

INFLUENCE OF TEMPERATURE ON THE COAGULATION OF SILVER HALIDE SOLS AND OF ARSENIC TRISULFIDE SOL.

By Tominosuke KATSURAI.

Received June 18th, 1932. Published August 28th, 1932.

In a previous paper a short note was given of the coagulation of silver halide sols and of arsenic trisulfide sol which were prepared according to the description of Wo. Ostwald.⁽¹⁾ In this experiment a porcelain beaker was used to contain the sol in heating it in the autoclave. Hydrogen sulfide was not removed from the arsenic sulfide sol used for the experiment.⁽²⁾

The present experiment was undertaken with the view to pursue the study in greater detail and to get more exact information as to the nature of coagulation. In heating the sol in an autoclave it is probable that the porcelain itself is affected by the sol above 100°C. and thus the dissolved impurities from the porcelain may cause some change to the coagulation. In order to get rid of this defect a transparent flask of fused quartz with the capacity of 100 c.c. was used in the present experiment. The results of experiments are given in each case.

Experimental.

Silver halide sols. The sols were prepared by mixing of dilute solution of potassium halide with silver nitrate solution, in the following three different proportions, viz.

(1) *In equivalent proportions.* 1 c.c. of 0.1N. potassium halide was diluted to 100 c.c. with water. This diluted solution was poured into 1 c.c. of 0.1N. silver nitrate which had been contained in a beaker.

(2) *Excess of silver nitrate.* 1 c.c. of the potassium halide solution and 2 c.c. of the silver nitrate solution were used.

(3) *Excess of potassium halide.* 2 c.c. of the potassium halide solution and 1 c.c. of the silver nitrate solution were used. The procedures of preparation both in (2) and (3) were same as in (1).

First the coagulation at 100°C. was studied. Test tubes of hard glass were used in this case. The test tubes, each containing the sols,

(1) T. Katsurai, *Sci. Pap. Inst. Phys. Chem. Research.* **12** (1929), 166.

(2) Cf. Wo. Ostwald: *Practical Colloid Chemistry*, (1926), 6-8.

were heated by the boiling water in a beaker, which was heated from below, and the coagulation taking place thereby was observed.

The three sols, viz. the AgCl-, AgBr- and AgJ-sol of (1) were noticeably turbid as soon as they were prepared indicating that they are unstable. At 100°C. these sols as well as the AgCl-sols of (2) and (3) completely coagulated and settled on the bottom of the test tubes. The sols of other composition viz. the AgBr- and AgJ-sol of (2) and (3) seemed to be very stable against the action of heat, and therefore their coagulation was studied by heating them in an autoclave. The procedure of the autoclave treatment was the same as was described in a previous paper,⁽¹⁾ the only difference being that the flask of quartz was used.

At 120°C. the AgBr- and AgJ-sol of (2) coagulated completely. It was at 180°C. that the AgBr-sol of (3) coagulated completely and settled. The temperature below 180°C. was not sufficient to cause complete coagulation. The AgJ-sol of (3) was the most stable and coagulated almost completely when it was heated at 200°C.

Arsenic trisulfide sol. The sol was prepared by blowing hydrogen sulfide into a solution of arsenious oxide.⁽²⁾ After the sol formation was complete the excess of hydrogen sulfide was removed by blowing a bubble of air into the sol for half an hour.

The coagulation was studied at 160°, 180° and 200°C. At 160°C. the colour of the sol changed to deep yellow and there was formed some precipitate on the bottom. At 180°C. this tendency predominated. At 200°C. almost of the sol was coagulated and settled on the bottom and the upper part of the sol was almost clear. This is quite different from the sol from which hydrogen sulfide was not removed and which dissolved completely at 180°C. It is suggested that the amount of hydrogen sulfide contained in the sol plays a important rôle in the process of coagulation.

With the intention of testing if there is any difference of light absorption between the two sols (the one from which hydrogen sulfide was not removed, and the other from which hydrogen sulfide was removed by a stream of air) the measurement was carried out within the range of visible light.⁽³⁾ But there was no noticeable difference between them.

(1) T. Katsurai, *Sci. Pap. Inst. Phys. Chem. Research*, **13** (1930), 89.

(2) Cf. Wo. Ostwald: *loc. cit.*

(3) The measurement was carried out by Mr. S. Fukushima.

Summary.

(1) The coagulation of silver halide sols which takes place when they were subjected to heating in an autoclave was studied. It was observed that the sols prepared by using an excess of potassium halide, especially the AgJ-sol in an excess of potassium iodide, were most stable against the action of heat.

(2) The arsenic trisulfide sol from which hydrogen sulfide was removed shows noticeable coagulation at 180° and 200°C. This behaviour is quite different from that of the sol from which hydrogen sulfide was not removed.

(3) The light absorptions of arsenic trisulfide sols, one which is free from hydrogen sulfide and the other containing hydrogen sulfide, were compared. No noticeable difference was observed.

The Institute of Physical and Chemical Research,
Komagome, Hongo, Tokyo.
