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, Gulten Izmirlioglu, 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 Haigiang 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

- 20.0 Conord nanding considerations, 100
- 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 Gleyn 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

x Contents

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