

**Food Analysis:
Analytical and Quality Control Methods
for the Food Manufacturer and Buyer**



**Food Analysis:
Analytical and Quality Control Methods
for the Food Manufacturer and Buyer**

*being the 3rd edition of
Laboratory Handbook of Methods of Food Analysis*

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***Food Analysis: Analytical and Quality Control Methods for
Food Manufacturer and Buyer***

Preface

The objective set when revising this handbook was to increase its usefulness to the factory chemist. In this edition, the listing of foodstuffs and procedures has been transferred to the front of the book: an unorthodox method of presentation, but one which greatly improves the ease of reference. This change in emphasis is also reflected in retitling the book: *Food Analysis: Analytical and Quality Control Methods for the Food Manufacturer and Buyer*.

The opportunity has also been taken to greatly increase the number of recommended methods. Around twenty-five per cent more headings have been added and the number of procedures increased by a third. The descriptive chapters which give guidance on procedures have been revised and tailored to meet the needs of the busy analyst.

It has never been the intention that this publication would be a conventional textbook on food analysis which would languish on a library shelf or become set reading for students. The changes made may therefore, surprise purists who have come to expect scientific books to develop in a conventional way. A few moments reflection will, I trust, demonstrate the practical advantages of the layout that has been adopted and the value of stepwise descriptions to the working analyst.

The aims of the book are: to bring together in one volume, those methods of analysis which are of most value to the factory control analyst; to present these methods in a readable and readily understandable form, and finally to indicate, where appropriate, such information as will aid the task of the analyst.

The interpretation of results obtained through analysis requires experience and knowledge of the manufacturing procedures for particular foodstuffs. No single book on food analysis can adequately cover the whole field and any notes that have been appended to the methods are offered only for guidance. Food analysis is undertaken for a range of motives which can include research, education, control, development and measurement of previously agreed standards. Some sections of this handbook will be found to be of value to the researcher and the educationalist but it has been written primarily for the control and development chemist and should be considered in that context. The methods are practical procedures which enable repeatable results to be obtained and have limited reliance on expensive research equipment.

Analysts, as a group, are possibly more prone to the onset of *ERTEL's*

PREFACE

disease than most—Experimental Results Taken to Exceptional Limits. The main symptom that can be detected is the adoption of a policy of expensive perfectionalism.

Cost effectiveness which takes account of time for analysis and labour, material and equipment costs should be given the same consideration in an analytical laboratory as it does in production.

Lists of minimum standards contained in the various Codes of Practice have not been included in this book for two reasons: Sales have a wider circulation than the United Kingdom alone, and Secondly, published standards tend to reduce quality to the nearest acceptable level to that standard. However, where relevant, commonly found values for particular components have been listed.

Introduction

This book has been prepared with the working chemist in mind. The methods detailed in Section II have been chosen because they give good repeatable results and are suitable for use in a factory laboratory. Some of these methods may not be completely applicable for research establishments whose needs differ in certain fundamental aspects to those of a busy control laboratory. The methods described in the text give results which can be repeated in duplicate and will agree with those found by other analysts. It matters little that a result is 0.1 per cent off absolute if the standards for that particular line has been based on the chosen method. For the majority of methods described, the research and control procedure is precisely the same as that given. Only when extensive analytical work is involved has a simpler method been substituted.

Equally it has not been the intention to fill the book with long descriptions of the theory behind an analytical technique. This type of material rightly belongs to a text book on that particular aspect of science. The final chapters have been prepared as a practical discussion of problems likely to be encountered during factory control analysis. These chapters include material which would have become repetitive if included under each method heading.

Section I has been compiled to provide an extensive cross-reference to the analytical methods appropriate to the particular food commodities. Most of the published books on food analysis are written in chapters which consider each type of product in turn. This method gives rise to considerable repetition because certain analytical techniques are basic and can be used for many different types of foodstuffs. Section I is an attempt to overcome this unwanted duplication. This system has considerable advantages in that it permits the methods section to be listed alphabetically, makes for easier reference, and enables comparison to be made between different approaches to the analysis of food products. Finally I have attempted to avoid the use of specialized terminology and to use an economy of words in order to achieve a readability suitable for the busy working chemist.

R. LEES

How to use the Book

Analysis of a Food Product

- (a) consult the methods applicable to product in Section I using the Alphabetical listing of foodstuffs;
- (b) use the procedures detailed in Section II.

Determination of one Component

- (a) consult the method located by its alphabetical position in Section II;
- (b) check the page number in the index at the end of the book.

Conversion Factors

consult appropriate table in Section III (6).

Logarithm Tables

consult appropriate table in Section III (6).

Discussion of Suggested Methods

consult Section III.

Contents

List of Tables	vi
Preface	vii
Introduction	ix
How to use the book	x
Section I INDEX TO METHODS OF ANALYSIS FOR NAMED FOODSTUFFS	1
Section II METHODS OF FOOD ANALYSIS	43
Section III NOTES ON GENERAL LABORATORY METHODS USED IN FOOD ANALYSIS	189
Chapter 1 Sampling	191
2 Laboratory techniques	195
3 Chromatography	203
4 Instrumental and optical techniques	210
5 Taste panel testing	223
6 Useful information for the food analyst	229
Index	239

List of Tables

I	Acid Factor; for 0.1 M Solution	59
II	Ethanol by Volume at 15.56°C from Apparent Specific Gravity at 20°C	62
III	Relationship of cm ³ 0.005 M Thiosulphate to the Weight of Sugars Present	70
IV	Blue, Green and Black Food Dyes	74
V	Yellow and Orange Food Dyes	75
VI	Red Food Dyes	75
VII	Additional EEC Colours	78
VIII	Suitable Solvents for Development of Dye Chromatograms	78
IX	Extreme and Average Composition of Fruits	105
X	Ratio of Absorption Coefficient to Scattering Coefficient (<i>K/S</i>) as a Function of Reflectivity in percent	116
XI	Invert Sugar Table for 10 cm ³ of Fehling's Solution	146
XII	Invert Sugar Table for 25 cm ³ of Fehling's Solution	147
XIII	Dextrose and Laevulose Content Determined by Fehling's Solution	148
XIV	Lactose Content Determined by Fehling's Solution	149
XV	Maltose Content Determined by Fehling's Solution	150
XVI	Factors for Luff Schorl Determinations	151
XVII	Refractive Indices of Sucrose Solutions at 20°C	161
XVIII	Temperature Correction for Refractive Sucrose Solids	162
XIX	Basic Whatman Filter Paper Grades	196
XX	Preparation of Indicator Solutions used in the Methods Section	198
XXI	Colour Changes and pH range of Certain Indicators	199
XXII	Strength of Aqueous Solutions of Various Common Acids and Ammonium Hydroxide	199
XXIII	Variation of Refractive Index of Distilled Water with Temperature	211
XXIV	Specific Rotation of '100 per cent' Carbohydrate Solutions at 20°C for Yellow Sodium Light	213
XXV	Absorbed Transmitted Hue	214
XXVI	Ilford Spectrum Filters	214
XXVII	Choice of Colour Filter for a Particular Solution Colour	215
XXVIII	Choice of the Similar Sample, Coded ϕ , for Presentation in Triangular Testing	224
XXIX	Number of Correct Answers Required for a Specified Number of Triangular Testings	226
XXX	Paired Comparison	226
XXXI	Terms to Describe Texture and Flavour	228
XXXII	Relationship of Weights and Measures	229
XXXIII	Decimal Prefixes for Measuring Units	230
XXXIV	Base Units in SI System	230
XXXV	Table of Atomic Weights	231
XXXVI	Logarithms	234
XXXVII	Antilogarithms	236

<i>Product</i>	<i>Determination</i>	<i>Reference</i>
Agar Agar	Preparation	as supplied (AA)
	Arsenic	A15
	Ash	A17
	Grade Strength	G6
	Lead	L3
	Moisture	M9c
	Solubility	S7
	On 2 per cent solution Colour	C12
	On 1 per cent solution Cloudiness	—
Almond Oil	Preparation	as supplied (AA)
	Acid Value	F5
	Antioxidants	A13
	Colour, Measurement of	C12
	Free Fatty Acid	F5
	Glyceride Composition	G5, F2a b
	Iodine Value	I4
	Organoleptic Examination	O3
	Peroxide Value	P3
	Rancidity	R1
	Refractive Index, 20 °C or 40 °C	R3
	Saponification Value	S3
	Specific Gravity, 15.5 °C	S10
	Unsaponifiable Matter	U1
Arrowroot	Preparation	as supplied (AA)
	Acid Insoluble Ash	A3
	Alcoholic Extract	A8
	Aqueous Extract	A14
	Arsenic	A15
	Ash	A17
	Crude Fibre	C20
	Ether Extract	E5
	Microscopic Appearance	M6
	Moisture	M9c
	Volatile Oil	V3
Baking Powder	Preparation	as supplied (AA)
	Acid Insoluble Ash	A3
	Arsenic	A15
	Ash	A17
	Carbon Dioxide	C6
	Cream of Tartar	C18
	Lead	L3
	Starch	S13b
Barley Flour	Preparation	as supplied (AA)
	Acidity	A4e
	Colour, Measurement of	C12
	Crude Fibre	C20
	Fat	F1i
	Microscopic Examination	M6
	Moisture	M9c
	Nitrogen	N2

FOOD ANALYSIS

<i>Product</i>	<i>Determination</i>	<i>Reference</i>
Barley Flour	Protein	P14a or b
<i>continued</i>	Starch	S13a
Bay Leaf	Preparation	A1
	Acid Insoluble Ash	A3
	Alcoholic Extract	A8
	Aqueous Extract]	A14
	Arsenic	A15
	Ash	A17
	Crude Fibre	C20
	Ether Extract	E5
	Microscopic Appearance	M6
	Moisture	M9c
	Volatile Oil	V3
Beans Canned	Preparation	AH
	Appearance	—
	Drained Weight	D2
	Organoleptic Examination	O3
	Texture	T2A
	On drained Liquor	
	Arsenic	A15
	Colour, Measurement of	C12
	Lead	L3
	Moisture	M9e
	pH	P4
	Potassium	P9
	Reducing Sugars, as Invert Sugars	R2a
	Total Sugars	S15, S16
	Zinc	Z1
Beetroot, Cooked	Preparation	AF, AG
	Moisture	M9e
	Pigment	P9
	Texture	T2c(ii)
Beverages	See Under	
	Cocoa	
	Coffee	
	Coffee, Instant	
	Fruit Juices	
	Orange Drink	
	Soft Drinks	
	Tea	
	Tea, Instant	
Bones	See Under 'Meat Bones'	
Bread	Preparation (remove crust)	AE
	Ash	A17
	Cold Water Extract	A14
	Crude Fibre	C20
	Fat	F1e
	Lactose	L1
	Milk Solids	L1
	Moisture	M9k

<i>Product</i>	<i>Determination</i>	<i>Reference</i>
Bread <i>continued</i>	Nitrogen	N2
	Protein	P14
	Preparation	as supplied (AA)
	pH	P4
	Product Structure	P13
	Texture	T2b
Breakfast Cereals	See Under 'Cereals, Breakfast'	
Brine	Preparation	as supplied (AA)
	Salt	S2b
	Specific Gravity	S10c
	Sugar	S15
Butter	Preparation	as supplied (AA)
	Ash	A17
	Colour, Measurement of	C12
	Curd	C21
	Curd Protein (use C21)	N2
	Extrusion Characteristics	E6
	Fatty Acid Examination	F2
	Fat	by difference
	Fat, Examination of	
	Acid Value	F5
	Free Fatty Acids	F5
	Incipient Melting Point	M4
	Iodine Value	I4
	Kirschner Value	R4
	Melting Point	M4
	Polenske Value	R4
	Refractive Index, 40 °C	R3
	Reichert Value	R4
	Saponification Value	S3
	Slip Point	M4
	Lead	L3
	Microscopic Examination	M6
	Moisture	M9i
	Organoleptic Examination	O3b
	Salt	S2
Cakes	See Under 'Flour Confectionery'	
Candied Fruit	See under 'Fruit, Candied'	
Cannelloni	Preparation	AC, AI
	Ash	A17
	Colour (Spinning Cup)	C12
	Cooked Weight	C15
	Cooking Loss/Gain	C15
	Crude Fibre	C20
	Egg Solids	E1
	Fat	F1e
	Moisture	M9c
	Nitrogen	N2
	Organoleptic Examination	O3
	Phosphorus	P8a
	Protein	P14

FOOD ANALYSIS

<i>Product</i>	<i>Determination</i>	<i>Reference</i>
Cannelloni	Salt	S2
<i>continued</i>	Water Solution Solids	W3
Capsicum	Preparation	as supplied (AA or AI)
	Acid Insoluble Ash	A3
	Alcohol Extract	A8
	Aqueous Extract	A14
	Arsenic	A15
	Ash	A17
	Crude Fibre	C20
	Ether Extract	E5
	Microscopic Appearance	M6
	Moisture	M9c
	Volatile Oil	V3
Caraway	Preparation	AI or AA
	Acid Insoluble Ash	A3
	Alcohol Extract	A8*
	Aqueous Extract	A14
	Arsenic	A15
	Ash	A17
	Crude Fibre	C20
	Ether Extract	E5
	Microscopic Appearance	M6
	Moisture	M9c
	Volatile Oil	V3
Cardamon	Preparation	AA
	Acid Insoluble Ash	A3
	Alcoholic Extract	A8
	Aqueous Extract	A14
	Arsenic	A15
	Ash	A17
	Crude Fibre	C20
	Ether Extract	E5
	Microscopic Appearance	M6
	Moisture	M9c
	Volatile Oil	V3
Cereals, Breakfast	Preparation	AI
	Crude Fibre	C20
	Moisture	M9c
	Nitrogen	N2
	Protein ($\times 6.25$)	P14
	Reducing Sugars, as Invert Sugar (clarify as described in S16d)	R2a
	Sugar Content	S16d
Cheese	Preparation	AJ
	Acidity	A4a
	Ash	A17
	Fat	F1f
	Fat, Examination of	
	Acid Value	F5
	Free Fatty Acid	F5

INDEX TO METHODS OF ANALYSIS FOR NAMED FOODSTUFFS

<i>Product</i>	<i>Determination</i>	<i>Reference</i>
Cheese <i>continued</i>	Fat, examination of	
	Iodine Value	I4
	Kirschner Value	R4
	Peroxide Value	P3
	Polenske Value	R4
	Reichert Value	R4
	Saponification Value	S3
	Lead	L3
	Moisture	M9g
	Nitrogen	N2
	Protein (nitrogen \times 6.38)	P14
Chicken Meat	Texture	T2b
	Preparation	AJ, AKb
	Fat	F1a
	Fatty Acid Composition	F2
	Hexane Soluble Matter	(as for E5)
	Moisture	M9e
	Nitrogen	N2
	Protein	P14
	Total Volatile Base	T5
	Preparation	AJ
Chocolate	Ash	A17
	Fat	F1b
	Fat, Examination of	
	Acid Value	F5
	Free Fatty Acid	F5
	Glyceride Composition	G5, F2a-b
	Incipient Fusion Point	M4
	Iodine Value	I4
	Melting Point	M4
	Peroxide Value	P3
	Refractive Index, 40 °C	R3
	Saponification Value	S3
	Slip Point	M4
	Solvent Extracted Cocoa Butter	S9
	Lactose (clarify)	R2b
	Lecithin (from phosphorus)	P8a
	Moisture	M9c
	Nitrogen	N2
	Phosphorus	P8c
	Sucrose	S1c
	Preparation	AA or AC
Cinnamon	Acid Insoluble Ash	A3
	Alcoholic Extract	A8
	Aqueous Extract	A14
	Arsenic	A15
	Ash	A17
	Crude Fibre	C20
	Ether Extract	E5
	Microscopic Appearance	M6

FOOD ANALYSIS

<i>Product</i>	<i>Determination</i>	<i>Reference</i>
Cinnamon <i>continued</i> Cloves, Dried	Moisture	M9c
	Volatile Oil	V3
	Preparation	as supplied (AA or AC)
	Acid Insoluble Ash	A3
	Alcoholic Extract	A8
	Aqueous Extract	A14
	Arsenic	A15
	Ash	A17
	Crude Fibre	C20
	Ether Extract	E5
	Microscopic Appearance	M6
	Moisture	M9c
	Volatile Oil	V3
Cocoa	Preparation	as supplied (AA)
	Alkalinity of Ash	A11
	Ash	A17
	Caffeine	C2
	Colour, Measurement of	C12
	Crude Fibre	C20
	Fat	F1b
	Microscopic Appearance	M6
	Moisture	M9c
	Nett Weight (if applicable)	N1
	Nitrogen	N2
	Organoleptic Examination	O3
	Solubility	S7
	Sucrose	S15
Cocoa Butter	Preparation	as supplied (AA)
	Acid Value	F5
	Free Fatty Acid	F5
	Glyceride Composition	G5, F2a-b
	Incipient Fusion Point	M4
	Iodine Value	I4
	Melting Point	M4
	Organoleptic Examination	O3
	Peroxide Value	P3
	Refractive Index, 40 °C	R3
	Saponification Value	S3
	Slip Point	M4
	Solvent Extracted Cocoa Butter	S9
Coffee	Preparation	AC
	Alkalinity of Ash	A11
	Ash	A17
	Caffeine	C2a or b
	Colour, Measurement of	C12
	Crude Fibre	C20
	Fat	F1b
	Microscopic Appearance	M6
	Moisture	M9c
	Nett Weight (if applicable)	N1