

Contents

List of Contributors, xi

1 Principles of Food Processing, 1

Sung Hee Park, Buddhi P. Lamsal, and V.M. Balasubramaniam

- 1.1 Processing of foods: an introduction, 1
- 1.2 Unit operations in food processing, 2
- 1.3 Thermophysical properties, microbial aspects, and other considerations in food processing, 4
- 1.4 Common food preservation/processing technologies, 7
- 1.5 Other food processing/preservation technologies, 12
- 1.6 Emerging issues and sustainability in food processing, 13
- 1.7 Conclusion, 13

2 Thermal Principles and Kinetics, 17

Prabhat Kumar and K.P. Sandeep

- 2.1 Introduction, 17
- 2.2 Methods of thermal processing, 17
- 2.3 Microorganisms, 20
- 2.4 Thermal kinetics, 21
- 2.5 Thermal process establishment, 24
- 2.6 Thermal process calculation, 26
- 2.7 Thermal process validation, 28
- 2.8 Process monitoring and control, 29
- 2.9 Emerging processing technologies, 29
- 2.10 Future trends, 30

3 Separation and Concentration Technologies in Food Processing, 33

Yves Pouliot, Valérie Conway, and Pierre-Louis Leclerc

- 3.1 Introduction, 33
- 3.2 Physical separation of food components, 34
- 3.3 Processes involving phase separation, 37
- 3.4 Membrane separations, 46
- 3.5 Sustainability of separation technologies in food processing, 57

4 Dehydration, 61

Robert H. Driscoll

- 4.1 Introduction, 61
- 4.2 Drying and food quality, 61
- 4.3 Hot air drying, 62
- 4.4 Drying theory, 67
- 4.5 Drying equipment, 71
- 4.6 Analysis of dryers, 75
- 4.7 Sustainability, 77
- 4.8 Conclusion, 77

- 5 Chilling and Freezing of Foods, 79**
Stephen J. James and Christian James
- 5.1 Introduction to the food cold chain, 79
 - 5.2 Effect of refrigeration on food safety and quality, 79
 - 5.3 Blanching, 83
 - 5.4 Principles of refrigeration systems, 84
 - 5.5 Heat transfer during chilling and freezing, 86
 - 5.6 Chilling and freezing systems, 87
 - 5.7 Chilled and frozen storage systems, 92
 - 5.8 Chilled and frozen transport systems, 93
 - 5.9 Refrigerated retail display systems, 95
 - 5.10 Recommended temperatures, 99
 - 5.11 Refrigeration and the environment, 100
 - 5.12 Specifying, designing, and commissioning refrigeration systems, 101
 - 5.13 Conclusion, 102
- 6 Fermentation and Enzyme Technologies in Food Processing, 107**
Ali Demirci, Gulden Izmirliglu, and Duygu Ercan
- 6.1 Introduction, 107
 - 6.2 Fermentation culture requirements, 108
 - 6.3 Fermentation technologies, 112
 - 6.4 Downstream processing, 114
 - 6.5 Fermented foods, 117
 - 6.6 Enzyme applications, 123
 - 6.7 Sustainability, 131
 - 6.8 Concluding remarks and future trends, 131
- 7 Alternative Food Processing Technologies, 137**
Hudaa Neetoo and Haiqiang Chen
- 7.1 Introduction, 137
 - 7.2 Alternative thermal processing technologies, 137
 - 7.3 Alternative non-thermal processing technologies, 144
 - 7.4 Sustainability and energy efficiency of processing methods, 159
 - 7.5 Conclusion, 160
- 8 Nanotechnology for Food: Principles and Selected Applications, 171**
Sundaram Gunasekaran
- 8.1 Introduction, 171
 - 8.2 Biosensing, 172
 - 8.3 Packaging, 191
 - 8.4 Nanotechnology and sustainability, 198
 - 8.5 Summary, 199
- 9 Sustainability and Environmental Issues in Food Processing, 207**
Fionnuala Murphy, Kevin McDonnell, and Colette C. Fagan
- 9.1 Introduction, 207
 - 9.2 Sustainable food processing drivers, 207
 - 9.3 Environmental impact of food processing, 210
 - 9.4 Green technologies: examples in the food processing industry, 213
 - 9.5 Environmental sustainability assessment methods, 214
 - 9.6 Conclusion, 227

10 Food Safety and Quality Assurance, 233*Tonya C. Schoenfuss and Janet H. Lillemo*

- 10.1 Introduction, 233
- 10.2 Elements of total quality management, 233
- 10.3 Hazard Analysis Critical Control Point (HACCP) system, 235
- 10.4 Sanitary processing conditions, 236
- 10.5 Supporting prerequisite programs, 242
- 10.6 Product quality assurance, 245
- 10.7 Conclusion, 246

11 Food Packaging, 249*Joongmin Shin and Susan E.M. Selke*

- 11.1 Introduction, 249
- 11.2 Functions of food packaging, 249
- 11.3 Packaging systems, 250
- 11.4 Materials for food packaging, 251
- 11.5 Other packaging types, 263
- 11.6 Sustainable food packaging, 268

12 Food Laws and Regulations, 275*Barbara Rasco*

- 12.1 Introduction, 275
- 12.2 The regulatory status of food ingredients and additives, 276
- 12.3 Adulteration and misbranding, 276
- 12.4 The global food trade: risk from adulterated and misbranded foods, 279
- 12.5 US Department of Agriculture programs, 280
- 12.6 Environmental Protection Agency programs, 283
- 12.7 The Food Safety Modernization Act, 283
- 12.8 Summary, 291

13 Crops – Cereals, 293*Kent D. Rausch and Vijay Singh*

- 13.1 Introduction, 293
- 13.2 Industrial corn processing for food uses, 293
- 13.3 Industrial wheat processing for food uses, 300
- 13.4 Sustainability of corn and wheat processing, 302

14 Crops – Legumes, 305*George Amponsah Annor, Zhen Ma, and Joyce Irene Boye*

- 14.1 Introduction, 305
- 14.2 Technologies involved in legume processing, 306
- 14.3 Traditional processing technologies, 307
- 14.4 Modern processing technologies, 310
- 14.5 Ingredients from legumes, 312
- 14.6 Novel applications, 329
- 14.7 Conclusion, 331

15 Processing of Fruit and Vegetable Beverages, 339*José I. Reyes-De-Corcuera, Renée M. Goodrich-Schneider, Sheryl Barringer, and Miguel A. Landeros-Urbina*

- 15.1 Introduction, 339
- 15.2 Juices, 341
- 15.3 Nectars, 356

- 15.4 Clean-in-place, 358
- 15.5 Conclusion, 360
- 16 Fruits and Vegetables – Processing Technologies and Applications, 363**
Nutsuda Sumonsiri and Sheryl A. Barringer
- 16.1 Raw materials, 363
- 16.2 Basic processing, 369
- 17 Milk and Ice Cream Processing, 383**
Maneesha S. Mohan, Jonathan Hopkinson, and Federico Harte
- 17.1 Introduction, 383
- 17.2 Physical and chemical properties of milk constituents, 383
- 17.3 Milk handling, 386
- 17.4 Dairy product processing, 391
- 17.5 US regulations for milk and milk products, 400
- 17.6 Sustainability of the dairy industry, 402
- 17.7 Conclusion, 402
- 18 Dairy – Fermented Products, 405**
R.C. Chandan
- 18.1 Introduction, 405
- 18.2 Consumption trends, 406
- 18.3 Production of starters for fermented dairy foods, 406
- 18.4 Biochemical basis of lactic fermentation for flavor and texture generation, 410
- 18.5 Yogurt, 410
- 18.6 Cultured (or sour) cream, 422
- 18.7 Cheeses, 424
- 18.8 Sustainability efforts in whey processing, 431
- 19 Eggs and Egg Products Processing, 437**
Jianping Wu
- 19.1 Introduction, 437
- 19.2 Shell egg formation, 437
- 19.3 Structure of eggs, 438
- 19.4 Chemical composition of eggs, 440
- 19.5 Shell egg processing, 441
- 19.6 Further processing of eggs and egg products, 444
- 19.7 Liquid egg products, 445
- 19.8 Pasteurization, 446
- 19.9 Desugarization, 448
- 19.10 Dehydration, 449
- 19.11 Egg further processing (value-added processing), 449
- 19.12 Sustainability, 450
- 19.13 Conclusion, 450
- 20 Fats and Oils – Plant Based, 457**
Amy S. Rasor and Susan E. Duncan
- 20.1 Introduction, 457
- 20.2 Sources, composition, and uses of plant-based fats and oils, 457
- 20.3 Properties of plant-based fats and oils, 460
- 20.4 Nutritional areas of interest, 461
- 20.5 Degradation of plant-based fats and oils, 462

- 20.6 General handling considerations, 463
- 20.7 Recovery of oils from their source materials, 463
- 20.8 Refining, 466
- 20.9 Modification of plant-based fats and oils, 469
- 20.10 Packaging and postprocessing handling, 473
- 20.11 Margarine processing, 473
- 20.12 Mayonnaise processing, 476
- 20.13 Sustainability, 477
- 21 Fats and Oils – Animal Based, 481**
Stephen L. Woodgate and Johan T. van der Veen
 - 21.1 Introduction, 481
 - 21.2 Raw materials, 481
 - 21.3 Land animals, 482
 - 21.4 Processing methods, 484
 - 21.5 EU legislation, 487
 - 21.6 Safety, 488
 - 21.7 Characteristics and quality, 490
 - 21.8 Applications, 493
 - 21.9 Health aspects, 496
 - 21.10 Sustainability, 497
 - 21.11 Conclusion, 497
- 22 Aquatic Food Products, 501**
Mahmoudreza Ovissipour, Barbara Rasco, and Gleyen Bledsoe
 - 22.1 Introduction, 501
 - 22.2 Aquatic plants and animals as food, 501
 - 22.3 Cultivation, harvesting, and live handling – reducing stress and maintaining quality, 502
 - 22.4 Animal welfare issues in fisheries, 507
 - 22.5 Harvesting methods and effect on quality, 507
 - 22.6 Reducing stress in live handling, 508
 - 22.7 Fishing methods, 510
 - 22.8 Refrigerated products, 514
 - 22.9 Freezing and frozen products, 515
 - 22.10 Surimi and surimi analog products, 520
 - 22.11 Curing, brining, smoking, and dehydration, 521
 - 22.12 Additives and edible coatings, 524
 - 22.13 Roes and caviar, 525
 - 22.14 Other non-muscle tissues used as food, 528
 - 22.15 Fish meal and protein hydrolyzates, and fish oil, 530
 - 22.16 Sustainability, 531
 - 22.17 Summary, 532
- 23 Meats – Beef and Pork Based, 535**
Robert Maddock
 - 23.1 Introduction, 535
 - 23.2 Beef and pork characteristics and quality, 535
 - 23.3 General categories of beef and pork processing, 537
 - 23.4 Equipment needed in beef and pork processing, 545
 - 23.5 Beef and pork processing and HACCP, 547
 - 23.6 Sustainability, 547

24 Poultry Processing and Products, 549

Douglas P. Smith

24.1 Poultry processing, 549

24.2 Turkey processing, 562

24.3 Duck processing, 562

24.4 Microbiology and food safety, 563

24.5 Sustainable poultry production and processing, 564

24.6 Conclusion, 565

Index, 567