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The Atomic Weight of Less Volatile Potassium Prepared by Hevesy

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Through the courtesy of Professor G. v. Hevesy we have been permitted to examine the "heavy" fraction of potassium obtained by "ideal" distillation some years ago.[1] Hönigschmid and Goubeau have already found the atomic weight of this potassium to be 39.109.[1] Since, however, the atomic weight of ordinary potassium was found by them to be 39.104,[2] while Richards and Staehler and Richards and Mueller,[3] and Baxter and MacNevin[4] have obtained a value nearly 0.01 unit lower, a redetermination of the atomic weight of this "heavy" potassium seemed to be of considerable interest.

Pure common potassium chloride was prepared by recrystallization of the chlorate, perchlorate and chloride in this order, in platinum vessels. This material was exactly similar to Samples D_1 and D_2 used by Baxter and MacNevin.[4] The "heavy" potassium, which was in the form of chloride, was in two portions. One portion had already been recrystallized as chloride, the other was compressed in a nickel cylinder. Both were converted to perchlorate by evaporation in platinum dishes with an excess of perchloric acid which had been distilled in quartz. The second lot of perchlorate was recrystallized three times and added to the first lot and the whole was then recrystallized as perchlorate three times more. Conversion to chloride followed, by cautious fusion in a platinum retort. The chloride was once crystallized from saturated hydrochloric acid and once from water. Filtration of the solution through platinum sponge and centrifugal drainage and rinsing of crystals in platinum containers were employed.

The chloride was prepared for weighing by fusion in a platinum boat contained in the quartz tube of a Richards bottling apparatus. This quartz tube had been used only for the fusion of potassium chloride. The fusion atmosphere in Analyses 1 and 3 was pure nitrogen; that in Analyses 2 and 4 was hydrogen containing a small amount of hydrogen chloride. After the boat and contents had been transferred to the weighing bottle in a current of dry air by means of the bottling apparatus the weight of the salt was found with the use of a counterpoise.

Solution of the samples and comparison with nearly equivalent amounts of the purest silver was carried out by the conventional equal opalescence method. During precipitation the solutions were less than 0.1 normal and

(1) Hevesy and Lögstrup, *Z. anorg. allgem. Chem.*, **171**, 1 (1928).
(2) Hönigschmid and Goubeau, *ibid.*, **163**, 93 (1927); **177**, 102 (1928).
(3) Richards and Staehler, THIS JOURNAL, **29**, 623 (1907); Richards and Mueller, *ibid.*, **29**, 639 (1907).
(4) Baxter and MacNevin, *ibid.*, **55**, 3185 (1933).

were at room temperature. The precipitates of silver chloride were allowed to stand in contact with the supernatant solutions for several weeks before the final end-points were found.

A vacuum correction per gram of silver of -0.000031 g. was applied. The vacuum correction for the potassium chloride was calculated in each case from the air density at the time of weighing, on the basis of the density 1.995.

THE ATOMIC WEIGHT OF POTASSIUM

Ag = 107.880 Cl = 35.457

Analysis	Sample of KCl	KCl in vac., g.	Ag in vac., g.	Ag added, g.	Corr. wt. of Ag, g.	KCl/Ag ratio	At. wt. of K
1	Common	4.92432	7.12549	+0.00010	7.12559	0.691075	39.096
2	Common	8.76118	12.67777	− .00010	12.67767	.691072	39.096
					Average	.691073	39.096
3	Hevesy	5.73312	8.29550	− .00090	8.29460	.691187	39.108
4	Hevesy	5.77933	8.36218	− .00090	8.36128	.691201	39.110
					Average	.691194	39.109

It is interesting that our average value for the heavy potassium agrees exactly with that of Hönigschmid and Goubeau, although our value for common potassium is nearly 0.01 unit lower. The difference which we have found between the two samples is 0.013 as contrasted with the difference 0.005 found by Hönigschmid and Goubeau.

The maximum difference to be expected in the distillation as calculated by Hevesy and Lögstrup is 0.010; but this is based on a percentage of K_{41} in ordinary potassium of 5.2, apparently calculated with the atomic weight 39.104 and integral values for the isotopes. Even with the lower atomic weight of potassium if the packing fraction of this element is assumed to be like that of argon and scandium, -7×10^{-4}, and with the conversion factor of Mecke and Childs, 1.00022, the percentage of K_{41} is found to be 6.6. The larger difference which we have found between the two samples is therefore not unreasonable. On the basis of our results the percentage of K_{41} in the heavy potassium is 7.3.

Summary

The atomic weights of common potassium and heavy potassium concentrated by ideal distillation by Hevesy and Lögstrup have been found to be 39.096 and 39.109, respectively.

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