

Processing of Poultry

Edited by G.C. Mead

This book brings together, in a comprehensive form, the large amount of technical and scientific information now available on poultry processing. A wide variety of scientific disciplines are included and aspects as diverse as bird welfare and the eating quality of the final products are covered. This volume deals first with the concept of quality and quality requirements in the industry and then with process technology and its effects on meat quality and yield. With the current awareness of microbiological hazards chapters are included on Problems and Control of Process Contamination and Microbiological Criteria for Poultry Products. Three of the eleven chapters are concerned with further processing and factors affecting the functional properties of meat in product development. There is also a full account of methods available for the disposal of processing wastes. The international authorship takes into account different legislative requirements affecting poultry meat production, particularly those of North America and the European Economic Community.

Processing of Poultry provides up-to-date reviews of research findings in all key areas with full references and will be invaluable to researchers and students of food science and technology and all those responsible for poultry meat production.

Poultry Feed from Waste

Processing and use

Edited by A.R.Y. El Boushy and A.F.B. van der Poel
Hardback (0 412 58280-5), 448 pages

Microbiology of the Avian Egg

Edited by R.G. Board and R. Fuller
Hardback (0 412 47570 7), 192 pages

SPRINGER-SCIENCE+BUSINESS MEDIA, B.V.

ISBN 978-1-071-60504-2



9 781071 605042

For sale in the Indian subcontinent only

MEAD

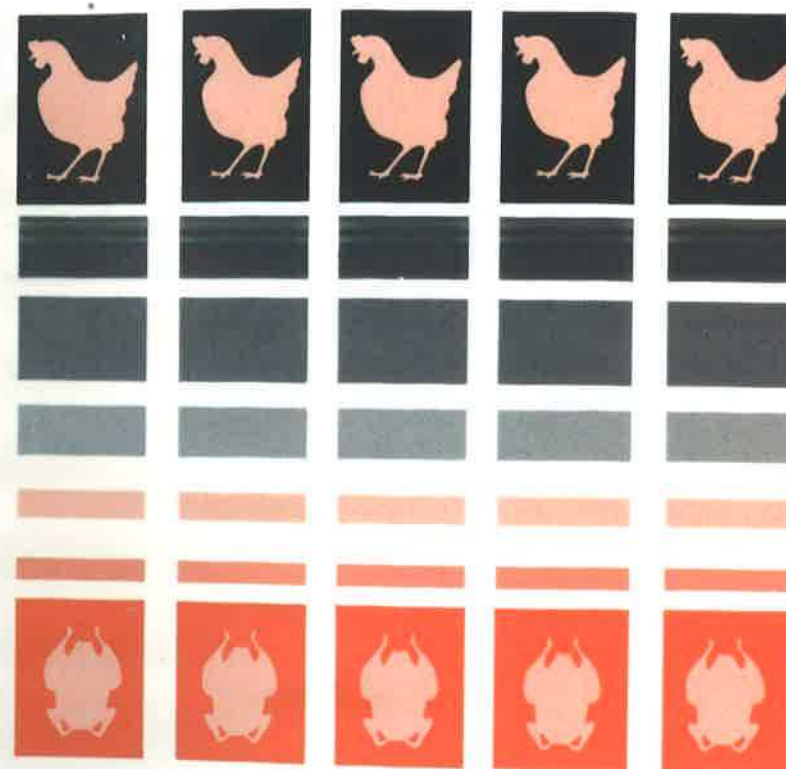
PROCESSING OF POULTRY



SPRINGER-SCIENCE+
BUSINESS MEDIA, B.V.

PROCESSING OF POULTRY

Edited by
G.C. MEAD



SPRINGER-SCIENCE+BUSINESS MEDIA, B.V.

2713

2612

PROCESSING OF POULTRY

Edited by

G. C. MEAD

*AFRC Institute of Food Research, Bristol Laboratory,
Langford, Bristol, UK*



SPRINGER-SCIENCE+BUSINESS MEDIA, B.V.

First South Asian Edition 2020
ISBN: 978-1-071-60504-2 (pbk)
First edition 1989
Reprinted 1995

© 1989 Elsevier Science Publishers Ltd: 1994 Chapman & Hall

© 1995 Springer Science+Business Media Dordrecht
Originally published by Chapman & Hall in 1995
Softcover reprint of the hardcover 1st edition 1995

ISBN 978-1-4613-5854-1 ISBN 978-1-4615-2059-7 (eBook)
DOI 10.1007/978-1-4615-2059-7

Apart from any fair dealing for the purposes of research or private study, or criticism or review, as permitted under the UK Copyright Designs and Patents Act, 1988, this publication may not be reproduced, stored, or transmitted, in any form or by any means, without the prior permission in writing of the publishers, or in the case of reprographic reproduction only in accordance with the terms of the licences issued by the Copyright Licensing Agency in the UK, or in accordance with the terms of licences issued by the appropriate Reproduction Rights Organization outside the UK. Enquiries concerning reproduction outside the terms stated here should be sent to the publishers at the London address printed on this page.

The publisher makes no representation, express or implied, with regard to the accuracy of the information contained in this book and cannot accept any legal responsibility or liability for any errors or omissions that may be made.

Printed in India by Replika Press Pvt. Ltd.

For sale in the Indian Subcontinent only

Preface

Over the last 40 years, poultry-meat production has undergone considerable expansion in much of the developed world. The industry has changed from an essentially farm-based operation to one where economies of scale in rearing and processing have led to a high degree of operational efficiency. As a sequel to these changes, however, there is now greater emphasis on product quality, rather than mere 'production at least cost'. Also, the more recent growth in further-processed and 'value-added' convenience items has helped to maintain a buoyant market for poultry, and has shown that the industry can rapidly adapt to changing consumer needs and preferences.

It is in the areas of primary processing and further-processed product development that the greatest technological changes have occurred within the industry. Processing, in particular, has become more mechanical, so that most stages in the production of oven-ready carcasses or cut-portions are now either semi- or fully-automated, thus reducing labour costs and helping to maximise the speed and efficiency of the process. However, not all of the changes that have taken place have necessarily been in the best interests of maintaining product quality, e.g. in relation to meat tenderness and microbial contamination, and it is essential for any processor to understand fully the effects of processing on all aspects of meat quality, including the efficacy of possible control measures.

A similar situation arises with regard to further processing and product development. Early formulations were relatively primitive and based on empirical observations, but present market demands and opportunities require greater sophistication. Development of high-quality products now involves an understanding of the functional

properties of the raw material, as well as a thorough knowledge of manufacturing technology and product distribution and marketing. In other words, to succeed, the modern producer has had to become highly professional in virtually all sectors of the business.

Although poultry meat is rightly regarded as a wholesome, nutritious and cheap form of dietary protein, it is not without some problems. One of these is an unfortunate association with human food-borne illness, due to microbial contamination and the unreliability of consumers in handling foods properly in the kitchen. The origin of this problem lies with the large-scale operations used for rearing and processing the birds. Under such conditions, the transmission of minority microorganisms, e.g. salmonellas, occurs readily and cannot be easily prevented. Nevertheless, it is in the interests of both processors and consumers that proper attention is given to plant hygiene, thus limiting contamination of the product with any organisms capable of causing either food poisoning or meat spoilage.

As the chapters in this book show, the processing of poultry has wide-ranging implications that involve a variety of scientific disciplines, and cover aspects as diverse as bird welfare and the eating quality of the final product. Hence, in planning a book of this kind, it soon became apparent that effective coverage of the subject would require a multi-author approach, with individual contributors providing a 'state-of-the-art' review of each of the main areas that together constitute 'processing'. In this form, a large amount of information can be put together to serve the needs of industry, legislators and students of food science and technology. Quite deliberately, the book has an international authorship and takes account of different legislative requirements affecting poultry-meat production, particularly those of North America and the European Economic Community.

Although the different aspects of poultry processing are inevitably interrelated, the overlap between chapters has been kept to a minimum, and I would like to thank the individual authors, both for their helpfulness and for the way in which they have cooperated in producing a book which aims to be informative, adequately referenced and up-to-date.

G. C. MEAD

Contents

<i>Preface</i>	v
<i>List of Contributors</i>	ix
1. Quality Requirements in the Modern Poultry Industry B. ERDTSIECK	1
2. Stunning and Slaughter N. G. GREGORY	31
3. Technological Developments in Pre-slaughter Handling and Processing R. T. PARRY	65
4. Chilling, Freezing and Thawing C. H. VEERKAMP	103
5. Influence of Processing on Product Quality and Yield J. M. JONES and T. C. GREY	127
6. Hygiene Problems and Control of Process Contamination G. C. MEAD	183

7. Microbiological Criteria for Poultry Products	221
B. SIMONSEN	
8. Further Processing of Poultry	251
R. C. BAKER and C. A. BRUCE	
9. Utilisation of Turkey Meat in Further-processed Products	283
R. I. RICHARDSON	
10. Developments in Enrobed Products	325
F. E. CUNNINGHAM	
11. Treatment and Disposal of Processing Wastes	361
V. C. NIELSEN	
<i>Index</i>	413

List of Contributors

R. C. BAKER

Department of Poultry and Avian Sciences, New York State College of Agriculture and Life Sciences, Cornell University, Rice Hall, Ithaca, New York 14853-5601, USA

C. A. BRUCE

Department of Poultry and Avian Sciences, New York State College of Agriculture and Life Sciences, Cornell University, Rice Hall, Ithaca, New York 14853-5601, USA

F. E. CUNNINGHAM

Department of Animal Sciences and Industry, Kansas State University, Leland Call Hall, Manhattan, Kansas 66506, USA

B. ERDTSIECK

Badhuisweg 149, 7314 JL Apeldoorn, The Netherlands

N. G. GREGORY

Agricultural and Food Research Council, Institute of Food Research, Bristol Laboratory, Langford, Bristol BS18 7DY, UK

T. C. GREY

Agricultural and Food Research Council, Institute of Food Research, Bristol Laboratory, Langford, Bristol BS18 7DY, UK

Index

- Achromobacter*, 338
- Acinetobacter*, 183, 191
- Activated sludge, 401-2
 - conventional, 402
 - high-rate, 403
- Additives, 5, 10
- Adenosine triphosphate (ATP), 129-30
- Aeration, 395-7, 404
 - extended, 403-4
- Aerators, 396-7
 - combined compressed-air and mechanical, 397
 - compressed-air, 396
 - mechanical, 396
 - mechanical sub-surface, 397
 - mechanical surface, 396
 - pumped-liquid, 397
- Aerobic treatment, 394-5, 401-5
 - choice of system, 405
- Aeromonas*, 185, 191
- Aesthetic factors, 4, 9, 10
- A-grade carcasses, 92
- Air pollution, 366
- Alcaligenes*, 338, 342, 343
- Alternaria*, 338, 343
- Alteromonas putrefaciens*, 191
- Ammonia, 364
- Anaerobic digestion, 391-4
- Animal Health and Welfare Act 1984, 81
- Appearance of poultry products, 5-7, 9, 130-5
- Arrival area, 75
- Arthobacter*, 343
- Aspergillus*, 338, 340, 342
- ATP-method, 236
- Bacillus*, 338, 341-3
- Bacillus cereus*, 184, 230, 340
- Bacteria, 342
- Batters. *See* Enrobing materials
- Binding (or knitting), 263
- Biochemical oxygen demand (BOD), 362-3
- Biological filters, 398-401
 - high-rate, 398
- Biological treatment
 - factors affecting, 399-401
 - processing effluents, 392
- Bleeding, 81
 - contamination problems, 197-200
 - efficiency, 55-7
 - losses due to, 147-52
- Blood
 - collection, 367
 - loss, 56
 - recovery, 368
 - vessels, 45
- Bone discoloration, 261, 265
- Brain failure, 47, 48
- Breeding, 312
- Breast meat, 3, 52
- Breast muscle, 130
- Brevibacterium*, 342
- Brochothrix thermosphacta*, 191

- Broilers, 2-3
cold evisceration, 58
damage, 65
survey data, 34
Brushed screens, 384
- Campylobacter*, 230, 233, 238, 240, 241, 313
Campylobacter jejuni, 184, 190-1, 200, 247
Candida, 342
Carbon dioxide, 137-8, 207, 270, 311
Carcass quality, 49-51
Cardiac arrest, 48, 53-6, 58
Carotid arteries, 58
Catching, 68-75
bird-stress and downgrading in, 65-8
influence on product yield, 145-7
Chemical oxygen demand (COD), 363
Chemical treatment, 390-1
Chilling
air, 116-17
brine, 140
contamination problems, 203-7, 231-2
future developments, 122-3
heat transfer, 106-7
immersion, 115-16
industrial practice, 114-17
influence on colour and appearance, 132
influence on tenderness, 140
mass transfer, 110
physical processes involved in, 103
waste products, 370
water usage, 158, 170
Chloride, 363
Chlorination, 232
effects on microbial levels, 205
Cladosporium, 338, 343
Cleaning
waste products, 371-2
see also Plant cleaning
Clostridium, 341, 342
Clostridium botulinum, 185, 270, 310, 340
Clostridium perfringens, 184, 187-8, 198, 199, 230, 233, 241, 242, 310, 340, 344-5
Coatings, 312
see also Enrobed products;
Enrobing materials
Code of Federal Regulations, 168
Code of Hygienic Practice, 223
Codex Alimentarius Commission, 14-17, 223, 267
Cold rooms, 16
Coli-aerogens, 390
Coliforms, 89, 201, 207, 240, 343
Colour, 130-5
changes, 264-5
waste products, 365
Computer programs, 104, 107, 110, 123
Conalbumin, 303
Condensation, 114
Condiments, 339-41
Consumer sampling, 275-6
Consumer satisfaction, 2, 3
quality requirements, 2-10
Consumerism, 7-10
Consumption statistics, 65
Contamination
control, 183-220
action required when limit values, 247-9
microbial, 57
mechanisms, 192-6
problems, 89
bleeding, 197-200
chilling, 203-7, 231-2
defeathering, 200-1
disinfection, 208, 232
evisceration, 201-3
factors affecting, 231-2
freezing, 207
plant cleaning, 208, 232
portioning, 232
post-chilling handling, 207
preslaughter handling, 196
scalding, 197-200

- Contamination—*contd.*
problems—*contd.*
spray-washing, 201-3
transportation, 196, 231
Convenience properties, 4
Convulsions, 42, 58
Cooling requirements, 16
COSTHERM computer program, 104
Coxiella burnetii, 342
Critical control points, 19-22
Cropping machine, 88
Cytophaga, 191
- Deboning, 94-5
hand, 260, 294-6, 308-9
influence on tenderness, 141-3
mechanical, 255, 257-60, 294-6, 298, 300-1, 305-9
see also Mechanically deboned meat
Debraining, 37
Decapitation, 48
Defeathering, 83-5
contamination problems, 200-1
waste products, 368-9
see also Feathers; Plucking
Defects, 5-7, 11
Desi-birds, 3
Direct epifluorescence filter technique (DEFT), 236
Disease agents, 184-91, 230
Disease incidence, 229
Disinfection, contamination problems, 208, 232
Dissolved air flotation, 386-8, 404
chemical flocculation, with, 388-91
Dry, firm, dark (DFD) meat, 130
Dry matter (DM), 363
Ducks, 48, 84, 136, 145, 151
- Edwardsiella*, 240
EEC, 13, 65, 85, 224
Directives, 68, 110, 168
Regulations, 158-65
- EEC—*contd.*
Working Party on Standardisation
of Perishable Produce 1986, 91-3
EEG waveform, 39-41
Effluents. See Processing effluents;
Waste products
Eggs, microbiology of, 343
Electrical stimulation, 165-8, 304-5
Electroconvulsive shock treatment, 41
Emulsification capacity (EC), 289-90, 296
Endproduct specifications, 16
Energy conservation, 98-9
Enrobed products, 325-59
characteristics of, 327-32
control of product composition and quality, 345-6
cooking media, 335-6
cooking methods, 336
established guidelines and standards, 346
examples of, 325-6
glossary of terms, 350-9
in frozen form, 326
ingredients, 329-31
microbiological aspects, 338-45
types of, 326-7
US Government Regulations, 345-6
Enrobing materials, 312, 331-2
Enrobing systems, 332-5
Enterobacter, 342
Enterobacteriaceae, 183, 195, 240
Environmental pollution. See Pollution
Environmental Protection Agency, 376
Epidemiological aspects, 229
Erwinia, 338
Escherichia coli, 184, 191-4, 196, 200, 203, 240, 313, 341
Evaporation, 113
Evaporative air-chilling, 114
Evisceration, 85-9

- Evisceration—*contd.*
 contamination problems, 201–3
 effect of holding time and temperature on yield as proportion of post-hold weight, 146
 product yield, 152–4
 waste products, 369–70
- Fat, 363–4
 Fat deposition, 144–7
 Fat-free dry matter (FFDM), 164
 Fat traps, 386
 Feathers, 368–9
 see also Defeathering; Plucking
 Filoplumes, 369
 Filters, high-rate, 404
 Fitness for use or purpose, 2
 Fixed crates, 69, 76
Flavobacterium, 183, 191, 338, 342, 343
 Flavour, influence of processing, 135–8
 Flocculation, 388–91, 404
 Food and Agriculture Organisation, 221, 223
 Food and Drug Administration, 14, 17, 266
 Food Hygiene Code of Practice, 224
 Food-cutter, 84
 Freezer-burn, 92
 Freezing, 92
 contamination problems, 207
 future developments, 122–3
 heat transfer, 107–10
 industrial practice, 118–20
 influence on colour and appearance, 132
 mass transfer, 111–12
 physical processes involved in, 103
 Freezing time, 105–6, 108–10
 Frozen food, enrobed products, 326
 Functional properties, 5
 Further processing, 251–82
 concept of, 251
 definition, 251
 economic value, 252–3
- Further processing—*contd.*
 formulations, 267
 government regulations, 266–7
 growth of, 252
 handling requirements, 269
 historical background, 251–2
 legal constraints, 266–7
 poultry meat, 255
 problems encountered, 263–5
 products suitable for, 261–2
 religious constraints, 266–7
 storage requirements, 261, 269
 techniques, 265
 turkey, 255, 283–324
 use of term, 283
 waste products, 371
Fusarium, 338
- Gas packaging, 311
Geotrichum, 342
 Giblets, 85, 86
 cooling, 16
 Gizzard harvester, 85
 Glazing, 113
 Good manufacturing practice (GMP), 14, 16, 223
 Government regulations, 266–7
 Grading, 89–91, 91–2
 Gram-negative bacteria, 340
 Gram-negative flora, 183
 Gram-positive bacteria, 340, 342
 Gram-positive rods, 183
 Grease, 363–4
- Handling requirements, further processing, 269
 Hanging-on procedure, 31
 Harvesting procedures, 68–75
 Hazard analysis and critical control points (HACCP), 12, 15, 19–22, 248
 Head pulling, 84
 Heat transfer, 103–10
 actual rate of, 105–6
 chilling, 106–7

- Heat transfer—*contd.*
 freezing, 107–10
 thawing, 107–10
 Herding systems, 72
 High-temperature short-time (HTST) extrusion cooking, 309
 Hot deboning, 304–5
 Hydraulic retention time, 399–400
 Hydrogen ion concentration. *See* pH value
 Hygiene control methods and problems, 183–220, 233–5
- ICMSF, 239, 241, 244–6
 Indicator organisms, 240–1
 Inedible offal, 369
 Inspection machine, 88
 Integrated quality control, 12, 19, 23–4
 International Commission on Microbiological Specifications for Foods, 222
 Irradiation, 312–13
 Irrigation, 378
- Killing line, 78–9, 81
 losses due to, 147–52
 Kjeldahl test, 364
Klebsiella, 193, 341
- Labelling, 5
Lactobacillus, 338, 341, 342
Lactobacillus brevis, 193
Lactobacillus plantarum, 340
 Least concentration end-point, 289
 Leg meat, 3, 130
 Legal constraints, 266–7
 Legislation, 12–14
 influence on process control, 168–71
 see also EEC
Leuconostoc, 341
- Listeria*, 313
Listeria monocytogenes, 185
 Loose crates, 68, 76
- M. gastrocnemius*, 293
M. pectoralis profundus, 155, 293
M. pectoralis superficialis, 155, 156
 Marketing
 commonly used classes in USA, 256
 factors influencing, 254
 microbiological criteria, 248–9
 Mass transfer, 103
 chilling, 110
 freezing, 111–112
 thawing, 113
 Mat harvesting systems, 74
 Mechanically deboned meat (MDM), 95–6, 257–60
 see also Deboning
Microbacterium, 341
 Microbiological control methods, 236–40
 accuracy, 237
 applicability, 238
 convenience and labour involved, 238
 cost, 237
 destructiveness, 237
 precision, 237
 purposes of, 236
 recovery of microorganisms, 238
 standardisation, 236–8
 Microbiological criteria, 221–50
 action required when limit values, 247–9
 definition of terms, 221–5
 elements in establishment and application, 227
 marketing, 248–9
 need for, 229–31
 points for and against, 225–9
 selection of, 233–47
 Microbiological guideline, 225
 Microbiological purchasing specification, 222

- Microbiological standard, 222
- Micrococcus*, 183, 338, 341-3
- Microorganisms, 184-92
 - enrobed foods, 338-45
 - milk, in, 341
 - pathogenic, 364-5
 - spices, in, 341
 - temperature effects, 400
- Milk and milk products,
 - microbiology, 341, 342
- Milk proteins, 303
- Mixture of sludge and organic matter (MLSS), 401
- Modular systems, 69-72
 - dump modules, 71-2, 77-8
 - metal drawers, 70, 77
 - multiple-floor, 69-70, 77
 - unrestrained plastic drawers, 70, 77
- Moraxella*, 183, 191
- Moulds, 338, 342, 343
- Mucor*, 338, 342, 343
- Muscle
 - post-mortem changes in, 128-30
 - product yield, 154
- Mycobacterium tuberculosis*, 342

- Neck cracker, 88
- Neck cutting, 36, 45, 54, 58, 81
- Neck dislocation, 36
- Neck-skin trimmer, 88
- Negative attributes, 5
- Nitrate, 364
- Nitrogen, 364
- Nitrogen spraying, 140
- Non-fat, dry milk (NFDM), 329
- Nuclear magnetic resonance (NMR), 289
- Nutrient balance, 399-400
- Nutrient content, 5, 10, 258-9, 270

- Odour assessment, 137-8
- Ohm's Law, 37, 38
- Oil, 363-4
- Ostrich, 37
- Over-wrapping, 311

- Packing and packaging, 92-3, 277, 310-12
- Pale, soft, exudative (PSE), 130
- Pediococcus cerevisiae*, 340
- Penicillium*, 338, 342, 343
- pH values, 130, 131, 139, 188, 196, 200, 290-1, 304, 364, 390-1, 400
- Plant cleaning, contamination problems, 208, 232
- Plucking, 57-8, 150, 368-9
 - losses due to, 147
 - machines, 83
 - see also Defeathering; Feathers
- Pollution, 361
 - air, 366
 - characteristics of, 373
 - controls, 362
 - parameters, 362-6
 - processing, 366-73
 - soil, 366
 - water, 362-5, 368
- Polysaccharide-containing ingredients, 329
- Portioning, 93-4
 - contamination problems, 232
 - influence on tenderness, 141-3
 - machine, 94
 - product yield, 154
- Positive attributes, 5
- Post-chilling handling, contamination problems, 207
- Post-mortem changes in muscles, 128-30
- Poultry
 - market, evolution of (1950s to 1980s), 254
 - meat
 - further processing. See Further processing
 - quality aspects. See Quality
 - unique characteristics of, 257
 - Meat (Hygiene) (Amendment) Regulations 1979, 89, 158
 - products
 - convenient-to-use, 253
 - development of, 253-4

- Poultry—*contd.*
 - products—*contd.*
 - nutritive content, 258-9, 270
- Preservation processes
 - influence on colour and appearance, 133-5
 - influence on flavour, 136-8
- Preslaughter handling, contamination problems, 196
- Preslaughter treatment, 49-51
- Process
 - control
 - impact of legislation, 168-71
 - influence on colour and appearance, 133
 - yield, 96-8
 - influence of mass transfer, 104
 - standards, 97-8
- Processing
 - factors affecting product yield, 143-54
 - influence of electrical stimulation, 165
 - influence of extraneous water, 155-65
 - influence on sensory quality, 130-43
 - losses, 371
 - pollution, 366-73
 - primary, 127
 - stages involved in, 65
 - see also Further processing
- Processing effluents
 - fine solids, fats and grease, 385-91
 - land spreading, 377-82
 - climate role, 381-2
 - high-rate percolation, 379
 - irrigation, 378
 - overland flow, 378
 - site-specific factors, 379-80
 - soil properties, 380-1
 - waste-specific factors, 382
- preliminary treatment, 382-5
 - choice of method, 391-2
- secondary treatment, 392-401
- sewer disposal, 376-7
- treatment of, 374-92

Processing effluents—*contd.*
 see also Waste products; Waste water

Processors

- quality aspects, 10-12
- responsibility of, 12-13

Product

- bind, 290-2
- development, 253-4, 270-80
- commercialisation stage, 279-80
- consumer sampling, 275-6
- formulating the product, 273-5
- future trends, 280
- gathering ideas for new products, 271
- packaging, 277
- production stage, 277-8
- shelf-life studies, 276
- taste panelling, 275
- test marketing, 278-9
- information, 5, 10
- presentation, 309-13
- preservation, 309-13
- shelf-life, 103, 134, 136-7
- yield
 - influence of catching and transportation, 145-7
 - muscle, 154
 - portions, 154
 - processing factors affecting, 143-54

- Production statistics, 65
- Protein extractability, 290-2
- Protein gelation, 292-3
- Proteus*, 341-343
- Pseudomonads, 183
- Pseudomonas*, 183, 191, 198, 338, 341-3
- Pseudomonas aeruginosa*, 195
- Pseudomonas fluorescens*, 191
- Pseudomonas fragi*, 191
- Pseudomonas putida*, 191
- Psychrobacter immobilis*, 191
- Psychrotrophs, 342
- Public health concerns, 241-7
- Pure Food and Drug Act 1906, 14

Quality

- assurance, 12, 19, 22-3
- attributes, 3, 5-7
- control, 10, 11, 17-25
 - concept of, 1-2
 - historical concept, 17-19
 - modern concept, 23
 - see also Integrated quality control; Total quality control
- criteria, 9
- definitions, 1-2, 127
- products, 1
- requirements, 1-30
 - consumer satisfaction, 2-7, 7-10
 - processor needs, 10-12
 - regulatory authorities, 12-17

Radiation odour, 313

Radicidation, 312

Radurisation, 312

Rancidity, 302-3

control methods, 264

Rapid screening methods, 235-6

Reception, waste products, 366-7

Reception area, 75

Recommended International Code of Hygienic Practice for Poultry Processing, 15, 224

Reforming technology, 296-8

Regulatory authorities

quality requirements, 12-17

responsibility of, 12-13

Relative humidity, 75, 114

Religious constraints, 266-7

Rhizopus, 338, 342

Rhodotorula, 342

Rigor mortis, 128, 139, 140, 165, 261, 265

Rotary cylindrical screens, 384

Royal Commission on Sewage Disposal, 363

Saccharomyces, 342

Salmonella, 89, 184-7, 194, 198, 202, 207, 228, 230, 233, 238, 240-5, 247, 309, 313, 343, 390

Salmonella cerro, 186

Salmonella newport, 200

Salmonella typhimurium, 186, 194, 197, 200, 246

Sarcina, 338

Scalding, 55-8, 81-3

contamination problems, 197-200

influence on colour and appearance, 131-2

losses due to, 147

waste products, 368-9

Scooping systems, 74

Sensory quality, 4

influence of processing, 130-43

Serratia, 338, 343

Serratia liquefaciens, 191

Sewer disposal, processing effluents, 376-7

Shelf-life studies, 267

Shewanella, 191

Shigella, 240

Shigella sonnei, 230

Sinew-puller, 84

Single-cell protein, 329

Slaughter, 45-9

cutter adjustments, 46

efficiency testing, 42

influence on colour and appearance, 131

losses due to, 149

physical reactions to, 41-4

technological aspects, 81

waste products, 367-8

Slaughter of Poultry Act 1967, 80

Slaughter of Poultry (Humane Conditions) Regulations 1984, 75, 80, 81, 169

Sludge disposal from treatment plants, 406-7

Sludge stabilisation, 406

Soils

physico-chemical properties, 380-1

Soils—*contd.*

pollution, 366

Spices, 339-41

Spinal cord severance, 57-8

Spoilage microorganisms, 191-2

Sporotrichum, 343

Spray-washing

contamination problems, 201-3

waste products, 369-70

Stability properties, 4

Staphylococcus, 343

Staphylococcus aureus, 184, 188-90, 193, 195, 197, 201, 230, 231, 233, 241, 242

Stationary screens, 383-4

Stein XL Breeding Machine, 332

Storage requirements, further processing, 261, 269

Streptococcus, 338, 341-3

Stunning, 31-45

current frequency effects, 57

effect on EEG, 39-41

effect on meat quality, 51-2

efficiency testing, 42

electrical, 34, 367

electrically charged water bath, 80

failure factors, 37-9

high current, 58

high-frequency, 44

influence on colour and appearance, 131

losses due to, 149

low-voltage, 43, 57

methods, 80

muscle reaction to, 52-3

physical reactions to, 41-4

reasons for, 31

recommendations and

requirements, 32

sources of impedance, 37

technological aspects, 80-1

waveform and frequency effects, 44-5

Suspended solids (SS), 365

Sweeping systems, 72-3

Taste panelling, 275

Technological characteristics, 5, 7, 8

Temperature effects, waste disposal, 365

Tenderising methods, 141

electrical stimulation, 165

Tenderness

assessment, 138

influence of portioning and

deboning, 141-3

influence of processing, 138-43

instrumental measurements, 139

Test-marketing, 278-9

Texture measurement, 168

Texture variation, 140

Thaw test, 161-2

Thawing

air, 120

electrical, 121

electromagnetic spectrum, 122

future developments, 122-3

heat transfer, 107-10

industrial practice, 120-2

mass transfer, 113

physical processes involved in, 103

vacuum-steam, 121

water immersion, 121

Thiobarbituric acid (TBA), 303, 307

Torula, 338

Torulopsis, 342

Total aerobic count, 233-40

Total quality control, 24

Total solids (TS), 363

Toxic substances, 400-1

Transport crates, 50-1

Transportation

bird-stress and downgrading in, 65-8

contamination problems, 196, 231

critical aspects of, 75

influence on product yield, 145-7

open-sided vehicles, 75

Trickling filters, low-rate, 398-9

Turbidity, waste products, 365

Turkey

grillsteak, 300

ham, 300

- Turkey—*contd.*
 meat
 action of salt and polyphosphate, 294
 bind, 303–4
 colour problems, 302
 functional properties of, 286–96
 functionality assessment, 288–90
 further processing, 283–324
 hand deboned, 294, 296, 308–9
 mechanically deboned, 294, 296, 298, 300–1, 305–9
 oxidative rancidity, 302–3
 product
 formulation, 298–301
 manufacture, 296–305
 presentation, 309–13
 preservation, 309–13
 problems, 302–3
 structure of, 286–7
 warmed-over flavour, 302–3
 nuggets, 301
 roast, reformed, 299
 roll, pre-cooked, 299–300
 sausage, 301
 Turkeys, 48, 52, 57, 80, 81, 84, 85, 86, 93, 130, 133, 136, 139, 141, 143, 145, 148–50, 153, 154, 229
 consumption statistics, 283
 electrical stimulation (ES), 304–5
 further processing, 255
 hot deboning, 304–5
 production statistics, 283
- Unloading methods, 76–8
- Vacuum harvesting systems, 73–5
 Vacuum packaging, 311
 Vent cutters, 87
 Ventilation, 75
- Vibrating screens, 384–5
 Volatile fatty acids (VFA), 393
 Volatile solids, 365
- Washing, 89
 waste products, 371–2
 water usage requirements, 158
- Waste
 disposal, 361
 temperature effects, 365
 processing, 361
 products
 chilling, 370
 cleaning, 371–2
 colour, 365
 defeathering, 368–9
 evisceration, 369–70
 further processing, 371
 reception, 366–7
 scalding, 368–9
 slaughtering, 367–8
 spray-washing, 369–70
 treatment on-site, 377
 turbidity, 365
 washing, 371–2
 see also Processing effluents;
 water
 characteristics, 373
 see also Processing effluents
- Waste-water load, 372
- Water
 absorption, 155
 accumulation, 155–65
 bacteriological examination, 344
 binding capacity (WBC), 294
 holding, 263–4, 293–5
 microbes in, 343
 pollution, 362–368
 retention, 155–65
 EEC Regulations, 160
 uptake, 111–13, 155–65
 EEC Regulations, 160
 usage, chilling, 170
 waste, *See* Waste water
- Wax stripping, 84
 Weighing, 89–91

- Wholesomeness, 3, 5, 10
 Wing-flapping, 50, 56
 Working Group on Microbiological
 Criteria for Foods 1979, 223
 World Health Organisation, 223
- Yeasts, 338, 342, 343
Yersinia, 240
Yersinia enterocolitica, 185, 241
 Yield. *See* Process yield; Product
 yield