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THE ATOMIC WEIGHT OF POTASSIUM FROM PLANT ASH

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It has been reported by F. H. Loring and J. G. F. Druce[1] that the potassium from the ash of potatoes fertilized from potassium chloride has an atomic weight of 40.5. The accepted atomic weight of potassium is 39.10.[2] It is known that normal potassium consists of two isotopes, 39 and 41, and the small beta radioactivity of potassium has been ascribed to the isotope of atomic weight 41. Loring and Druce cite Zwaardemaker's work[3] on the importance of radioactive material in maintaining life and were led to their experiment from a consideration of the well-known fact that plant cells selectively absorb potassium salts from solutions containing both potassium and sodium. If it is assumed that the reason for this selective absorption is the need of the plant for the radioactive isotope of potassium, it is reasonable to expect that some mechanism may have been developed by the plant cells to absorb selectively the radioactive isotope of potassium from the normal mixture of isotopes. It may be further assumed that the radioactive isotope would be concentrated in those cells which provide the food for the embryo plant, *i. e.*, the seeds. To check these hypotheses 25 pounds of cotton—seed hairs—and 75 pounds XXXX Superfine flour—wheat kernels—were ashed, the potassium chloride separated from the ash and purified and the ratio of potassium to chlorine determined.

The ashing was carried out at a low temperature to avoid volatilization of the potassium salts. The ash was extracted with water and excess ammonium carbonate added. The extract was filtered, evaporated to dryness in platinum and the excess ammonium carbonate volatilized. The residue was dissolved in water, acidified with hydrochloric acid, filtered, re-evaporated to dryness, fused, redissolved in a small quantity of water and filtered. The alkali chlorides were then precipitated with hydrogen chloride gas, filtered and then fused. Preliminary analysis of the cotton ash showed a ratio of potassium to sodium of approximately 10 and this ratio for the wheat flour is approximately 40.[4] In the case of the chlorides from cotton ash approximately 20 g. of sodium-free potassium chloride was obtained by fractional crystallization of the aqueous solution at room temperature. It proved much more difficult to secure a pure potassium chloride from the flour ash and the procedure given above for the original purification, including the precipitation of the chlorides with

[1] Loring and Druce, *Chem. News*, **140**, 34 (1930).

[2] G. P. Baxter, THIS JOURNAL, **52**, 861 (1930).

[3] Zwaardemaker, *Arch. Ges. Physiol.*, **213**, 82 (1926), and later papers.

[4] Bailey, "The Chemistry of Wheat Flour," **1925**, p. 148.

hydrogen chloride gas and fusion, was repeated four times. Approximately 3 g. of sodium-free potassium chloride was finally obtained from the wheat flour ash. Analyses of the fused potassium chloride were made for chlorine using silver nitrate, making all precipitations and filtrations in the dark. Microscopic examination of a drop of solution allowed to crystallize on a slide showed no impurities. The percentages of chlorine obtained in multiple analyses of the two samples are given below.

Sample	Chlorine in KCl from cotton ash, %
1	47.63
2	47.50
3	47.52
4	47.56
5	47.54
Av.	47.550 ± 0.016

Sample	Chlorine in KCl from wheat flour ash, %
1	47.57
2	47.52
3	47.60
Av.	47.563 ± 0.020

The ± figures given represent the probable errors calculated according to the method of Shewhart[5] for averages obtained from small samples.

Assuming the atomic weight of chlorine to be 35.457,[2] the atomic weights of the potassium may then be calculated to be 39.111 ± 0.013 from the cotton ash and 39.091 ± 0.016 from the wheat flour ash, respectively. Both values are so close to the accepted value of 39.10 that no separation of the potassium into its isotopes is indicated.

The results reported above do not confirm the hypotheses proposed nor the results obtained by Loring and Druce. They cannot be used, however, as a direct contradiction of Loring and Druce's findings, since the potassium they obtained was from potatoes, which are morphologically different from the cotton fiber and the wheat flour.

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[5] Shewhart, *Bell System Tech. J.*, **5**, 308 (1926).