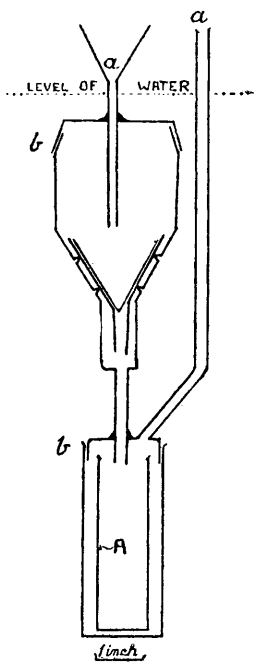
CCCXI.—*The Solubility of Silver Iodide in Solutions of Alkali Iodide in Acetone.*

By Frederick Karl Victor Koch.

In a previous communication (this vol., p. 1554) it was shown that silver iodide behaves as a sparingly soluble salt in solutions of sodium iodide in water, methyl alcohol, and ethyl alcohol. Some results are now given which show that, whereas silver iodide is practically insoluble in pure acetone, it is easily soluble in solutions of alkali iodide in acetone—more than 3 g. of silver iodide being soluble in 50 c.c of an $N/10$-sodium iodide solution in acetone.



The reagents were purified as previously described (*loc. cit.* and J., 1928, 272). The solutions were made up by weight, saturated at 25° ± 0·02° with silver iodide and filtered in the thermostat at 25° in the apparatus represented in the diagram.

This filtering apparatus has the advantages (1) that the solution is kept at constant temperature during filtration, and (2) that evaporation of the solvent is prevented, since the atmosphere surrounding the filter funnel is saturated therewith. The filter-paper was kept in position by means of a clip. The ground-in joints *b* were greased, and the tubes *a* closed with wads of cotton wool when not in use. The vessel A (for which there is a ground-in stopper) was weighed empty and again with the filtered solution. It was then transferred to a small electrical oven, made of asbestos, in a large desiccator. The temperature of the oven was not allowed to rise above 40° (acetone boils at 56° at 760 mm.) and evaporation was effected by passing a current of air, dried by a calcium chloride tube about one yard long, over the surface of the solution. The residue was dried over phosphoric oxide in a vacuum.

Results and Discussion.—

G.-mol. NaI per 800 g. acetone.	Wt. of soln.	Wt. of residue.	Mols. AgI / Mols. NaI
0·01450	22·49	0·3370	2·96
0·04390	21·88	0·9702	2·98
0·1021	23·69	2·3079	2·90

G.-mol. KI per 800 g. acetone.	Wt. of soln.	Wt. of residue.	Mols. AgI / Mols. KI
0·03327	25·98	0·8997	2·97
0·06109	29·00	1·7985	2·96

It thus appears that three molecules of silver iodide are taken up per molecule of alkali halide. Since the solubility of sodium iodide is much greater than that of potassium iodide in acetone, it is, of course, advisable to employ the former salt when using these solutions as a solvent for silver iodide.

The solubility of sodium bromide in acetone at 25° was found to be only 0·08 g. per 100 g. of acetone, and sodium chloride is practically insoluble in acetone. Appreciable quantities of silver chloride and silver bromide dissolve, however, in solutions of sodium iodide in acetone, so that the above cannot be used as a quantitative method of separation. It is possible that the silver chloride or silver bromide reacts with a certain amount of sodium iodide, forming some silver iodide and some sodium chloride or bromide.

Birkenstock (*Z. physikal. Chem.*, 1928, **138**, 439) concluded, from transport number and conductivity data, that sodium iodide does not undergo auto-complex formation in acetone. A probable explanation of the solubility of silver iodide in solutions of alkali iodide in acetone is the formation of a complex anion $I(IAg)_3^-$ and this is supported by the fact that on electrolysis of these solutions (which are colourless) iodine and silver iodide are deposited on the anode. It appears that the ion $I(IAg)_3^-$ is very stable under the conditions of this investigation and only dissociates slightly.

The following results for the specific conductivities in mhos/cm. at 25° of sodium iodide in acetone both before (κ_1) and after (κ_2) saturation with silver iodide show that κ_1 is in both cases greater than κ_2 and may be explained by assuming a decrease in mobility of the anion.

G.-mol. NaI per 800 g. acetone	0·01346	0·1014
$\kappa_1 \times 10^3$	1·127	5·443
$\kappa_2 \times 10^3$	0·9385	4·234

The existence of a complex anion $I(IAg)_3^-$ is of interest in connexion with the phosphors formed by a trace of silver halide in alkali halide (compare Fromherz and Menschick, *Z. physikal. Chem.*, 1929, *B*, **3**, 1). It was found that mercuric iodide, which is not very soluble in pure acetone, is easily soluble in solutions of sodium iodide in acetone. Mercuric iodide thus behaves in a similar manner to silver iodide.

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IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY,
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