

# **Flavours and Fragrances**

Chemistry, Bioprocessing and Sustainability



R. G. Berger (Ed.)

# Flavours and Fragrances

Chemistry, Bioprocessing  
and Sustainability

With 231 Figures and 61 Tables

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## Preface

Our ancestors lived in intimacy with nature and knew well that their survival depended on a safe and fertile environment. The introduction of three-field rotation in the eighth century bc, for example, counteracted the depletion of soil and increased crop yields without negative side effects. The first definition of the modern term “sustainability” is usually ascribed to forest chief captain H. C. von Carlowitz, who in 1713 in his *Sylvicultura Oeconomica* formulated principles for a sensible economy of wood. From J. S. Mill (*Of the Stationary State*) to modern academic representatives, such as K. Boulding, D. E. Meadows (*The Limits to Growth*), R. Easterlin and H. E. Daly, the “ecological economists” have remained a concerned but rather ignored minority. The situation started to change after the famous Brundtland report (*Our Common Future*) of the UN defined sustainability as a desirable characteristic of development, which will not only meet current needs of people, but also will not jeopardise the ability of future generations to meet their demands and to choose their style of life. This definition includes a social dimension and was also adopted by Agenda 21 of the UNCED in 1992 in Rio de Janeiro.

A set of rules may aid in assessing the sustainable quality of a process:

- Consumption and regeneration of the raw materials should be balanced.
- Non-regenerative goods should be replaced.
- Generation of waste and its biological elimination should be balanced.
- Technical processes should match biological processes on the time scale.

A merely growth oriented economy must violate these rules. According to the first law of thermodynamics, energy in a closed system like the planet earth is finite (if we neglect the solar photon flux). Today mankind secures its survival by exploiting low-entropy resources, such as fossil fuels, concentrated minerals and higher plants, and by converting them to high-entropy products, such as carbon dioxide, cars and fine chemicals. However, as proven by our office desks, high entropy levels can only be lowered by energy input. Here the first and the second law of thermodynamics collide, and we apparently encounter the inner core of the conflict.

With the world running out of crude oil, species dying out at an alarming rate and political leaders seemingly little concerned about the predicted disasters, scientists should feel challenged to suggest solutions. A sustainable production

of natural flavours, like wood, fats and oils, saccharides, phytomedicines, bio-ethanol, biopolymers and natural colours, mainly depends on the existence of reliable plant sources. But how long will the traditional sources of flavours last? Quality of soil, unfavourable weather conditions, insect infestations and socio-political instabilities may all adversely affect classical agricultural production. Are there new biosources that could replace exhausted ones? Will, as with vanillin production, the exploitation of waste streams of the agricultural and food industries gain importance? “White biotechnology” is propagated as an alternative option, but will bioprocesses possess stability, specificity, up-scalability and profitability? Will the recent advances in biotechnology be successfully transferred to industrial scales? How can the aspired match of economy and ecology be achieved?

In an attempt to compile the current status of sustainability in the flavour industry and the developments in the foreseeable future of flavour production, the present volume discusses consumer trends and preferences, legal and safety aspects; it describes renewable resources of flavours, such as spice plants, fruits, vegetables, fermented and heated plants, and natural building blocks; it presents analytical methods, such as gas chromatography coupled to human or electronic noses or to mass spectrometers; it deals with the isolation, quality control and formulation of flavours for liquid or dry products, with biotechnology to provide novel renewable resources, with enzymes, microbial and fungal cells to bio-transform cheap substrates or to produce flavours *de novo*, and with plant cells as a resource of genes coding for metabolic activities in transgenic producers.

The manufacturers of flavours and fragrances and their scientists are working at the leading edge of research, they look back on a long history of using natural resources, and are profitable on the basis of renewables. A wealth of experience has been gathered on issues such as provenance and quality, safety, authenticity and on problems of isolation, processing and shelf life. On the basis of this fundament of knowledge, we should start to deal with sustainability now, before the looming problems start to deal with us.

Finally, I should like to express my sincere thanks to the contributors for their thoughts and writing efforts, and to the publishers for their continuing support and patience.

Hanover, Summer 2006

Ralf Günter Berger

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# Contents

<b>1</b>	<b>The Flavour and Fragrance Industry—Past, Present, and Future</b> .....	<b>1</b>
	MATTHIAS GUENTERT	
	References .....	14
<b>2</b>	<b>Flavours: the Legal Framework</b> .....	<b>15</b>
	DIRK A. MÜLLER	
2.1	Definitions .....	15
2.2	Legal Positions .....	16
2.2.1	Current Situation in the EU .....	16
2.2.2	Expected Regulations on Flavourings in the EU in the Future .....	18
2.2.3	Current Situation in the USA .....	19
2.2.4	Current Situation in Japan .....	20
2.2.5	Global Approach .....	21
2.3	Legal Situation and Natural Flavourings, a Brief Reflection .....	22
	References .....	23
<b>3</b>	<b>Olfaction, where Nutrition, Memory and Immunity Intersect</b> .....	<b>25</b>
	J. BRUCE GERMAN, CHAHAN YERITZIAN, VLADIMIR B. TOLSTOGUZOV	
3.1	Introduction .....	25
3.2	Memory Consolidation—Short-Term, Long-Term and Permanent Memories .....	27
3.3	Multidimensional Biomemory .....	30
3.4	Flavour Sensation as a Part of Personal Dietary Choices .....	31
3.5	Measuring Flavour Perception Is Influenced by Several Factors .....	31
3.6	The “Melody” of Coffee .....	33
3.7	Metabolomics and the Metabolic Response to Foods .....	36
3.8	Profiling of Postprandial Plasma Lipid Composition .....	37
3.9	Profiling Signalling Lipids .....	38
3.10	Conclusion .....	39
	References .....	40
<b>4</b>	<b>Chemistry of Essential Oils</b> .....	<b>43</b>
	K. HÜSNÜ CAN BAŞER, FATİH DEMİRCİ	
4.1	What Is an Essential Oil? .....	43
4.1.1	Non-terpenoid Hydrocarbons .....	44

4.1.2	Terpenoids .....	45
4.1.3	C <sub>13</sub> Norterpenoids .....	63
4.1.4	Phenylpropanoids .....	64
4.1.5	Esters .....	65
4.1.6	Lactones .....	66
4.1.7	Phthalides .....	67
4.1.8	Nitrogen-Containing Essential Oil Constituents .....	68
4.1.9	Sulphur-Containing Essential Oil Constituents .....	69
4.1.10	Isothiocyanates .....	70
4.2	Impact of Chirality: Enantiomers .....	71
4.3	Analysis of Essential Oils .....	73
4.4	Conclusions .....	75
	References .....	83
<b>5</b>	<b>Bioactivity of Essential Oils and Their Components .....</b>	<b>87</b>
	ADOLFINA R. KOROCH, H. RODOLFO JULIANI, JULIO A. ZYGADLO	
5.1	Introduction .....	87
5.2	Antimicrobial Activity .....	87
5.3	Antiviral Activity .....	90
5.4	Antioxidant Activity .....	91
5.5	Analgesic Activity .....	93
5.6	Digestive Activity .....	94
5.7	Anticarcinogenic Activity .....	96
5.8	Semiochemical Activity .....	100
5.9	Other Activities .....	102
5.10	Conclusions .....	102
	References .....	103
<b>6</b>	<b>Citrus Flavour .....</b>	<b>117</b>
	RUSSELL ROUSEFF, PILAR RUIZ PEREZ-CACHO	
6.1	Introduction .....	117
6.2	Physical Characteristics of Citrus Fruit .....	118
6.3	Technological Flavour Products .....	119
6.3.1	Peel Oil .....	119
6.3.2	Essences .....	120
6.3.3	Petitgrain Oil .....	120
6.3.4	Oil of Neroli .....	120
6.4	Botanical Sources of Citrus Flavours .....	121
6.4.1	Sweet Orange ( <i>Citrus sinensis</i> ) .....	121
6.4.2	Sour/Bitter Orange ( <i>C. aurantium</i> ) .....	122
6.4.3	Lemon ( <i>C. lemon</i> ) .....	122
6.4.4	Grapefruit ( <i>C. paradisi</i> ) .....	123
6.4.5	Lime ( <i>C. aurantifolia</i> ) .....	124
6.4.6	Mandarin ( <i>C. reticulata</i> ) .....	124
6.5	Flavour-Impact Compounds .....	125
	References .....	132



<b>7</b>	<b>Fruits and Vegetables of Moderate Climate</b> .....	<b>135</b>
	LARS P. CHRISTENSEN, MERETE EDELENBOS, STINE KREUTZMANN	
7.1	Introduction .....	135
7.2	Formation of Flavours in Fruits and Vegetables .....	136
7.2.1	Compounds Formed by Degradation of Fatty Acids .....	137
7.2.2	Compounds Formed from Amino Acids .....	140
7.2.3	Compounds Formed from Glucosinolates .....	142
7.2.4	Compounds of Terpenoid Origin .....	143
7.2.5	Phenols and Related Compounds .....	143
7.3	Fruits .....	145
7.3.1	Pome Fruits .....	145
7.3.2	Stone Fruits .....	148
7.3.3	Berry Fruits .....	157
7.3.4	Soft Fruits .....	165
7.4	Vegetables .....	166
7.4.1	Alliaceae .....	166
7.4.2	Brassicaceae (Formerly Cruciferae) .....	169
7.4.3	Cucurbitaceae .....	172
7.4.4	Fabaceae (Formerly Leguminosae) and Solanaceae .....	173
7.4.5	Apiaceae (Formerly Umbelliferae) .....	176
7.5	Conclusions .....	180
	References .....	181
<b>8</b>	<b>Tropical Fruit Flavour</b> .....	<b>189</b>
	MÁRIO ROBERTO MARÓSTICA JR, GLÁUCIA MARIA PASTORE	
8.1	Introduction .....	189
8.2	Guava (Genus <i>Psidium</i> ) .....	189
8.3	Banana (Genus <i>Musa</i> ) .....	190
8.4	Mango ( <i>Mangifera indica</i> ) .....	192
8.5	Melon ( <i>Cucumis melo</i> ) .....	193
8.6	Papaya ( <i>Carica papaya</i> ) .....	194
8.7	Passion Fruit ( <i>Passiflora edulis</i> ) .....	195
8.8	Pineapple ( <i>Ananas comosus</i> ) .....	196
8.9	Cupuacu ( <i>Theobroma grandiflorum</i> ) .....	197
8.10	Bacuri ( <i>Platonia insignis</i> M. or <i>Platonia sculenta</i> ) .....	198
8.11	Sustainability of Tropical Cultivation .....	199
	References .....	200
<b>9</b>	<b>Vanilla</b> .....	<b>203</b>
	H. KORTHOU, R. VERPOORTE	
9.1	Introduction .....	203
9.2	The Plant .....	204
9.3	Vanillin .....	205
9.4	Biosynthesis .....	205
9.5	Enzymes .....	206
9.6	Curing .....	209

9.7	Chemistry .....	210
9.8	Biotechnological Production of Vanillin .....	211
9.9	Conclusions .....	213
	References .....	213
<b>10</b>	<b>Flavour of Spirit Drinks: Raw Materials, Fermentation, Distillation, and Ageing</b> .....	<b>219</b>
	NORBERT CHRISTOPH, CLAUDIA BAUER-CHRISTOPH	
10.1	Introduction .....	219
10.2	Flavour Compounds in Distilled Spirits .....	220
10.2.1	Carbonyl Compounds .....	220
10.2.2	Aliphatic and Aromatic Alcohols .....	223
10.2.3	Fatty Acids .....	223
10.2.4	Esters .....	224
10.3	Important Flavour Compounds from Raw Materials .....	224
10.4	Distillation—Separation and Fractionation of Flavour .....	225
10.5	Flavour Compounds Originating from Ageing .....	226
10.6	Flavour and Flavour-Related Aspects of Distilled Spirits .....	227
10.6.1	Wine and Wine-Pomace Brandies .....	227
10.6.2	Fruit Spirits .....	228
10.6.3	Grain Spirits .....	230
10.6.4	Vodka .....	231
10.6.5	Rum, Cachaça .....	231
10.6.6	Juniper-, Caraway-, and Aniseed-Flavoured Spirits .....	232
10.6.7	Tequila, Mezcal .....	233
10.6.8	<i>Shochu</i> , <i>Soju</i> , <i>Awamori</i> .....	234
10.6.9	Absinth .....	234
10.6.10	Liqueurs and Speciality Products .....	235
10.7	Sustainability in Production of Flavour of Spirits .....	237
10.8	Conclusions .....	237
	References .....	238
<b>11</b>	<b>Wine Aroma</b> .....	<b>241</b>
	ULRICH FISCHER	
11.1	Introduction .....	241
11.2	Logic behind Varietal Aroma .....	242
11.3	Chemical Basis of Varietal Aroma .....	243
11.3.1	Monoterpenes .....	243
11.3.2	C <sub>13</sub> Norisoprenoids .....	246
11.3.3	Methoxypyrazines .....	247
11.3.4	Sulphur Compounds with a Thiol Function .....	247
11.4	Impact of Viticulture and Growing Conditions .....	249
11.4.1	Sun Exposure .....	249
11.4.2	Stress-Induced Aroma Compounds .....	251
11.5	Impact of Enology .....	253
11.5.1	Grape Processing .....	255

11.5.2	Impact of Yeast .....	256
11.5.3	Impact of Modern Wine Technology .....	258
11.6	The Mystery of Wine Ageing .....	262
11.7	Conclusion .....	263
	References .....	264
<b>12</b>	<b>The Maillard Reaction: Source of Flavour in Thermally Processed Foods .....</b>	<b>269</b>
	DONALD S. MOTTRAM	
12.1	Introduction .....	269
12.2	The Chemistry of the Maillard Reaction .....	270
12.2.1	Stages in the Maillard Reaction .....	270
12.2.2	Strecker Degradation .....	272
12.3	Classes of Aroma Compounds Formed in the Maillard Reaction .....	274
12.3.1	Oxygen-Containing Compounds .....	275
12.3.2	Nitrogen-Containing Compounds .....	276
12.3.3	Sulphur-Containing Compounds .....	278
12.4	Conclusion .....	281
	References .....	282
<b>13</b>	<b>Chemical Conversions of Natural Precursors .....</b>	<b>285</b>
	PETER H. VAN DER SCHAFT	
13.1	Introduction .....	285
13.2	Terpenes as Renewable Resources for Terpene Flavour Molecules .....	286
13.2.1	Pinenes from Turpentine .....	286
13.2.2	Citral .....	288
13.2.3	The Mint Components L-Menthol and L-Carvone .....	289
13.2.4	Terpene Sulfur Compounds .....	291
13.2.5	Other Terpene Derivatives .....	292
13.3	Vanillin .....	294
13.3.1	Vanillin Synthesis .....	294
13.3.2	Vanillin Derivatives .....	294
13.3.3	Heliotropine from Safrole .....	295
13.4	Sugars as Precursors .....	297
13.4.1	Sources of Xylose and Rhamnose .....	297
13.4.2	Examples of Flavour Chemicals Derived from Sugars .....	297
13.5	L-Cysteine and L-Methionine as Sources of Hydrogen Sulfide and Methanethiol ...	299
13.5.1	Cysteine .....	299
13.5.2	Methionine .....	299
13.6	Chemical Conversions of Natural Precursors Obtained by Fermentation or from Residual Streams .....	299
13.6.1	Aliphatic and Aromatic Esters .....	299
13.6.2	Heterocyclic Flavour Molecules .....	300
13.7	Conclusions .....	301
	References .....	301

<b>14</b>	<b>Industrial Quality Control</b> .....	<b>303</b>
	HERBERT J. BUCKENHUESKES	
14.1	Introduction .....	303
14.2	Quality and Quality Management Systems .....	303
14.3	Quality Control .....	305
14.4	Physicochemical Methods .....	306
14.5	Sensory Evaluation .....	307
14.6	Specific Safety Aspects .....	307
14.7	Microbial Aspects and Microbiological Methods .....	308
14.8	Residues of Plant-Conditioning and Plant-Protective Agents .....	310
14.9	Biologically Active Substances .....	311
	References .....	312
<b>15</b>	<b>Advanced Instrumental Analysis and Electronic Noses</b> .....	<b>313</b>
	HUBERT KOLLMANNSSBERGER, SIEGFRIED NITZ, IMRE BLANK	
15.1	Introduction .....	313
15.2	Multidimensional Gas Chromatography .....	314
15.2.1	Classical Multidimensional Gas Chromatography .....	314
15.2.2	Comprehensive Two-Dimensional Gas Chromatography .....	317
15.3	Fast Gas Chromatography .....	322
15.4	Electronic Noses .....	326
15.4.1	Catalytic or Metal Oxide Sensor .....	327
15.4.2	Metal Oxide Semiconductor Field-Effect Transistor .....	327
15.4.3	Conducting Polymer Sensors .....	327
15.4.4	Acoustic Wave Sensors .....	328
15.4.5	Mass Spectrometry Based Systems .....	328
15.4.6	Other Sensor Technologies .....	329
15.4.7	Data Processing .....	330
15.4.8	Applications, Potential and Limitations .....	331
15.4.9	Conclusions .....	334
15.5	Time-Resolved Analysis of Volatile Organic Compounds .....	336
15.5.1	Proton-Transfer-Reaction Mass Spectrometry .....	337
15.5.2	Resonance-Enhanced Multiphoton Ionisation Time-of-Flight Mass Spectrometry ..	344
	References .....	349
<b>16</b>	<b>Gas Chromatography–Olfactometry of Aroma Compounds</b> .....	<b>363</b>
	WERNER GROSCH	
16.1	Introduction .....	363
16.2	The GC-O Experiment .....	363
16.2.1	Introduction .....	363
16.2.2	Isolation of the Volatile Fraction .....	364
16.2.3	Yield .....	366
16.3	Screening for Odorants by GC-O .....	367
16.4	Dilution Analysis .....	368
16.4.1	Introduction .....	368

16.4.2	Aroma Extract Dilution Analysis (AEDA)	368
16.4.3	Aroma Extract Concentration Analysis	369
16.4.4	GC-O of Static Headspace Samples	371
16.4.5	Limitations of Extract Dilution Techniques	373
16.5	Enrichment and Identification	373
16.6	Aroma Model	374
16.6.1	Quantitative Analysis	374
16.6.2	Odour Activity Values	375
16.6.3	Aroma Model	375
	References	377
17	<b>Enantioselective and Isotope Analysis—Key Steps to Flavour Authentication</b>	379
	A. MOSANDL	
17.1	Introduction	379
17.1.1	Isotope Discrimination	379
17.1.2	Enantioselectivity	379
17.2	Enantioselective Capillary Gas Chromatography	380
17.2.1	Scope	380
17.2.2	Analytical Conditions	382
17.2.3	Enantioselective Multidimensional Gas Chromatography	383
17.2.4	Detection Systems	383
17.2.5	Limitations	385
17.3	Results and Discussion	388
17.3.1	Chiral $\gamma$ -Lactones and $\delta$ -Lactones	388
17.3.2	2-Alkylbranched Acids (Esters)	390
17.4	Stir-Bar Sorptive Extraction—Enantioselective Multidimensional Gas Chromatography—Mass Spectrometry	390
17.4.1	Tea Tree Oils	392
17.4.2	Isotope Discrimination	394
17.5	Capillary Gas Chromatography—Isotope Ratio Mass Spectrometry Techniques	394
17.5.1	Fundamentals	394
17.5.2	Validation	395
17.6	Comprehensive Authenticity Assessment	396
17.6.1	( <i>E</i> )- $\alpha$ -Ionone and ( <i>E</i> )- $\beta$ -Ionone	396
17.6.2	Lavender Oil	400
17.7	Concluding Remarks	402
	References	403
18	<b>Flavour-Isolation Techniques</b>	409
	GARY A. REINECCIUS	
18.1	Introduction	409
18.2	Isolation of Flavour Compounds for Analysis	409
18.2.1	Absorption (Polymer Trapping, Solid-Phase Microextraction, Stir Bar, Solid-Phase Extraction)	410
18.2.2	Distillation (Simultaneous Distillation/Extraction, Vacuum Distillation)	412

18.2.3	Solvent Extraction .....	413
18.2.4	Combinations of Methods .....	414
18.2.5	Comments on Aroma-Isolation Methods .....	414
18.3	Isolation of Flavour from Plant Materials for Commercial Use .....	414
18.3.1	Distillation (Essential Oils) .....	415
18.3.2	Solvent Extraction (Oleoresins, Extracts, and Infusions) .....	416
18.3.3	Cold Pressing (Citrus Oils) .....	416
18.4	Isolation of Flavouring Materials from Waste Streams .....	417
18.4.1	Spinning Cone Concentrator .....	418
18.4.2	Absorption/Adsorption .....	420
18.4.3	Extraction (from Gas or Liquid Streams) Using Cryogenic Traps or Solvents .....	421
18.4.4	Membranes .....	423
18.5	Summary .....	425
	References .....	425
<b>19</b>	<b>Aroma Recovery by Organophilic Pervaporation .....</b>	<b>427</b>
	THOMAS SCHÄFER, JOÃO G. CRESPO	
19.1	Membrane Processes in the Food Industry .....	427
19.2	Recovery of Aromas and Aroma Profiles by Pervaporation .....	429
19.2.1	Limitations and Technical Challenges .....	432
19.2.2	Market Opportunities .....	435
19.3	Concluding Remarks .....	436
	References .....	437
<b>20</b>	<b>Encapsulation of Fragrances and Flavours: a Way to Control Odour and Aroma in Consumer Products .....</b>	<b>439</b>
	JEROEN J.G. VAN SOEST	
20.1	Introduction .....	439
20.2	Encapsulation .....	440
20.2.1	Matrix or Coating Materials .....	441
20.2.2	Hydrophilic Matrices .....	442
20.2.3	Processing Routes .....	442
20.2.4	Recent Developments and Trends .....	447
20.3	Performance of Fragrances in Consumer Products .....	450
20.4	Market Developments and Products .....	452
20.5	Conclusions .....	453
	References .....	453
<b>21</b>	<b>Creation and Production of Liquid and Dry Flavours .....</b>	<b>457</b>
	RAINER BARNEKOW, SYLVIA MUCHE, JAKOB LEY, CHRISTOPHER SABATER, JENS-MICHAEL HILMER, GERHARD KRAMMER	
21.1	Modern Flavour Creation .....	457
21.1.1	The Roots of Flavour Work .....	457
21.1.2	Raw Materials—the Foundation of Every Creation .....	458
21.1.3	Process Flavours .....	463

21.1.4	Taste Modifiers .....	464
21.1.5	Chemosensates .....	470
21.1.6	Modern Tools for Flavour Development—Flavour Creation .....	473
21.1.7	The Specifics of Flavour Application .....	476
21.2	From Formula to Product .....	477
21.2.1	Shelf-Life Stability .....	477
21.2.2	Accelerated Shelf-Life Testing .....	478
21.2.3	Chemical Interactions .....	480
21.3	Flavour Production .....	482
21.3.1	Liquid Flavours .....	482
21.3.2	Dry Flavours .....	483
21.4	Conclusion .....	486
	References .....	486
<b>22</b>	<b>Enzymes and Flavour Biotechnology .....</b>	<b>489</b>
	M. MENZEL, P. SCHREIER	
22.1	Introduction .....	489
22.2	Hydrolytic Enzymes .....	489
22.2.1	Lipases (EC 3.1.1.X) .....	489
22.2.2	Glycosidases (EC 3.2.1.X) .....	493
22.2.3	Flavorzyme® .....	494
22.3	Oxireductases .....	495
22.3.1	Horse Liver Alcohol Dehydrogenase (EC 1.1.1.1) .....	495
22.3.2	Lipoxygenase (EC 1.13.11.12) .....	496
22.3.3	Peroxidases (EC 1.11.1.X) .....	497
22.3.4	Laccase (EC 1.10.3.2)/Germacrene A Hydroxylase .....	499
22.3.5	Microbial Amine Oxidases (EC 1.4.3.X) .....	499
22.3.6	Vanillyl Alcohol Oxidase (EC 1.1.3.38) .....	500
22.4	Transferases .....	501
22.4.1	Cyclodextrin Glucanotransferase (EC 2.4.1.19) .....	501
22.5	Lyases .....	502
22.5.1	D-Fructose-1,6-biphosphate Aldolase (EC 4.1.2.13) .....	502
22.5.2	Sesquiterpene Synthase (EC 4.2.3.9) .....	502
22.6	Conclusion .....	502
	References .....	503
<b>23</b>	<b>Microbial Flavour Production .....</b>	<b>507</b>
	JENS SCHRADER	
23.1	Introduction and Scope .....	507
23.2	Characteristics of Microbial Flavour Production .....	509
23.3	Non-volatile Flavour Compounds .....	513
23.4	Volatile Flavour Compounds .....	518
23.4.1	Aliphatic Compounds .....	518
23.4.2	Aromatic Compounds .....	530
23.4.3	Terpenes .....	540

23.4.4	Lactones .....	555
23.4.5	O-Heterocycles, S- and N-Containing Compounds .....	561
	References .....	566
<b>24</b>	<b>Microbial Processes .....</b>	<b>575</b>
	C. LARROCHE, J.-B. GROS, P. FONTANILLE	
24.1	Introduction: General Concepts on Biotransformation Multiphase Systems .....	575
24.1.1	Supercritical Fluids .....	575
24.1.2	Ionic Liquids .....	577
24.1.3	Organic–Aqueous Reaction Systems .....	579
24.2	Solvent Selection in Organic–Aqueous Systems .....	580
24.2.1	Molecular Toxicity of the Solvent .....	581
24.2.2	Phase-Toxicity Effect .....	582
24.3	Engineering Aspects .....	584
24.3.1	Vapour Pressure .....	585
24.3.2	Phase Equilibrium. Activity Coefficients .....	586
24.3.3	Contact Between Phases. Mass Transfer .....	589
24.4	Conclusion .....	595
	References .....	595
<b>25</b>	<b>The Production of Flavours by Plant Cell Cultures .....</b>	<b>599</b>
	A.H. SCRAGG	
25.1	Introduction .....	599
25.2	Flavours .....	600
25.3	Plant Cell and Tissue Culture .....	602
25.3.1	Micropropagation .....	604
25.3.2	Plant Cell Suspensions .....	604
25.3.3	Biotransformation .....	609
25.3.4	Scale-Up .....	610
25.4	Discussion .....	610
	References .....	611
<b>26</b>	<b>Genetic Engineering of Plants and Microbial Cells for Flavour Production .....</b>	<b>615</b>
	WILFRIED SCHWAB	
26.1	Genetic Engineering .....	615
26.2	Terpenoids .....	616
26.3	Hexenals .....	619
26.4	Esters .....	621
26.5	Vanillin .....	622
26.6	Miscellaneous .....	624
26.7	Conclusion .....	625
	References .....	626
	<b>Subject Index .....</b>	<b>629</b>



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