

## ON MERCURIC IODATE; ITS PREPARATION AND REACTIONS.

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SOMETIME ago, I introduced ferric iodate as a therapeutic substitute for the unstable ferrous iodide, having found from the results of some experiments conducted at the Lock Hospital, Dublin, that the medicinal properties of both compounds were nearly identical. Having had occasion whilst engaged in these experiments to prepare some iodates, I found that the descriptions of some of these compounds given in the larger treatises on chemistry, were both meagre and inaccurate. In the present paper, I propose to describe new methods of preparing mercuric iodate, and to detail several interesting reactions which I observed in connection with this substance.

The only chemists who appear to have studied mercuric iodate are Rammelsberg and Pleischl: they state that it can only be prepared by digesting recently precipitated mercuric oxide with iodic acid; and that neither iodic acid nor alkaline iodates precipitate mercuric salts. This is an erroneous statement, for though iodic acid fails to precipitate with mercuric chloride, it throws down precipitates from other salts of dyad mercury.

Iodic acid added to a hot solution of oxyecyanide of mercury in the ratio indicated by the equation:  $\text{—Hg. Cy}_2 + \text{Hg.O} + 2\text{HIO}_3 = \text{Hg } 2\text{IO}_3 + \text{Hg. Cy}_2 + \text{H}_2\text{O}$ —gave a white amorphous precipitate, almost insoluble, which was with difficulty attacked by nitric acid, but which readily dissolved in hydrochloric acid. Exactly similar precipitates were obtained by mixing iodic acid and iodate of potassium with nitrate, and acetate of dyad mercury.

The white precipitate thus procured was dissolved in excess of pure potassium iodide solution, and on being acidulated yielded iodine corresponding to 46.32 per cent. in the form of iodic anhydride, the proportion required by theory in mercuric iodate being 46.18 per cent.; the precipitate was completely volatilised by heat, and in other respects comported itself like Rammelsberg and Pleischl's iodate.

Mercuric iodate is, I find, soluble in solutions of alkaline chlorides, bromides, iodides, cyanides and cyanates, of disodic hyposulphite, and of chlorides of zinc and manganese when dilute. Hydrochloric acid, even when highly diluted dissolves it: but when it is mixed with hydrobromic acid, bromine is set free, and it liberates iodine from hydriodic acid; in both cases the mercury salt is dissolved.

Mercuric iodate is insoluble in soda, potash, ammonia, hydric disodic phosphate, borax, corrosive sublimate, and alkaline iodates, chlorates, bromates, and sulphites, and in acetic, fluoric, and silicofluoric acids. It is with difficulty attacked by strong nitric acid. Mercuric bromate reacts with hydrobromic and hydriodic acids in the same way as mercuric iodate, but it is not soluble in alkaline chlorides, bromides, &c., which, however, decompose it.

Mercuric iodate, dissolved in ammonium chloride solution, yields with ammonia a white precipitate, insoluble in excess of the latter, and solution of the iodate in disodic hyposulphite, gives with hydrochloric acid a red precipitate, soluble in excess of the acid. The nature of these precipitates has yet to be ascertained.

To a solution of potassium chloride, mercuric iodate was added until it ceased to be taken up. The solution was filtered and evaporated. The crystals which first made their appearance contained the merest trace of mercury, and yielded on analysis 58.78 per cent. of iodine, the amount required by theory, assuming the crystals to be potassium iodate, being 59.34 per cent. in the form of iodic acid. These crystals, therefore, consisted of slightly impure potassium iodate.

To a solution of ammonium chloride, mercuric iodate was added in the proportion of two molecules of the former to one of the latter. The solution was filtered from excess of mercuric iodate, evaporated, and the substances therein contained crystallized out in four fractions.

Fraction 1. A relatively large amount of the substance separated in this fraction, and proved on analysis to be almost absolutely pure ammonium iodate.

Fraction 2 was identical with Fraction 1.

Fraction 3 contained a trace of mercury and consisted of slightly impure ammonium iodate.

Fraction 4 consisted of a mixture of mercuric and ammonium iodates.

The mother liquor gave with potash a yellow precipitate, not soluble in cold dilute nitric and hydrochloric acids, but soluble in them by the aid of heat.

Mercuric iodate dissolves in three molecules of ammonium chloride, sodium chloride, and potassium bromide, in the cold, and in two if the solution be boiling. Four molecules of potassium iodide, dissolve one molecule of Mercuric iodate.

When mercuric iodate is dissolved in say 4 molecules of iodide of potassium, and the solution evaporated, potassium iodate separates, leaving in solution the crystallizable double salt,  $\text{HgI}_2 + 2\text{KI}$ . A great many double salts of mercuric chloride with alkaline chlorides, bromides, &c., may be formed in this way.

A mixture of mercuric iodide, potassium chlorate, and water, heated to  $170^\circ \text{C}$ ., in a sealed tube, undergoes no change, but at about  $200^\circ \text{C}$ ., and especially with excess of chlorate, the brilliant scarlet color of the mixture soon vanishes. The tube, on being cooled, will be found filled with tufts of colorless crystals, completely soluble; on evaporating the solution of the contents of the tube, potassium iodate separates, leaving in solution mercuric chloride.

It is a rule, that two soluble compounds will decompose each other, when by an interchange of their constituents, an insoluble substance can be formed. The production of a precipitate under such conditions may, however, be prevented, by the formation of a soluble double salt, composed of an insoluble (*per se*) salt, combined with a soluble one. For example, solution of mercuric chloride fails to produce a precipitate when added to an excess of solution of potassium iodide, because the mercuric iodide formed in the solution, and insoluble in water, forms with potassium iodide the soluble salt,  $2\text{KI} + \text{Hg.I}_2$ . The behaviour of mercuric iodate with soluble iodides, bromides, &c., is, however, quite different from that of the iodide of mercury; the latter dissolves in solutions of certain iodides, &c., but the double salts thereby formed are readily procurable by the evaporation of their solutions. On the other hand, mercuric iodate dissolves in solution of, say, ammonium chloride, but when the solution is evaporated it is neither the insoluble mercuric iodate, nor a double salt of mercuric iodate with ammonium chloride, which appears, but merely ammonium iodate.

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As mercuric iodate would undoubtedly in the stomach become converted into mercuric chloride, this iodate cannot be employed for medicinal purposes.

In the present paper I have not exhausted the subject of mercuric iodate and its reactions, but I hope soon to lay before the Society the results of further experiments with this and other iodates, on which I am at present engaged.