Index

Acid caseins, 37, 234	Alkaline cleaning cycle, membrane	Carbon monoxide detectors, 361
conventional treatment,	filtration, 119-121	Casein and related products, 4, 29,
239-241	Analyses of milk powder, 215-230	36–39, 233–249, <i>See</i>
supercritical fluid processing,	bulk density, 217	also Phosphocasein;
242–243	case in number, 217	Rennet casein
Acid cleaning cycle, 122	coffee test, 230	acid casein, 234, 239-241
Acid whey, 253	dispersibility, 229	casein number, 217
chemical composition, 254	flowability, 221	casein peptides, 238
1938 Act, 55	hot water test (HWT), 229-230	casein phosphopeptides, 237
Actuator technology, in evaporation	interstitial air, 219	caseinates, 234-235
and drying, 333	moisture, 215	casein-derived peptides,
Additives, EU legislation, 52	particle density/occluded air,	245-246
Adulteration of Food and Drugs	217	caseinomacropeptide, 237-238
	sludge, 229	$\alpha_{\rm vl}$ -caseins, 4
Act 1860, 54	solubility, 221	α_{r2} -caseins, 4
Age thickening, 19	surface free fat, 224	β-caseins, 4
Agglomeration, 130, 194–202	Antioxidants, 21	к-caseins, 4, 16
combination of methods, 197	Atomising devices, in spray drying,	CMP, 246
fines return systems, 197-198	127	co-precipitate, 236
forced primary agglomeration,	Australia legislation, 73-75	definitions, 234–138
194	Autoignition temperature, 352	fractionation of casein,
forced secondary	•	243-244
agglomeration, 195-196	Bacteria, in raw milk, 182-184	fragments, 237
in milk processing, 187	Bacterial enzymes, 6	functionality, 247–248
sources of fines, 198-199	Bio-fouling, 18	formation of
attrition, 198-199	Brazil, 'dulce de leche' production	protein-stabilised
classification, 199	in, 159	emulsions, 247–248
separation, 198	Bulk density, 217	heat and alcohol stability,
spontaneous primary	determination, 218	247
agglomeration, 194	Butter milk powder (BMP), 7	of peptides derived from
spontaneous secondary	Buttermilk, 36	casein, 248
agglomeration, 195-196	Butterinia, 50	solubility, 247
structure and powder	Calaires 5 0	viscosity, 247
properties, 199–202	Calcium, 5, 9 calcium phosphate, 4	Irish legislation, 61
compact grape structure,		isolated and enriched casein
201–202	free ionic calcium, 10	fractions, 236–237
grape structures, 200	heat stability and, 17 insoluble calcium, 9	manufacture methods,
loose grape structure, 201	· · · · · · · · · · · · · · · · · · ·	238–240
onion structured, 200–201	soluble or non-micellar	milk protein concentrate
raspberry structures, 200	calcium, 10	(MPC), 236
- ·	Carbohydrates, 8–9	milk protein isolate (MPI), 236
Air, 11–12	infant formulae, 307–308	phosphopeptides from β-casein,
occluded air, factors	lactose, 8	246
influencing, 11–12	specialised and novel powders,	proline-rich peptides, 246
Air-flow stability in spray dryers,	267	Rennet casein, 4
341	sucrose, 8–9	Remier Casem, 4

Casein and related products, 4, 29,	for concentrated milks, 84-86	Concentrated milk products, 1-12,
36–39, 233–249, <i>See</i>	for dairy-based products, 85	See also under
also Phosphocasein;	dairy products and analogues,	Legislation
Rennet casein	81	Codex Alimentarius for,
(continued)	dried whey and whey products,	84-86
sodium caseinate, 240	excluding whey cheeses,	mineral composition of, 10
stress-relieving peptide, 246	82	protein in, 2
structure, 234–138	for dried milks, 84–86	Concentrated whey products,
technical adjuvant permitted in,	follow-up formulae, 82	257-259
37	food additives and, 80-83	unit operations in, 257-259
acid caseins, 37	GATT agreements, 78	centrifugation, 258
caseinates, 37	infant formulae, 82	heat treatment, 258
rennet caseins, 37	liquid whey and whey products,	lactose crystallisation step,
total milk protein, 245	excluding whey cheeses,	258
United Kingdom legislation, 57	81	lactose pre-crystallisation
Caseinates, 6, 36–39, 234–235,	membership, 76	step, 259
241-242	milk and cream powder and	Condensed milk
composition, 235	powder analogues, 81	EU legislation on chemical
Irish legislation, 61	milk powder and cream powder	composition, 69–70
solubility, 235	(plain), 81	Irish legislation, 60
technical adjuvant permitted in,	standards, 76-78	United Kingdom legislation,
37	structure, 76–77	56–57
United Kingdom legislation, 57	TBT Agreements, 78	US legislation on chemical
Caseinomacropeptide (CMP), 235,	whey and whey products,	composition, 69–70
237–238, 246	excluding whey cheeses,	Constituents, milk, See also
Casson's and Herschel-Bulkley's	81	Carbohydrates; Fats;
model, 165	Coffee test, 230	Minerals; Proteins in
Cheese powder, 278	Coffee whitener powders, 268–271	evaporation and drying,
Chlorinated fluorocarbon	chemical composition,	1–22
compounds (CFCs), 363	268-269	Containment, 365
Cholesterol, 7	full-cream, 269	Control philosophies, in
Chymosin, 4	low-fat, 269	evaporation and drying,
CIP-able bag filters, 139–141	functional properties,	334
Circulation evaporation, 152–153	269–270	Control technology, in evaporation
Cleaning chemical reuse,	manufacturing process, 269	and drying, 331–332
122–123	recent developments, 270–271	Co-precipitation, 236, 242
Cleaning-in-place (CIP) capacity,	Cold gelling WPCs, 274–275	of whey protein with casein, 275–276
105	Colour additives, US legislation, 72	
Coating, in milk processing, 187	Combustion in drying, 349–351	Cream powders, 282–285
Code of Federal Regulations,	deflagrations, 350	dried cream powders, 282
United States	detonations, 351	physicochemical properties of, 284–285
legislation, 63–64	flaming combustion, 350	emulsion stability,
Codex Alimentarius/Codex	secondary explosions, 351	282–283
Alimentarius	smouldering combustion, 350	processing of, 283–284
Commission (CAC), 33, 75–86	Common Agricultural Policy (CAP), 29	reconstitution process, 285
	Communication technology	Critical control points (CCPs),
aims, 76 Annex I, 80	in evaporation and drying,	325
Appendix A, 80	333–334	Cyclones, 137–139
beverage whiteners, 81		Cyclones, 157 157
Codex Committee on Food	integration of digital control systems, 333	Daim, Braduas Ast 1024 50
	•	Dairy Produce Act 1924, 59
Additives (CCFA), 85 Codex hygiene codes of	Compact grape structured	Dairy-based products, Codex
7.6	agglomeration, 201–202	Alimentarius for, 85
practice, 79–80 condensed milk and analogues	Composition	Deflagrations, 350 Dehydrated milks, EU legislation,
	United Kingdom legislation on,	
(plain), 81	56–58, <i>See also under</i> United Kingdom	50 Detenations 351
content of, 78	Onited Kingdom	Detonations, 351

Direct heating methods	whole milk powder (WMP),	ultrafiltered 'dulce de leche',
dried milk products, 189–191	181	171
direct steam injection, 189	Dried whey, 253-264, See also	Dust characteristics, 351-354
milk concentrate spraying,	Concentrated whey	combustibility/explosibility,
189	products	351
Disc atomising dryers, 340-341	chemical composition, 255	maximum explosion pressure
Dispersibility, 229	foam formation, 261	and the rate of pressure
Dried infant formulae (powders),	unit operations, 257-259	rise, 353
311-319	Dry powder suppression, 362	minimum ignition energy,
dry mix process	Dryers, technology, 99-144	352-353
advantages, 311	roller drying, 100	minimum ignition temperature,
disadvantages, 311	spray drying, 99	352
drying parameters, 317-318	Drying, 330-347, See also under	moisture content, 354
finished powder conveying	Hazards in drying;	particle size, 354
system, 318	Process control	upper and lower explosible
high carbohydrate content,	constituents role in, 1–22	limits, 351–352
317–318	Ducts, 137–139	Dust explosion hazards, 360
high fat content, 317	'Dulce de Leche', production,	
high protein content, 317	158-177	Electrical sparks, 357
microbiological	in Brazil, 159	Electron spectroscopy for chemical
examination, 318–319	compositional quality, 167	analysis (ESCA), 284
drying, 312	consistency, sample, 168	Emulsion stability, 282–283
evaporation, 312	control 'dulce de leche', 171 enzymatic determination of	Enriched casein fractions, 236–237
hygiene and production time between CIP cleaning,	starch in, 165	Environmental contamination,
316	glucose in, 162	187–188
manufacture of, 311-319	gross composition, 155	Enzymatic cleaning cycle, in
preparation of the mix, 312	industrial manufacturing stages,	membrane filtration, 121–122
spray drying, 315–316	160	lipases, 121
structure of powder, 316–317	lactose crystals in, 170, 172	proteinaceous fouling, 121
wet mix processing line,	Maillard reaction, 161	Enzymes in milk, 5
312–314	manufacturing formulations,	bacterial enzymes, 6
Dried milk products, 1–12, 33,	167	lipases, 5–6
180–231, See also under	manufacturing stages, 163	proteases, 5-6
Legislation; Raw milk	in Mexico, 159	Ethylenediaminetetraacetic acid
classification, 182	microbiological enumeration,	(EDTA), in membrane
Codex Alimentarius for, 84-86	169–173	filtration, 120
environmental contamination,	microscopy, 169	European Food Safety Agency
187-188	milk protein function in, 162	(EFSA), 52
EU legislation on chemical	mineral content, 168	European Union (EU) legislation,
composition, 69-70	packaging of, 164	31-54
international definitions,	product properties, 164-165	access to, 31
180-182	rheological parameters,	amended Commission
Irish legislation, 60	165–166	Regulation (EEC) No.
key determining technology,	sandiness influencing, 176	2921/90, 39
182	stability of 'dulce de leche', 163	acid casein, 39
milk processing, 185–187	sucrose in, 162	caseinates, 40
mineral composition of, 10	technological problem during,	rennet casein, 39
process monitoring, 188	161	amended Council Directive
protein in, 2	lactose crystallisation, 161	83/417/EEC, 38
technical aspects consideration,	sandiness problem, 161	caseinates, 38
188–202, See also Heat	seeding, 161 transmission electron	edible acid caseins, 38
treatment United Kingdom legislation,	microscopy, 173–174	rennet caseins, 38 buttermilk, 36
56–57	types of, 150	casein, 31
US legislation on chemical	UF process for studying,	Council Directive
composition, 69–70	166–177	2001/114/EC, 34
r,		

European Union (EU) legislation,	falling film evaporation,	Finished powder conveying system,
(continued)	153	dried infant formulae,
Council Directive 89/107/EEC	manufacturing stages, 157	318
(EU, 1989a), 47	mechanical vapour	Fire detection, 360–362
Council Directive 92/46/EEC	compression, 154	carbon monoxide detectors,
(EU), 42	multiple-effect	361
Council Directive 94/36/EEC	evaporation, 152	fast-acting temperature sensors,
(EU, 1994b), 48	product properties,	360
Directive 2000/13/EC, 35	154-156	infra-red optical detectors, 360
European Parliament and	thermal vapour	operator observation, 362
Council Directive	recompression,	pressure sensors, 361
95/2/EEC (EU, 1995c),	153-154	Fire fighting, 365–366
49-50	vacuum evaporation, 151	Flaming combustion, 350
flavourings, 51	US legislation on chemical	Flavourings, EU legislation, 51
follow-on formulae, 39-41	composition, 69–70	Flowability, 221
forthcoming changes as regards	Evaporation technique, 100-108,	Fluid-bed dryers, 130–131,
to additives, 52	See also under Process	137–138
horizontal food additives	control	Follow-on formula, 295
legislation, 45-52	cleaning of, 105-106	Codex Alimentarius, 82
horizontal hygiene and food	configuration, plant design of,	EU legislation, 39-41
safety requirements,	104	Irish legislation, 61
41-45	constituents role in, 1-22	United Kingdom legislation, 57
infant formulae, 39-41	falling film evaporators, 101	Food additives
labelling requirements for	installation, heat economy in,	Codex Alimentarius, 80-83
foods, 52-53	104–105	EU legislation, 45-52
labelling requirements, 37	mechanical vapour	US legislation, 72–73
packaging legislation, 53-54	compression (MVR)	colour additives, 72
preserved milks, 32-36	heating system of, 102	GRAS, 72
raw milk supply criteria, 46	principles, 100–101	new food additives, 72
antibiotic residues, 46	thermal vapour recompression	prior sanction, 72
plate count, 46	(TVR), 102	Food and Drugs Act 1875, 59
temperature during storage	versus membrane filtration,	Food and Drugs Act 1906, 62
on farm, 46	106–108	Food Safety Objectives (FSOs), 43
temperature during storage	Explosion suppression, 362–363	Food safety, infant formulae,
prior to processing, 46	chlorinated fluorocarbon	309-310
temperature during	compounds (CFCs), 363	Food Standards Australia New
transport, 46	dry powder suppression, 362	Zealand (FSANZ),
Regulation (EC) No. 852/2004	explosion venting, 363–365	73-74
(EU, 2004d), 44	venting principles, 363	Forced primary agglomeration,
Regulation (EC) No. 853/2004	Explosion venting, 363–365	194
(EU, 2004e), 44–45	Explosion venting, 505 505	Forced secondary agglomeration,
skimmed milk powder, 36	Ealling film assessmention 101 152	195
vertical legislation	Falling film evaporation, 101, 153	Fouling, 18
on concentrated and dried	Fast-acting temperature sensors,	denaturation of β-lactoglobulin
milk products, 31–41	360	affecting, 18
on dried milk products,	Fat contents, standardisation in	factors influencing, 18
31–41	milk processing, 186	in membrane filtration, 116
Evaporated milks, 32	Fats, 6–8	minimisation/control,
EU legislation on chemical	globules, 7	116-118
composition, 69–70	lecithin, 7	microbial fouling, 18
gross composition, 155	phospholipids, 7	temperature and, 18
production, 149-177	triglycerides, 7	Fractionation of casein, 243–244
circulation evaporation,	Federal Food, Drug, and Cosmetic	Free fat in WMP, 225
152–153	Act (FFDCA), 62	Free fat, 7
evaporated milk	Filtermat dryer, 131	Free fatty acids (FFAs), 6
production, 154	Fines return systems,	Full-cream coffee whitener
evaporation, 151	197-198	powders, 269

Functionality, casein and related	pre-heat treatment affecting,	hot surfaces, 355-356
products, 247-248	1617	hot work, 357
formation of protein-stabilised	recombined evaporated milk	impact sparks, 356
emulsions, 247-248	(REM), 15	mechanical friction, 356
heat and alcohol stability, 247	Heat treatment	self-ignition, 358–359
solubility, 247	bacteriological requirements in	Impact sparks, 356
viscosity, 247	dried milk products,	Incubation, 324
Furosine, 20	191–194	Indirect heating systems, dried milk
	heat classification of SMP	products, 188-189
German Infant Nutritional	by casein number (CN),	Inerting, 365
Intervention (GINI)	191	Infant cereals, 295
study, 280	high-heat heat-stable milk	Infant formulae powders and
Globules, 7	powder, 193	liquids, 292-326, <i>See</i>
Glucose, in 'Dulce de Leche'	instant quality of WMP,	also Dried infant
production, 162–164	194	formulae; Liquid infant
Godbert-Greenwald furnace, 352	keeping the quality of	formulae
Good hygiene practices (GHP), 324	WMP, 193	carbohydrates, 307-308
Good manufacturing practices	dried milk products, 188–194	classification, 294-295
(GMP), 324	direct heating methods, 189-191	Codex Alimentarius, 82
Grape structured agglomeration,		definition, 294-295
200	indirect heating systems, 188–190	essential composition, 303-309
GRAS, US legislation, 72		EU legislation, 39-41
Growing-up formula, 295	in milk processing, 186–187 Heat-denatured whey protein,	food safety, 309-310
Gunpowder, 358	272 – 274	food additives, 309
Gunpowder, 338	High-fat content, specialised and	hygiene and
T. D	novel powders, 267	microbiological
Hagen-Poiseuille equation, 332	High-temperature short time	standards, 309-310
Hazard appraisal (analysis) critical	(HTST) pasteurisation,	historical background, 292-294
control points	5, 44	Irish legislation, 61
(HACCP), 43	dairy UK Code of practice for,	lipids, 307
Hazards in drying, 349-366, See	58-59	minerals, 308-309
also Combustion; Dust	Homogenisation, 16–17	calcium, 308
characteristics; Dust	Hot water test (HWT), 229–230	iron, 308
explosion hazards;	Hot work, 357	magnesium, 308
Explosion suppression;	Hydrolysates, 278–281	nutrient composition, 304
Ignition sources	manufacture of, 279	protein-nitrogen conversion,
containment, 365	UF/nanofiltration (NF) step,	305
fire detection, 360-362	280	proteins, 303-307
fire fighting, 365–366	Hydroperoxides, 21	raw materials/ingredients,
inerting, 365	Hygiene	310-311
isolation, 365	Codex hygiene codes of	general aspects, 310
Heat and alcohol stability, casein	practice, 79–80	milk, 310
and related products,	and food safety requirements,	oils, 311
247	EU legislation on,	syrups, 311
Heat classified SMP, 191	41–45	regulations governing,
Heat economy of spray drying,	Irish legislation, 60	299-303
132-133	requirements, 64-66	Australia, 301
Heat sensitivity of whey protein,	United Kingdom legislation, 58	Codex Alimentarius
259-260	United States legislation,	Commission, 301
Heat stability, 14-17	64-66	country wise nutrition
calcium contents and, 17	Hygroscopicity, of lactose, 260	regulations, 300
HCT test, 14-15		cultural and religious
homogenisation, 16-17	Identity, US standards of, 66-71	aspects, 299
lecithin incorporation and, 17	Ignition sources, 354–359	European Union, 301
minerals role in, 17	electrical sparks, 357	labelling, 299-300, 302
pH and, 15–16	flames, 354–355	New Zealand, 301

Infant formulae powders and	Lactose and lactose derivative	microbiological
liquids, 292–326, <i>See</i>	products, 8, 181,	examination, 324-325
also Dried infant	255-257	oils and fat addition,
formulae; Liquid infant	crystallisation, during 'Dulce de	319-320
formulae (continued)	Leche', production, 161,	retort sterilisation,
procedures for placing	170, 172–173	321-322
infant food product on	free moisture in, 261-262	second stage of
market, 300-302	hygroscopicity, 260	standardisation, 321
United States, 301	pharmaceutical lactose	UHT sterilisation and
soya protein, 306	products, 256	aseptic processing, 322
United Kingdom legislation, 57	solubility, 260	Liquid milk products, 1-12
vitamins, 309	temperature effect on, 260	protein in, 2
world market of, 295-299	types, 256	mineral composition of, 10
annual production figures,	Lactosylation, 20-21	Loose grape structured
295-297	Lecithin, 7	agglomeration, 201
based on the origin of	heat stability and, 17	Low-fat coffee whitener powders,
ingredients used, 296	lecithin-dosing equipment, 206,	269
based on the age of its	209	Low-heat SMP for cheese
consumers, 296	two-stage lecithination of	production, 209-210
worldwide manufacturers of,	WMP, 208	
297-299	Legislation on concentrated and	Macropeptides, 279
Infra-red optical detectors, 360	dried milk products,	Maillard reactions, 8, 19–20, 156,
Insolubility index, 222	28-88, See also Codex	261
Insoluble calcium, 9	Alimentarius; European	furosine measurement, 20
Instant milk powders, 203-208	Union (EU) legislation;	Lysine affected by, 20
Instant SMP, 204-208	Irish legislation; United	quality deterioration by, 20
processing stages for, 205	Kingdom legislation;	sulphur-containing amino acids
lecithin-dosing equipment,	United States (US)	affected by, 20
206	legislation	Manufacture of milk powders
Instantisation, 194-202	Australia, 73	instant milk powders, 203–208
International definitions, dried milk	during Middle Ages, 30	instant SMP, 204
products, 180-182	Food Standards Australia New	instant WMP, 205–208
Interstitial air, 219	Zealand (FSANZ),	ordinary milk powders, 202-203
Iodoacetamide, 16	73-74	parameters, 202–210
Irish legislation, 59-61	'Joint Food Standards Code',	typical processes, 202–210
caseinates, 61	73–74	Mechanical vapour compression
condensed milk, 60	New Zealand, 73-75	(MVR) heating system,
Dairy Produce Act 1924, 59	private standards and	102–103, 154
dried milk, 60	specifications, 87	Membrane filtration, 108–123
follow-on formula, 61	Linoleic acid, 307	cleaning in, 116–123
Food and Drugs Act 1875, 59	Lipases, 5-6	acid cleaning cycle, 122
on hygiene, 60	Lipids, infant formulae, 307	alkaline cleaning cycle,
infant formula, 61	Liquid infant formulae	119-121
Sale of Food and Drugs (Milk)	manufacture, 319-325	chelating agents in, 120
Act 1935, 59	aseptic filling machines and	cleaning chemical reuse,
Isolated casein fractions, 236–237	packaging materials,	122-123
Isolation, 365	323-324	enzymatic cleaning cycle,
	dissolving of ingredients,	121-122
Labeling	319	fouling minimisation/
requirements for foods, EU	final conditioning, 321	control, 116
legislation, 52–53	first heat treatment and fat	polysulfone ultrafiltration
US standards of, 66–71	emulsification, 321	membrane, 120
Lactalbumin manufacture,	first stage of	Sodium hypochlorite
272–273	standardisation, 319	(NaOCl), 121
Lactic acid, content of, 260–261	intermediate aseptic	configurations, 114–115
β-Lactoglobulin, 5, 16, 21	storage, 323	in dairy industry, 115–116

evaporation versus, 106-108	Minerals, 9-10, 276 278	Oxidation, 20–22
first generation (cellulose	calcium, 9, 277	hydroperoxides, 21
acetate), 112	compositional data, 277	packaging techniques
heat economy in, 115	concentrated milk products, 10	influencing, 21
hollow fibre module, 113	dried milk products, 10	specialised and novel powders,
permeability (P), 111	heat stability and, 17	267-268
plate-and-frame membrane	lactocalcium, 277	temperature and, 21
system, 113	liquid milk products, 10	••••••••••••••••••••••••••••••••••••••
plate-and-frame modules, 113		Declaring logislation EU 52 54
	micellar calcium phosphate,	Packaging legislation, EU, 53-54
principles, 108–112	277	Partially dehydrated milk, EU
rejection or retention (R), 111	phosphorus, 9	legislation, 50
second generation (synthetic	whole cow's milk, 9	Particle density/occluded air, 217
polymers), 112	Moisture, in lactose powders,	Particle solubility, specialised and
spiral wound module, 113	261-262	novel powders, 268
and systems, 112-113	Moisture analyses of milk powder,	Particular Nutritional Uses
third generation (mineral in	215	(PARNUTS), 39
type), 112	Most probable number (MPN)	Partly dehydrated products, 32
vibration membrane system,	method, 169	EU Council Directive
113	Multiple-effect evaporation, 152	2001/114/EC, 34
Mexico, 'dulce de leche'	Multi-Stage Dryer (MSD), 132	Pasteurised Milk Ordinance
production in, 159		(PMO), United States
Micelles in milk, 4-5	N-ethyl maleimide, 16	legislation, 65-66
Microbial fouling, 18	New food additives, US legislation,	Peptides, casein, 238
Microbiological enumeration	72	PH measurement, 211
dried infant formulae, 318-319	New Zealand legislation, 73-75	Phosphocasein, 234, 235
'Dulce de Leche' production,	Animal Products Act 1999, 75	Phospholipids, 7
169-173		Phosphopeptides from β-casein,
liquid infant formulae,	Fair Trading Act 1986, 75	246
324-325	Food Act 1981, 74	Phosphopeptides, casein, 237
Microfiltration (MF), 185–186	Food Hygiene Regulations	Phosphorus, 9
Microparticulated whey protein	1974, 75	Plasmin, 5
(MWP), 273–274	Food Safety Regulations 2002,	Powders, 3, 12–14, 212, See also
Microscopy, 'Dulce de Leche'	74	Analyses of milk
production, 169	Weights and Measures	powder; Surface
Milk and Dairies (Consolidation)	Regulations 1999, 75	composition
Act 1915, 55	Novel whey products, 271–276,	chemical composition, 212
Milk and Dairies Amendment Act	See also Specialised	physical properties, 212
	powders	proximate composition, 3
1922, 56	cold gelling WPCs, 274-275	Pre-heat treatment affecting heat
Milk fat globule membrane, 7	heat-denatured whey protein,	stability, 16
Milk processing, 185–187	272-274	
agglomeration, 187	lactalbumin manufacture,	Preserved milks, EU legislation on, 32–36
bactofugation, 185–186	272-273	
clarification, 185–186	microparticulated whey protein	Pressure sensors, 361
coating, 187	(MWP), 273–274	Prior sanction, US legislation, 72
concentration, 187	milk mineral, 276–278	Process control in evaporation and
fat contents standardisation,	whey protein in nutraceutical	drying, 330–347, See
186	applications, 271–272	also Spray dryer control
heat treatment, 186–187	Nozzle atomising dryers, 341	actuator technology, 333
homogenisation, 187	<u> </u>	communication technology,
microfiltration, 185-186	Nutraceutical applications, whey	333-334
protein contents	protein in, 271 - 272	control philosophies, 334
standardisation, 186		control technology, 331-332
spray drying, 187	Occluded air, 217	evaporator control, 335-339
Mineral content, 'Dulce de Leche',	factors influencing, 219-220	analytical model, 338
168	Onion structured agglomeration,	cleaning systems, 339
Mineral mixture powder,	200-201	condenser water flow rate,
composition, 257	Ordinary milk powders, 202-203	336

Process control in evaporation and	Quality control, 248-249	Self-ignition, 358-359
drying, 330-347, See	determination, 249	Skimmed Milk and Non-Milk Fat
also Spray dryer control	Quality issues, 14-22, See also	Regulations 1960, 57
(continued)	Heat stability	Skimmed milk powder (SMP), 4,
energy input, 335-336	'Quantum satis' principle, 50	33, 36, 266, See also
feed flow rate, 335		Instant SMP
level of total solids in the	Raspberry structured	low-heat SMP for cheese
concentrate, 336-337	agglomeration, 200	production, 209-210
linear regression model,	Raw materials/ingredients, infant	quality aspect, 211
338	formulae, 310–311	surface composition, 13
modelling approaches for,	Raw milk, 182–185	United Kingdom legislation,
338	initial bacterial load of, 182	57-58
modular neural network	microbiological quality of, 182	Skimmed Milk with Non-Milk Fat
model, 338	pathogens control in, 183	(Scotland) Regulations
pre-heat temperature, 335	psychrotrophic bacteria,	1960, 57
measurement technology, 332	184–185	Slowly dispersible particles (SDP),
process dynamics, 335	refrigeration temperature,	200
Process monitoring, dried milk	significance, 184	Sludge, 229
products, 188	Raw milk supply criteria, EU	Smouldering combustion, 350
Processing control, specialised and	legislation, 46	Sodium carbonate, 150
novel powders, 268	antibiotic residues, 46	Sodium caseinates, 6, 240
Programmable logic controllers		Sodium hydroxide, 6
(PLCs), 331	plate count, 46	Solubility, 221
· · · · · · · · · · · · · · · · · · ·	temperature during storage	casein and related products, 247
Proline-rich peptides, 246 Proportional-integral-derivative	on farm, 46	of lactose, 260
•	prior to processing, 46	quality aspect, 215
(PID) algorithms, 331	temperature during transport, 46	Soluble polymers, 255
Proteins 1 6 202 207 See also	Raw whey, 253–257	Somatic cell counts (SCC), 183
Proteins, 1–6, 303–307, See also	chemical composition, 254	Specialised powders, 266-286, See
Caseins; Infant	Recombined evaporated milk	also Coffee whitener
formulae; Whey proteins	(REM), 15	powders; Novel whey
concentrated milk products, 2	Regulations governing infant	products
dried milk products, 2	formulae, 299–303, See	carbohydrate content, 267
liquid milk products, 2	also under Infant	high-fat content, 267
sodium caseinate, 6	formulae	moisture content, 266-267
sodium hydroxide, 6	Rennet caseins, 4, 37, 235–236,	oxidation, 267-268
standardisation in milk	241	particle solubility, 268
processing, 186	Reverse osmosis (RO), 150	principles, 266-268
Protein-stabilised emulsions, casein	Rheological parameters, in 'Dulce	processing control, 268
and related products,	de Leche' production,	Spontaneous primary
247–248	165–166	agglomeration, 194
Proteolytic enzymes, 238	Ringer's solution, 169	Spontaneous secondary
Psychrotrophic bacteria, raw milk,	Roller drying, 29	agglomeration, 195
184–185		Spray Bed Dryer (SBD), 132
	Sale of Food and Drugs (Milk) Act	Spray dryer control, 339-346
Quality aspects, 211-230	1935, 59	air-flow stability in spray
analyses for milk, 211-213	Sale of Food and Drugs Act 1875,	dryers, 341
milk concentrate analyses,	54-55	chamber pressure, 342
214-215	Sale of Food and Drugs Act 1955,	concentrate flow rate
air content, 214-215	55	in disc atomising dryers,
scorched particles, 215, 224	Salt balance theory, 17	340-341
solubility, 215	Scorched particles, quality aspect,	in nozzle atomising dryers,
milk quality, 211	215, 224	341
pH measurement, 211	test for determining, 224	Dummy outlet temperature,
skimmed milk, 211	Scraped surface heat exchanger	344-345
titratable acidity, 211-213	(SSHE), 273	energy input, 340
whole milk 211	Secondary explosions 351	evaporative demand, 339

inlet air flow rate, 341	Surface free fat, 224	legislative basis, 54
inlet air temperature, 342	determination, 226	Milk and Dairies
moisture control, 345	Sweet whey, 253	(Consolidation) Act
outlet temperature	Sweetened condensed milk, 28-29,	1915, 55
in dryers without static	32	Milk and Dairies Amendment
fluid beds, 342-343	EU legislation on chemical	Act 1922, 56
in spray dryers with	composition, 69–70	Sale of Food and Drugs Acts
integrated fluid beds,	gross composition, 158	1875, 54–55
343	manufacturing stages, 157	Sale of Food and Drugs Act
powder moisture content, 340	production, 156–158	1955, 55
protein content of powder,	stages, 156–158	United States (US) legislation,
influence of, 345–346	.	61–73
Spray drying technology, 29, 99,	US legislation on chemical	Code of Federal Regulations,
123–142, 258, 315–316	composition, 69–70	63–64
advantages, 129		concentrated products, 67
•	Temperature and fouling, 18	additive functional classes
atomising devices, 127	Temperature and oxidation, 21	permitted in, 68
centrifugal, 127–128	Thermal vapour recompression	<u>-</u>
nozzle atomisation, 127	(TVR) evaporators,	dried products, 67 additive functional classes
pressure (nozzle)	102-103, 153-154, 336	
atomisers, 127	Titratable acidity, quality aspect,	permitted in, 68
CIP-able bag filters, 139–141	211-213	FDA
cleaning of dryers, 133	Total fat content in WMP, 224	evolution and development
cyclone separation, 129	Total milk protein, 245	63
cyclones, 137–139	Totally dehydrated milk, 32	food additives in, 72–73
disadvantages, 130	Council Directive	hygiene requirements, 64–66
drying chamber, 128, 134-137	2001/114/EC, 34	identity, 66–71
ducts, 137-139	Traditional lactalbumin, 255	labeling, 66–71
expenses, 133	Transmission electron microscopy,	Pasteurised Milk Ordinance,
fluid-bed drying, 130-131	in 'Dulce de Leche'	65-66
heat economy of, 132-133	study, 173–174	standards for grade 'A' milk
instantisation methods, 130	Triglycerides, 7	products, 66
in milk processing, 187		USDA specifications and
plant design of, 130	Tubular heat exchanger (THE), 127	grading schemes, 71–72
principles, 123-127		United States Department of
Sanicip bag filter, 135	Ultra high temperature (UHT)	Agriculture (USDA), 29
techniques and systems,	treatments, $5-6$, 104 ,	United States Public Health Service
127-130	150	(USPHS), 64
three-stage spray drying	Ultrafiltration (UF), 150	Unsweetened condensed milk,
chamber, 131	United Kingdom legislation, 52-59	28-29, 32, 156
vapour proof dampers/butterfly,	1938 Act, 55	USDA Bureau of Chemistry
140-142	Adulteration of Food and Drugs	(USDABOC), 62
Vibro-Fluidizer, 135, 138	Act 1860, 54	
Streptococcus brevis, 186	on composition, 56-58	Vacuum evaporation, 151
Streptococcus faecalis, 186	caseinates, 57	Van't Hoff equation, 109
Streptococcus thermophilus, 186	caseins, 57	Vent doors and panels, 364–365
Stress-relieving peptide, 246	condensed milk, 56-57	Vent ducts, 364
Sucrose, 8–9	dried milk, 56-57	Venting, explosion, 363–365
in 'Dulce de Leche' production,	follow-on formulae, 57	Vertical legislation
162, 164	infant formula, 57	on concentrated milk products,
Supercritical fluid processing,	skimmed milk with	31–41
242–243	non-milk fat and other	on dried milk products, 31–41
Surface composition of powders,	concentrated and dried	Vibratory shear-enhanced filtration
12–14	milk, 57–58	(VSEP), 118
flowability, 13	dairy UK Code of Practice for	Vibro-Fluidizer, 206–207
• /	HTST pasteurisation,	
industrial spray dried dairy	58–59	Viscosity, 19
powders, 13 skimmed milk powders, 13	on hygiene, 58	casein and related products, 247 Vitamins, infant formulae, 309
SKHIIIIIed MIIK DOWGERS, 13	on nygiene, 58	v itamins, infant formulae. 309

non-enzymatic Maillard
browning reaction, 261
production and storage,
technological
complexities in,
259-262
protein in, 2
standard and modified, 254
whey protein nitrogen index
(WPNI), 5
Whiteners, See Coffee whitener
powders
Whole milk powder (WMP), 6, 181
free fat in, 225
total fat content in, 224

two-stage lecithination of, 208

WMP with high free-fat content, 208–209

Whole milk, quality aspect, 211

World market of infant formulae, 295–299, See also under Infant formulae

Worldwide manufacturers of infant formulae, 297–299

Abbott nutrition, 298

Mead Johnson, 298

Nestlé SA, 297–298

Royal numico, 298

Wyeth nutrition, 298–299