THE ACTION OF PROTECTING COLLOIDS ON MERCURIC IODIDE.

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J. N. Friend[1] described that the mercuric iodide deposited from the mercuric chloride and the potassium iodide solutions in the presence of gelatine is the yellow modification. We have done some experiments on this subject which is described in the following.

When 1 c.c. of 0.1 normal mercuric chloride solution and 1 c.c. of 0.1 normal potassium iodide solution are added to 100 c.c. of 0.0025% gelatine solution, the deposition of mercuric iodide is considerably retarded, but the deposited iodide is ordinary red modification.

When 1.5 c.c. of 0.1 normal mercuric chloride and potassium iodide solutions are added to 100 c.c. of 0.005% gelatine solution, there appears pink coloured turbidity, which, after a while, separates itself into a red precipitate and a white turbid liquid.

When 1.5 c.c. of 0.1 normal mercuric chloride and potassium iodide solutions are added to 0.01% (or more concentrated) gelatine solution, an yellow precipitate appears, which then changes to white. This white substance again changes to the red precipitate after several days.

The yellow precipitate is a modification of mercury iodide which is stable at the temperature higher than 127°. If the pure mercuric chloride and pure potassium iodide solutions are mixed together, the yellow precipitate will appear at first, but it instantaneously changes to the stable red form. If, however, there is a protecting colloid such as gelatine in the solution, then the yellow particles will quickly be enveloped by the colloid, and are prevented to change to the stable modification. The gelatine envelope will prevent the contact of the yellow particles to each other, so the crystal nuclei of red modification can not grow itself, as can be seen in the case of large crystals or a fused mass of mercuric iodide.[2] Moreover, the solubility of the unstable yellow form in water is, of course, greater than that of the stable red form in water, but the rate of solution will considerably be retarded when the particles are wrapped by the gelatine films. So the rate of growing of the stable crystal by the expense of the unstable one will also be retarded.

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(1) J.N. Friend, *Nature*, 109 (1922), 341.

(2) Damiens, *Compt. rend.*, 177 (1923); 178 (1924), 326.

The white precipitate is probably the addition compound of yellow mercuric iodide and gelatine though this is not a stable substance but decomposes into red mercuric iodide and gelatine after a few days.

When 4 c.c. of 0.1 normal mercuric chloride and 4 c.c. of 0.1 normal potassium iodide solutions are added to 100 c.c. of 0.025% gelatine solution, the white liquid has the appearance of the milk. The white substance was separated from the liquid by using a centrifugal machine, and dried and weighed. The dried mass was heated to 400° to decompose the gelatine, and the sublimed mercuric iodide was dissolved into the potassium iodide solution. Then the mercury was estimated by passing hydrogen sulphide in this solution. By this analysis we have seen that the white precipitate was composed of 93% of mercuric iodide and 7% of gelatine, and that 1/4 of the whole gelatine in the solution combined with mercuric iodide.

In the next place, we have examined the protecting action of other colloidal substances than gelatine. The milk, the albumen, the legumine, the extracts of meats, the human saliva, the extracts of vegetables, the solution of wheat flour, etc. have the protecting power on the yellow mercuric iodide. Among these the egg albumen and the extract of the fish have the strongest protecting power, and the mercuric iodide produces not only as the yellow modification but also as an yellow transparent colloidal solution. The agar, the sodium silicate, the starch, the soap, the dextrin, the glycerin, the cane sugar, the urea etc. show no protecting action on yellow mercuric iodide, and precipitate the red form instantaneously.

Generally, we can say that the albuminous substances have the protecting action in this case.

In the following table, the "gold number" of various colloidal substances are compared with their protecting power on the yellow mercuric iodide. The gold number has been determined by the method given by Zsigmondy.[1] The protecting power on mercuric iodide was measured by the quantity of protecting colloid which is necessary to keep the substance in yellow form for 20 minutes, when 5 c.c. of 0.1 normal mercuric chloride and 5 c.c. of 0.1 normal potassium iodide solutions are added to 100 c.c. of water which contains the protecting colloid.

Protecting colloid	Gold number	Protecting power on yellow mercuric iodide
Gelatine	0.009	0.002 gr.
Egg albumen	0.1–0.4	0.01 gr.
Meat extract	1.	0.005 c.c.
Legumine solution	2.	0.1 c.c.
Gum arabic	0.05–0.08	10. gr.
Carrot extract	800.–1000.	50. c.c.

(1) Zsigmondy, "Kolloidchemie," (1922), p. 174.

Protecting colloid	Gold number	Protecting power on yellow mercuric iodide
Agar	0.08–0.1	No action
Sodium oleate	0.8–1.1	No action
Starch	2.	No action
Dextrin	9.–12.	No action
Silicic acid	∞	No action

Thus the protecting action on the colloidal gold and on the yellow mercuric iodide are not quite parallel. The colloids which contain much nitrogen compounds have great protecting power on the yellow mercuric iodide.

A part of the present experiment was done in the chemical laboratory of the Tohoku Imperial University, Sendai.

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