



Official Methods of Analysis

of AOAC INTERNATIONAL



Instituto Nacional
de Tecnología Industrial
Extensión y Desarrollo
División Biblioteca

131804

18th Edition, 2005

Dr. William Horwitz, Editor

Dr. George W. Latimer, Jr., Assistant Editor

Published by

AOAC INTERNATIONAL

SUITE 500

481 NORTH FREDERICK AVENUE

GAITHERSBURG, MARYLAND 20877-2417, USA

COPYRIGHT © 1920, 1925, 1931, 1936, 1940, 1945, 1950, 1955, 1960, 1965
BY THE ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS

1970, 1975, 1980, 1984, 1990
BY THE ASSOCIATION OF OFFICIAL ANALYTICAL CHEMISTS

AND
1995, 1996, 1997, 1998, 1999, 2000, 2002, 2003, 2005
BY AOAC INTERNATIONAL

The methods of the Association were also copyrighted in 1916, when they were published
in the *Journal of the Association of Official Agricultural Chemists*.

All rights reserved. No part of this book may be reproduced in any form or by any means
without the written permission of the Association.

Printed in the United States of America

Printed on acid-free paper

ISBN 0-935584-75-7

A copy of the 18th Edition of this publication is on file with the Office of the Federal Register.
U.S. Government Agencies may apply to the Director of the Office of the Federal Register for
approval to incorporate this edition by reference in their regulations. The procedures that Federal
agencies must follow in applying for the Director's approval are in Title 1, Part 51, of the
Code of Federal Regulations.



Contents

Important Notices	v
Preface	vii
About the Association	xiii
Guide to Method Format	xv
Definition of Terms and Explanatory Notes	xvi
AOAC® <i>Official Methods</i> SM Validation Program	xxiii

1. Agricultural Liming Materials

1.1 Liming Materials—General	1
1.2 Calcium Silicate Slags	3
1.3 Gravimetric Elemental Analyses	4
1.4 Chelometric Elemental Analyses	6
1.5 Colorimetric Elemental Analyses	6

2. Fertilizers

2.1 Fertilizers—General	1
2.2 Water	4
2.3 Phosphorus	5
2.4 Nitrogen	12
2.5 Potassium	21
2.6 Other Elements	25
2.7 Peat	36
2.8 Soils	40

3. Plants

3.1 General Methods	1
3.2 Metals	2
3.3 Individual Metals	5
3.4 Nonmetals	13
3.5 Other Constituents	23
3.6 Pigments	28
3.7 Tobacco	30

4. Animal Feed

4.1 Animal Feed—General	1
4.2 Protein	20
4.3 Urea	30B
4.4 Nitrogen	30C
4.5 Fat	33
4.6 Fiber	34
4.7 Sugars	38G
4.8 Minerals	40
4.9 Microscopy	50
4.10 Additives	52

5. Drugs in Feeds

5.1 Feeds—General Methods	1
-------------------------------------	---

5.2 Chemical Methods for Antibiotics	34
5.3 Microbiological Methods for Antibiotics	41
Common and Chemical Names of Drugs	60

6. Disinfectants

6.1 Phenol Coefficient Methods	1
6.2 Hard Surface Carrier Test Methods	3
6.3 Other Tests	8

7. Pesticide Formulations

7.1 General Methods	1
7.2 Inorganic and Organometallic Pesticides and Adjuvants	8
7.3 Fungicides	22
7.4 Herbicides	42
7.5 Pesticides Related to Natural Products and Their Synergists	49
7.6 Organohalogen Pesticides	60
7.7 Thiophosphorus and Other Organophosphorus Pesticides	89
7.8 Miscellaneous Pesticides	112
Common and Chemical Names of Pesticides	118

8. Hazardous Substances 1

9. Metals and Other Elements at Trace Levels in Foods

9.1 Multielement Methods	1
9.2 Single Element Methods	22

10. Pesticide and Industrial Chemical Residues

10.1 General Multiresidue Methods	1
10.2 Organochlorine Residues	17
10.3 Organophosphorus Residues	26
10.4 Fumigant Residues	40
10.5 Carbamate Residues	41
10.6 Individual Residues	48
10.7 Pesticides in Water	78
Common and Chemical Names of Pesticides	97

11. Waters; and Salt

11.1 Water	1
11.2 Salt	31

12. Microchemical Methods	1
13. Radioactivity	1
14. Veterinary Analytical Toxicology	1
15. Cosmetics	
15.1 General Methods	1
15.2 Deodorants and Antiperspirants	6
15.3 Depilatories	11
15.4 Face Powder	11
15.5 Hair Preparations	12
15.6 Suntan Preparations	13
16. Extraneous Materials: Isolation	
16.1 General	1
16.2 Beverages and Beverage Materials	6
16.3 Dairy Products	8
16.4 Nuts and Nut Products	13
16.5 Grains and Their Products	14
16.6 Baked Goods	21
16.7 Breakfast Cereals	23
16.8 Eggs and Egg Products	24
16.9 Poultry, Meat, and Fish and Other Marine Products	25
16.10 Fruits and Fruit Products	28
16.11 Snack Food Products	31
16.12 Sugars and Sugar Products	31
16.13 Vegetables and Vegetable Products	32
16.14 Spices and Other Condiments	39
16.15 Miscellaneous	48
16.16 Animal Excretions	56
16.17 Mold	66
16.18 Fruits and Fruit Products	69
16.19 Vegetables and Vegetable Products	70
17. Microbiological Methods	
17.1 Eggs and Egg Products	1
17.2 Chilled, Frozen, Precooked, or Prepared Foods, and Nutmeats	4
17.3 Coliforms	27
17.4 <i>Escherichia coli</i>	46
17.5 <i>Staphylococcus</i>	73
17.6 Sterility (Commercial) of Foods (Canned, Low Acid)	91
17.7 <i>Clostridium</i>	96
17.8 <i>Bacillus</i>	105
17.9 <i>Salmonella</i>	109
17.10 <i>Listeria</i>	192
17.11 <i>Vibrio</i>	229
17.12 Viruses	234
17.13 Somatic Cells	236
17.14 <i>Bacillus anthracis</i>	238

18. Drugs: Part I

18.1 General Methods	1
18.2 Solvents	2

18.3 Halogenated Drugs	3
18.4 Inorganic Drugs	5
18.5 Antihistamines	18
18.6 Alkanolamines	21
18.7 Phenethylamines	27
18.8 Aminobenzoates	28
18.9 Synthetics	32
18.10 Microchemical Tests	44
18.11 Microscopy	54
18.12 Miscellaneous	55
18.13 Antifungal	55
18.14 Antiparkinsonian	56
18.15 Antihypertensive	57
Common and Chemical Names of Drugs	59

19. Drugs: Part II

19.1 Acids	1
19.2 Phenolic Drugs	2
19.3 Analgesics and Antipyretics	7
19.4 Hypnotics and Sedatives	13
19.5 Anticoagulants	20
19.6 Sulfonamides	24
19.7 Thiazides	27
19.8 Other Sulfur-Containing Drugs	30
Common and Chemical Names of Drugs	36

20. Drugs: Part III

20.1 Opium Alkaloids	1
20.2 Tropane Alkaloids	6
20.3 Xanthine Alkaloids	7
20.4 Ipecac Alkaloids	8
20.5 Ephedra Alkaloids	9
20.6 Ergot Alkaloids	11
20.7 Physostigmine Alkaloids	14
20.8 Chinchona Alkaloids	16
20.9 Rauwolfia Alkaloids	18
20.10 Other Alkaloids	25
20.11 Digitalis	27
20.12 Other Natural Products	30
Common and Chemical Names of Drugs	35

21. Drugs: Part IV

21.1 Natural Estrogens	1
21.2 Synthetic Estrogens	3
21.3 Progestational Steroids	6
21.4 Adrenocortico Steroids	8
21.5 Thyroid	14
Common and Chemical Names of Drugs	15

22. Drugs: Part V

Common and Chemical Names of Drugs	7
------------------------------------	---

23. Drugs and Feed Additives in Animal Tissues

Common and Chemical Names of Drugs	27
------------------------------------	----

24. Forensic Sciences	1	34. Eggs and Egg Products	1
25. Baking Powders and Baking Chemicals	1	35. Fish and Other Marine Products	1
26. Distilled Liquors		36. Flavors	
26.1 Spirits	1	36.1 General Methods	1
26.2 Cordials and Liqueurs	19	36.2 Vanilla Extract and Its Substitutes	1
27. Malt Beverages and Brewing Materials		36.3 Lemon, Orange, and Lime Extracts, Flavors, and Oils.	12
27.1 Beer	1	36.4 Almond Extract	18
27.2 Barley	23	36.5 Cassia, Cinnamon, and Clove Extracts	20
27.3 Malt	24	36.6 Flavor Extracts and Toilet Preparations	21
27.4 Cereal Adjuncts	31	37. Fruits and Fruit Products	1
27.5 Hops	34	38. Gelatin, Dessert Preparations, and Mixes	1
27.6 Brewing Sugars and Syrups	36	39. Meat and Meat Products	1
27.7 Wort	38	40. Nuts and Nut Products	1
27.8 Yeast	39	41. Oils and Fats	1
27.9 Brewers' Grains	41	42. Vegetable Products, Processed	
28. Wines		42.1 Canned Vegetables	1
28.1 General	1	42.2 Dried Vegetables	10
28.2 Preservatives	17	42.3 Frozen Vegetables	10
28.3 Flavors	18	43. Spices and Other Condiments	1
29. Nonalcoholic Beverages and Concentrates	1	44. Sugars and Sugar Products	
30. Coffee and Tea	1	44.1 Sugars and Syrups	1
31. Cacao Bean and Its Products		44.2 Molasses and Molasses Products	18
31.1 General	1	44.3 Confectionary	24
31.2 Shell	3	44.4 Honey	25
31.3 Chocolate Liquor	9	44.5 Maple, Sap, Maple Syrup, Maple Syrup Products	37
31.4 Fat	9	44.6 Sugar Beets	47
31.5 Other Constituents	12	44.7 Corn Syrups and Other Starch Derived Sweeteners	48
32. Cereal Foods		45. Vitamins and Other Nutrients	
32.1 Wheat Flour	1	45.1 Chemical Methods	1
32.2 Wheat, Rye, Oats, Corn, Buckwheat, Rice, Barley, and Soybeans and Their Products Except Cereal Adjuncts	27	45.2 Microbiological Methods	53
32.3 Bread	49	45.3 Bioassay Methods	70
32.4 Baked Products	54	45.4 Nutritionally Related Components	81
32.5 Macaroni, Egg Noodles, and Similar Products	56	46. Color Additives	
33. Dairy Products		46.1 Separation and Identification of Color Additives in Foods, Drugs, and Cosmetics	1
33.1 Sampling	1	46.2 Intermediates	14
33.2 Milk	4	46.3 Subsidiary and Lower Sulfonated Dyes	21
33.3 Cream	52	46.4 Metals and Other Elements	22
33.4 Evaporated and Condensed Milk	57	46.5 Halogens	25
33.5 Dried Milk, Nonfat Dry Milk, and Malted Milk	59	46.6 Miscellaneous	26
33.6 Butter	63		
33.7 Cheese	68		
33.8 Ice Cream and Frozen Desserts	82		

47. Food Additives: Direct

47.1	General Methods	1
47.2	Antioxidants	1
47.3	Chemical Preservatives	7
47.4	Emulsifying Agents	37
47.5	Enzymes	39
47.6	Miscellaneous	40

48. Food Additives: Indirect

49. Natural Toxins

49.1	Mycotoxins	1
49.2	Aflatoxins	2
49.3	Aflatoxin M ₁	40
49.4	Deoxynivalenol	47
49.5	Fumonisin	49
49.6	Ochratoxins	55
49.7	Patulin	68
49.8	Sterigmatocystin	73
49.9	Zearalenone	75
49.10	Seafood Toxins	79
49.11	Plant Toxins	82

50. Infant Formulas, Baby Foods, and Enteral Products

51. Dietary Supplements

50.1	Ephedra Alkaloids	1
------	-------------------	---

*Appendix A

Standard Solutions and Reference Materials	1
--	---

Appendix B

Laboratory Safety	1
-------------------	---

Appendix C

Reference Tables	1
------------------	---

Appendix D

Guidelines for Collaborative Study Procedures to Validate Characteristics of a Method of Analysis	1
--	---

Appendix E

Laboratory Quality Assurance	1
------------------------------	---

Subject Index	1
---------------	---

Index of Method Numbers	1
-------------------------	---