LEAVENING AGENTS: YEAST, LEAVEN, SALT-RISING FERMENTATION, BAKING POWDER, AERATED BREAD, MILK POWDER

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RICHARD N. HART

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BY

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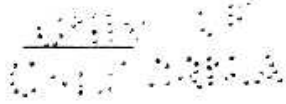

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PREFACE

This volume fills a gap in the literature of baking in this country. The baker knows a good deal about his flours and also how they are made, but he knows very little about his yeast and less still about his baking powder. He has been well supplied with literature on the technology and chemistry of flour, but much of the data on his aerating agents has either been aimed over his head or else has been purposely misleading.

Aerated bread has been added because of its historical value and because of its possible future. *Dry Milk* is another recent important addition to baking materials.

Yeast, which is necessarily a technical subject, has been treated in as condensed and simple a manner as possible. The author acknowledges his indebtedness to an anonymous friend for the section on the manufacture of yeast. This is the first exact and detailed description of yeast manufacture in English, and is an important addition to the literature of chemical technology.

Baking powder is a subject on which the bakers and the public have been misinformed. The water has been so badly stirred up by the "baking powder controversy," that the non-technical man has been unable to see beyond the words "alum" and "cream of tartar." This section has been written without personal bias and the facts have been verified.

The author also wishes to express his thanks for the data and valuable criticisms given him by Dr. Edward Hart, the librarians of the John Crerar Library of Chicago, Meek-Barnes Baking Co., of Los Angeles, Lewis C. Merrell and Charles Trefzger, and to acknowledge the assistance of his friends.

R. N. HART.

Peoria, Ill., Aug. 1914.

CONTENTS

YEAST

The study of yeast falls under three heads: (1) Briefly, the discovery of the source and nature of alcoholic fermentation, and a growing knowledge of what yeast is;[1] (2) the characteristics of the yeast plant; (3) yeast manufacture and use. To this is added (4) the action of yeast in bread and (5) Leaven and homemade yeasts.

FERMENTATION AND ITS CAUSE

Fermentation has always been an interesting and puzzling subject to the physical scientist. The alchemists of old hoped to bring about a fermentation of the base metals to produce gold and silver; the "philosopher's stone" would induce this fermentation. Yeast, of course, is as old as fermentation. But fermentation, until 100 years ago, was thought to be a chemical reaction. For instance, Basil Valentine, a German Monk of the fifteenth century, held with others that it was a purification of the *must*, by which the true nature of the alcohol appeared, and the excrement or baser substances settled as *lees*. When yeast was added to wort "an internal inflammation is communicated to the liquid, so that it raised itself, and thus the segregation and separation of the feculant from the clear, takes place."

Leeuwenhoeck opened the book of yeast in 1680, when he discovered the beer yeast globules, by means of his improved microscope; but it did not occur to him that the cells were alive. de Latour, Schwann and Kuetzing turned the first page, with the discovery of a vegetable mass of cells that reproduced by budding. In 1838 Meyer created the yeast genus *Saccha-*

[1] For an excellent treatise on "Fermentation" see *Encyclopedia Brittanica*, 1911; Vol. X, p. 275: also "American Handy Book of Brewing, Malting and Auxiliary Trades," Wahl and Henius, Chicago, 1908.

romyces of the fungi; because it was now known that yeast breathed oxygen and excreted fermentation products, without secreting chlorophyll (leaf green). In 1870 Dr. Max Rees narrowed the term yeast to those cells which broke up sugar into alcohol, excluding all other bacteria and fungi which produced fermentation.

Taken in detail the history of fermentation research is seen to include the names of the most illustrious chemists since the foundation of chemistry. Liebig, whose deductions were of less importance than the controversy he started, threw the immense weight of his influence in favor of the hypothesis that fermentation was a chemical reaction. He entered this field of research about 1838 and was not successfully challenged until Pasteur published his "Étude sur la Bière" in 1876. Pasteur's work compelled Liebig to modify his own views somewhat. In later years Pasteur's work has been amplified and amended by Traube, Buchner and A. J. Brown.

The present knowledge of yeast and fermentation has come by way of the following theories: (1) *Physical.* Naegeli surmised that the yeast cell transferred its physical activity to the medium within a radius equal to three to six diameters; (2) *Chemical.* Liebig rationalized the ideas of the alchemists coming through Stahl a century before; he presumed yeast to be an unstable albuminoid which produced fermentation by chemical reaction; (3) *Physiological.* Pasteur controverted the first two theories by confirming the vegetable nature and action of yeast. His careful research gave valuable theoretical and practical results; (4) *Enzymic.* Traube, working along the same line, stated in 1858 that yeast secreted substances called enzymes, (see page 9), which had been found independent of yeast in 1833. In 1897 the fermenting enzyme, *zymase*, was separated

from yeast and named by Buchner, who thus confirmed the theory that alcoholic fermentation is the result of the action of an enzyme produced by the yeast cell.

LIFE AND CHARACTERISTICS OF YEAST

Bread yeasts belong to the *fungi*, the lowest order of the sub-kingdom Cryptogamia or non-flowering plants, without leaves, stems, etc. Specifically, they are the "top yeasts" of the class *Saccharomyces*, order *cerevisiae*. *Top* yeasts, in distinction with *bottom* or lager beer yeasts, become most active at a higher temperature and rise to the top of the fermenting liquor, though they afterwards settle to the bottom of the cold wash water. They are identical with the distillers' yeast and the yeasts of the sweet English beers. Top and bottom, together with wine and "wild" yeasts, lactic acid and innumerable other bacteria, are found in the floating air dust, in the soil, on vegetation, and very thickly on the skin of ripening fruits.

Bread may be made with bottom or brewer's yeast. But its lower temperature of fermentation, its weaker action, its bitter taste and its tendency to darken the bread all tell against it; moreover it keeps poorly in the warm months.[1] For these reasons brewers' yeasts are not held to be bread yeasts in this country.

Yeast breathes oxygen and feeds on albuminoids, substances similar to egg albumen, which have been degraded to amids and peptones, and on organic and inorganic salts. It also ferments sugars into alcohol and carbon dioxid; other products of fermentation, though in almost negligible quantities, are glycerin, succinic acid and higher alcohols. It is believed, though not proven, that leavened bread owes its flavor to these latter organic

[1] "The Technology of Bread Making," Jago and Jago, London, 1911; p. 233.