DATA SOURCEBOOK FOR FOOD SCIENTISTS AND TECHNOLOGISTS

Y.H. HUI

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PREFACE

This handbook provides domestic and foreign food scientists and technologists easy access to certain useful scientific, technical, and legal information most of which is normally distributed over many documents in the United States. As a reference book, it covers the following groups of information:

1. Functional and economical chemicals used in processing foods and on raw agricultural products respectively.
2. Classification and profiles of pathogens ingested in foods, beverages, and drinking water.
3. The application of biotechnology in food processing and related areas.
4. Product categories: fruits and vegetables, meat and poultry, bakery products, and alcoholic beverages.
5. U.S. government's recommended nomenclature for food fishes.
6. Safety of workers in food processing plants.
7. Sanitation in food processing.
8. Laws and regulations governing the safety and economic attributes of domestic and imported food products.

Because this handbook covers a variety of information, it can be used by professionals in government, industry, and academia. Further, students and instructors in food science, technology, engineering and related fields will benefit from this book when they do library research for term papers, tests, and research projects.

I personally believe that this handbook will serve well all domestic and foreign libraries associated with:

1. Academic food science, technology, and engineering programs.
2. Food companies, ingredient and equipment suppliers, and commercial laboratories.
3. Government research laboratories.

In general, this book will be useful if one needs answers to those questions listed under different areas in the table presented at the end of this preface.

Those questions are not meant to be exhaustive. The data in this book will provide answers to many other scientific, technical, and legal questions in food processing and related areas. Interested persons will find the complete and detailed table of contents (in the front matter) useful in determining how this book can serve them. However, the above questions serve to provide the reader with a general idea of coverage in this handbook.

Perhaps, you may agree with me on the unique qualities of this handbook if we consider the following perspectives:

1. Information management: data from literature reprocessed for easy access and understanding.
2. Interdisciplinary approach: covering many disciplines within food science and technology.
3. Areas covered: chemistry, biology, nutrition, manufacturing processes, formulations, selected products, laws and regulations, definitions, etc.
4. Emphasis: processes, practices, and chemical substances legally permitted and recommended for usage and application in the manufacturing of foods and beverages.

Most of the information, though available in the literature, has not been assembled or appeared together in one source or in any current reference book in the market.

All legal language has been reworded or removed to facilitate easy understanding. Directions for obtaining original materials are provided. Since some of the information has been extracted from very costly legal documents,

its easy access here has eliminated the need of purchasing original publications that contain much unneeded data.

Let me explain that, although I determined what data appear in this handbook, I am not the author of the information. Rather, I have served as an editor and a manager of information. After having determined what information to include, I identified, extracted, collated, and edited it. Therefore, I would like to emphasize the following:

1. Most of the materials have been abstracted from documents that are either in public domain or from copyrighted materials. For all of them, proper reference and credit are given. Where applicable, permission to do so is indicated.
2. This book contains a fair amount of technical and legal information, most of which has been paraphrased or reorganized from original documents, and the interpretation or editing are entirely the editor's. Every reasonable effort has been made to assure accuracy in the process. Because of the voluminous amount of materials involved, this editor does not assume any liability for errors or omissions. Persons using this source should always consult the original document referenced to obtain further details and should use their own interpretation when necessary.
3. My role in handling certain legal information is management and I assume no legal expertise. The legal information contained in this book cannot and should not be used as *prima facie* evidence in a court of law. If such is needed, consult the original documents or an attorney-at-law for professional assistance.

Y. H. Hui
November 1991
Cutten, California

A Table Listing Examples of Questions That Will Be Answered by Data in This Book

Food Chemicals

1. What are the functional and chemical characteristics of common chemicals used in food processing?
2. How may I ascertain if one or more of a group of chemicals is used as a pesticide (or related formulation) on raw agricultural products? Where is the information located?
3. Has a tolerance been established for this pesticide (or a related chemical) in a specific processed food? Where is the information located?

Biotechnology

1. What are the U.S. government agencies responsible for regulating biotechnology products and proposals on research and development?
2. What are some examples of applying biotechnology to food processing and related areas?
3. What are the definitions for some terms commonly encountered in biotechnology?
4. How are the fermentative productions of amino acids related to such factors as fundamental considerations; enzyme processes; application of gene technology; auxotrophic mutants, regulatory mutants and auxotrophic-regulatory mutants; and biosynthetic precursors?
5. What types of fermented foods are available in industrial societies and third world countries? What are the microorganisms used? What are the substrates? What are the products?
6. What are the fundamentals of manufacturing fermented dairy products?
7. What are the classifications and sources of enzymes? What are the representative industrial enzymes of the six major classes? What are the profiles of enzymes with industrial-scale applications? What are the major classes of enzymes of commercial interest and some of their sources?
8. What are the biology and properties of some major enzymes used in food processing and related areas?
9. What are some examples of applying gene technology to food processing enzymes?
10. When using fermentation to produce enzymes, what are the procedures? Microorganisms used? Techniques employed? Culture and media conditions? Requirements for fermentation?

11. When using enzymes in food processing, what enzymes are matched with what processing steps? What are the profiles of major enzymes used in food processing? What are the typical trade names and manufacturers for enzymes used in food processing?
12. How are yeasts applied in food processing?
13. What are the enzymes used in diagnostics and food analysis? What are the enzymes used in the processing of various food products?
14. What are the differences and similarities in the production of the fermented products–beer, whiskey, and bread?
15. When using immobilized enzymes, what are the considerations in relation to such factors as fundamental requirements, advantages, classification of methods, characteristics of an enzyme carrier, classification of enzyme matrixes, classes of immobilization techniques, Michaelis constants, optimum pH, and activation energies?
16. When applying the immobilized cell systems, what are the considerations in relation to such factors as fundamental requirements; nature of the catalytic reaction; organic and inorganic supports; available methods; examples of cells entrapped in gels, polyacrylamide, photo-crosslinking resin prepolymers, urethane polymers, collagen, gelatin, agar or agarose, carrageenan, alginate, or membrane reactors?
17. What are the industrial applications of immobilized cells?
18. What are some examples of immobilized cell systems activated *in situ*? Immobilized microbial cells utilized in analysis? Immobilized plant cells?
19. What are the iron complex products obtained from microorganisms?
20. What are the lipid contents of some microorganisms?
21. In relation to microbial products, what are the considerations in relation to such factors as classification, metabolic functions, and sources of coenzymes?
22. What are the various microbial α-glucosidase inhibitors?

Foodborne Diseases

1. If I have a description of the symptoms of a suspected food poisoning, what type of *tentative* diagnosis can I make about the causative agent, sampling, prevention, and so on?
2. What are the characteristic features of water- and foodborne pathogenic bacteria and parasites?
3. What are some well-known unsafe herbs? Why are they unsafe?
4. What are the definitions for various terms associated with food poisoning?

Table Listing Questions (continued)

Fruits and Vegetables

1. What is the water content for each of the major fruits and vegetables?
2. What is the pH for each of the major fruits and vegetables?
3. What are some characteristic features of those organisms that can spoil canned fruits or vegetables?
4. What are the storage requirements for fresh fruits and vegetables in relation to temperature, humidity, time, water content, and specific heat?
5. What are some characteristic features of using controlled atmospheres to store fruits and vegetables?
6. Which fresh and processed fruit or vegetable has a standard for grades promulgated by the U.S. Department of Agriculture?
7. How is a common fruit or vegetable processed?

Meat and Poultry Products

1. What are the general considerations for processing meats?
2. What raw ingredients are used to prepare processed meats?
3. Which types of meats are used in comminuted processed meats?
4. What are the different categories of perishable cooked and cured meat products?
5. What are the basic considerations in curing and smoking meat products?
6. What are the basic considerations for canning meats?
7. What are the formulas for curing some meat and poultry products?
8. What are the formulas for canning some meat and poultry products?
9. What are the commercial and legal classifications for sausages?
10. What different types of animal casings are used for making sausages?
11. What factors must be considered in meat fermentation?
12. What are the microorganisms used in preparing starter cultures for curing meat products?
13. What are the formulas for different types of sausages: ground, summer, dry, emulsion, specialty, and so on?
14. What are the defect criteria established by the federal government for meat from animal carcasses?
15. What are the definitions for special terms used in meat and poultry labeling?
16. What food additives are used in meat processing? What are the federal requirements for their usage?
17. For which meat products has the federal government issued definitions and standards? What are the contents of definitions and standards for

individual processed meat products? What is the required percentage of meat in processed meat products sold in the United States?

18. What food additives are used in poultry processing? What are the federal requirements for their usage?
19. For which poultry products has the federal government issued definitions and standards? What are the contents of definitions and standards for individual processed poultry products? What is the minimal or maximal percentage requirement of poultry meat in processed poultry products?

Bakery Products

1. What are the fundamental considerations in the manufacture of baked goods?
2. What are the pH values of various bakery products?
3. What are the baking times and temperatures for various baked goods?
4. What are the factors causing external and internal bread faults?
5. What are the formulas for some rolls, cakes, cookies, and variety baked goods?
6. What are the United States enrichment standards for cereals and flours?
7. What are the different processes for making sour doughs?

Fish List

1. What is the market name for a fish if one knows its scientific name?
2. What is the scientific name for a fish if one knows the market or regional name?

Alcoholic Beverages

1. What are the fundamental considerations in manufacturing beer?
2. What are the classical beer types throughout the world?
3. What are the legal classes and types of beer in the United States?
4. What are the legal definitions for major terms used in the manufacture of beer in the United States?
5. What are the flows of processing materials in malting, brewing, fermentation, and finishing?
6. What are the components of a quality assurance program in a brewery?
7. What are the fundamental considerations in the manufacture of wine and brandy?
8. What are the legal classes and types of wine manufactured in the United States?

Table Listing Questions (continued)

9. What are the legal definitions for major terms used in the manufacture of wine in the United States?
10. What chemical substances are authorized for the treatment of wine and juice in the United States? What are the limitations?
11. What materials are authorized for treatment of distilling material in the United States and what are the limitations?
12. What processes are authorized for the treatment of wine, juice, and distilling material in the United States and what are the limitations?
13. What factors must be considered in the manufacturing of distilled beverage spirits?
14. What are the legal definitions for some major terms used in the manufacture of distilled beverage spirits in the United States?
15. What are the legal classifications of liquor in the United States?
16. What natural flavoring substances are permitted in alcoholic beverages? What are the limitations?
17. What legal natural flavoring substances and natural substances are used in conjunction with flavors in the manufacture of alcoholic beverages?

Workers Safety And Sanitation in Food Processing Plants

1. What are the safety hazards in a food processing plant? What are the safety controls?
2. What are the occupational hazards associated with various jobs in food processing and related areas, for example, agricultural migrant workers, meat processing, eateries?
3. What are the biological and chemical agents commonly associated with injuries to and diseases of workers in food processing plants?
4. What are the exposure standards for chemicals associated with the food processing industry?
5. What is the hazard analysis critical control point system in food processing? What are the seven principles? What are hazards? What are risk assessments?
6. What cleaning and sanitizing operations are used in a food service or food processing establishment?
7. When using chemical and physical agents in a cleansing operation, what are the factors to be considered in relation to efficiency, properties, etc.?
8. What are the FDA food defect action levels? What are the defects? What are the foods?
9. What are the FDA food action levels for poisonous or deleterious substances? What are the poisonous substances? What are the foods?

10. What legal food color additives are exempt from certification?
11. What legal food color additives are subject to certification?
12. What are the legal uses and limitations of food preservatives?
13. What are the synthetic flavoring substances and adjuvants permitted in food?

Laws and Regulations

1. What are the responsibilities of the U.S. Food and Drug Administration (FDA) in relation to the relevant federal statutes?
2. What are the responsibilities of the FDA in safeguarding health and economic integrity of the food system in the United States?
3. What types of regulations does the FDA promulgate?
4. What types of enforcement actions does the FDA use?
5. What administrative and legal terms are used by the FDA?
6. What are the food additive regulations promulgated by the FDA in relation to listing, classification, limitations, categories (e.g., generally recognized as safe), and other factors?
7. What are the food standards promulgated by the FDA?
8. What does the FDA Inspection Operations Manual cover?
9. What does the FDA Regulatory Procedures Manual cover?

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Part of the contents of this text have been obtained from government documents, most of which are unauthored. All materials used are credited with the specific sources at the beginning or end of each section or chapter. Where applicable, the source is stated in the footnote of a table. Although all such writings are in public domain and can be reproduced where the need arises, I would like to thank all those government experts who have painstakingly composed the voluminous amount of laws and regulations. As a "manager" of information, I would not have been able to develop and complete the book without their anonymous contribution.

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Chapter Headings and Subheadings