Physico-chemical Studies on the Composition of Complex Arsenites of Metals. I. Conductometric and Thermometric Studies on the Composition of Copper Arsenite (Scheele's Green) Complexes

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The formation and composition of copper arsenite (Scheele's Green) has been investigated by conductometric and thermometric titrations between copper sulfate and sodium arsenite at several dilutions of the reactants by direct and reverse methods. The composition arrived at both by conductometric and thermometric titrations is $Cu(AsO_2)_2$.

There are variable formulae suggested in literature for the composition of copper arsenite: $CuHAsO_3$ or $Cu_3(AsO_3)_2 \cdot 2H_2O$ (Bornemann 1922; Inorganic Chemistry Partington p. 628). There is hardly any reference in literature on the composition of copper arsenite by applying physico-chemical methods. In order to arrive at decisive conclusions and to throw light on the composition of copper arsenite it was considered worthy of interest to study its composition by conductometry and thermometry.

A. R. (B. D. H.) reagents were used. Standard sodium arsenite solution was prepared and estimated as described (Vogel; Text Book of Quantitative Inorganic Analysis, p. 342). Copper sulfate solution was standardized against standard sodium thiosulfate solution.

Using different concentrations of the solutions of copper sulfate and sodium arsenite, conductometric and thermometric titrations were carried out by direct and reverse methods, i. e., when copper sulfate solution was added from micro-burette to sodium arsenite solution taken in conductivity cell or thermos flask and vice versa. The titrations were performed both in aqueous and aqueous alcoholic medium, the maximum alcoholic concentration in the latter case being 20% by volume. The results are shown in Figs. 1, 2 and 3.

Considering the strength of solutions of copper sulfate (M/10, M/20) and sodium arsenite (M/40, M/80), the observed titre values in conductometric titrations are 2.6, 2.2, 2.1, 2.6, 2.3

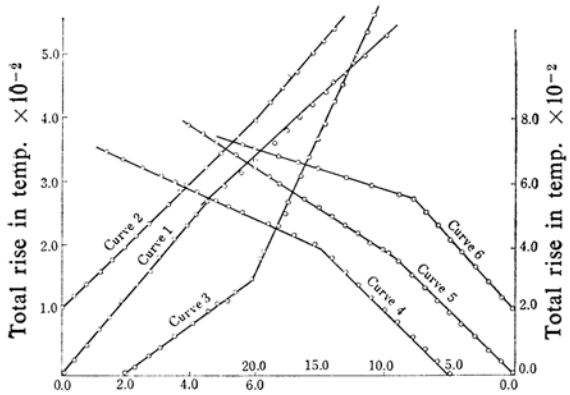

Fig. 1. Direct-titrations.
Curves 1, 2, 3 M/5 $CuSO_4$ and M/20 $NaAsO_2$
Curves 4, 5, 6 M/5 $CuSO_4$ and M/10 $NaAsO_2$

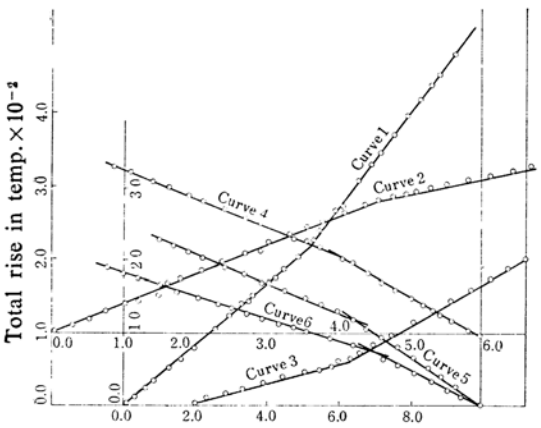

Fig. 2. Direct-titrations.
Curves 1, 2, 3 M/5 $NaAsO_2$ and M/20 $CuSO_4$
Curves 4, 5, 6 M/5 $NaAsO_2$ and M/10 $CuSO_4$

and 2.1 which are in agreement with the theoretical values 2.5, 2.25, 2.0, 2.5, 2.25, and 2.0 for 20.18 cc. and 16 cc. of sodium arsenite in case of direct titrations. The observed values in reverse titrations show a fair agreement

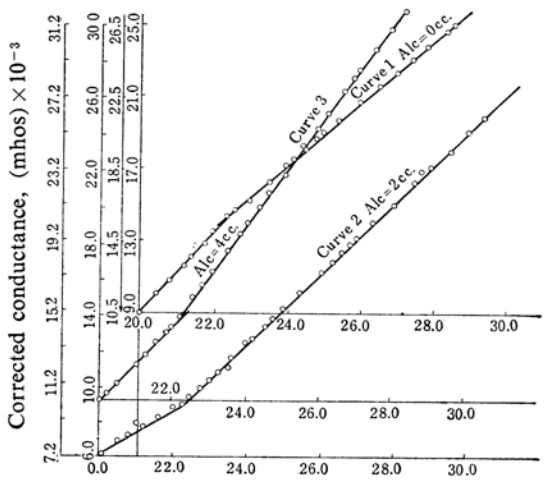

Fig. 3. Reverse-titrations.
Curves 1, 2, 3 M/5 $NaAsO_2$ and M/40 $CuSO_4$
Curves 1, 2, 3 M/10 $NaAsO_2$ and M/80 $CuSO_4$

with the theoretical values. Similarly in thermometric titrations the theoretical titre values calculated for 20.18 cc. and 16 cc. of solution in thermos flask show a notable agreement with the observed values, both in direct and reverse titrations. The details have not been given for the sake of brevity.

Thermometric and conductometric titration curves, both in direct and reverse methods, show one break corresponding to the point of equivalence in the ratio of 1 : 2 ($CuSO_4$: $NaAsO_2$) suggesting the formation of $Cu(AsO_2)_2$ which can be explained on the basis of the following equation:

$$CuSO_4 + 2NaAsO_2 = Cu(AsO_2)_2 + Na_2SO_4 \quad (1)$$

Studies on the complex by potentiometric titrations and Job's method of continued variation are in progress and the results will be communicated shortly.

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