M.D., F.R.S. Edin.

WHEN the juice of beetroot undergoes fermentation at temperatures varying from 30° to 40° C., the cane-sugar which it contains is at first converted into sugar of grapes, and after some time into mannite, lactic acid and a gummy substance, having a composition identical with that of gum-arabic. This is remarkable, inasmuch as it affords an instance of what may be called a retrograde chemical action, the sugar being converted into dextrine,—a change similar to that which occurs in fruits when they lose their sweetness, and assume that condition commonly called “sleepy.” The conversion of cellulose into dextrine and sugar seems to be a process of continual occurrence and great importance in the vegetable œconomy, but we are not aware of any example of the reverse of this action, except those instances mentioned above; in the former of which sugar is converted by fermentation into a body having all the properties and composition

of gum; in the latter, the sugar being changed into cellulose*. We therefore consider the observation we are about to describe to be possessed of some interest, as affording another case of a similar retrograde action. It has been observed that the effervescing drinks known as lemonade, gingerade, &c., made by forcing carbonic acid gas into solutions of sugar variously flavoured with tartaric acid and essential oils, in certain cases lose their fluidity, and assume a thick, slimy consistence. When the bottles containing these thickened liquids are opened, the expansion of the carbonic acid expels their contents with difficulty, owing to their extreme tenacity. Instances of this change are of continual occurrence, all the manufacturers of whom we have inquired having observed it when the bottles had been kept for some time. Various opinions have been expressed by them as to the cause of the conversion, but it seems to occur invariably when the liquor is kept long enough. We are indebted to Mr. Baidon of this city (Edinburgh) for an opportunity of examining a sample of gingerade, in which this thickening had occurred. This liquid is made by sweetening an infusion of ginger-roots with cane-sugar, and flavouring it with oil of lemons and tartaric acid; this is then placed in bottles, and carbonic acid forced by pressure into the fluid. Another manufacturer uses the following ingredients in the preparation of effervescing lemonade:—2 ounces of honey, 4 pounds of sugar, 2 ounces of citric acid, 2 drachms of oil of lemons and $1\frac{1}{2}$ ounce of bicarbonate of soda. According to the opinion of this manufacturer, the change occurs chiefly in winter, when the liquid is exposed to cold, and he thinks that the addition of a double proportion of honey tends to prevent it. To separate the substance to which the viscosity was owing, the contents of a bottle were digested with six or seven parts of alcohol, under the action of which the gummy matter consolidated, and when dried became so hard as to be pulverizable. After being powdered, it was again digested and washed with alcohol until nothing more was dissolved. When dried at 100° C. it had the appearance of a semi-transparent horny substance, and was sufficiently elastic to render pulverization difficult. The alcohol contained in solution a quantity of sugar of a brownish colour, quite uncrystallizable, and rendered sour by the presence of the acid used in the manufacture.

The gummy substance treated with cold water slowly re-assumes its original appearance. When treated with a large quantity of boiling water it forms a mucilage, which filters with difficulty. Iodine produces no effect on the solution.

* See Mulder's *All. Phys. Che.*, p. 243 *et seq.*

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Subjected to Trommer's test for dextrine, sugar and gum, this did not indicate the presence of any of these substances. With nitric acid it produces oxalic acid. It gives a precipitate with diacetate of lead. It contains, after having been washed with alcohol, a small quantity of ashes, amounting to 1.37 per cent. It was analysed in the usual manner.

I. 0.746 of substance gave, with oxide of copper and chloride of potash, 4.070 HO and $1.1735 \text{ CO}_2 = 0.04727 \text{ H}$ and 0.32448 C.

II. 0.1525 of substance gave 0.092 HO and $0.232 \text{ CO}_2 = 0.010222 \text{ H}$ and 0.06474 C.

These numbers, allowance being made of the ashes, give the following proportions:—

	I.	II.	Atoms.	Calculated.
Carbon . .	43.80	43.31	24	43.71
Hydrogen . .	6.14	6.80	21	6.25
Oxygen . .	50.06	49.89	21	50.04

From this it would appear that this gummy substance is isomeric with cellulose and inulin*.

This substance, which has a composition similar to cellulose and inulin, is evidently formed from the cane-sugar in the lemonade, as all its other constituents exist in too small quantity to admit the idea of their having been its origin.

2 atoms sugar	C 24	H 22	O 22
1 ... water		H	O
1 ... gummy substance	C 24	H 21	O 21

This substance is formed then from 2 atoms of sugar by the abstraction of 1 atom of water.

As a solution of the gummy substance gave a compound with lead, we endeavoured to obtain by its aid its atomic weight. 0.260 of the precipitate gave of lead and oxide of lead quantities equal to 0.316 oxide of lead, which, when allowance is made for ashes, is equal to 55.8 per cent. of oxide of lead. We had not enough of the salt to enable us to make the combustion, but have calculated the formula from the quantity of lead.

* Cellulose, Payen. Endine.	From turnip. Fromberg.
Carbon . 43.40	Carbon . 43.95
Hydrogen . 6.12	Hydrogen . 6.13
Oxygen . 50.38 ^a	Oxygen . 49.66 ^b
Inulin. Parnell.	From Dahlia root. Payen.
Carbon . 43.95	Carbon . 44.19
Hydrogen . 6.30	Hydrogen . 6.17
Oxygen . 49.75 ^c	Oxygen . 49.64 ^d

^a *Ann. de Sc. Nat.*, 1840, p. 73. Bot.

^b Mulder, *Op. cit.*, p. 203.

^c *Ann. der Chem. und Pharm.*, Bd. xxxix. S. 213.

^d *Op. cit.*, p. 91.

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		Atoms.	Calculated.
Carbon .	19·31	24	1834·4 = 18·7
Hydrogen	2·76	21	260·0 = 2·7
Oxygen .	22·11	21	2100·0 = 21·4
PbO . .	55·80 found	4	5578·0 = 57·1

From 55·8 per cent. oxide of lead the atomic weight found is 4400·0. The calculated one is 4198·4.

We had imagined that this curious change in sugar might have been the effect of organization, but our friend Mr. John Goodsir was kind enough to examine the substance, and informed us that he could discover no trace of organization.