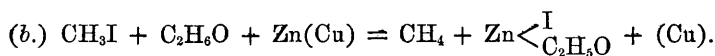
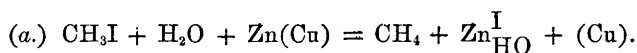


XXIII.—*Note on the Preparation of Marsh-Gas.*

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IN 1873 (*Chem. Soc. J.*, **26**, 682) we described two reactions in which marsh-gas was produced free from other hydrocarbons. The reactions were brought about by the action of the copper-zinc couple on methyl iodide in presence of water or alcohol, in accordance with the equations—



The experiments which enabled us to deduce these equations were made on a somewhat small scale, and no attempt was made to prevent the methyl iodide from being carried away by the gas. The loss from this cause was in fact considerable. In presence of water, for example, 23 per cent. of the organic iodide was lost in this way; and, in presence of alcohol, when the action was allowed to proceed by itself, there was a loss of 52 per cent., and even when the containing vessel was kept immersed in cold water, the loss amounted to 43 per cent.

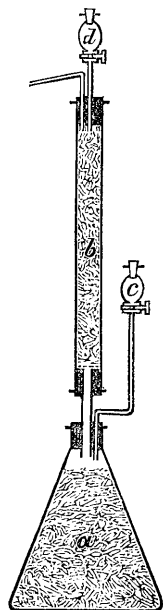
It was evident, however, that the reaction in which alcohol took a part, supplied the basis of a simple and expeditious method for preparing marsh-gas in a state of purity. We have now the pleasure of communicating to the Chemical Society an account of the modifications in our original experiments, which place the preparation of marsh-gas among the most simple of chemical operations. We employed in the old experiments the expensive zinc-foil, but we find that this may be replaced by the metal in the ordinary granulated condition.

Experiment I.—550 grams of somewhat thinly granulated zinc were placed in a flask *a* (see figure) having a capacity of 600 c.c., and 150 grams in a glass tube *b*, 12 inches long by 1 inch internal diameter, which is intended to serve the double purpose of a copper-zinc couple scrubber, and an inverted condenser. To prevent any finely divided copper or zinc from dropping from *b* to *a*, the orifice of the tube which connected the two parts of the apparatus was covered with copper gauze. In order to prepare the couple, the zinc was treated for a few minutes with dilute sulphuric acid, and washed twice or three times

with water. A 2 per cent. solution of copper sulphate was poured on to the clean metal and allowed to remain until nearly or completely decolorised. The solution of ZnSO_4 was poured off, and the treatment with the dilute copper solution, &c., repeated three times. The couple was washed three or four times with water until the sulphate was practically removed. The water was next replaced by ordinary rectified alcohol, sp. gr. 0.805, which, after a few minutes, was poured away; the vessels were filled again with alcohol, and again after a little while this was poured off, leaving the now prepared couple wet with alcohol.

The parts of the apparatus being put together, 20 c.c. (45 grms.) of methyl iodide were poured into the tap funnel *c*, together with an equal volume of alcohol, and the mixture allowed to run into *a*. The reaction expressed by equation (*b*) commenced at once, and the gas was collected over water (temp. 30°C ., barom. 749 mm.). The 1st litre of marsh-gas was evolved in 8 minutes; the second in 11 minutes; the 3rd in 12 minutes; the 4th and 5th each in 11 minutes; the 6th in 15 minutes; the 7th in 27 minutes. We now ceased observing, but during the night 500 c.c. more of the gas were collected, making a total of 7500 c.c., which corrected for temperature, pressure, &c., correspond to 7053 c.c. As the theoretical amount of marsh-gas capable of being produced from 45 grams of the iodine is only 7100, this shows that the loss is almost entirely prevented by this modification of the process, 99.3 per cent. of the possible amount of marsh-gas having been obtained.

Experiment II.—In this experiment 650 grams zinc were placed in the flask, the difference in weight being due to the greater thickness of the granulated metal. In all other respects the preliminaries of this experiment were similar to Experiment I. As before, marsh-gas was immediately evolved on pouring the mixture of methyl iodide and alcohol (20 c.c. of each) into the flask. The 1st litre was collected in 9 minutes; the 2nd in 10; the 3rd in 15; the 4th in 16; the 5th in 20; the 6th in 30; and the 7th in 96 minutes. 40 c.c. of the iodide mixed with 20 c.c. of alcohol were now introduced into the flask, by the funnel *c*, and 20 c.c. more alcohol were added little by little, and from time to time, during the evolution of the gas, by the funnel *d*. The 8th litre of marsh-gas was collected in 11 minutes; the 9th in 23; the 10th in 31; and the 11th in 45 minutes. The bottom of the flask was next immersed about 2 inches in water at 40° , and the water



kept at this temperature. The 12th litre of gas was collected in 22 minutes; the 13th in 10 minutes; the 14th, 15th, 16th, and 17th each in 11 minutes; the 18th in 13; and the 19th in 20 minutes. We now ceased collecting the gas, but in about 12 hours the action was found to be completed. This shows that the process can be greatly expedited, if desired, by raising the temperature.

The gas, as it left the delivery tube, contained traces of methyl iodide and alcohol, from which of course it may be separated by well known methods.
