THE OCCURRENCE OF ALUMINIUM IN VEGETABLE PRODUCTS, ANIMAL PRODUCTS AND NATURAL WATERS

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A CONTRIBUTION TO THE BIBLIOGRAPHY OF THE SUBJECT.

BY
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INTRODUCTION.

THE material included in this contribution to the bibliography of aluminium deals only with the occurrence of this element in vegetable products, animal products, natural waters, and a few miscellaneous materials, such as edible earths. The general purpose has been to include only reference to such articles as report separate determinations of aluminium or some of its salts, and to omit the very large number in which iron and aluminium are reported together. In a few cases analyses have been cited which report "traces" of aluminium, but the bulk of this material also has been omitted. In older investigations, particularly those dealing with the mineral constituents of plants, data regarding aluminium are more abundant than in later works, and doubtless some of the aluminium reported came from impure reagents, from dirt contaminating the sample, or some similar cause. Such a criticism would not be limited to the constituent under consideration, but applies more or less, in principle at least, to many of the determinations included in early analytical work. The greater part of the material included in the compilation does not seem open to that objection, for, as time has progressed, analytical methods and chemical manipulations have improved, and there is no reason why determinations of aluminium made within recent years should not be fairly good.

No attempt has been made to comment on the value of individual analyses cited, as the object of this bibliography was the collection of data rather than the critical examination of them.

In collecting the data, a systematic search has been made of the files of the Journal of the London Chemical Society,

The American Journal of Pharmacy, The Analyst, Jahresbericht der Thier-Chemie, Jahresbericht der Agricultur-Chemie, Just's Botanischer Jahresbericht, Chemical News, Zeitschrift für Untersuchung der Nahrungs- und Genussmittel, Experiment Station Record, the later volumes of the Comptes Rendus, de l'Académie des Sciences, Paris, Zeitschrift für Physiologische Chemie, the bulletins and other publications of the United States Geological Survey, and the reports of the Geological Survey of Canada, as well as numerous scientific journals, bulletins and reports of the Agricultural Experiment Stations, reports of State Boards of Geology and of Agriculture, and miscellaneous volumes on chemistry, mineral waters, foods, and other topics, including such works as Wolff's "Aschen-Analysen von Landwirtschaftlichen Producten, Fabrik-Ausfällen, und Wildwachsenden Pflanzen," König's "Chemie der Menschlichen Nahrungs- und Genussmittel," etc.

In a great many instances the data found in a periodical or work of reference have been verified in the original publication and so cited. All possible precautions have been taken to insure accuracy, but those who have engaged in similar work know how difficult it is to eliminate all error.

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ALUMINIUM IN VEGETABLE PRODUCTS.

Aderholdt (Ann. Chem. u. Pharm., 82 (1852), p. 111) reports 6.1 per cent ash in the dry matter of a club moss (*Lycopodium chamaecyparissus*) gathered in March, of which 51.85 per cent was said to be Al_2O_3, and 57.364 per cent Al_2O_3 in the ash (4.5 per cent total) of a sample gathered in November. A club moss (*L. clavatum*) was found to contain in dry matter 4.7 per cent ash, 26.65 per cent being alumina. No alumina was found in other plants of the same region (near Bonn), such as oak, fir, and beech.

Allen, A. H. (Analyst, 13 (1888), p. 41; Jour. Chem. Soc. London, 54 (1888), p. 631), concedes on the statements of analysts that aluminium is present in minute proportions as a normal constituent of wheat, the amount corresponding to about 8 grains of alum in a four-pound loaf of bread. A method for determining the alumina present is proposed.

Andreasch, R. (Jour. Prakt. Chem., n. ser., 18 (1878), pp. 204–207), studied the ash of different parts of the garden pink and rose. The following is quoted:

ALUMINIUM IN CERTAIN PLANTS.

	Total Ash.	Al_2O_3.
	Per Cent.	Per Cent.
Garden pink (*Dianthus caryophyllus*):		
Root	5.64	2.56
Stem	5.26	trace
Leaves	4.44	
Flower	5.59	
Garden rose (*Rosa remontana*):		
Root	2.04	trace
Stem	2.31	
Leaves	9.43	
Flowers	6.27	

Apoiger (Vierteljahressch. Prakt. Chem., 6, p. 481; Jahresb. Chem., 1857, p. 530) found 7.76 per cent ash in the seed of *Maesa pic'a* dried at 100°. This contained 0.98 per cent Al_2O_3.

Athenstaed, W. (Ber. Deut. Bot. Gesell., 3 (1885), p. 57; Just's Bot. Jahresbericht, 1885, pt. 1, p. 81), reports the ash analyses of a mixture of leaves, flowers, and fruit of Labrador tea (*Ledum palustre*) according to the method of Grandeau and Fresenius. The crude ash constituted 3.95 per cent of the total dry matter and of this 1.17 per cent was Al_2O_3. The pure ash constituted 2.77 per cent of the total dry matter and of this 1.67 per cent was Al_2O_3.

Baer, W. (Arch. Pharm., 2d ser., 66, p. 285; Pharm. Centbl., 1851, p. 826; Jahresb. Chem., 1851, p. 710, Tab's C and C, p. 708), reports in rape-seed (dry material) 6.98, 5.97, 5.93, and 4.58 per cent ash respectively, containing 0.56, 1.02, 0.60, and 0.49 per cent alumina respectively. He also reports 4.47 and 4.41 per cent total ash in rape-straw (dry material) with respectively 0.63 and 0.22 per cent alumina.

Bailey, E. H. S. (Trans. Kansas Acad. Sci., 11 (1887–8), p. 49), found that the ash of corn-cobs contained a "little over one per cent of ash," 2.02 per cent of this being Al_2O_3.

Bastin, E. S., and H. Trimble (Amer. Jour. Pharm., 69 (1897), pp. 90–97), in an article on North American Coniferæ, report that the bark of hemlock (*Tsuga canadensis*) (air-dry) contains 1.42 per cent ash. Alumina was a consituent of this; the amount not reported.

Baudrimont, E. (Jour. Pharm., 3d ser., 42, p. 388; Jahresb. Chem., 1862, p. 512), reports 23.28 per cent ash in eel-grass (*Zostera marina*). Of this 0.26 per cent was Al_2O_3.

Béchamp, A. (Compt. Rend. Acad. Sci. Paris, 73, p. 337; Jour. Chem. Soc. London, 24 (1871), p. 855), notes a trace of alumina in the ash of yeast; the total ash in the dry yeast being 9.730 per cent.

Bell, J. Carter (Analyst, 4 (1879), pp. 126–133), reports that in four analyses of flour called No. 2 Crown and ground from a mixture of English and California wheat, he found 0.021 and 0.017, 0.020 and 0.024 per cent respectively of aluminium phosphate. Five pounds was made into bread, the crumb containing, according to analyses, 0.011 per cent aluminium phosphate. A Russian and a Ghirka flour, which the author states were "coarse grains flours such as a good baker would not like to use," contained respectively 0.58 and