

The following paper shows that this expectation has been fulfilled.

Dr Walker and I are at present engaged in applying this method to other dibasic carbon acids, saturated and unsaturated, and hope shortly to communicate further results.

The Electrolysis of Potassium-Ethyl Malonate and of Potassium-Ethyl Succinate. By Prof. Crum Brown and Dr James Walker.

(Read February 17, 1890.)

(Abstract.)

Synthesis of Succinic Acid.—Potassium-ethyl malonate is easily prepared according to the directions of Freund (*Berichte der deut. chem. Gesellschaft*, xvii. 780).

The conditions most favourable for the electrolysis were found to be as follows:—A large platinum crucible formed the cathode, while a spiral of stout platinum wire was used as the anode. The source of electricity was a battery of accumulators, and the current was so regulated that while passing through the solution it had an electromotive force of 12 volts and a strength of not more than 5 amperes. Under these circumstances the heat developed in the solution could be easily conducted away by a stream of cold water flowing round the platinum crucible. Heating is to be avoided, on account of possible saponification of the potassium ethyl salt by the action of the caustic potash formed at the cathode. With the above arrangement, however, the hydrogen developed at the cathode serves to stir up the liquid and bring the potash into contact with the carbonic acid liberated at the anode, and thereby convert it into carbonate, which, far from being prejudicial to the action, seems on the whole advantageous. One point to be attended to is that the solution should not be too concentrated. When this is the case the liquid has a high resistance, and the electrolysis proceeds slowly; the product, too, is not so satisfactory as when the solution is so far diluted that a brisk evolution of gas takes place at both poles without any excessive frothing being occasioned by the viscosity of the

liquid. After the current has passed for some time, a deposit begins to be formed in the solution. This is mainly potassium carbonate, with possibly some bicarbonate. When this has increased somewhat in quantity the current is broken, and the contents of the crucible transferred to a separating-funnel, where they are shaken up with ether. A further quantity of carbonate is thereby precipitated. The aqueous layer is then allowed to run out, nearly all the solid carbonate remaining behind, and the ethereal layer is poured off. The former is again submitted to electrolysis, and the extraction with ether repeated. The ethereal liquids are united, dried with calcium chloride, and the ether distilled off on a water-bath.

In our first experiment, made with 15 grams of the double malonate, there remained in the distilling-flask over 3 grams of a nearly colourless liquid of ethereal odour. This liquid was subjected to fractionation; it passed over almost entirely at 213° (uncorr.): the boiling-point of succinic ether is 216°. A portion of the distillate was analysed, with the following results:—

·2619 gr. substance gave ·5287 gr. CO₂
and ·1930 gr. H₂O

	Found.	Calculated for Succinic Ether.
C	55·06%	55·17%
H	8·19	8·05

There was thus little doubt that the substance so obtained was succinic ether. In confirmation, however, a portion of the ether was saponified, and the white silver salt precipitated. This salt was then carefully ignited, and the residue of silver weighed.

·1878 gr. substance gave ·1215 gr. silver.

	Found.	Calculated.
Ag.	64·7	65·0

Synthesis of Adipic Acid.—Heintz (*Poggendorff's Annalen*, 108, 82 [1859]) obtained potassium-ethyl succinate by treating succinic anhydride with absolute alcohol, neutralising with potassium carbonate, and precipitating the double salt from its alcoholic solution with ether.

The conditions to be observed in the electrolysis are quite the same as in the case of potassium ethyl malonate, and the mode of

extraction is identical. The residue left on distilling off the ether on the water-bath is a liquid of pale straw-colour, with a pleasing but faint odour of melons. It boils with decomposition at about 240°. An analysis of the substance thus obtained, after drying in an exhausted desiccator, gave the following numbers:—

	·1735 gr. substance gave ·3770 gr. CO ₂ and ·1423 gr. H ₂ O	
	Found.	Calculated for Adipic Ether.
C	59·26	59·41
H	9·11	8·91

The product thus appears to be practically pure adipic ether. From 70 grams potassium ethyl succinate 15 grams of adipic ether were obtained.

A portion of the ether was saponified with alcoholic potash, and from part of the potassium salt thus produced the silver salt was precipitated, while another part was converted into the acid, which was purified by shaking its ethereal solution repeatedly with small quantities of water. The acid melted at 147°: the melting-point of adipic acid is 148°. The white silver salt was analysed for silver with the following results:—

	·2388 gr. silver salt gave ·1428 gr. silver.	
	Found.	Calculated for Silver Adipate.
Ag.	59·8	60·0

The Action of Sodium Carbonate and Bromine on Solutions of Cobalt and Nickel Salts. By Dr John Gibson.

(Read February 17, 1890.)

(*Abstract.*)

In 1862 Field gave a brief account of a peculiar green solution, prepared by adding nitrate of cobalt to a solution of bicarbonate of soda containing a small quantity of the hypochlorite of that alkali. The author observed the formation of a similar green solution when making qualitative separations of chromium from other members of