

**THE LABORATORY
BOOK OF
DAIRY ANALYSIS**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649427543

The Laboratory Book of Dairy Analysis by H. Droop Richmond

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OF
DAIRY ANALYSIS

BY

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ILLUSTRATED WITH PHOTOGRAPHS BY THE AUTHOR



LONDON
CHARLES GRIFFIN AND CO. LIMITED
EXETER STREET, STRAND
1905

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S. N. R. P. R.

PREFACE

THIS work is intended to contain working directions for the analysis of milk and dairy-products; the estimation of all constituents of diagnostic value is shortly described in detail, and is in many cases illustrated by photographs of chemists actually carrying out the determination.

A chapter on the application of analysis to the solution of problems usually placed before the chemist is included, and a very short summary of the composition of milk and its products is given.

In the Appendix the composition and preparation of the various solutions is detailed. Tables are given to facilitate the working out of results; these Tables are condensed to occupy one page each, and the saving of time by avoiding the turning over of pages will more than compensate for the slight extra labour due to the condensation.

While not intended to be a complete guide to the analysis of milk, it is hoped that this work will afford assistance to analysts, health officers, dairy students, and those engaged in the supervision of dairies; with this object in view the more simple tests have been described in a manner which will render their working by

persons other than chemists possible ; it must be remembered, however, that though these methods are easy, they are often fallaciously easy, and lack of chemical training may lead to the making of errors, and the overlooking of important points ; no amount of careful following of directions can replace a thorough training in chemical science and manipulation, and though simple tests have a real value as a guide, they have not the reliability of an analysis made by a skilled chemist.

H. D. R.

September 1905.

CONTENTS

CHAPTER I

INTRODUCTION

	PAGE
The Constituents of Milk—Products Derived from Milk—Composition of Milk—and of its Products	I

CHAPTER II

THE ANALYSIS OF MILK

Preparation of the Sample—Specific Gravity—Total Solids—Ash—Mineral Constituents—Acidity—Fat—Gerber Method—Gravimetric Methods—Milk Sugar—Proteids—Nitrogen—Curd—Relation between Fat, Solids not Fat, and Specific Gravity	5
---	---

CHAPTER III

THE ANALYSIS OF LIQUID MILK-PRODUCTS

Skim Milk—Cream—Butter-milk—Whey—Sterilised Milk—Condensed Milk—Sour Milk	43
---	----

CHAPTER IV

THE APPLICATION OF ANALYSIS TO THE SOLUTION OF PROBLEMS

The Detection of Adulteration—Preservatives—Poor Milk—Sweet Milk—High Colour—Sour Milk—Unusual Taste—Dirty Milk—Detection of Adulteration of Cream—and Skim Milk	49
--	----

CHAPTER V

THE ANALYSIS OF BUTTER

	PAGE
Water—Curd and Salt—Preservatives—Examination of the Fat—Reichert-Wollny Method—Soluble and Insoluble Fatty Acids and Mean Molecular Weight—Density—Examination under Polarised Light—Iodine Absorption—Refractive Index—Detection of Adulteration	60

CHAPTER VI

THE ANALYSIS OF CHEESE

Water, Ash, and Salt—Fat—Nitrogen—Products of Ripening—Examination of the Fat—Detection of Adulteration—Application of Analysis to Cheese-making	75
TABLES FOR CALCULATION	79
APPENDIX. Standard Solutions	82
INDEX	87

CHAPTER I.

INTRODUCTION.

Milk consists of (1) fat in small globules (Fig. 1) ranging in size from 0.01 mm. in diameter to 0.0016; (2) milk-sugar and (3) various salts in solution in water; and (4) casein, combined with lime and



FIG. 1.—Milk (magnified 400 diameters).

phosphoric acid, and (5) albumin in less perfect solution. There are in addition (6) other compounds in small quantities.

The fat will be treated of in the section on butter; the milk-sugar belongs to the class of carbo-hydrates and crystallises with 1 OH_2 , and is one of the hexa-bioses. It rotates the plane of polarisation, its specific

rotatory power being 52.5° for the crystallised sugar; and reduces solutions of copper salts.

Casein is a proteid belonging to the class of the nucleo-albumins; it contains carbon, hydrogen, oxygen, nitrogen, sulphur, and phosphorus; in milk it exists as a salt of lime and soda combined with calcium phosphate; acids precipitate the free casein if dilute, while strong acids re-dissolve it. Rennet splits casein up



FIG. 2.—Cream (magnified 400 diameters).

into curd, which is a combination of para-casein with the lime and the calcium phosphate of the casein, the soda being split off, and whey proteid which is free from phosphorus.

Albumin is a proteid which is distinguished by coagulating on heating to 70° C.; in milk it probably exists as a salt, and this does not coagulate until the milk is acidified. Unaltered albumin is not precipitated by acids.

When micro-organisms act on milk various products are formed; the most important change is the formation of lactic acid from the sugar, which causes milk to become sour, and curdles it by precipitating the casein.

The fat globules are lighter than the aqueous serum,