XII.—*On a New Method of Forming Organo-metallic Bodies.*

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Eight years ago I showed that sodium attacks zinc-ethyl, precipitating zinc, and forming sodium-ethyl. Having observed similar reactions between zinc-ethyl and the metals potassium, lithium, calcium, and strontium, and having regard to the great facility with which these displacements of metal are effected, I was led to compare them to the well-known electro-chemical precipitation from ordinary metallic solutions, and to regard them as examples of a very general method of producing a number of the organo-metallic bodies.

On the present occasion I have to announce a different method of procedure. Instead of taking an organo-metallic compound of

a less positive metal and attacking it with a more positive metal, I take an organo-metallic compound of one of the most positive metals and attack it with mercury, or with an amalgam, or a mixture of mercury with some other metal. The result of the operation is an amalgam of mercury with the positive metal, whilst the organic radical unites either with the mercury or with the other metal.

Thus the new method of forming organo-metallic bodies consists in utilizing for that purpose the great affinity of mercury for the alkali-metals. The following examples will serve to characterize it:—

Mercury, Zinc and Sodium-ethyl.

When the crystalline compound of sodium-ethyl and zinc-ethyl,* which is prepared by treating zinc-ethyl with sodium, is heated in the water-bath with mercury and zinc, it is rapidly resolved into zinc-ethyl and sodium-amalgam, according to the following equation:—

$$\ddot{\mathrm{H}}\mathrm{g} + \dot{\mathrm{Z}}\mathrm{n} + 2\mathrm{NaC_2H_5} = \ddot{\mathrm{H}}\mathrm{gNa_2} + \dot{\mathrm{Z}}\mathrm{n}(\mathrm{C_2H_5})_2.$$

In one experiment, I took about 10 grms. of the compound containing sodium-ethyl, and sealed it up with mercury and zinc, and heated in the water-bath. The result was a quantity of pretty pure zinc-ethyl, not less than 7 grms., and an amalgam of sodium very rich in sodium. I made an analysis of a portion of the 7 grms. of zinc-ethyl. It did not contain so much as 0·5 per cent. of sodium.

Mercury, Magnesium, and Sodium-ethyl.

Some of the crystals containing sodium-ethyl were sealed up with mercury and magnesium-wire. After a short heating in the water-bath they did not form a liquid as in the last case, but a white solid. On opening the tube it was observed that the mercury† was very considerably alloyed with sodium, and that the white solid, which did not fume, took fire spontaneously in the air, and contained magnesium and zinc, but not more than traces of sodium. Evidently, therefore, the reaction was essentially—

* Ann. Ch. Pharm. (1858).

† The mercury effervesced furiously with water, much more violently than a simple amalgam of sodium does. It would seem that the presence of a little metallic magnesium in sodium-amalgam heightens the activity of the amalgam.

$$Hg + Mg + 2NaC_2H_5 = HgNa_2 + Mg(C_2H_5)_2.$$

the magnesium-ethyl forming a compound with the zinc-ethyl previously in union with the sodium-ethyl.

Mercury, Copper, and Sodium-Ethyl.—Mercury, Iron, and Sodium-Ethyl.—Mercury, Silver, and Sodium-Ethyl.

The result in each of these three cases is mercury-ethyl and sodium-amalgam, the presence of the copper, or iron, or silver appearing to have little or no influence on the course of the reaction.

The foregoing reactions exhibit sodium-ethyl in a new light. It is a sodium compound which possesses the very singular property of giving up its sodium to mercury.

In conclusion, I would remark that since the organo-metallic bodies are liable to be attacked by mercury, very little reliance can be placed on those vapour-density determinations of organo-metallic bodies which have been made by the method of Gay-Lussac, involving, as it does, the employment of mercury in contact with the organo-metallic body in a state of vapour. Most probably the anomalous results obtained by Buckton and Odling, viz., that the vapours of aluminum-methyl and aluminum-ethyl do not expand regularly, depend upon the decomposition of those compounds by the mercury of the bath. And most probably vapour-density determinations of these compounds will be found to yield perfectly intelligible and normal results when the method of Dumas instead of the method of Gay-Lussac is employed.