

Gordon Wickham Monier-Williams OBE, MC, MA, PhD, FRIC (1881-1964)

A Major Contributor to the Improvement in Quality and Purity of Foodstuffs via his Professional Influences and Innovations in Analytical Chemistry

D Thorburn Burns^a and Michael J Walker^b

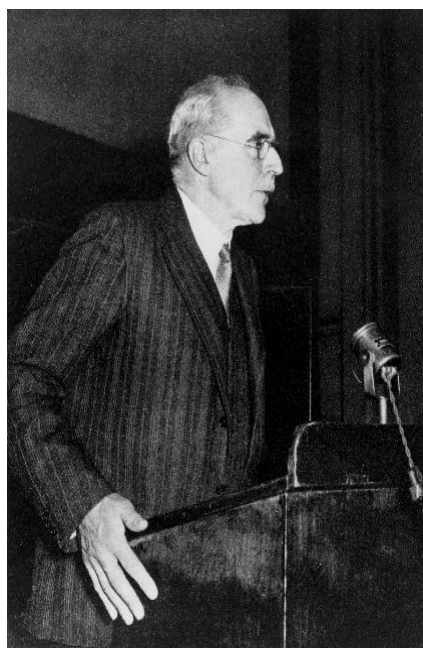
a Institute for Global Food Security, The Queen's University of Belfast, Belfast, BT9 5HN, Northern Ireland, UK

b Laboratory of the Government Chemist, LGC, Teddington, Middlesex, TW11 0LY, UK

Summary

The career of Gordon Wickham Monier-Williams, well known to chemists owing to the eponymous method for the determination of sulphite in foods, is reviewed. His contributions to the improvement in both quality and purity of foodstuffs are described and the full details of his researches in the development of his method for the determination of sulphite is made available.

Introduction



G.W. Monier-Williams

The name of Monier-Williams is well known to chemists, owing to the eponymous method for the determination of sulphite in foods^{1,2} but most will be unaware of his other scientific contributions or of his influence on the analytical world via his public office.

Education and Early Career

Gordon Wickham Monier-Williams was born on April 17 1881 at Womersley, near Guildford and died on May 20, 1964³⁻⁶. He came from a well-known legal family, the effects of which were often displayed in his approach to his chemical work and in his dealings with those he encountered in his official capacity. He was educated at Winchester and then at University College, Oxford where he got a first in chemistry in 1903, having spent part of the 1902 summer vacation at Leipzig studying physical chemistry. From Oxford he went to Ludwig Gattermann's laboratory at Freiberg University (1903-05) for research where he

obtained his PhD after which he studied distillation for some weeks at Cognac. He spent short periods of time as research chemist at the Gas Light and Coke Company at Becton and with A Chaston Chapman FRS, (1869 – 1932), Public Analyst, before commencing in January 1909 as an assistant inspector of foods at the Local Government Board.

The Local Government Board, set up in 1871, and headed by a “president”, a sitting member of the House of Commons and usually a member of the Cabinet, took over responsibility for all aspects of local government from various ministries and the Poor Law Board. The appointment of a Public Analyst was sanctioned by the Local Government Board. The Board was succeeded by the Ministry of Health in 1919.

In 1906 an expert subdivision of the medical department of the Local Government Board was established:

“... to advise the board as to the administration of the sale of food and drugs acts and other acts relating to food questions; to deal with matters relating to the purity and adulteration of foods which are brought to the Board's attention by public analysts, medical officers of health, and others; to obtain information upon special questions relating to the purity and adulteration of food, and the use of deleterious substances therein; and to make suitable inquiries and investigations for the purpose.”⁷

By 1911 the work was under the control of a chief inspector of foods and five inspectors, who had access to laboratory facilities. The medical department of the Local Government Board published from time to time special reports of the inspectors of foods, in addition to annual reports by the chief inspector. There are 13 special reports by Monier-Williams. These reports are of great interest and of particular value in many ways to those who are interested in the relation of food to public health. The reports dealt with subjects such as lead and arsenic in tartaric acid, citric acid and cream of tartar, vinegar, preservatives in cream and other foods, tin in canned foods, “facing” of rice, formaldehyde to meat, bleaching of flour and the addition of so-called “improvers” to flour. Monier-Williams first contributed as sole author to “On the Chemical Changes Produced in Flour by Bleaching” (1911).

Monier-Williams was gazetted as Second Lieutenant, June 6, 1907, in the 22nd Middlesex (Central London Rangers) Volunteer Rifle Corps⁸. In the First World War he went to France with the Expeditionary Force. After the Germans used gas he was transferred from the front line to the Special Brigade, Royal Engineers on its formation in 1915, to study anti-gas measures and precautions, being appointed adjutant of the depot at Helfaut where he served for the remainder of the War, being awarded the MC and appointed OBE for his services.

In 1919 he was appointed in charge of the Food Research Laboratory in the new Ministry of Health, which had taken over the powers and duties of the Local Government Board and other health related matters⁹.

Scientific Output

His initial publications were on organic chemistry, the synthesis of aldehydes by Grignard's reaction¹⁰, later he worked on the hydrolysis of cotton cellulose¹¹. His further scientific output, on topics of analytical chemistry, over the years was considerable.

Much of his work appeared via Reports of the Local Government Board and then of the Ministry of Health¹²⁻²⁹ many of which had longstanding influence on methods of analysis for official purposes. For example, his report "The Determination of Sulphur Dioxide in Food"¹⁹, published in 1927 remains a major contribution to the topic.

A scanned copy of GW Monier-Williams, (1927), The Determination of Sulphur Dioxide in Food, Reports on Public Health and Medical Subjects, 43, HMSO, London is [available](#).

Analysts familiar with the current reference methods for sulphites in foodstuffs will recognise Monier-Williams apparatus, Fig. 2.

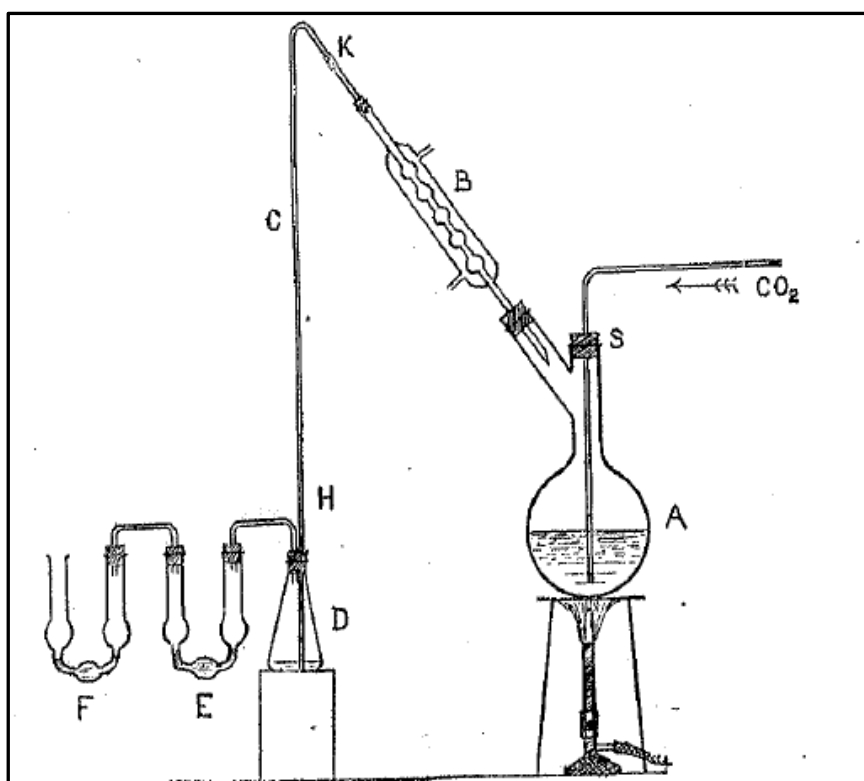


Figure 2 – Monier-Williams Recommended Distillation Apparatus for the Determination of Sulphites in Food

The Prefatory Notes to the Reports by the Chief Medical Officer contain useful information as to the cause for concern of the topic, comments about Dr GW Monier-Williams, Chemist in Charge of the Foods Laboratory of the Ministry, his detailed comprehensive literature reviews and experimental approach of great value to the profession at large. For example, in Report 39 on benzoic acid¹⁸ we read:

“Dr GW Monier-Williams has prepared a comprehensive review of the available literature on the subject, and has discussed fully the analytical difficulties involved, which are of no mean order. His comments upon the statements of the various authors are supported in many instances by his own laboratory investigations providing information which it is hoped may be useful and timely to public analysts, chemical advisors of industrial concerns, and laymen and others charged with duties or responsibilities in this matter (Testing under the Public Health Regulations).”

In addition to material published in *Reports* authored by Monier-Williams some of his other work can be found in other *Reports* such as that in Hancock’s, “Occurrence of Glass Fragments in Foods Packed in Glass Containers”²⁶ This investigation was undertaken in consequence of reports by Public Analysts. He developed a method for recovering mineral matter from foodstuffs, examined by polarised light microscopy for a variety of materials stored in glass, in earthenware and in cans.

His scientific journal and review publications were mainly in the *The Analyst*²⁷⁻⁴⁸, from 1911 to 1961 and these include some extended abstracts of his *Reports* and book reviews^{49(a)-(i)} Several of his other publications were in the *Journal of the Society of the Chemical Industry*⁵⁰⁻⁵³. Monier-Williams authored two booklets^{58,59} and two monographs, *Power Alcohol*⁶⁰ and *Trace Elements in Foods*⁶¹. He also took an interest in historical aspects of food⁶² and preservatives⁶³.

Impact

Apart from his work as an analyst and inspector of foods, Monier-Williams was a recognised authority at the Ministry, to whom Public Analysts or manufacturers could appeal for advice on what was believed to be the legal interpretation of various food orders. However, even more importantly, he provided guidance as to what had been the underlying intention of the Ministry when a particular item had been introduced into a statutory order. His researches improved the quality and purity of foodstuffs and revealed many hidden dangers in their preparation and manufacture which were afterwards removed by public health legislation and regulations. Owing to his retiring nature he gave the impression that he was reserved, combined with his government experience he made an ideal officer in his posts. Public Analysts had cause to be grateful to Monier-Williams and his colleague R Butcher for the investigation of any complaints which they might have in their dealings with local authorities³. The value of

Monier-Williams' research contributions was noted by C Ainsworth Williams (Editor of *The Analyst*) in the publication celebrating the first fifty years of The Society of Public Analysts and other Analytical Chemists in 1932 as follows,

*“It was in 1920 that we first welcomed the first direct communication to the Society from our member, Dr GW Monier-Williams of the Chemical Laboratory of the Ministry of Health. Dr Monier-Williams, during earlier years, had recorded much original work in his published reports to the Local Government Board, and the paper referred to was the forerunner of a series of valuable contributions to our own proceedings. The Society is particularly indebted to him for his monumental investigations into questions of the estimation of sulphur dioxide and of benzoic acid, following the issue of the preservatives regulations of 1925.”*⁶⁴

Although he served three periods on the Council of the Royal Institute of Chemistry it was to the Society of Public Analysts that he gave his greatest support, serving for seven periods as a member of council or vice-president and finally during 1945, as President. With increasing deafness, he gradually withdrew from public life.

Family and Other Activities

He was a skilled artist, especially in water colours, and exhibited his landscapes at the Royal Academy and elsewhere. Other recreations included carpentry, fishing and shooting. He was married twice; by his first wife, who died young, he had two daughters, and by his second wife, one son.

Conclusions

Gordon Wickham Monier-Williams holds an established place in the history of food safety in the UK owing to his eponymous method for the determination of sulphites in food. That the method he adopted in 1927 has stood the test of time is a tribute to his comprehensive survey of the then extant chemistry of sulphur compounds in food and his practical skills as an analyst. The breadth of his investigations in chemistry and toxicology was wide including:

- metallic contaminants, (Al, As, Pb, Sb),
- additives such as preservatives and colours,
- foreign matter in food,
- “blowing” of canned food,
- the freezing point of milk and the detection of added water,
- solubility of glazes and enamels used in cooking utensils,
- hydrogen cyanide for fumigation purposes,
- natural and artificial bleaching of flour,

- determination of pH,
- determination of sucrose, lactose and invert sugar in sweetened condensed milk.

Aside from food he studied the eradication of bed-bugs, and presciently, the use of alcohol as a fuel.

This comprehensive contribution to improvements in public health via analytical chemistry, to professional bodies and advice to Public Analysts or manufacturers on the interpretation of food law and its underlying purposes are exemplars of public service that merit recognition and emulation in the 21st century.

Acknowledgement

The photograph of Monier-Williams is reproduced with the permission of the Science and Society Picture Library, Science Museum Group Enterprises Ltd., Science Museum Group, Exhibition Road London SW7 2DD.

References

- 1 BS EN 1988-1:1998, Foodstuffs – Determination of sulphite- Part 1: Optimized Monier-Williams Method
- 2 Monier-Williams AOAC official method (optimized method) 990.28 - 1994, in AOAC Official Methods of Analysis, chapter 47, 29–30, 200
- 3 J. R. Nicholls (1964), Obituary: Gordon Wickham Monier-Williams, Proc Soc Analyt Chem, *1*, 97
- 4 Anon. (1964), Obituary: Gordon Wickham Monier-Williams, J Roy Inst Chem, 400
- 5 T. McLachlan (1964), Obituary: Dr GW Monier-Williams, OBE, Nature, 203, 346
- 6 A. S. MacNalty (1964), Obituary: GW Monier-Williams, OBE, MC, MA, PhD, FRIC, Brit Med J, **1**, 1573-1574
- 7 Dunlap, Frederick Levy, 1911, Food laws of the United Kingdom and their Administration, US Department of Agriculture, Bureau of Chemistry, Bulletin no 143
https://archive.org/stream/foodlawsofunit00dunlrich/foodlawsofunit00dunlrich_djvu.txt (last accessed 15th December 2017)
- 8 The London Gazette, July 26, 1907, 5122

- 9 The National Archives, Health and Social Policy 1919-1939
<http://www.nationalarchives.gov.uk/help-with-your-research/research-guides/health-social-policy-1919-1939/> (last accessed 15th December 2017)
- 10 GW Monier-Williams (1906), A Synthesis of Aldehydes by Grignard's Reaction, J Chem Soc, 89, 273-280, See also Proc Chem Soc (1906), **22**, 22-23
- 11 GW Monier-Williams, (1921), The Hydrolysis of Cotton Cellulose, J Chem Soc Trans, **119**, 803-805
- 12 GW Monier-Williams (1911), On the Chemical Changes Produced in Flour by Bleaching, Reports to the Local Government Board, Food Reports, No12 HMSO, London. For extended abstract see 49
- 13 GW Monier-Williams (1912), Analyses and Methods of Detection of Certain Proprietary Substances Sold as Preservatives for Milk, Cream etc, Food Report to Local Government Board, No 17, HMSO, London
- 14 GW Monier-Williams (1912), Nature of the Colouring Matter of Flour and its Relation to Processes of Natural and Artificial Bleaching, Food Reports to the Local Government Board, No. 19, HMSO, London
- 15 GW Monier-Williams (1914), The Freezing Point of Milk Considered in Relation to the Detection of Added Water, Report to the Local Government Board on Public Health and Medical Subjects, New Series No. 103 Food Reports, No 22, HMSO, London 80 references.
- 16 PG Stock and GW Monier-Williams (1923), Preliminary Report on the Use of Hydrogen Cyanide for Fumigation Purposes, Reports on Public Health and Medical Subjects, No 19, HMSO, London 32 references
- 17 GW Monier-Williams (1925), The Solubility of Glazes and Enamels used in Cooking Utensils, Reports on Public Health and Medical Subjects, No 29, HMSO, London 7 references.
- 18 GW Monier-Williams (1927), The Determination of Benzoic Acid in Foodstuffs, Reports on Public Health and Medical Subjects No 39, HMSO, London 106 references
- 19 GW Monier-Williams (1927), The Determination of Sulphur Dioxide in Food, Reports on Public Health and Medical Subjects, Vol 43, HMSO, London
- 20 GW Monier-Williams (1930), A Report on the Determination of Sucrose, Lactose and Invert Sugar in Sweetened Condensed Milk, Reports on Public Health and Medical Subjects, No 57, HMSO, London 28 references.

- 21 GW Monier-Williams (1930), The Effect on Foods of Fumigation with Hydrogen Cyanide, Reports on Public Health and Medical Subjects, No 60, HMSO, London
- 22 GW Monier-Williams (1934), Report of the Bed-bug Committee on the Eradication of Bed-bugs, Ministry of Health, Reports on Public Health and Medical Subjects, No 72, HMSO, London 237 references.
- 23 GW Monier-Williams (1934), Antimony in Hollow-ware, Reports on Public Health and Medical Subjects, No 73, Ministry of Health, HMSO, London 9 references
- 24 GW Monier-Williams (1935), Aluminium in Food, Reports on Public Health and Medical Subjects, No 78, Ministry of Health, HMSO, London 278 references
- 25 GW Monier-Williams (1938), Lead in Food, Reports on Public Health and Medical Subjects, No 88, Ministry of Health, HMSO, London 190 references.
- 26 GH Hancock (1927), A Report on the Occurrence of Glass Fragments in Foods Packed in Glass Containers, Reports on Public Health and Medical Subjects, No 37, Ministry of Health, HMSO, London
- 27 GW Monier-Williams (1911), On the Bleaching of Flour and the Addition of So-called "Improvers" to Flour, *Analyst*, **36**, 254-256
- 28 GW Monier-Williams (1912), Report to the Local Government Board on Analyses and Methods of Detection of Certain Proprietary Substances Sold as Preservatives for Milk, Cream etc, *Analyst*, **37**, 155-156
- 29 GW Monier-Williams (1912), Report to the Local Government Board on the Nature of the Colouring Matter of Flour and its Relation to the Process of Natural and Artificial Bleaching, *Analyst*, **37**, 254-256, 596-597
- 30 GW Monier-Williams (1920), An Examination of Certain Milk Records, *Analyst*, **45**, 203-218
- 31 GW Monier-Williams (1921), Notes on the Measurement of Hydrogen Ion Concentration, *Analyst*, **46**, 315-324
- 32 GW Monier-Williams (1923), Electrolytic Method for the Estimation of Arsenic, *Analyst*, **48**, 112-114
- 33 GW Monier-Williams (1923), Estimation of Arsenic by the Electrolytic Method, *Analyst*, **48**, 262-263
- 34 GW Monier-Williams (1923), The Estimation of Boric Acid in "Liquid Eggs" and other Foodstuffs, *Analyst*, **48**, 413-415

- 35 GW Monier-Williams (1924), Hydrogen Electrode for Use with Meat Pastes etc, Analyst, **49**, 224-225
- 36 GW Monier-Williams (1925), Solubility of Glazes and Enamels used in Cooking Utensils, Analyst, **50**, 133-134
- 37 GW Monier-Williams (1926), "Blowing" of Canned Fruit Due to Chemical Action, Analyst, **51**, 402-403
- 38 GW Monier-Williams (1927), Determination of Sulphur Dioxide in Foods, Analyst, **52**, 415-416
- 39 GW Monier-Williams (1927), A New Method for the Determination of Benzoic Acid in Foods, Analyst, **52**, 572-575
- 40 GW Monier-Williams (1928), Polarimetric Determination of Sucrose in Mixtures of Milk and Sucrose, Analyst, **53**, 569-582
- 41 GW Monier-Williams (1930), Determination of Sucrose, Lactose and Invert Sugar in Sweetened Condensed Milk, Analyst, **55**, 573-577
- 42 GW Monier-Williams (1931), The Effect on Foods of Fumigation with Hydrogen Cyanide, Analyst, **56**, 46-48
- 43 GW Monier-Williams (1931), The Nitrate Test for the Detection of Added Water in Milk, Analyst, **56**, 397-398
- 44 GW Monier-Williams (1933), The Determination of the True Freezing Point of Milk, Analyst, **58**, 254-264
- 45 GW Monier-Williams (1934), Antimony in Enamelled Hollow-ware, Analyst, **59**, 489-490
- 46 GW Monier Williams (1939), Lead in Food, Analyst, **64**, 32-34
- 47 GW Monier-Williams (1947), Address of the Retiring President, Analyst, **72**, 137-142
- 48 GW Monier-Williams (1951), Report of the Joint Committee on Preservative Regulations, Analyst, **76**, 276-279
- 49 GW Monier-Williams book reviews:
- (a) Fatty Foods, by ER Bolton and C Revis, Churchill, London, Analyst, **38**, 51, (1913)
 - (b) A Textbook of Quantitative Analysis, by AC Cumming and SA Kay, Gurney and Jackson, London, Analyst, **39**, 240-241, (1914)

- (c) Bleaching Powder and its Action in Bleaching, J Heywood, Manchester, Analyst, **48**, 517-518 (1923)
 - (d) Canned food in relation to health, by WG Savage, University Press Cambridge, Analyst, **49**, 302-303, (1924)
 - (e) Konduktometrische Titrationsen, by IM Kolthoff, T Steinkopff, Dresden, Analyst, **49**, 607608, (1924)
 - (f) The Destructive Distillation of Wood, by HM Bunbury, Benn Brothers, London, Analyst, **50**, 159-160, (1925)
 - (g) Fluorine Intoxication - A Clinical Hygienic Study with a Review of the Literature and some Experimental Investigations, by K Roholm, A Busck, Copenhagen, Analyst, **62**, 911-912, (1937)
 - (h) Practical Public Health Problems, by W Savage, Second Edition, Churchill, London, Analyst, **74**, 478, (1949)
 - (i) Pure Food and Pure Food Legislation, by AJ Amos (ed.), Butterworths, London, Analyst, **86**, 490, (1961)
- 50 GW Monier-Williams (1911), The Chemical Changes Produced in Flour by Bleaching, J Soc Chem Ind, **30**, 568
- 51 GW Monier-Williams (1912), Analyses and Methods of Detection of Certain Proprietary Substances Sold as Preservatives for Milk, Cream, etc, J Soc Chem Ind, **31**, 241
- 52 GW Monier-Williams (1913), Nature of the Colouring Matter of Flour and its Relation to the Processes of Natural and Artificial Bleaching, J Soc Chem Ind, **33**, 1144
- 53 GW Monier-Williams (1915), The Freezing Point of Milk Considered in Relationship to the Detection of Added Water, J Soc Chem Ind, **34**, 444
- 54 GW Monier-Williams (1927), Determination of Benzoic Acid in Foodstuffs, Chem Druggist, **106**, 351-352
- 55 GW Monier-Williams (1927), Determination of Sulphur Dioxide in Foods, Brit Food J, **29**, 51-53
- 56 GW Monier-Williams (1934), Efficiency of the Open Method of Burning Sulphur for the Fumigation of Unloaded Ships, Bull Hygiene, **9**, 77-90
- 57 GW Monier-Williams (1948), Public Health Aspects of Metallic Contaminants in Food, J Soc Chem Ind, **67**, 387-389

- 58 GW Monier-Williams (1924), *Chemistry in Relation to Food*, E Benn, London
- 59 GW Monier-Williams (1935), *Food and the Consumer*, Institute of Chemistry of Great Britain and Ireland
- 60 GW Monier-Williams (1922), *Power Alcohol: Its Production and Utilisation*, H Frowde and Hodder & Stoughton, London
- 61 GW Monier-Williams (1949), *Trace Elements in Foods*, J Wiley, New York, 2nd edn 1950.
- 62 GW Monier-Williams (1951), Historical Aspects of the Pure Food Laws, *Brit J Nutric*, **5**, 363-367
- 63 GW Monier-Williams (1953), Colouring Matters in Food: Position of the United Kingdom Law, *Food Drug Cosmetic Law J*, 92-100
- 64 B Dyer and C Ainsworth Mitchell (1932), *The Society of Public Analysts and other Analytical Chemists: Some Reminiscences of its First Fifty Years and a Review of its Activities*, W Heffer and Sons, Cambridge p 67