

Index

#

- 1-octen-3-ol, 190
- 1-phenylethanol, 85
- 1-phenylpropane-1,3-diol, 84
- 2,2-isopropyl-N-2,3-tributylamide, 259
- 2,4-decadienal, 285, 287
- 2,5-dimethyl-3-hydroxy-3-furanone, 326, 329
- 2-acetyl pyrazine, 191
- 2-acetyl-thiazoline, 132
- 2-ethoxyphenol, 86–87
- 2-ethyl-thiazolidine, 131, 136
- 2-heptanone, 190
- 2-isobutyl-thiazolidine, 131, 135
- 2-isopropyl-N,2,3-trimethylbutanamide, 102
- 2-isopropyl-thiazolidine, 131
- 2-l-menthoxyethanol, 100
- 2-(1-methyl-propyl)-thiazolidine, 135–136
- 2-methoxy-4-propyl phenol, 287
- 2-methyl-3-furanthiol (MFT), 143–144, 151
- 2-pentyl-thiazolidine, 131, 136
- 2-phenylpropene, 88
- 2-propionyl-thiazoline, 132, 136
- 2-tert-butylcyclohexanol, 88–89
- 2-tert-butylcyclohexyl-acetate, 88–89
- 3-cyclohexylbutane-1-ol, 81–82
- 3-cyclohexylpropanate, 89–90
- 3-cyclohexylpropane-1-ol, 81–82
- 3-l-menthoxypropane-1,2-diol, 100, 104
- 3-mercapto-2-butanone, 327
- 3-phenylbutane-1-ol, 81–83
- 3-phenylpropane-1-ol, 81–82, 84
- 4-hydroxybenzaldehyde, 15
- 4-hydroxybenzoic acid, 15
- 4-mercapto-4-methyl-2-pentanone, 332–333
- 4-methylpent-3-en-2-one, 87
- 4-phenyl-1,3-dioxane, 83–84
- 4-phenyl-4-methyl-1,3-dioxane, 81–82

A

- Acacia trees, 227
- acai, 380
- account managers, 361
- acculturation, 348
- acetals, 182–183
- acetate, 79
- acetic acid, 41
- acetophenone hydrogenation, 85
- achiral-phase gas chromatography, 266, 267, 276
- acid-base conditions, effect of, on water solubility of vanillin, 179–182
- acyclic carboxamides, 102
- agglomeration, 117, 337
- air drying, 18–19

aldehydes, 128–129
alginate beads, 115
aliphatic constituents, 42–43
American natural flavors regulations, 297–298
Amigo and Arditi S.A., 74
analogs, of menthol, 78
analytical support, 361–362
analytical techniques, 396–397
anethol, 325
anisic acid esters, 45
anisic alcohol, 45
anisic aldehyde, 45
anisic ethers, 45
applications teams, 362–363
Arocet, 88
Aroco Co., 90
Arol, 88
aroma, 39–40, 45–47
 qualitative differences in,
 among species, 47–48
 terminology, 48
aroma chemicals, 45–46
 chocolate, 147–148, 149, 150
 coffee, 141–143, 150
 future of, 151–152
 high impact, 139–154
 off-notes, 148–151
 roast beef, 143–147, 150
 sensitivity to, 152–153
 sweet, 140
 trends in, 157–163
Aroma Co., 81, 88–89, 90
aroma compounds, 210
 mango, 265–278
 papaya, 265–278
 SPME-headspace, 268–271, 273–276
aromatic chemistry, 391–393

aromatic constituents, 40–41, 44
artificial vanilla, 34
assimilation, 348
autolyzed yeast extracts (AYE), 166

B

Baeyer-Villiger oxidation, 371
baking methods, influence of, in
 aroma retention, 219–220
baking time, 219–220
Bayer-AG, 75–76
 β -cyclodextrin, 122–123
benzyl ethers, 44
benzyl-acetate, 81
beverages, 261, 263
 β -glucosidase, 14, 17, 21, 24, 26–29
 curing and, 49
 flavor development and, 48, 50
biomembranes, 21
biotechnologic vanillin, 307
Bordas, 77
Boulder Canyon Natural Foods, 381
Bourbon vanilla, 45, 47, 350
Brasway S.A., 74
Brazil, 62, 63, 65, 66, 74
browning, 20–21, 29–31
bubble gum, 262–263
business cycle, 386–388
by-products, of menthol, 77

C

calcium oxalate, 11, 12
Camphor and Allied, 77
Candida antarctica, 321–325, 371–375
caramelization, 326

- carbon-carbon bonds, 85, 371
- carbonyl groups, 182–183
- carboxamides, 101–103, 258
- carrier systems
 - flavor, 231–232
 - spray drying, 226–228, 231–235
- catechin staining, 21
- catty olfactophore, 144
- cell wall hydrolyzing enzymes, 22–23
- cellular changes, during curing, 19–21
- chemical reactions, during frying
 - of meat, 127–136
- chemicals. *See* aroma chemicals
- chemistry
 - aromatic, 391–393
 - of vanilla flavor, 40–45
- chewing gum, 262–263
- chicken, 168
- chicken liver extract, 128–130
- chili, 380
- China, menthol production in, 62–66, 73, 74–75
- chiral-phase gas chromatography, 266, 271, 276
- chloroplasts, 12
- chocolate, 34, 147–148, 149, 150, 397
- cinnamic aldehyde, 321–322
- cis* compound, 44, 88–89
- cis*-4-heptenal, 189–190
- CO₂, 19–20, 29
- coacervation, 121, 337
- coating, 337
- co-crystallization, 116
- coffee, 141–143, 150, 332
- cola beverages, 34
- commercial flight, 385–386
- commercial vanilla products, 33–34
- compacting, 117
- complex formulations, 359–361
- conditioning stage, 2, 3, 12, 18–19
- coniferyl alcohol, 323
- coniferyl aldehyde, 323
- contact dryers, 238–239
- controlled-release flavors, 210–211
- controlled-release systems, 104
- convenience foods, 209, 261
- conventional baking, 215–217
- cookies
 - dough preparation, 211–212
 - loss of volatile ester from, 209–222
- Coolact 38D, 104, 105
- Coolact P, 104, 105
- cooling agents. *See* physiological cooling agents
- cooling cocktails, 105–106
- cornmint oil, 62, 65, 73
- cranberry, 380
- creative pride, 358
- cucumber flavors, 311–319
- cultural blends, 348–349
- curing process, 14–19, 35–36
 - cellular and metabolic changes during, 19–21
 - changes in enzymatic activity during, 21–31
 - conditioning stage, 2, 3, 12, 18–19
 - drying stage, 2, 12, 18–19
 - killing/blanching stage, 2, 12, 15–18
 - natural, 9–10
 - objective of, 10
 - purpose of, 14–15
 - sweating stage, 2, 3, 18
 - traditional methods, 15–19
 - vanilla, 1–8
 - vanillin during, 53–54

customers, understanding, 356
cyclic ethers, 371–375
cyclic ketals, 88–89
cyclodextrin complexation, 337
cysteamine, 128, 130

D

da Vinci principles, 365–370
Dayspring Co. Ltd, 75
decarboxylation, 128
deionized water, 228
demand, reduced, 35
density, 243, 249–250
Department of Organic Technology
(DOT), 90–91
derivative of D-alanine, 101
derivatives, of menthol, 79
diacetyl, 327, 329
difurfuryl, 329
difurfuryl disulfide, 332
dihydromenthofurolactone, 374
divanillin, 54–56
d-neo-menthol, 79
drum-drying, 238–241, 245–254
drying processes
 air drying, 18–19
 comparison of, 240–255
 drum-drying, 238–241, 245–254
 for flavor encapsulation, 237–255
 freeze-drying, 238–242, 245–254
 spray drying, 111–112, 116–117,
 225–235, 237–238, 241, 245–254
 tray-drying, 238, 241, 245–254
drying stage, 2, 12, 18–19
 δ -tetradecalactone, 189
d-xylose, 329, 330

E

electronic nose, 396–397
emulsion stability, 244–245, 252–253
emulsions, 337
encapsulated flavors, 210–211
 morphologies of, 112–113
 to protect against aroma loss during
 baking, 220–222
 spray drying and, 231
encapsulation
 case studies, 341–345
 definitions, 336–339
 economics of, 337–346
 necessity of, 335–336
 usage level and, 344–345
encapsulation methods/technologies,
 111–125
 agglomeration, 117, 337
 β -cyclodextrin, 122–123
 coacervation, 121, 337
 coating, 337
 commercial, 226
 compacting, 117
 comparison of, 342–343
 cyclodextrin complexation, 337
 drying processes, 237–255
 emulsions, 337
 extrusion, 119–121, 337
 fluidized bed methods, 118–119
 fluidized spray drying, 118
 molecular inclusion, 122–123
 overview, 124–125
 requirements of, 112–116
 spray chilling, 122, 337
 spray drying, 111–112, 116–117,
 225–235, 337
 submerged nozzle process, 121
 toolbox approach, 123
energy drinks, 263, 264
enzymatic activity
 cell wall hydrolyzing enzymes, 22–23
 changes in, during curing, 21–31
 glycosyl hydrolases, 23–29

- oxidative enzymes, 29–31
 - protease activity, 21–22
 - enzymatic processes, in flavor development, 48–51
 - enzyme hydrolysis, 167
 - enzyme modified cheese (EMC), 167
 - enzyme technology, 395–396
 - epidermis, 11
 - essential oils, 168
 - ester concentrations, loss of, during baking of cookies, 209–222
 - ethanol, 210
 - ethnic sodas, 352
 - ethyl butyl ketone, 286, 288
 - ethylene, 19–20, 29
 - ethyl-vanillin, 86
 - eugenol, 300, 323
 - European natural flavors regulations, 297–299
 - extraction, 32
 - extrusion processes, 119–121, 337
- F**
- fermentation process, 296
 - ferulic acid, 51, 296, 299–300, 323, 325
 - flavor addition, 210–211
 - flavor applications, of cooling agents, 262–263
 - flavor carrier systems, 231–232
 - flavor compounds, 12
 - synthesis of, 321–325
 - flavor creation, 281–293
 - categorizing ingredients for, 289–290
 - da Vinci approach to, 365–370
 - formulation, 393–395
 - ingredient selection, 281–284
 - intensity determination, 284–286
 - management of, 355–363
 - trends in, 157–163
 - using qualitative sensory data and quantitative intensity ratings, 290–292
 - flavor emulsion, 228–229
 - flavor encapsulation technologies. *See* encapsulation methods/technologies
 - flavor incorporation, stage of, 217–218
 - flavor industry, state of, 157–163
 - flavor load, 242, 246
 - flavor precursors, 12, 14, 23
 - flavor profile, 384–385
 - flavor retention, during baking of cookies, 209–222
 - flavor synthetics, production of, 81–91
 - flavorists, management of, 355–363
 - flavors
 - controlled-release, 210–211
 - encapsulated, 112–113, 210–211, 220–222, 231
 - fruit, 311–319, 380–381
 - FTNE, 311–319
 - of the future, 391–397
 - most popular, 352
 - process, 327–334, 393
 - reaction, 327–334
 - regulations on natural, 297–299
 - savory, 165–171
 - snack, 377–381
 - spicy, 379–380
 - synthetic, 81–91
 - fluidized bed methods, 118–119
 - floral nectaries, 11
 - fluidized spray drying, 118
 - food applications, of cooling agents, 262–263
 - food polymers, 228
 - formulation, 359, 366, 369, 393–395

fragrance, 260
freeze-drying, 238–242, 245–254
freezing, 15, 16–17
French natural flavors regulations, 298–299
Frescolat MGA, 104
Frito Lay, 381
frozen foods, 209
fruit anatomy, 11–13
fruit components, 11
fruit flavors, 311–319, 380–381
fruit regions, 10–11
frying, chemical reactions during, 127–136
FTNF (from the named food) flavors, 311–319
furfural, 31, 330
furfuryl mercaptan, 144–145, 332
future flavors, 391–397

G

gas chromatographic-spectroscopic method, 266
gas chromatography, 392
gas regimes, 20
GC-olfactory, 133
GC-sniffing-technique, 266, 271
genetic modification, 378
gerstel GC-Thermal desorption, 212–213
glassy state, 231
Glidco-SCM, 64
glucovanillin, 2–4, 14, 21–29, 51, 181–182
glycosyl hydrolases, 14, 23–29
goji berries, 380
gold standard, 366
grains, 380

granulation technology, 118–119
GRAS ingredients, 281, 282–283
Guadeloupe vanilla, 48
gum acacia, 240, 248–249
gum arabic, 227

H

Haarmann & Reimer (H&R), 64–65, 75–76
headspace, 392
health foods, 209–210, 377–379, 380
heterocyclics, 42
Hispanic flavor preferences, 347–353
hot water killing, 15, 16, 17
hydrocinnamoc alcohol, 81
hydrogen bonding, 184–185
hydrogen sulfide, 329, 331, 332–333
hydrogenation, 85–86
hydrolysis, 46
 enzyme, 167
 of glucovanillin, 2, 3, 4, 22–29
hydrolyzed vegetable protein (HVP), 165–166

I

ICE 12000, 102–103
ice cream, 16, 34
in vitro monitoring, 198–200
in vitro sampling, 196–197
India, menthol production in, 66–70, 73, 74–75
Indian vanilla beans, 44, 47, 62, 65
information gathering, 367–368
ingredients
 categorizing, 289–290
 evaluation criteria, 283–284

- intensity profiles, 286–288
 - intensity determination, 284–286
 - quantitative sensory evaluation of, 284
 - selection of, 281–283, 369
 - in-nose monitoring, 200–205
 - in-nose sampling, 196, 197–198
 - innovation, 383–389
 - intensity profiles, 286–288
 - intensity rating reproducibility, 285–286
 - intensity ratings, 290–292
 - interfacial polymerization, 116
 - isoeugenol, 323, 325
 - isopulegol, 374
 - isotope ratio mass spectrometry (IRMS), 301–305
 - isovaleraldehyde, 333–334
 - isovalerate, 79
- J**
- Japan, 62, 63
 - Java vanilla, 45, 47
 - Jindal Drugs Ltd., 74
- K**
- killing/blanching stage, 2, 3, 12, 15–18
 - Kraft Foods, 378
 - Kujawski, Dennis, 157–163
- L**
- lactones, 42, 371–375
 - l-cysteine, 327, 329, 330
 - lead user process, 387–389
 - leaf alcohol, l-menthone
 - Leffingwell & Associates, 93
 - lignin, 6, 7, 300–301
 - Likens-Nickerson extraction, 213–214
 - linalool oxides, 324, 325, 372
 - lipase, 321–325
 - lipase B, 371–375
 - lipid peroxides, 22
 - liposomes, 115
 - liquid flavorings, 210
 - l-isopulegol, 100, 104
 - l-menthol. *See* menthol
 - l-menthone glycerol ketal, 100, 104
 - l-menthyl ester of 4-(N,N-dimethylamino)-4-oxobutanoic acid, 98–99, 103–104
 - l-menthyl lactate, 103
 - l-menthyl pyrrolidin-2-one-5-carboxylate, 97–98
 - l-methyl lactate, 94–96
 - l-monomenthyl glutarate, 96–97, 105
 - l-monomenthyl succinate, 96–97, 103
 - low notes, 165–166
 - low-calorie snacks, 378
- M**
- Madagascan Vanilla curing process, 1–8
 - Madagascar, 34, 35
 - Maillard reaction, 6, 127–128, 133, 170, 183–185, 326, 396
 - mangos, 265–278, 351
 - mass spectrometry, 392
 - matrix composition effects, 215–217
 - matrix particles, 113
 - mature fruit, 13–14
 - meat frying, chemical reactions during, 127–136
 - meats, top notes, 168

- melon flavors, 311–319
 - memory, 397
 - Mentha and Allied Products Ltd., 74
 - menthofuran, 79, 372, 373–374
 - menthofurolactone, 372, 373–374
 - menthol, 57–80
 - analogs, 78
 - by-products, 77
 - cooling strength, 259
 - cooling/anesthetic effect, 57–58
 - derivatives, 79
 - history of, 59–66
 - natural, 58
 - natural sources, 59
 - origins of production, 62–66
 - overview, 60
 - prices, 63, 64, 71–72
 - production capacity, 74–75
 - production of, 64–70
 - racemic, 59
 - substitutes, 78–79
 - supply of, 72–74
 - synthetic, 58–59, 63–64, 73–77
 - world consumption, 70–71, 72
 - menthone, 79
 - menthone glycerol ketal, 259
 - menthoxy cooling agents, 94–100
 - 2-l-menthoxyethanol, 100
 - 3-l-menthoxypropane-1,2-diol, 100
 - l-isopulegol, 100
 - l-menthone glycerol ketal, 100
 - l-menthyl ester of 4-(N,N-dimethylamino)-4-oxobutanoic acid, 98–99
 - l-menthyl pyrrolidin-2-one-5-carboxylate, 97–98
 - l-methyl lactate, 94–96
 - l-monomenthyl glutarate, 96–97
 - l-monomenthyl succinate, 96–97
 - menthyl 3-hydroxybutyrate, 99–100
 - p-menthane-3,8-diol, 100
 - menthyl 3-hydroxybutyrate, 99–100
 - menthyl esters, 106
 - menthyl hydroxybutyrate, 259
 - menthyl lactate, 259
 - menthyl salicylate, 79
 - menthyl valerate, 79
 - mercaptans, 332
 - metabolic changes, during curing, 19–21
 - methional, 151
 - methyl furfuryl disulfide, 332–333
 - methyl thiobutyrate, 191
 - methylester, 89
 - Mexican vanilla, 47
 - microcapsules, 113
 - microencapsulation processing technology, 384–385
 - microwave baking, 217, 219
 - microwave foods, 209
 - middle notes, 167
 - milk fat, 168–169
 - modified food starch, 240
 - moisture content, 243, 248–249
 - molecular inclusion, 122–123
 - monosodium glutamate (MSG), 154
 - mouth, aroma release and anatomy of, 200
 - mouthwash, 261–262
- ## N
- N-(1-isopropyl-1-methylisobutyl) anisamide, 103
 - N-(2-ethoxyethyl)-2,3-dimethyl-2-isopropylbutanamide, 102
 - N-(3-p-menthanoyl) sulfadiazine, 102
 - N-(4-aminocarbonylphenyl)-p-menthane carboxamide, 101
 - N-(4-cyanomethylphenyl)-p-menthane carboxamide, 101

Nagaoka & Co. Ltd, 75

N-aryl-p-menthane-3-carboxamides, 102

natural flavors

processing for, 311–319

regulations on, 297–299

natural vanillin, 296, 299, 307–308

authentication of, 301–305

preparation of, 299–301

N-(ethoxycarbonylmethyl)-p-menthane-3-carboxamide, 101

N-ethyl-p-menthane-3-carboxamide, 101, 258, 259

nonvolatile components, 44

nucleophiles, 182

nucleotides, 165–166

O

octenyl-succinic acid anhydride (OSAN) starches, 227

off-notes, 148–151

oil retention, 245–247

oleoresins, 168

olfactoric correlation, 266

opoxides, 321

optimization, 369–370

oral coolants, 259–263

oral hygiene market, 261–262

orange oil, 384–385

organic snacks, 378

OSAN-starches, 227, 229

oven killing, 15, 16

oxidase, 49

oxidation, 21, 47, 113, 130, 371

oxidation reactions, 321–325

oxidative enzymes, 29–31, 49

oxydating reagents, 305

oxygen, 20

P

papaya, 265–278

Papua New Guinea vanilla, 48, 350

Paraguay, 62

parenchyma cells, 12

patents, for physiological cooling agents, 103–106

pectinase, 23

peppermint, 62

peracetic acid, 321

perfume

cooling agents and, 260

production of synthetic, 81–91

peroxidase, 17, 30–31, 49–51

phenolics, 42

phenols, 44–47

phloem, 12

p-hydroxy benzyl methyl ether, 41

p-hydroxybenzaldehyde, 3, 6–7, 8, 25, 41, 50

p-hydroxybenzoic acid, 3, 25, 41, 45, 50

p-hydroxybenzyl ether, 44

p-hydroxybenzyl methyl ether, 44

physiological cooling agents, 93–107, 257–264

beverages and, 263

commercial aspects of, 259–264

controlled-release systems, 104

flavor applications, 261

food and flavor applications, 262–263

formulation challenges, 258–259

fragrance and perfumery

applications, 260

menthoxy cooling agents, 94–100

oral hygiene and, 261–262

patent trends in, 103–106

WS coolants, 101–103

p-menthane-3,8-diol, 100, 104, 105

p-menthane-3 carboxamides, 102
pollination, 9, 13
polymerization, 46–47
polymers, 228
polyphenol oxidase (PPO), 17, 30–31
pomegranate, 380
prices
 menthol, 63, 64, 71–72
 vanilla, 34, 35
Pringles, 379–380
process flavors, 327–334, 393
processed flavors, 127
product development, 369–370
production technologies, for flavor
 synthetics, 81–91
propagation, 10
propanal, 131
propionate, 79
protease, 17, 21–22
protein content, changes in, 17
proteolysis, 49
proton transfer reaction mass
 spectrometry (PTR-MS), 193–206
pyrolysis oil, 6–8, 168
pyrrolidinone carboxylic acid, 98

Q

qualitative sensory data, 290–292
Questice, 97–98

R

racemic menthol, 59
raphides, 12–13
rapid drying, 19
reaction flavors, 327–334

reaction systems, 127–136
 experimental procedures, 133–134
 spectroscopic data, 134–136
regulatory issues, 162, 297–299
resins, 45
retroacculturation, 348
Réunion, 2, 3
Rhovanil Natural, 296
ripening period, 16
roast beef flavor, 143–147, 150
roasted, 379
rosemary, 397

S

saffron, 397
savory flavors, 379–380
 composing, 165–171
 example formulations, 169–171
 low notes, 165–166
 middle notes, 167
 top notes, 167–169, 170
savory olfactophore, 146
scanning electron microscopy (SEM),
 230, 245, 253–254
Schiff base formation, 183
sensorial detection limit, 392
sensorial evaluation, 396
sensory analysis, 362
sex pheromones, 152
shelf life, 244, 250–252, 384–385
site-specific natural isotope
 fractionation (SNIF-NMR), 302–305
slow drying, 19
snack bars, 379
snack flavors, 377–381
solid-phase-microextraction (SPME),
 266, 267

- sorbic acid, 85, 86
- species differentiation, 47–48
- spicy flavors, 379–380
- Spinny Chips, 381
- SPME-headspace aroma compounds, 268–271, 273–276
- sports beverages, 263, 264
- spray chilling, 122, 337
- spray dry carrier, 226–228
- spray dryer, 229–231
- spray drying, 111–112, 116–117, 225–235, 237–238, 241, 245–254, 337
- alternate systems, 232–235
 - carrier systems, 231–235
 - case study, 341–342
 - dryer and the drying process, 229–231
 - encapsulated flavor and, 231
 - factors in, 225–226
 - flavor carrier systems, 231–232
 - flavor emulsion, 228–229
 - fluidized, 118
 - glassy state, 231
 - spray granulation, 118–119
- spray granulation, 118–119
- stomata, 11
- strawberry flavor, 351
- Strecker degradation, 127, 128, 326
- striking a balance, 365–366
- “stuck” situations, 358–359
- submerged nozzle process, 121
- substitutes
- for menthol, 78–79
 - for vanilla, 34
- sulfur compounds, 151
- sulfurol, 146, 190
- sun drying, 18–19
- sun killing, 15, 16
- surface oil, 242–243, 246, 247–248
- sweating stage, 2, 3, 12, 18
- Symrise, 75
- synthetic flavors, production of, 81–91
- synthetic menthol, 75–77
- synthetic vanillin, 12, 296
- ## T
- Tahitian vanilla, 45, 48
- Takasago, 64, 65, 75, 76–77
- technology, 383–389
- cycles, 386–388
 - and innovation, 383–386
- temperature
- baking, 219–220
 - effect of, on water solubility of vanillin, 175–179
- terpenoids, 43
- tetramethylpyrazine, 327
- thermal desorption, 212–213, 214, 222
- thiazolidines, 128, 130–131, 133, 134–136
- thiazolines, 127
- threshold values, 392
- toothpaste, 261–262
- top notes, 167–169, 170
- toxins, 152–153
- trans* compound, 44, 85–86, 88–89
- tray-drying, 238, 241, 245–254
- ## U
- Uganda vanilla, 48
- ## V
- V. planifolia*, 10–14, 40, 45, 47–48
- V. pompona*, 40
- V. tahitensis*, 40, 45

- Valldol, 79
- vanilla
- aroma of, 45–47
 - Bourbon, 45, 47, 350
 - Guadeloupe, 48
 - Hispanic preferences and, 350
 - Java, 45, 47
 - overview, 9–10
 - Papua New Guinea, 48, 350
 - popularity of, 295–296
 - propagation of, 10
 - Tahitian, 45, 48
 - Uganda, 48
 - uses of, 34
- vanilla absolute, 32, 33
- vanilla beans
- anatomy, 11–13
 - components, 11
 - prices, 16, 34, 35
 - production of, 10, 16
 - regions, 10–11
- vanilla consumption, 16
- vanilla curing process. *See* curing process
- vanilla extract, 12, 32, 33
- divanillin content of, 55
 - uses of, 34
- vanilla flavor, 39–40, 45–47
- chemical constituents of, 40–45
 - constituents of, 15
 - divanillin and, 54–56
 - enzymatic processes in development of, 48–51
 - qualitative differences in, among species, 47–48
- vanilla oleoresin, 32, 33
- Vanilla planifolia*, 10–14, 40
- vanilla pod, botany of, 10–14
- vanilla powder/sugar, 32, 33
- vanilla products, 32–34
- vanilla-flavored milk, 295
- vanillic acid, 15, 25, 41, 50
- vanillin, 7, 13–14, 15, 21, 39, 50–51
- aggregate and soluble state of, 174–175
 - concentration, 2–6
 - during curing, 53–54
 - economic overview, 301
 - end-use value, 305–307
 - from eugenol, 300
 - from ferulic acid, 299–300
 - formation, 23–29
 - industrial production constraints, 301
 - IRMS analysis of, 8
 - from lignin, 300–301
 - natural, 296, 299, 307–308
 - physics and chemistry of, 173–186
 - precursors, 322–323
 - preparation of, 299–301
 - synthesis and authentication of
 - natural, 295–308
 - synthetic, 296.12
 - water solubility of, 175–182, 186
 - water structuring and, 182–185
- vanillin content, 26–29, 40
- vanillyl ether, 44
- vanillyl methyl ether, 44
- vascular bundles, 11–12
- vegetable flavors, 380–381
- vegetarian snacks, 378
- vitispiranes, 44
- volatile chemicals, 41–44, 46
- volatile esters, loss of, from cookies, 209–222
- volatile flavor release monitoring, 193–206
- in-nose monitoring, 200–205
 - methodology, 194–198
 - PTR-MS, 194–198
 - in vitro* monitoring, 198–200
- volatile organic compounds, 129–130

W

- water solubility, of vanillin, 175–182, 186

- water structuring, vanillin and, 182–185
- watermelon flavors, 311–319
- Wilkinson Sword (WS) coolants, 101–103
- 2-isopropyl-N,2,3-trimethylbutanamide, 102
 - derivative of D-alanine, 101
 - N-(1-isopropyl-1-methylisobutyl)anisamide, 103
 - N-(2-ethoxyethyl)-2,3-dimethyl-2-isopropylbutanamide, 102
 - N-(3-p-menthanoyl) sulfadiazine, 102
 - N-(4-aminocarbonylphenyl)-p-menthane carboxamide, 101
 - N-(4-cyanomethylphenyl)-p-menthane carboxamide, 101
- N-(ethoxycarbonylmethyl)-p-menthane-3-carboxamide, 101
- N-ethyl-p-menthane-3-carboxamide, 101
- WinSense Extra, 105
- Wright, Marie, 157–163
- WS-23, 102–103, 104, 105, 106
- WS-3, 101, 104, 106
- WS-5, 101, 104
- Wurster coating, 119, 120
- X**
- xylem, 12
- Y**
- Yah Sheng Chong S.A., 74