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Handbook of Perfumes and Flavors

By

Dr. Olindo Secondini

Chemical Publishing Co., Inc.
New York, NY
To my wife, Ann Katya
The Author

Dr. Olindo Secondini has worked in the fields of Essential Oils, Flavors, Perfumes, Cosmetics, Toiletries, and Aromatic Chemicals in the United States, Europe, Latin America, Africa, and the Middle East. He has also taught Chemistry and Chemical Engineering at several universities.

Dr. Secondini has published in various languages, particularly in Spanish with the leading newspaper “El Imparcial” of Guatemala, Central America, where he worked on research and development of natural resources.

He is a Fellow of the American Institute of Chemists.
First Foreword

By Paul B. Slawter, Jr. FAIC
Former Executive Secretary, The American Institute of Chemists
Former Editor, The Chemist

Some years ago, Dr. Olindo Secondini brought me a manuscript to consider for a publication of which I was an editor, "The Chemist," official organ of The American Institute of Chemists. Dr. Secondini was an experienced chemist in the field of essential oils, flavors, perfumes, cosmetics, toiletries, and aromatic chemicals.

I was fascinated by his story and published it in the next issue. It had a somewhat whimsical title, "Is our Sense of Scent Lost?"

The article must have made a lot of sense because we had more editorial reaction to it than to any article I had published in 60 issues over a five-year span. Dr. David W. Young, a noted American scientist, then President of the AIC, said it was the best he had ever read on this interesting subject. Several essential oil companies ordered extra copies for distribution.

Recently, Dr. Secondini brought me another manuscript, this time a formidable tome on flavors and perfumes. I must say: This is the best I have ever read on these interesting subjects. Dr. Secondini is to be congratulated by the likes of me and thanked by the likes of people in the business of essential oils and related materials for providing what has to be the last word on the compounding of flavors and perfumes. His entire book should be subtitled "The Gamut of Flavors and Perfumes from A to Z."

As one peruses this volume, from the history of perfumes and cosmetics to the constituents of the essential oils so important to the industry, one gets the feeling that everything, which means anything to a flavorist or a perfumer, is here for the reading.

Today, there is increased interest and awareness on the part of the general public in flavors and perfumes, which, like food and clothing, are growth industries with unlimited futures. Dr. Secondini shows how the level of production is now sufficiently large to make flavors and perfumes a most important factor in American economy and resource planning.

Its 474 pages make the publication more than a handbook for practical formulation of flavors and perfumes. It is truly a workbook of inestimable value for an industry with no place to go but upward.
Second Foreword

By Donald A. Davis
Editor, Drug & Cosmetic Industry (magazine)

There haven't been nearly enough additions to the sparse body of technical books about perfuming and flavor materials over the past two decades, though the technological advances in this area have been remarkable. In fact, it was almost as though the late Steffen Arctander had a monopoly on the subject during his long and productive lifetime. That said, it is good to have this contribution from Dr. Olindo Secondini, who has had a varied career in academia, in industry, and even in medicine.

This is far more than a simple handbook for perfumer or chemist or research worker in the field. Besides giving a comprehensive outline of each essential oil, aromatic, flavor, and fixative, it breaks down the physical and chemical character of natural materials. What is more, it provides valuable clues for the compounding or manufacture of a wide range of synthetic versions of those increasingly scarce, sometimes unbelievably expensive derivatives from rare animals or plants that grow only in remote jungles or savannahs. There is little chaff here, Dr. Secondini staying throughout with what he originally set out to do. The prediction from this quarter is that this will become a standard reference work, and remain one for years until someone equally ambitious undertakes to do another 30 or 40 years hence. One interesting addition not usually seen in such a book is a small section suggesting new kinds of perfumes, some oriented toward fragrances far different than are encountered in any now on the market. Such targets of opportunity seem worthy of attention by some innovative compounder—and reflect well on the author's imagination.
Third Foreword

By David W. Young, Sc.D., P.E.
Vice President, Young & Kather Associates, Inc.
Member of Board of Directors, ACC&CE

This book is based on a fresh approach to the analysis and interpretation of odor evaluation tests. Utilizing his years of experience, observation, and personal judgment, the author presents new insights and attitudes regarding the nature and method of odor evaluation testing. Dr. Secondini published a similar article in “The Chemist,” the official publication of the AIC.

This book is strictly practical while at the same time provides indispensable technical and scientific details. The book presents important information for all. The chemist will require this work as well as the student of chemistry. It is a fresh theme in the area of industrial chemistry.

I strongly recommend this book to anyone involved in the application of odors for commercial use.
Fourth Foreword

By Annette Green, Executive Director, The Fragrance Foundation

In the last twenty-five years, the universe of olfaction has expanded beyond anyone’s imagination and the pleasures of fragrance, in particular, have captured the minds and hearts of people in every culture, every environment, every social level.

As we enter an even more highly developed technological decade, it becomes increasingly clear that many of the challenges we will all face will call on a completely new mindset in interpreting sensory needs and providing a vast range of experiences which will be resolved through sensory experiences.

It has never been more imperative to provide scientists, students, perfumers, and scholars with the most effective and authoritative tools. They must not only provide the broadest possible perspectives of the extremely complex field of fragrance creation (historically, culturally, scientifically), but also create an environment for higher consciousness and creativity.

I believe Dr. Secondini has accomplished this monumental feat in his extraordinary work which is represented in this volume. I salute him and thank him for his masterful contribution to the world of fragrance and the sensory lives of societies of the future.
Preface

In line with the human necessities, flavors and perfumes, like the food and clothing industries, are omnipresent and fast growing.

The correlated literature, however, although necessary for bringing up-to-date information for research and development, is comparatively slow and rather scarce. Even educational institutions are still not interested in giving courses in this important field of daily consumption comprehending biological, botanical, and chemical sciences.

This book provides a general orientation to the subject and information on the compounding of basic flavors for food and floral perfumes for personal use, for cosmetics, soaps, disinfectants, deodorants, and antipollutants. All are concisely described in the 995 formulas of perfumes and flavors and the related material reported in this book.

Regardless of scientific and technical education, or experience in this field, this book can contribute to the necessary knowledge for the compounding of any flavor or perfume. However, since the perception of taste and odor is intrinsically individual, a creative technique is indispensable for improving and expanding on this very fascinating industrial activity.

The author, who has many years of practical experience in this field, gratefully acknowledges and thanks the authors of the very valuable books listed in the bibliography, which have amply helped in the compilation of this book.

Olindo Secondini
Explanatory Notes

1. CLASSIFICATION OF FORMULAS

The formulas, as reported in this book, are classified in four categories:

1. **Essences:** Compounds made with natural products, such as Essential Oils, Balsams, Resinoids
2. **Extracts:** Made from barks, roots, leaves, seeds, buds, fruits, flowers, in their natural state.
3. **Imitation:** A mixture of essences, extracts, and esters in prevalence.
4. **Synthetics:** A duplication of the natural product, made generally with a combination of esters. Esters are fragrant compounds formed by the reaction between an acid and an alcohol. For example, ethyl acetate is made by heating acetic acid and ethyl alcohol in the presence of sulfuric acid and distilling. The synthetic formula, when there is more than one of the same species, has a progressive number.

2. COMPOSITION

All the formulas are of a general orientative nature. It remains exclusively to the compounder to improve each one, either reducing, increasing, or modifying the components in each formula, in accordance with his taste and olfactory stimulus. Good flavors, or perfumes, are not derived from the best formulas. The success, in compounding the ingredients (which must be excellent in taste and odor) depends on the sense of taste and scent of the compounder.

3. TURBIDITY

The ingredients must be blended thoroughly and totally clear in an absolute pure and odorless solvent such as ethyl alcohol 95% from grain, propylene glycol, neutral glycerin, distilled water, and other solvents. Many of the formulas will probably give turbidity in their compounding. This can be eliminated, or at least reduced, by increasing the amount of solvent, or by repeated filtration.

4. UNSPECIFIED UNITS FOR WEIGHTS, VOLUMES, OR PERCENTAGES

The unit measures in the manufacture of synthetic aromatic basic material, or formulas
for flavors and perfumes, could either be in kilograms, if the material is solid, or liters, if the material is liquid.

The amount of 1000, for instance, with unspecified unit, could be either 1000 kilograms or 1000 grams (1 kilogram); or 1000 liters or 1000 milliliters (1 liter).

As standard practice in the use of all components no units are specified. The same chosen unit must be applied to all items in the required material or formulas.

Example:

1. Distilled Water 1000
2. Ethyl Alcohol 1000
3. Sugar 500

In this case, because the units are unspecified, all components are measured by weight, which will be either in kilograms or grams. The formula must therefore be understood as:

1. Distilled Water 1000 grams
2. Ethyl Alcohol 1000 grams
3. Sugar 500 grams

The unspecified units facilitate any system of measure, particularly those of foreign countries. Therefore, the unspecified amount could be: kilograms, grams, liters, milliliters, ounces, etc.

In this book all unspecified amounts must be understood as parts by weight.

5. USES OF THE FORMULAS FOR ESSESNCES

The amount of any formulas, to be basically employed in making essences, is in the proportion of 2 or 3 parts (2 or 3 grams × 1 kilogram (1000 grams) of solvent).

6. CONCRETE, ABSOLUTE, RESINOID

Concrete—a waxy solid obtained from roses by extraction without solvents, or after removing the solvent; the essential oil. Absolute—free from admixture with other substances, e.g., absolute alcohol which is dehydrated as ethyl alcohol 99% pure. Resinoid—any thermosetting synthetic natural, vegetable-derived resin. The best known are rosin and balsam from coniferous trees. Their use is in varnishes and adhesives.

7. TINCTURES

Tincture—an alcoholic or aqueous-alcoholic solution of vegetable material.
All tinctures are made by maceration, stirring every day for one hour, until total
dissolution is obtained in flavor and odor (approximately one week) and filtering at the
end until completely clear.

8. UNSPECIFIED NATURAL PRODUCTS (OIL OR CONCRETE)

When a natural product, such as carnation, gardenia, etc. is not specified, either as an
oil or concrete, it refers to its imitation or synthetic formula reported in the book.

9. COLORS

In coloring flavors or perfumes, only certified colors or the natural, legally exempted
from certification colors must be used. The color must be added before filtration, which
is necessary even if the product appears clear.

10. TEMPERATURE

The temperature is in Centigrade (°C), with the exception of flash point TCC
(Tagliabue Closed Cup) given in Fahrenheit (°F). Specific gravity is given at 25/25°C.
Refractive index and optical rotation are at 20°C. Different temperatures are specified in
parenthesis.

11. SOLUBILITY

Number refers to the amount of alcohol, or other solvent, needed to dissolve the
material. Example 2/70% means two volumes of alcohol at 70%; 3/80% means three
volumes of alcohol at 80%; 2–8/70% means that the volume of alcohol may be from two
to eight volumes at 70%.

12. FORM OF THE MATERIAL

If it is not liquid, a specification is given either as a powder, crystals, etc.

13. HABITAT

When the habitat is not specified, worldwide existence is assumed.

14. SOLUTION

When not specified, the solvent for solutions is ethyl alcohol 95%.
15. NATURAL PRODUCTS

For natural products, when particular parts, e.g., oil, concrete, bark, flowers, leaves, resinoid, roots, tops are not specified, they must be used in their total natural state.

16. CAS NUMBERS

Wherever possible, the American Chemical Society’s Chemical Abstract Service (CAS) registry numbers have been included to facilitate accurate identification of a given chemical substance.

17. ABBREVIATIONS

C ................................................................. degrees Centigrade
cc ................................................................. cubic centimeter
CC ............................................................... closed cup
cl ................................................................. centiliter
cml .............................................................. centimilliliter
EDTA ......................................................... ethylene diamine tetraacetate
F ................................................................. degrees Fahrenheit
FDA ............................................................. Food and Drug Administration
g ............................................................... gram
gal ............................................................. gallon
h ................................................................. hour
kg ............................................................... kilogram
l ................................................................. liter
max ............................................................ maximum
min ........................................................... minimum, minutes
ml ............................................................. milliliter
OC ............................................................ open cup
sol’n ........................................................... solution
TCC ............................................................ Tagliabue Closed Cup
> .............................................................. greater than
NOTICE

Neither the author nor the publisher assumes any liability with reference to the use, applications, or for damages resulting from the use, any information, apparatus, methods, or processes described in this book.
# Table of Contents

Forewords .......................................................... v
Preface ................................................................. ix
Explanatory Notes .................................................. x

I  Odors ........................................................................ 1
   Introduction .......................................................... 1
   Historical Classification of Odors ............................ 4
   Subjective Classification of Odors ............................ 12
   General Classification of Odorous Substances .......... 13

II Natural Essences ..................................................... 17
   Introduction .......................................................... 17
   Constituents of the Essential Oils ......................... 20
   Essential Oils Directory ........................................ 24

III Synthetic Essences .................................................. 74
   Introduction .......................................................... 74
   Materials Employed as Odorants ............................ 75
   Chemical Components of Flavors and Perfumes ......... 77

IV Aromatic Chemicals ................................................. 132
   Aromatic Chemicals Used in Flavor and Perfume Compounds  132

V Perfumes ................................................................. 157
   Natural Odors Simulated with Aromatic Chemicals .... 157
   Simulated Flower Scents ....................................... 159
   Simulated Marine Scents (Algae) ........................... 171
   Suggested New Perfumes ....................................... 172
   Fixatives for Perfumes ......................................... 173

VI Basic Flavoring Materials ......................................... 174
   Introduction .......................................................... 174
   Natural Flavors Simulated with Synthetic Chemicals .... 175
   Aromatic Chemicals Used in Flavor Compounding ...... 195

VII Solvents ............................................................... 209
   Introduction .......................................................... 209
   Solvents Commonly Used for Flavors and Perfumes .... 209
Chapter I:

ODORS

Introduction

"The Rose distills a healing balm
The beating pulse of pain to calm"
—Alexander Farkas

From early Spring to late Fall, scent is all around us, particularly in the Southern states, where plants are more extensively flowering and where Spring starts earlier and Fall lasts longer. The color of all these flowers, in their beautiful multi-variety, is overwhelming. But very few people will probably pay any attention to their odors.

Paradoxically, even though odors—currently called perfumes—are extensively used by almost everyone, either applying them directly to the body, or indirectly through the use of soaps, creams, powders, detergents, etc., the human sense of smell has degenerated during the last centuries, and is in danger of being lost.

The impact of pollution has already had a deleterious effect, beginning during the Industrial Revolution when people started to desert farms and countryside in order to find work in the growing factories and continuing through this century with the evolution of mechanical transportation. Our cities are now filthy with smoke of factories and exhaust from cars. Parks and countrysides smell of pesticides and chemical fertilizers. Highways offend our sight and nose with the bodies of innocent animals killed by our crushing transportation.

The first men who populated our planet certainly had a better sense of smell, as wild animals still have. Early man had to use primarily smell and taste in order to investigate what kind of food he could use for his nourishment. Forced to select organic materials which could be poisonous, putrefied, and so forth, the nose was the master guide with the sense of taste as supervisor.

Until the beginning of this century, flowers and herbs were still collected for their scent and aroma, and preserved in order to be used during the nonflowering seasons. Cities had herbal shops for this purpose, and druggists and pharmacists stored them in their laboratories. Since the beginning of civilization men of science and lovers of nature have attempted to distinguish and classify odors. A fundamental classification of odors is reported throughout history.
EARLY HISTORY OF PERFUMES

Early in the history of humanity it appears that men burned various kinds of woods for warmth and light during the nights and cold winter seasons. Thus, they accidentally discovered the pleasant smell of the smoke that drifted through the air over the flames from some of the naturally perfumed woods. The French name “parfum” comes from the Latin preposition “per” meaning through and the substantive “fumus” meaning smoke.

Primitive men also accidentally discovered that putting resinous wood in water made it oily and odorous. Rubbing the body with the resinous material produced a feeling of pleasure by improving their body odor and protecting their skin. The development of perfumes, therefore, can be traced as far back as the beginning of the history of humanity.

Perfumes have been found in the Egyptian pharaohs’ tombs. The Ebers’ papyrus, which refers to the beginning of recorded history in the Nile Valley, contains formulas in which botanicals, minerals, and animal products were employed. They are still utilized today in the manufacture of perfumes.

Ancient Greeks and Romans learned from the Egyptians. For many centuries perfumes remained an exclusive oriental art. During the period of the Crusades in the early decades of the thirteenth century, perfumes were brought from Palestine to Europe. Trade in spices followed.

In the 1500’s perfumes became popular through those made by a certain René, a perfumer from Florence, Italy. René travelled to France with Catherine de Medicis when she went to marry Prince Henry, who later became Henry II of France.

HISTORY OF THE WATER COLOGNE

The perfume which rapidly became the most popular was “Eau de Cologne.” The name derives from the fact that the product was initially made in the city of Cologne (Köln), Germany, on the Rhine river, in the early 1700’s.

It was first prepared in the town of Cologne by Jean Marie Farina. He was born in Italy in the town of Saint Marie Major, and went to Cologne to trade perfumes. He first prepared this very famous composition in 1709. It is known, however, that the “Eau de Cologne” was first marketed by Paul de Feminis in Milan, Italy, and it was afterwards made in Cologne from 1690. The formula was then passed to his nephew Jan Antoine Farine, who started manufacturing it in Paris in 1806.

The popularity of “Eau de Cologne” since the early 18th century is due to its fresh and clean smell. Many manufacturers in Cologne and elsewhere have continued its trade worldwide. It has perpetuated as a standard type of a lightly refreshing scent. It is a water-alcohol solution of a concentrated citrus essence prevalently extracted from lemon, bergamot, orange flowers, and blended with some lavender and orris roots, with traces of benzoin as a fixative. The finest “Eau de Cologne” is produced by distilling pure ethyl alcohol with the previously mentioned ingredients. Some neroli is further added. The distillate is then left to mature for at least one year.
ODORS

THE PERFUME INDUSTRY

Alexander Farkas, in the introduction to his book Perfume Through the Ages, says:

"The perfume industry is perhaps the most romantic of all industries."

It is indeed true that the perfume industry, even from the chemical point of view, is the most fascinating.

The art of blending natural essences and synthetic odorants to obtain a stable, odoriferous alcohol solution embraces all kinds of organic chemicals, and more extensively than in any other branch of the chemical industry. The psychological influence of a perfume determines its appeal for the customer, and thus its success. Today, all kinds of papers are perfumed to improve their salability. Perfumed merchandise is preferred, and outsells its odorless counterpart by a large margin.

The products of the perfume industry are classified as:

1. Gaseous: Aerosols
2. Liquids: Lotions, Perfumes
3. Pastes: Creams, Toothpastes
4. Solids: Soaps, Powders

THE COSMETICS INDUSTRY

Cosmetics are preparations applied to the surface of the body for the purpose of enhancing its appearance. Cosmetic products aid the whole human body—face, hair, teeth, hands, feet—with the triple purpose of preserving, restoring, or simulating beauty. In a larger sense, cosmetics are products of perfumery. Perfumes of natural origin, such as essential oils, and of synthetic production are usually employed in cosmetics. Cosmetics are liquids, solids, creams, pastes, and powders.

Cosmetics can be generally classified as:

1. Cutaneous cosmetics: Lipsticks, creams, soaps, toilet water
2. Capillary cosmetics: Brilliantines, shampoos, depilatories
3. Dental cosmetics: Toothpastes, liquids, powders

In accordance with their specific properties and intended application, cosmetics may be classified in various categories:

1. Creams
2. Lotions
3. Eye makeup and other eye preparations
4. Lipsticks and other lip preparations
5. Nail preparations
6. Face and body makeup
7. Perfumes and scented preparations
8. Bath preparations
9. Skin cleanser and other skin preparations
10. Shampoo and hair rinses
11. Hair preparations
12. Depilatories
13. Shaving preparations
14. Deodorants and antiperspirants
15. Suntan preparations

**Historical Classification of Odors**

**CLASSIFICATION OF ARISTOTLE (384–322 B.C.)**

The Greek philosopher Aristotle, the greatest influential thinker of Western culture, was the first to classify odors. He classified odors in six groups in accordance with the sensations:

1. Sweet odors
2. Acid odors
3. Severe odors
4. Fatty odors
5. Sour odors
6. Fetid odors

**CLASSIFICATION OF LINNAEUS (1707–1778)**

Linnaeus, the celebrated Swedish botanist, based his odor classification on seven groups:

1. Aromatic odors: Clove, laurel
2. Fragrant odors: Jasmine, lily
3. Ambrosiac odors: Moss, amber
4. Alliaceous odors: Garlic, asafoetida
5. Fetid odors: Valerian
6. Repulsive odors: Solanaceous
7. Distusting odors: Hellebore

Many others have attempted to classify odors, but very few have achieved a passable classification.

**CLASSIFICATION OF FOURCROY (1755–1809)**

Antoine Francois Fourcroy, a French chemist and politician, founded the French Museum of Natural Sciences, and with Antoine Laurent Lavoisier and C.I. Bertholett, the
INDEX

Abbey, Benedictine, flavor formula, 264
Abies alba, 43, 65
   A. siberica, 43
Absinthe, 414
   flavor formula, 264
Absolute alcohol, 385
Acacia (Acacia), 159, 414
   A. decurrens, 52
   A. farnesiana, 33
   A. greggii, 159, 414
   A. senegal, 221
gum, 221
   perfume formula, 225
Acer (maple)
   A. macrophyllum, 186, 428
   A. palmatum, 186
   A. pennsylvanicum, 186, 428
   A. platanoides, 186
   A. pseudoplatanus, 186
   A. rubrum, 186, 428
   A. saccharinum, 186, 428
   A. spicatum, 186, 428
Acetaldehyde, 77, 374
Acetate, 75
   Acetate C-8, 77, 206, 375
   Acetate C-9, 77, 375
   Acetate C-10, 77, 197, 375
   Acetate C-11, 78, 375
   Acetate C-12, 78, 375
   Acetate PA, 78
Acetogenol, 103
Acetic acid benzyl ester, 134, 379
Acetic acid butyl ester, 381
Acetic acid p-cresol acetate, 142
Acetic acid ethyl ester, 211, 385
Acetic acid n-propyl ester, 409
Acetic acid phenyl ester, 407
Acetic acid phenyl methyl ester, 89, 134, 379
Acetic acid, tincture, perfume formula, 226
Acetic aldehyde, 77, 374
Acetic ester, 211, 385
Acetic ether, 211, 385
Acetic glacial, pure, 78
Acetoacetic acid ethyl ester, 385
Acetoacetic ester, 100, 385
1' and 2'-Acetonaphthone, 406
α and β-Acetonaphthylene, 406
Acetone, 209
Acetophenone, 79, 132
Acetylbenzene, 132
Acetyl-p-cresol, 142
Acetyl eugenol, 103
Acetylphenol, 407
Acid, 21, 22, 76
Acid anhydrides, 22
Acorus calamus, 31, 418
Adonis quinquifolia, 172
Advocaat, flavor formula, 264
Aether nitricus, 389
   oenanthicus, 389
Agar-agar, 221
Agar, 414
Agaricus campestris, 414, 423
Alcohol, 21, 76, 385
   Alcohol C-7, 79
   Alcohol C-8, 79, 206
   Alcohol C-9, 79, 205
   Alcohol C-10, 80, 197
   Alcohol C-11 (undecylenic), 80, 347
   Alcohol C-11 (undecylic), 80
   Alcohol C-12, 80
   Alcohol C-16, 81
   Aldehyde, 22, 76, 374
   Aldehyde B, 143
   Aldehyde C-7, 81, 201
   Aldehyde C-8, 81, 206
   Aldehyde C-9, 81, 205
   Aldehyde C-10, 82, 198, 382
   Aldehyde C-11, 208
   Aldehyde C-11 (undecylenic), 82
   Aldehyde C-11 (undecylic), 82
   Aldehyde C-12 (lauric), 82, 399

446
INDEX

Aldehyde C-12 (MNA), 83, 198, 204
Aldehyde C-14, 208
Aldehyde C-14 (myristic), 83
Aldehyde C-14 (pure), 83, 155, 376
Aldehyde C-16, 205
Aldehyde C-16 (pure), 84, 376
Aldehyde C-18, 84, 152, 195, 376
Aldehyde C-19, 84
Aldehyde C-20, 84
Ale, 189
Algae, 171, 221
Aliphatic compounds, 75
Alkanet, 214
Alkanna tinctoria, 214
Allium cepa, 56, 193, 431
A. sativum, 44, 192, 424
Allomalic acid, 104
Allspice, 61, 433
flavor formula, 264
oil, 414
Allyl catechol methylene ether, 410
1-Allyl-3,4-dimethoxybenzene, 114
Allyldiarylene methylene ether, 410
4-Allylguaiacol, 103, 144, 391
Allyl isothiocyanate, 193
Allyl mercaptan, 193
4-Allyl-2-methoxyphenol, 103, 144, 391
4-Allyl-2-methoxyphenyl acetate, 103
1-Allyl-3,4-methylenedioxybenzene, 410
4-Allyl-1,2-methylenedioxybenzene, 410
m-Allyl pyrocatechelin methylene ether, 410
Allyl pyrocatechol methylene ether, 410
Allyl sulfide, 84, 192, 326, 376
4-Allylveratrole, 114
Almond, 414
artificial essential oil of, 134, 379
flavor formula, 266
Almond, bitter, 24
flavor, 184
flavor formula, 264–266
Almond, milk (orzata), flavor formula, 266
Almond, peach, flavor formula, 266
Aloe (Aloe), 415
A. vera, 415
Alpestrine, perfume formula, 226
Alpine violet, 143
Alpinia officinarum, 423
Amber, 415
acid, 410
perfume formula, 226
Ambergris, 24, 415
as fixative, 173
perfume formula, 226
Ambrette, seed, 24
Ambrettolide, 85
2-Aminobenzoic acid methyl ester, 148, 403
Anomum cumcuma, 439
Amoore, 11
Amyl acetate, 377
Amyl acetate ester, 377
Amyl acetic ester, 377
Amyl alcohol, 377
Amyl benzoate, 85
Amyl butyrate, 377
n-Amyl butyrate, 85
γ-n-Amylbutyrolactone, 376
γ-n-Amyl butyrolactone nonanolide-1,4, 152
Amyl carbinol, 394
α-Amylcinnamaldehyde, 85
Amyl cinnamic aldehyde, 85, 133
α-Amyl cinnamic aldehyde, 133
Amylene hydrate, 377
Amyl formate, 378
Amyl isovalerate, 378
Amyl phenyl acetate, 86
α-n-Amyl-β-phenyl acrolein, 85, 133
Amyl propionate, 86, 396
Amyl salicylate, 107, 133, 396
Amyl valerate, 378
Amyl valerianate, 378
Amyris balsamifera, 64
Anacardium occidentale, 184, 419
Ananas (pineapple), 433
A. comosus, 433
flavor, 183
flavor formula, 338–341
Andropogon (genus), 420
Anethole, 86, 195, 378
Anethum graveolens, 40
Angelic acid, 86
Angelica, flavor formula, 267
Angelica (Angelica), 415
A. archangelica, 415
A. officinalis, 415
root, 25
seed, 25
Angostura, 25, 415
flavor formula, 267
Aniba rosaedora, 63
Anisaldehyde, 133, 195, 378
p-Anisaldehyde, 87, 133
Anise, 415
alcohol, 87
camphor, 86, 378
flavor formula, 267
seed, 25
star, 26, 435
Aniseed, flavor formula, 267
Anisette, flavor formula, 267
Anisic acid, 87
Anisic alcohol, 87
Anisic aldehyde, 87, 133, 378
Anisole, 87
Anisyl acetate, 88
Anisyl alcohol, 87
Anisyl aldehyde, 378
Anisyl formate, 88
Anatto, 214
Annona cherimola, 182, 420
Annona odoratissima, 171
Anthemis nobilis, 35, 419
Anthoxanthum odoratum, 44
Anthranilic acid, 88
Anthriscus cerefolium, 420
Apis mellifera, 28
Apium graveolens, 34
β-Apo-8'-carotenal, 214
Apple, 415
acid, 401
color, 219
essence, 378
flavor, 175
flavor formula, 267–271
oil, 378
Apricot, 415
color, 219
flavor, 175
flavor formula, 271–273
Aquavit, 189
Arabic gum, 221
Arachis hypogaea, 185
Arborea rotundifolia, 217
Archangelica officinalis, 25
Arethusa (genus), 167
Ariaria comosus, 183
Aristotle, 4
Aromatherapy, 15
Aromatic compounds, 75
Arrack, 177
Artemisia (Artemisia), 26
A. absinthium, 72, 414
A. arborescens, 414
A. dracunculus (tarragon), 41, 192, 436
A. judaica, 414
A. maritima, 72
A. pallens, 40
A. tridentata, 414
A. vulgaris, 26, 414
Asafetida, 27, 415–416
Asant, 415–416
Asarum (Asarum), 26
A. canadense, 26, 424
Ascabin, 136, 380
Ascabiol, 136, 380
Asperula odorata, 72, 187, 438
Astragalus gummifer, 224
Attar, 168
Aubepine, 87, 133, 195, 416
flavor formula, 273
Avilla (genus), 185
Avocado, 416
flavor, 182
flavor formula, 273
Baccharis dracunculifolia, 70
Balm, 27, 416
Balsam, Copaiba, 38
gurjun, 46
Peru, 61
Tolu, 68
Balsamic odors, 157
Banana, 416
flavor, 182
flavor formula, 274–275
oil, 182, 377
Barbecue, 416
flavor formula, 275–276
Barberry, 416
flavor, 175
flavor formula, 276
Barley, 266
Baros camphor, 381
Barosma betulina, 30
Basil, sweet, 27
Basis, 159
Basswood, 165
Bay, 27
sweet, 27
Bean gum, locust, 222
Bee balm, 416
Beer, 428
flavor, 188
Beeswax, 28
Beet, 214
<table>
<thead>
<tr>
<th>Compound</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benedicte</td>
<td>416</td>
</tr>
<tr>
<td>flavor formula</td>
<td>276</td>
</tr>
<tr>
<td>Benzylic</td>
<td>380</td>
</tr>
<tr>
<td>Benzalacetone</td>
<td>137</td>
</tr>
<tr>
<td>Benzoaldehyde</td>
<td>88, 134, 195, 379</td>
</tr>
<tr>
<td>1-Benzazole</td>
<td>146</td>
</tr>
<tr>
<td>Benzene</td>
<td>210</td>
</tr>
<tr>
<td>Benzeneacetalddehyde</td>
<td>118, 152</td>
</tr>
<tr>
<td>Benzeneacetic acid</td>
<td>153, 408</td>
</tr>
<tr>
<td>Benzeneacetic acid ethyl ester</td>
<td>102, 153, 390</td>
</tr>
<tr>
<td>1,2-Benzenedicarboxylic acid</td>
<td>379</td>
</tr>
<tr>
<td>1,3-Benzodioxole-5-carboxaldehyde</td>
<td>145, 394</td>
</tr>
<tr>
<td>Benzoic acid</td>
<td>89, 379</td>
</tr>
<tr>
<td>Benzoic acid benzyl ester</td>
<td>136, 380</td>
</tr>
<tr>
<td>Benzoic acid ethyl ester</td>
<td>386</td>
</tr>
<tr>
<td>Benzoic acid methyl ester</td>
<td>113, 404</td>
</tr>
<tr>
<td>Benzoic acid phenyl methyl ester</td>
<td>136, 380</td>
</tr>
<tr>
<td>Benzoic aldehyde</td>
<td>134, 379</td>
</tr>
<tr>
<td>Benzoin</td>
<td>416</td>
</tr>
<tr>
<td>Benzoin siam</td>
<td>28</td>
</tr>
<tr>
<td>B. sumatra</td>
<td>28</td>
</tr>
<tr>
<td>Benzoil cyclohexatriene</td>
<td>210</td>
</tr>
<tr>
<td>Benzophenone</td>
<td>143</td>
</tr>
<tr>
<td>2-H-1-Benzopyran-2-one</td>
<td>142</td>
</tr>
<tr>
<td>Benzopyrone</td>
<td>97, 142</td>
</tr>
<tr>
<td>Benzopyrrole</td>
<td>146</td>
</tr>
<tr>
<td>Benzoyl acetone</td>
<td>137</td>
</tr>
<tr>
<td>Benzoyl benzene</td>
<td>143</td>
</tr>
<tr>
<td>Benzyl acetate</td>
<td>89, 134, 379</td>
</tr>
<tr>
<td>Benzyl alcohol</td>
<td>135, 380</td>
</tr>
<tr>
<td>Benzylate</td>
<td>136</td>
</tr>
<tr>
<td>Benzyl benzene carboxylate</td>
<td>136, 380</td>
</tr>
<tr>
<td>Benzyl benzoate</td>
<td>89, 136, 380</td>
</tr>
<tr>
<td>Benzyl butyrate</td>
<td>195</td>
</tr>
<tr>
<td>Benzyl carbinitol</td>
<td>154, 408</td>
</tr>
<tr>
<td>Benzylcarbinyl acetate</td>
<td>118, 153, 408</td>
</tr>
<tr>
<td>Benzylcarbinyl anthranilate</td>
<td>119, 409</td>
</tr>
<tr>
<td>Benzylcarbinyl butyrate</td>
<td>119, 409</td>
</tr>
<tr>
<td>Benzylcarbinyl cinnamate</td>
<td>120</td>
</tr>
<tr>
<td>Benzylcarbinyl formate</td>
<td>120</td>
</tr>
<tr>
<td>Benzylcarbinyl propionate</td>
<td>120, 409</td>
</tr>
<tr>
<td>Benzylcarbinyl salicylate</td>
<td>121</td>
</tr>
<tr>
<td>Benzylcarbinyl α-toluate</td>
<td>120</td>
</tr>
<tr>
<td>Benzyl cinnamate</td>
<td>89, 136</td>
</tr>
<tr>
<td>Benzyl formate</td>
<td>90, 380</td>
</tr>
<tr>
<td>Benzyl o-hydroxybenzoate</td>
<td>90</td>
</tr>
<tr>
<td>Benzyl-o-hydroxybenzoxybenzoate</td>
<td>137</td>
</tr>
<tr>
<td>Benzylidene acetone</td>
<td>137</td>
</tr>
<tr>
<td>Benzyl isobutyrate</td>
<td>84</td>
</tr>
<tr>
<td>Benzylic phenyl acetate</td>
<td>90</td>
</tr>
<tr>
<td>Benzylic propionate</td>
<td>90</td>
</tr>
<tr>
<td>Benzylic salicylate</td>
<td>90, 137</td>
</tr>
<tr>
<td>Benzylic α-toluate</td>
<td>90</td>
</tr>
<tr>
<td>Benzylic valerate</td>
<td>91</td>
</tr>
<tr>
<td>Benzylic valerianate</td>
<td>91</td>
</tr>
<tr>
<td>Benzylic valerianic ether</td>
<td>91</td>
</tr>
<tr>
<td>Berberis juliana</td>
<td>175</td>
</tr>
<tr>
<td>B. thunbergiae</td>
<td>175</td>
</tr>
<tr>
<td>B. vulgaris</td>
<td>175, 416</td>
</tr>
<tr>
<td>Bergammonia, disinfectant, perfume formula</td>
<td>226</td>
</tr>
<tr>
<td>Bergamol</td>
<td>110, 148, 400</td>
</tr>
<tr>
<td>Bergamot</td>
<td>28, 158, 159, 416</td>
</tr>
<tr>
<td>flavor formula</td>
<td>276</td>
</tr>
<tr>
<td>perfume formula</td>
<td>277</td>
</tr>
<tr>
<td>Bertolletia excelsa</td>
<td>184</td>
</tr>
<tr>
<td>Beta vulgaris</td>
<td>214</td>
</tr>
<tr>
<td>Betula alba</td>
<td>29</td>
</tr>
<tr>
<td>Betula oil</td>
<td>115, 150, 406</td>
</tr>
<tr>
<td>Beverages, crystal, flavor formula</td>
<td>298</td>
</tr>
<tr>
<td>Bihimsaim camphor</td>
<td>381</td>
</tr>
<tr>
<td>Biacetyl</td>
<td>384</td>
</tr>
<tr>
<td>Bilberry</td>
<td>417</td>
</tr>
<tr>
<td>flavor</td>
<td>176</td>
</tr>
<tr>
<td>flavor formula</td>
<td>277</td>
</tr>
<tr>
<td>Billot, M., 11</td>
<td></td>
</tr>
<tr>
<td>Birch, tar</td>
<td>29</td>
</tr>
<tr>
<td>Bitter almond, synthetic oil of</td>
<td>134</td>
</tr>
<tr>
<td>Bitters</td>
<td>188, 417</td>
</tr>
<tr>
<td>flavor formula</td>
<td>278</td>
</tr>
<tr>
<td>Bixia orellana</td>
<td>214</td>
</tr>
<tr>
<td>Blackberry</td>
<td>417</td>
</tr>
<tr>
<td>color</td>
<td>219</td>
</tr>
<tr>
<td>flavor</td>
<td>176</td>
</tr>
<tr>
<td>flavor formula</td>
<td>278–279</td>
</tr>
<tr>
<td>Black cherry, flavor formula</td>
<td>279, 287</td>
</tr>
<tr>
<td>Black currant, flavor</td>
<td>176</td>
</tr>
<tr>
<td>flavor formula</td>
<td>279</td>
</tr>
<tr>
<td>Black pepper, flavor formula</td>
<td>279–280</td>
</tr>
<tr>
<td>Blueberry</td>
<td>417</td>
</tr>
<tr>
<td>flavor</td>
<td>176</td>
</tr>
<tr>
<td>flavor formula</td>
<td>280</td>
</tr>
<tr>
<td>Bois de rose</td>
<td>50, 203</td>
</tr>
<tr>
<td>Boletic acid</td>
<td>104</td>
</tr>
<tr>
<td>endo-2-Bornanol</td>
<td>138, 381</td>
</tr>
<tr>
<td>Bornco camphor</td>
<td>381</td>
</tr>
<tr>
<td>Bornole</td>
<td>138, 381</td>
</tr>
<tr>
<td>Bornol acetate</td>
<td>138, 381</td>
</tr>
<tr>
<td>Bornyl acetate</td>
<td>91, 138, 381</td>
</tr>
<tr>
<td>Bornyl acetate pure laevo</td>
<td>381</td>
</tr>
</tbody>
</table>
HANDBOOK OF PERFUMES AND FLAVORS

Bornyl acetic ether, 138, 381
Bornyl alcohol, 138, 381
Boronia (Boronia), 29
B. megastigma, 29
Boswellia carterii, 55
Bouquet, 417
  perfume formula, 227
Bourbonal, 195, 391
Bouvardia (Bouvardia), 417
  B. densiflora, 417
  B. heterophylla, 417
  B. leiantha, 417
  B. longiflora, 417
  B. scabra, 417
  B. tenyioloba, 417
  B. ternifolia, 417
  perfume formula, 227
Branca, 423
Brandy, 188, 417
  color, 219
  flavor formula, 280
Brandy, cherry, flavor formula, 288
Brassica alba, 192
  B. juncea, 192
  B. nigra, 53 192
Brazil nut, flavor, 184
Bread, 417
  flavor formula, 280
Brewing, 189
Briar, sweet, 422
Brier, tree, 29
Bromelia, 407
  perfume formula, 247
Bromo styrol, 91
Broom, 29
Brumelia lycioides, 215
Bruxere, 29
Buchu, leaf, 30
Buckthorn, 215
Bulnesia sarmientii, 46
Bursera delpechiana, 50
Butaldehyde, 92
Butanal, 92
Butanedioic acid, 410
Butanedione, 384
Butanoic acid, 382
Butanoic acid butyl ester, 381
Butanoic acid ethyl ester, 386
Butanoic acid methyl ester, 404
Butanoic acid pentyl ester, 377
trans-Butanedioic acid, 104
Buter, 417
  color, 219
  flavor, 190
  flavor formula, 280–281
Butter nut, 184
Butter, rum, flavor formula, 281
Butterscotch, 417
  color, 219
  flavor formula, 281–282
n-Butyl acetate, 381
n-Butyl aldehyde 92
Butyl benzoate, 91
Butyl butanoate, 381
n-Butyl butyrate, 381
n-Butylcarbinol, 377
4-t-Butyl-3,5-dinitro-2,6-dimethyl acetophenone, 151
6-t-Butyl-3-methyl-2,4-dinitroanisole, 150
Butyl-2,4,6-trinitro-m-xylene, 151
Butyric acid, 92, 382
Butyric acid butyl ester, 381
Butyric acid ethyl ester, 386
Butyric aldehyde, 92
Buxine, 85
Cabreuva, 30
Cacao, 418
  butter, 412
  flavor formula, 282–283
Cade, 30
Cadinene, 92
Caesalpina echinata, 217
Cajeput, 30
Cajeputene, 399
Cajeputol, 383
Cake, 418
  flavor formula, 283
  glace, flavor formula, 305
  pound, flavor formula, 346
Calamus, 31, 418
  perfume formula, 227
Calendula (Calendula), 31
  C. officinalis, 31
Calonycion aculeatum, 166
Calopogon (genus), 167
Calympso (genus), 167
Camellia sinensis, 188, 436
Campeachy, 215
endo-2-Camphanol, 138, 381
Camphoi, 138
Camphor, 31, 418

450
INDEX

borneo, 381
mentha, 402
peppermint, 402
perfusion formula, 227
Canada snakeroot, 26
Cananga (Cananga), 32
  C. odorata, 32, 72, 171, 439
  perfusion formula, 227
Canangium odoratum, 439
Canarium luzonicum, 41
Cane, 411
Cantharellus cinnabarinus, 215
Canthaxanthin, 215
Caper, 418
  flavor formula, 283
Capparis spinosa, 418
Capraldehyde, 82, 382
Caprylic acid, 92
Capric alcohol, 80
Caprylic acid, 82, 382
Capric acid, 93
Caprylaldehyde, 81
Caprylene, 117
Caprylic acid, 93
Caprylic alcohol, 79
Caprylic aldehyde, 81, 206
Caprylyl acetate, 206
Capsicum (Capsicum), 418
  C. annum, 192, 418
  C. frutescens, 192, 418
  C. tetragonum (paprika), 192, 217
  flavor, 192
  flavor formula, 283
  perfusion formula, 228
Caramel, 215, 418
color, 219, 382
  flavor formula, 283
Caraway, 32
  flavor formula, 284
Carbinol, 113
Carbonic acid diethyl ester, 387
Carboxybenzene, 379
Cardamom, 32, 418
  flavor formula, 284
Carica papaya, 183
Carnation, 159, 418
  flavor formula, 284
  perfusion formula, 228
Carob, 435
  flavor formula, 355
  Carrageen, 222
Carrot, 32, 418
  flavor formula, 284
Carthamus tinctorius, 217
Carum carvi, 32
Carvacrol, 93
Carvone, 196
Carya alba, 194
  C. australis, 194
  C. laciniosa, 194
  C. ovata, 194
  C. pecan, 185
Caryophyllene, 93
Caryophylllic acid, 144, 391
Caryophyllus aromaticus, 160, 421, 424
Cascarilla, 33, 419
  flavor formula, 284
Cashew, 419
  flavor, 184
  flavor formula, 285
Cassia (Cinnamomum cassia), 33, 419
Cassia (Cassia), 160
  C. acutifolia, 160
  C. angustifolia, 160
  C. fasciculata, 160
  C. mallindia, 160
  flavor formula, 285
Cassie, 33
Castaneae dentata, 184
  C. pumila, 184
Castor (Castor), 419
  C. fiber, 33
  perfusion formula, 228
Castereum, 33
Catechu (Catechu), 215
  C. gambier, 215
Catnip, 54
Catsup. See Ketchup
Cedar, 419
Cedarleaf, 34
Cedarwood, 34
Cedrela, 419
  perfusion formula, 229
Cedrene, 94
Cedrus atlantica, 419
  C. deodara, 419
Cedryl acetate, 94
Celery, 34
Centauria americana rubra, 419
Centaury, 419

451
Cephalin, 141, 384
Cerastium marasca, 429
Cerastium silvatica, 435
Cerbelaud, R., 9
Cetyl alcohol, 81
Chamaecyparis (genus), 419
Chamomile, 419
German, 35
Roman, 35
Champaca, 35
Champagne, 419
flavor formula, 286
Champol, 381
Chartreuse, 420
flavor formula, 286
Cheese, 190-191, 420
blue, flavor formula, 286-287
color, 219
flavor formula, 287
Roquefort, flavor formula, 287
Cheiranthus cheiri, 71, 170, 438
Chenopodium (Chenopodium), 35
C. ambrosioides, 35
Cherimoya, 420
flavor, 182
flavor formula, 287
Cherry, 420
black, flavor formula, 279, 287
blossom, flavor formula, 288
brandy, flavor formula, 288
color, 219
flavor, 176
flavor formula, 289-293
red (agrio), flavor formula, 291
wild (agrio), flavor formula, 293
Chervil, 420
flavor formula, 293
Chestnut, flavor, 184
Chevrefeuille, 162
Chinese bean oil, 213
Chinese cinnamon, 33
Chionanthus virginicus, 173
Chironium persicum, 431
Chloroform, 383
Chlorophyll, 215
Chocolate, 187, 420
color, 219
flavor formula, 293
hardener, flavor formula, 293
Chondrus crispus, 171, 222
Chrysanthemum, 160
Chypre, flavor formula, 293
Cicely, 420
Cincholepide, 149
Cinchona (Cinchona), 420
C. officinalis, 420
Cinene, 399
Cineol, 383
Cineole, 383
Cinnamal, 140
Cinnamaldehyde, 140, 383
Cinnamal, 389
Cinnamene, 89, 136
Cinnamene, 126
Cinnamic acid, 94, 139
trans-Cinnamic acid benzyl ester, 136
Cinnamic acid cinnamyl ester, 95
Cinnamic alcohol, 139
Cinnamic aldehyde, 94, 140, 196, 383
Cinnamic methyl ketone, 137
Cinnamol, 126
Cinnamomum camphora, 31, 418
C. cassia, 33, 419
C. ceylanicum, 36
C. laureifolia, 420
C. zeylanicum, 420
Cinnamon, 420
flavor formula, 294
bark, 36
leaf, 36
Cinnamyl acetate, 95
Cinnamyl alcohol, 139
Cinnamyl alcohol, 139, 196
Cinnamyl aldehyde, 140, 383
Cinnamyl benzoate, 95
Cinnamyl butyrate, 196
Cinnamyl cinnamate, 95
Cinnamyl formate, 95
Cinnamyl propionate, 196
Cinnamylic ether, 387
Cinnamon, 139
C. ladaniferus, 36
Citral, 96, 140, 196, 383
Citrine acid, 96
Citronella, 37, 420
perfume formula, 229
Citronellal, 96, 141, 384
Citronellal hydrate, 146, 394
Citronellol, 141, 197, 384
l-Citronellol, 410
Citronellyl acetate, 96

452
INDEX

Citronellyl butyrate, 97
Citronellyl formate, 97
Citronellyl propionate, 97
Citronellyl valerianate, 97
Citrus (Citrus), 420
  C. aurantifolia, 49, 178, 428
  C. aurantium, 179, 431
  C. aurantium amara, 167
  C. aurantium var. amara, 56, 57, 61, 167
  C. aurantium var. bergamia, 28
  C. aurantium var. bigaradia, 54
  C. aurantium var. dulcis, 57
  C. aurantium var. reticulata, 39
  C. bergamia, 159, 416
  C. bigaradia, 431
  C. decumana, 46, 178, 425
  C. deliciosa, 436
  C. grandis, 425
  C. kungwai, 428
  C. limon, 427
  C. limonia, 178
  C. limonia, L. medica, 427
  C. limonum, 49
  C. madurensis, 428
  C. maxima, 178, 425
  C. nobilis, 51, 179, 428, 436
  C. paradisi, 178, 425
  C. reticulata, 428, 436
  C. sinensis, 167, 179, 431
  fruits, flavor formula, 294
  odors, 157
  trees, 157–158
Civet, 37
Civetitis civetta, 37
Cladastis lutea, 218
Clary sage, 37
Clove, 160, 421, 424
  bud, 37
  flavor formula, 294, 305
  leaf, 38
Clover, 160, 437
  perfume formula, 259
Coaen oil, 140
Cobnut, 185
Coca, 421
  flavor formula, 294
Cochineal, 216
Cocoa, 187, 421
  butter, 412
  flavor formula, 294
  Coconut, 421
    flavor, 183
    perfume formula, 229
  Coconut aldehyde, 84, 152, 376
  Cocos nucifera, 183, 421
  Coffea arabica, 187, 421
  Coffee, 421
    color, 219
    flavor, 187
    flavor formula, 294–295
  Cognac, 421
    flavor, 188
    flavor formula, 280, 295–297
    oil, 199
    oil synthetic, 389
  Cola (Cola), 421
    C. acuminata, 188, 421
    flavor formula, 297
  Colchicum (genus), 192
  Cologne, 421
    eau de, 2
    perfume formula, 229
  Colorants, 214–220
  Color base, perfume formula, 229–230
  Commiphora erythraea, 56
    C. katof, 431
    C. myrrha, 53
  Conifers, 167
  Convallaria majalis, 164, 428
    C. montana, 164, 428
  Copaiba balsam, 38
  Copalifer officinalis, 38
  Copra, 183
  Cordial, 190
  Coriander, 38, 421
    flavor formula, 297
  Coriandrum sativum, 38, 421
  Corn oil, 210
  Corylus (genus), 185
    C. americana, 425
    C. avellana, 425
    C. cornuta, 425
  Cosmetics industry, 3
    products, 3
  Costus, 38
  Cottonseed oil, 210
  cis-o-Coumarianic acid lactone, 142
  Coumarin, 97, 142, 197
  Coumarin acid, 98
  Coumarinic anhydride, 97, 142
  Cover odor, perfume formula, 230

453
Cranberry, 422
  flavor, 177
  flavor formula, 298
_Crataegus crus-galli_, 162, 416
  C. mollis, 162, 416
  C. monogyna, 416
  C. oxyacantha, 162, 416
Cravo, 39
Cream nut, 184
Cream paste, flavor formula, 298
p-Cresyl acetate, 98, 142
p-Cresylic acetate, 142
p-Cresylic acetic acid ester, 142
p-Cresyl methyl ether, 143
p-Cresyl phenyl acetate, 98
_Crocus (Crocus)_,
  C. sativus, 63, 217, 434
  C. susianus, 192
Croker and Henderson, 9
_Croton eleuteria_, 33, 419
Crystal beverages, flavor formula, 298
Cubeb, 39
Cucumber, 422
  flavor, 192
  flavor formula, 298
_Cucumis melo_, 429
  C. sativus, 192, 422
Cud bear, 216
Culinary, 422
  extracts, flavor formula, 298–299
Cumarin, 97
Cumic aldehyde, 197
Cumin, 39
Cuminc aldehyde, 98
_Cuminum cyminum_, 39
_Cupressus sempervirens_, 40
Curaçao, 422
  flavor formula, 299–300
Curcuma (Curcuma), 39, 216
  C. longa, 39, 192, 216, 218
Currant, 422
  color, 219
  flavor formula, 300–302
black, flavor, 176
black, flavor formula, 279
red, flavor, 181
_Cyanopsis tetragonoloba_, 222
Cyclamal, 143
Cyclamen (Cyclamen), 161, 422
  C. africanum, 422
  C. europaeum, 422
  C. neapolitan, 422
  C. persicum, 422
  perfume formula, 230
Cyclamen aldehyde, 143
α or β-Cyclocitrilyldenacetone, 147, 395
Cyclocitrilene methyl ethyl ketone, 405
Cyclohexane, 210
Cydonia oblonga, 181, 434
Cymbopogon (genus), 420
  C. citratus, 49
  C. martini, 45, 58
  C. nardus, 37
Cymene, 99
Cymol, 99
Cypress, 40
_Cypripedium (genus)_ , 167
Dactylotis coccos, 216
Daffodil, 167, 430
  perfume formula, 239
Damson plum, 429
Date, 422
  flavor, 177
  flavor formula, 302
_Daucus carota_, 32, 418
  D. sativa, 418
Davana, 40
Decanal, 82
n-Decanal, 198, 382
Decanedioic acid diethyl ester, 391
Decanoic acid ethyl ester, 386
1-Decanol, 80, 197
Decyl acetate, 77, 197
Decyl acetate, 375
n-Decyl alcohol, 80, 197
n-Decyl aldehyde, 82, 198, 382
Deodorant, perfume formula, 231
Devil’s dung, 415–416
Dicetonic ester, 100, 385
Diacetyl, 384
  perfume formula, 231
Diallly sulfide, 84, 376
_Dianthus caryophyllus_, 159, 418
Diethyl carbonate, 387
Diethyl malonate, 389
Diethyl phthalate, 211
Diethyl sebacate, 391
2,3-Dihydroxybutanedioic acid, 411
1,2-Dihydroxypropane methylethylene glycol, 213
Dihydroxyisuccinic acid, 411
INDEX

Dihydrocitronellol, 99
Diketobutane, 2,3-, 384
Dill, 40
Dimethoxy-4-propenylbenzene, 1,2-, 405
Dimethyl benzyl carbinyl acetate, 99
Dimethyl carbinol, 212
Dimethyl diketone, 384
Dimethylethyl carbinol, 377
Dimethyl glyoxal, 384
3,7-Dimethyl-7-hydroxyoctanal, 146, 394
Dimethyl ketone, 209
3,7-Dimethyl-2,6-octadienal, 140, 383
cis and trans-3,7-Dimethyl-2,6-octadiene-1-al, 140
2,6-Dimethyl-2,6-octadien-8-ol, 145, 152, 391, 407
2,6-Dimethyl-2,7-octadien-6-ol, 147, 399
3,7-Dimethyl-1,6-octadien-3-ol, 147, 399
cis-3,7-Dimethyl-2,6-octadien-1-ol, 152, 407
trans-3,7-Dimethyl-2,6-octadien-1-ol, 145
(E)-3,7-Dimethyl-2,6-octadien-1-ol, 391
trans-3,7-Dimethyl-2,6-octadien-1-ol, 391
3,7-Dimethyl-1,6-octadien-3-yl acetate, 110, 148, 400
cis-3,7-Dimethyl-2,6-octadien-1-yl acetate, 117
trans-3,7-Dimethyl-2,6-octadienyl acetate, 104, 392
3,7-Dimethyl-1,6-octadien-3-yl benzoate, 400
trans-3,7-Dimethyl-2,6-octadienyl benzoate, 392
3,7-Dimethyl-1,6-octadien-3-yl butyrate, 110, 400
trans-3,7-Dimethyl-2,6-octadienyl butyrate, 105, 392
3,7-Dimethyl-1,6-octadien-3-yl formate, 111, 400
trans-3,7-Dimethyl-2,6-octadienyl formate, 393
trans-3,7-Dimethyl-2,6-octadienyl phenyl acetate, 105, 393
3,7-Dimethyl-1,6-octadien-3-yl propionate, 111, 401
trans-3,7-Dimethyl-2,6-octadienyl propionate, 105, 393
Dimethyl octanol, 99
3,7-Dimethyl-1-octanol, 99
3,7-Dimethyl-6-octenal, 141
3,7-Dimethyl-6-octen-1-al, 141, 384
3,7-Dimethylec-6 (or 7)-enal, 141, 384
2,6-Dimethyl-2-octen-8-ol, 384
3,7-Dimethyl-6 (or 7)-octen-1-ol, 141
3,7-Dimethyl-6-octen-1-ol, 384
3,7-Dimethyl-7-octen-1-ol, 410
3,7-Dimethyl-6-octen-1-yl acetate, 96, 124
3,7-Dimethyl-6-octen-1-yl butyrate, 97
3,7-Dimethyl-6-octen-1-yl formate, 97, 124
3,7-Dimethyl-6-octenyl propionate, 97
2,6-Dimethyl-2-octen-8-ol, 141
α,α-Dimethylphenylacet acid, 99
1,1-Dimethyl-2-phenyl acetate, 99
Dimethyl phenyl carbinyl acetate, 99
Dimethylpropyl alcohol, 1-, 377
2,6-Dinitro-3,5-dimethyl-4-aceto-t-butylbenzene, 151
3,5-Dinitro-2,6-dimethyl-4-t-butyl acetophenone, 151
2,6-Dinitro-3-methoxy-4-t-butyltoluene, 150
2,4-Dinitro-3-methyl-6-t-butylanisole, 150
Dinitro-pseudo-butyl xylol ketone, 151
Dioxymethylene protocatechuic aldehyde, 145, 394
Diphenyl ether, 100, 144
Diphenyl ketone, 143
Diphenyl methane, 143
Diphenyl oxide, 100, 144
Dipterocarpus turbinatus, 46
Dipteryx odorata, 69
Disinfectant, bergammonia, 226
Dittany, 422
Dodecanal, 82, 399
1-Dodecanol, 80
Dodecyl acetate, 78, 375
Dodecyl alcohol, 80
Dodecyl aldehyde, 198, 399
n-Dodecyl aldehyde, 82
n-Dodecylaldehyde, 399
Dracarylic acid, 379
Dryobalanops camphor, 381
Dwarf pine, 40
Dyes, 192
natural, 230

Eau de Cologne, history, 2
perfume formula, 231
Eau de verveine, 170
Eau d'oro (golden water), 164
Egg, color, 219
Eglantine, 108, 422
perfume formula, 232
Elaea (genus), 167
Elder, 422
Elderberry, color, 219
Elecampane, 422
Elemi, 41
Elettaria cardamomum, 32, 418
Enantochrom acid, 106
Enzactin, 212
Epoxy linalyl acetate, 100
Erica arborea, 29
Erigeron (Erigeron), 44
E. canadensis, 44
Erysimum (genus), 438
Erythrosine, 216
Erythroxylum coca, 421
Essence of niobe, 113, 404
Essential oils, 17
analysis, 19
antiseptic value, 16
characteristics, 18
constituents, 20–23
constituents, acid, 21–22
constituents, acid anhydrides, 22
constituents, alcohol, 21
constituents, aldehyde, 22
constituents, ester, 21
constituents, hydrocarbon, 20
constituents, ketone, 22
constituents, nitrogenous, 23
constituents, phenol, 23
constituents, phenol esters, 23
derivation, 17–18
description format, 23
extraction, 18–19
nonoxygennated, 20
oxygenated, 20
uses, 15
Esters, 21, 75
in flavoring, 174
neutral base for flavors, 264
general base, perfume formula, 232
Estragon, 41
Ethanal, 77, 374
Ethanol, 100, 211, 385
Ethers, 76
Ethovan, 391
3-Ethoxy-4-hydroxybenzaldehyde, 391
2-Ethoxynaphthalene, 407
Ethyl acetate, 198, 211, 385
Ethylacetic acid, 382
Ethyl acetacetate, 100, 198, 385
Ethyl alcohol, 100, 211, 385
Ethyl aldehyde, 77, 374
Ethyl o-aminobenzoate, 101, 386
Ethyl anisate, 101
Ethyl anthranilate, 101, 386
Ethyl benzoate, 101, 198, 386
Ethyl butanoate, 386
Ethyl butyrate, 198, 386
Ethyl caprate, 386
Ethyl caproate, 101, 387
Ethyl caprylate, 387
Ethyl carbonate, 387
Ethyl cinnamate, 102, 387
Ethyl decanoate, 386
Ethyl enanthate, 389
Ethylene carboxylic acid, 410
Ethylenesuccinic acid, 410
Ethyl α, β-epoxy-β-methylhydrocinnamate, 84, 376
Ethyl formate, 102, 388
Ethyl formic acid, 122
Ethyl formic ester, 388
Ethyl heptanoate, 199, 389
Ethyl n-hexanoate, 389
Ethyl hexanoate, 101, 387
Ethyl hexoxate, 101, 387
Ethyl hexyl carbinyl acetate, 102
Ethyl hydrate, 385
Ethyl hydroxybenzoate, 390
Ethyl o-hydroxybenzoate, 103
Ethyl isobutyrate, 388
Ethyl isovalerate, 200, 388
Ethyl linalyl acetate, 102
Ethyl malonate, 199, 389
Ethyl p-methoxybenzoate, 101
Ethyl 2-methyl butyrate, 388
Ethyl methyl phenyl glucidate, 84, 205, 376
Ethyl-p-methyl β-phenyl glycidate, 84
Ethyl myristate, 199, 389
Ethyl 2-naphthyl ether, 407
Ethyl nitrate, 389
Ethyl nonate, 390
Ethyl nonylate, 199
Ethyl octanoate, 387
Ethyl octoate, 387
Ethyl octylate, 387
Ethyl oenanthate, 199, 389
Ethyl 3-oxobutanate, 385
Ethyl pelargonate, 199, 390
Ethyl phenyl acetate, 102, 390
Ethyl phenyl acrylate, 102, 387
Ethyl phenyl glycidate, 390
Ethyl β-phenyl glycidate, 390
Ethyl phthalate, 211
Ethyl propionate, 199
INDEX

Ethyl protal, 391
Ethyl protocatechuic aldehyde, 391
Ethyl salicylate, 103, 390
Ethyl sebacate, 200, 391
Ethyl tetradecanoate, 199, 389
Ethyl valerate, 200, 388
Ethyl valeriate, 388
Ethyl vanillin, 174, 195, 391
Ethyl α-toluate, 102, 153, 390
Eucalyptol, 383
Eucalyptus (Eucalyptus), 41–42
E. citriodora, 41
E. dives, 41
E. globulus, 42
E. staigeriana, 42
Eugenia aromatica, 421
E. caryophyllata, 37, 38, 160, 421, 424
Eugenic acid, 103, 144, 391
Eugenol, 103, 144, 200, 391
Eugenol acetate, 103
Eugenyl acetate, 103
Eugenyl methyl ether, 114
Eversnia furfuracea, 69, 166
E. prunastri, 55, 166
Extract
fruit, flavor formula, 304
vegetable, flavor formula, 303

Fatty odors, 158
oils, 18
Fenchene, 104
Fennel, bitter, wild, 42
sweet, 42
Fenugreek, 43, 423
perfume formula, 232
Fermented drinks, 189
Fern, 161, 423
perfume formula, 232
Fernet (branca), 423
flavor formula, 303
Ferula foetida, 415–416
F. narthex, 27
F. rubicaulis, 415–416
Ficus carica, 177, 423
Fig, 423
flavor, 177
flavor formula, 303
Filbert, 185
Fir needle, 43
Siberian, 43
silver, 65
Fish odor, flavor formula, 303
Fixative, for perfume, 173
perfume formula, 226
Fixed oils, 18, 374
Flag lily, 426
Flavors
alcoholic beverages, 188–190
almond bitter, 184
apple, 175
apricot, 175
avocado, 182
banana, 182
barberry, 175
beer, 189
bilberry, 176
bitter, 190
blackberry, 176
black currant, 176
blueberry, 176
brazil nut, 184
butter, 190
capsicum, 192
cashew nut, 184
cheese, 190
cherimoya, 182
cherry, 176
chestnut, 184
cocoa-chocolate, 187
coconut, 183
coffee, 187
cognac, 188
cranberry, 177
cucumber, 192
culinary, 192–194
daily beverages, 187–188
dairy products, 190–191
date, 177
dry fruit, 184–185
extraction, of fruits, 263
fermented drinks, 189
fig, 177
fortified beverages, 189
fresh fruit, 175–182
fruity, 175
garlic, 192
gooseberry, 177
grape, 177
grapefruit, 178
guava, 183
hazelnut, 185
hickory smoke, 194
honey, 186
hop, 178
huckleberry, 178
kola, 188
lemon, 178
licorice, 186
light or still, 189
lime, 178
loganberry, 179
macadamia, 185
mandarin, 179
mango, 183
maple, 186
melon, 179
milk, 191
mulberry, 179
mustard, 192
onion, 193
orange, 179
papaya, 183
paprika, 192
peach, 180
peanut, 185
pear, 180
pecan, 185
pineapple, 183
pistachio, 185
plum (prunes), 180
pomegranate, 181
powdered, formula, 346
quince, 181
raspberry, 181
red currant, 181
rum, 188
safron, 192
smoke, 193–194
sparkling wines, 189
strawberry, 182
sweet, 186–187
tarragon, 192
tea, 188
tomato, 193
tropical fruit, 182–184
turmeric, 192
vanilla beans, 187
vermouth, 189
walnut, 185
whiskey, 189
woodruff, 187
yogurt, 191
Fleabane, 44
Fleur de lis (flower of the lily), 163
Floral, families of odors, 9–10
  fragrance, perfume formula, 232
Fiove, 44
Flower of flowers, 72
Flower scents, 13, 159–171
Flowery odors, 158
Foeniculum vulgara, 42
Foin coupé, 160, 430
  perfume formula, 248
Folione, 405
Fondant, flavor formula, 303
Food of the Gods, 415–416
Formic acid, 104
Formic acid benzyl ester, 380
Formic acid phenylnitro ester, 380
Forsyth, William, 172
Forsythia (Forsythia), 172
  F. intermedia, 172
  F. spectabilis, 172
  F. suspensa, 172
  F. viridissima, 172
Fortified beverages, 189
Fougère, 161, 423
  perfume, 161
  perfume formula, 232–233
Fourcroy, A.F., 4
Fragaria chiloensis, 435
  F. virginiana, 182, 435
Fragarol, 205
Frangipanni, 161, 423
  perfume formula, 233
Frankincense, 55
Freesia refracta, 163
Freshener perfume, formula, 233
Fringe tree, 173
Fruit
  citrus, flavor formula, 294
  extract, flavor formula, 304
  flavor extraction, 263
  fresh, flavors, 175
  soda, flavor formula, 304
Fruity flavors, 175
Fumaric acid, 104
Fungi, 423
  flavor formula, 304
Gage, green, 425
  flavor formula, 309
Gage, William, 425
Galangal, 423
INDEX

Galbanum, 44
_Galipea officinalis_, 25, 415
Garden, Alexander, 162
Gardenia (Gardenia), 44, 162, 424
  _G. grandiflora_, 44
  _G. jasminoides_, 424
    perfume formula, 234
Garlic, 44, 424
  flavor, 192
  flavor formula, 304
  oil, 376
Gattefossé, R.M., 9–10, 15
Gaultheria oil, 150, 406
_Gaultheria procumbens_, 71, 171, 438
Gaylussacia baccata, 178, 216, 426
_Gelidium cornum_, 221
Gentian, 424
_Gentiana crinita_, 424
Geraniol, 96, 140, 383
Geranialdehyde, 140, 383
Geraniol, 104, 145, 200, 391
Geraniol acetate, 104, 392
Geraniol butyrate, 105, 392
Geraniol formate, 393
Geraniol propionate, 105, 393
Geranium, 45, 162, 424
  crystals, 144
    perfume formula, 234
Geranyl acetate, 104, 200, 392
Geranyl benzoate, 392
Geranyl butyrate, 105, 392
Geranyl n-butyrato, 200
Geranyl caproate, 105
Geranyl formate, 393
Geranyl phenyl acetate, 105, 393
Geranyl propionate, 105, 393
German chamomile, 35
Germander, 424
_Gigartina speciosa_, 221
Gin, 190, 424
  flavor formula, 304
Ginger, 45, 424
  flavor formula, 304–305
Gingergrass, 45
  flavor formula, 305
  perfume formula, 234
Giroflié, 424
  flavor formula, 305
  perfume formula, 234
Glacé, 424
  cake mix, flavor formula, 305
Glacial acetic acid, 78
Glucose, 411
Glycerin, 212, 393
Glycerinum, 393
Glycerol, 212, 393
Glycerol alcohol, 393
Glyceryl tracetate, 212
Glycyl alcohol, 212
_Glycyrrhiza glabra_, 186, 427
  _G. lipidata_, 186, 427
Golden bell, 172
Goldenlack, 170
Gold water, perfume formula, 235
Gooseberry, 425
  flavor, 177
  flavor formula, 306–307
_Gossypium herbaceum_, 210
_Gracilariia lichenoides_, 221
Grain alcohol, 100, 211, 385
Grape, 425
  color, 219
  flavor, 177
    flavor formula, 307–309
Grapefruit, 46, 425
  flavor, 178
Grassy odors, 158
Green-floral odors, 158
Green gage, 425
  flavor formula, 309
Grenadine. See Pomegranate
Guaiacwood, 46
Guanine, 216
Guar gum, 222
Guava, 425
  flavor, 183
    flavor formula, 309
Gum, 221
  arabic, 221
  dragon, 224
  guar, 222
  karaya, 222
  locust bean, 222
  tragacanth, 224
Gurjun balsam, 46
_Habernaria_ (genus), 167
_Haematoxylon campechianum_, 215
Halogenated compounds, 74, 76
Halo sea salt odor, perfume formula, 234
Ham glaze, flavor formula, 310
Harsh-pungent, odors, 158
Hawthorn, 162, 416
flavor formula, 273
perfume formula, 235
Hazelnut, 425, 430
flavor, 185
flavor formula, 310
Heather shrub, 29
Heath, white, 29
_Hedeoma pulegioides_, 59
_Helichrysum (Helichrysum), 46
_H. angustifolium, 46
Heliotrope, 162, 425
perfume formula, 235
Heliotropin, 106, 145, 201, 394
_Heliotropium arborescense, 162, 425
Hemlock, 66
Hendecanal, 82
Hendecenal, 82
Henning, H., 8
n-Heptaldehyde, 81
Heptane, 106
n-Heptanoic acid, 106
Heptanoic acid ethyl ester, 389
Heptanol, 81
1-Heptanol, 79
n-Heptioic acid, 106
Heptyl alcohol, 79
γ-n-Heptylbutyro lactone, 155, 376
Heptylic aldehyde, 201
Heptyne carboxylic acid methyl ester, 149, 405
Herbal base, perfume formula, 235
cream, flavor formula, 310
Herb-like odors, 158
Hexahydrobenzene, 210
Hexahydrothymol, 402
Hexamethylene, 210
Hexanaphthene, 210
n-Hexane, 212
Hexanoic acid, 93
Hexanoic acid ethyl ester, 101, 387
1-Hexanol, 394
Hexoic acid, 93
Hexyl acetate, 394
Hexyl alcohol, 394
Hickory smoke flavor, 192
Hip, perfume formula, 235–236
rose, 425
History of odor, 1–2, 4–11
of perfume, early, 2
Honey, 426
color, 219
flavor, 186
flavor formula, 310–312
perfume formula, 236
Honeysuckle, 162, 426
perfume formula, 236
Hop, 46, 426
flavor, 178
flavor formula, 312
Horsemint, 52
Huckleberry, 216, 426
flavor, 178
flavor formula, 312–313
_Humulus lupulus, 46, 178, 426
H. lupulus americanus, 178, 426
H. scandens, 178, 426
Hyacinth, 47, 163, 426
perfume formula, 236
Hyacinthin, 118, 152
_Hyacinthus orientalis, 47, 163, 426
Hydrangin, 129
endo-2-Hydrocamphane, 381
Hydrocarbons, 20, 75
Hydrocinnamic aldehyde, 201
Hydrocinnamyl acetate, 121
Hydrocinnamyl formate, 122
Hydrocyanic acid, 184
Hydrogen oxide, 213
Hydroprussic acid, 184
2-Hydroxybenzoic acid methyl ester, 150, 406
2-Hydroxybenzoic acid phenyl methyl ester, 137
Hydroxybutatenedioic acid, 401
deo 2-Hydroxy-camphane, 138
Hydroxycitronellal, 146, 201, 394
Hydroxycoumarin, 129
7-Hydroxy-3,7-dimethyloctan-1-al, 146, 394
β-Hydroxyethyl benzene, 154, 408
1-Hydroxyhexane, 394
3-Hydroxymethane, 402
3-Hydroxymethene, 402
4-Hydroxy-3-methoxybenzaldehyde, 156, 412
1-Hydroxy-2-methoxy-4-propenyl benzene, 398
4-Hydroxy-3-methoxy-1-propenyl benzene, 398
3-Hydroxy-2-methyl-4-H-pyran-4-one, 402
3-Hydroxy-2-methyl-4-pyrones, 402
3-Hydroxy-2-methyl-γ-pyrone, 402
4-Hydroxynonanoic acid, 376
4-Hydroxynonanoic acid lactone, 152
γ-Hydroxyoctanoic acid lactone, 407
Hydroxysuccinic acid, 401
α-Hydroxytoluene, 135, 380

460
INDEX

4-Hydroxyundecanoic acid lactone, 83, 155, 376

Hypnose, 132
Hyssop, 47, 426
Hyssopus officinalis, 47, 426

Ilex paraguariensis, 51
Illicium verum, 26, 435
Indian tragacanth, 222
Indigofera indigo, 216
Indigotin, 216
Indole, 106, 146
Inula helena, 422
Ionone, 107, 147, 201, 395
perfume formula, 236
β-Ionone, 147
Ipomea batatas, 433
Ipomoeae purpurea, 166
Iris (Iris), 163, 426
I. florentina, 431
I. kaempferi, 163, 426
I. pseudacorus, 163, 426
I. pumila, 163, 426
I. sibirica, 163, 426
I. spuria, 163, 426
I. versicolor, 163, 426
perfume formula, 236
Irish moss, 171, 222
Irione, 147, 395
Irone, 202, 405
Isocapryl acetate, 107, 202, 395
Isocapryl alcohol, 395
Isocapryl benzoate, 85
Isocapryl butyrate, 202, 396
Isocapryl n-butyrate, 377
Isocapryl butyric ester, 377
Isocapryl formate, 378, 396
Isocapryl-o-hydroxybenzoate, 133
Isocapryl isovalerate, 378
Isocapryl phenylacetate, 86
Isocapryl propionate, 86, 396
Isocapryl salicylate, 107, 133, 396
Isocapryl valerate, 202, 378
Isocapryl valerianate, 378
Isobutyric acid, 108, 202, 397
Isobutyraldehyde, 108
Isobutyl benzoate, 108
Isobutyl butyrate, 202
Isobutyl n-butyrate, 397
Isobutyl carbinol, 395
Isobutyl cinnamate, 108
Isobutyl formate, 397
Isobutyl o-hydroxybenzoate, 109, 398
Isobutyl isobutyrate, 397
Isobutyl isovalerate, 397
Isobutyl phenyl acetate, 108, 398
Isobutyl propionate, 398
Isobutyl quinoline, 109
α-Isobutyl quinoline, 109
Isobutyl salicylate, 109, 398
Isobutyl α-toluate, 108, 398
Isobutyl valerate, 397
Isoeugeneol, 86, 378
Isoeugenol, 203, 398
Isoeugenol methyl ether, 405
Isopentyl benzoate, 85
Isopentyl formate, 378
Isopentyl phenylacetate, 86
Isopentyl propionate, 86
Isopentyl salicylate, 133
Isopropanol, 212
Isopropyl alcohol, 212
Isopropyl anthranilate, 109
Isopropyl-4-methylcyclohexan-2-ol, 402
4-Isopropyl-1-methylcyclohexan-3-one, 402
1-Isopropyl-4-methylcyclohex-2-ylacetate, 403
p-Isopropyl-α-methylhydrocinnamic aldehyde, 143
p-Isopropyl-α-methyl phenylpropyl aldehyde, 143
Isopropyltoluene, 99

Jacinthe, 163
Jasmine, 47, 163, 427
aldehyde, 85, 133
perfume formula, 237–238
Jasminoides (genus), 162
Jasminum officinale, 47, 163, 427
J. grandiiflorum, 163, 427
Jonquil (daffodil), 164, 427
perfume formula, 239
Juglans californica, 438
J. cinerea, 185, 438
J. hindsii, 185, 438
J. nigra, 185, 438
J. regia, 185, 438
Juice, flavor formula, 313
Juleps, color, 219
Juniper berry, 48
wood, 30
Juniperus (genus), 419
J. communis, 48
J. oxycedrus, 30
HANDBOOK OF PERFUMES AND FLAVORS

*J. sabina*, 65
*J. virginiana*, 34

Karaya gum, 222
Kautschin, 399
Kenneth, J.H., 14
Kernel, 427. See also Nuts
Ketchup, 193, 419
color, 219
flavor formula, 313
Ketones, 22, 76
β-Ketopropane, 209
Kino, 217
Kola, flavor, 188
nut, 421
Kummel, flavor formula, 314

Labdanol, 108
Labdanum, 36
Lactic acid, 109
Lactone, 76
γ-Lactone, 152, 155
Larixin acid, 402
*Lathyrus latifolius*, 168
*L. odoratus*, 168, 436
Lauraldehyde, 82, 399
Laurel, 48
Lauric acid, 110
Lauric aldehyde, 82, 198, 399
Laurine, 146, 394
*Laurus nobilis*, 48
Lauryl acetate, 78, 375
Lauryl alcohol, 80
Lauryl aldehyde, 198, 399
Lavandin, 48
*Lavandula latifolia*, 427
*L. officinalis*, 48, 164, 427
*L. spica*, 66, 427
*L. vera*, 48, 164, 427
Lavender, 48, 164, 427
flavor formula, 314
perfume formula, 239–241
spike, 66
Lazurite, 218
Leaf-green, odors, 158
Leather, perfume formula, 241
*Leccano raceal roccellacea*, 216
Lees, 308, 412
Lemon, 49, 427
color, 219
flavor, 178
flavor formula, 314–316
Lemongrass, 49
Lemonol, 145, 391
Lepidine, 149
*Levisicum officinalis*, 50
Lichenic acid, 104
Licorice, 427
color, 219
flavor, 186
flavor formula, 316
Lilac, 164, 427
perfume formula, 241–243
Lilacin, 411
*Lilium* (genus), 427
Lily, 427
perfume formula, 243
Lily of the valley, 164, 428
perfume formula, 244
Lime, 49, 428
color, 219
flavor, 178
flavor formula, 316–317
tree, 165
Limonene, 399
Linaloe wood, 50
Linalol, 147, 399
Linalool, 110, 147, 203, 399
Linalool oxide acetate, 100
Linalyl acetate, 110, 148, 203, 400
Linalyl benzoate, 400
Linalyl butyrate, 110, 203, 400
Linalyl cinnamate, 111
Linalyl formate, 111, 400
Linalyl isobutyrate, 400
Linalyl propionate, 111, 401
Linalyl valerianate, 111
Linden, 165
Linnaeus, 4
*Lippia citriodora*, 70, 170
*L. triphylla*, 70
Liqueur, 188, 353
Liquidambar orientalis, 67
Liquor, 188
*Lüsea cubeba*, 50
Locust bean gum, 222
Loganberry, flavor, 179
*Lonicera* (genus), 163
*L. bertholeii*, 169
*L. caprifolium*, 426
*L. fragrantissima*, 426
*L. peryctyymenum*, 426

462
<table>
<thead>
<tr>
<th>INDEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. sempervirens, 426</td>
</tr>
<tr>
<td>L. tatarica, 426</td>
</tr>
<tr>
<td>L. uliginosus, 169</td>
</tr>
<tr>
<td>Lotus corniculatus, 169</td>
</tr>
<tr>
<td>Lovage, 50</td>
</tr>
<tr>
<td>Lycopersicum esculentum, 193</td>
</tr>
<tr>
<td>Macadamia (Macadamia)</td>
</tr>
<tr>
<td>M. ternifolia, 185</td>
</tr>
<tr>
<td>flavor, 185</td>
</tr>
<tr>
<td>Mace, 50</td>
</tr>
<tr>
<td>Macrocystis pyrifera, 171</td>
</tr>
<tr>
<td>Magnesium carbonate, 401</td>
</tr>
<tr>
<td>Magnolia (Magnolia), 165, 428</td>
</tr>
<tr>
<td>M. acuminata, 165, 428</td>
</tr>
<tr>
<td>M. grandiflora, 165, 428</td>
</tr>
<tr>
<td>M. macrophylla, 165, 428</td>
</tr>
<tr>
<td>M. tripetala, 165, 428</td>
</tr>
<tr>
<td>M. virginiana, 165, 428</td>
</tr>
<tr>
<td>perfume formula, 243</td>
</tr>
<tr>
<td>Maize oil, 210</td>
</tr>
<tr>
<td>Malayan camphor, 381</td>
</tr>
<tr>
<td>Malic acid, 111, 401</td>
</tr>
<tr>
<td>Mallow flowers, 217</td>
</tr>
<tr>
<td>Mallow hibiscus, 24</td>
</tr>
<tr>
<td>Malonic acid, 401</td>
</tr>
<tr>
<td>Malonic ester, 389</td>
</tr>
<tr>
<td>Malt, 428</td>
</tr>
<tr>
<td>flavor formula, 317–318</td>
</tr>
<tr>
<td>Maltol, 402</td>
</tr>
<tr>
<td>Maltose, 428</td>
</tr>
<tr>
<td>Malus (genus)</td>
</tr>
<tr>
<td>M. baccata, 175, 415</td>
</tr>
<tr>
<td>M. pumila, 175, 415</td>
</tr>
<tr>
<td>M. sylvestris, 175, 415</td>
</tr>
<tr>
<td>Malva silvestris, 217</td>
</tr>
<tr>
<td>Mandarin, 51, 428</td>
</tr>
<tr>
<td>flavor, 179</td>
</tr>
<tr>
<td>flavor formula, 318–319</td>
</tr>
<tr>
<td>Mangifera indica, 183, 428</td>
</tr>
<tr>
<td>Mango, 428</td>
</tr>
<tr>
<td>flavor, 183</td>
</tr>
<tr>
<td>flavor formula, 319</td>
</tr>
<tr>
<td>Maple, 428</td>
</tr>
<tr>
<td>color, 219</td>
</tr>
<tr>
<td>flavor, 186</td>
</tr>
<tr>
<td>flavor formula, 319</td>
</tr>
<tr>
<td>Marasca, 429</td>
</tr>
<tr>
<td>Maraschino, 429</td>
</tr>
<tr>
<td>flavor formula, 320</td>
</tr>
<tr>
<td>Marine scents, 171</td>
</tr>
<tr>
<td>Marjoram, 51, 429</td>
</tr>
<tr>
<td>Marjorana hortensis, 429</td>
</tr>
<tr>
<td>Marshmallow, flavor formula, 320</td>
</tr>
<tr>
<td>Masking agents, perfume formula, 231</td>
</tr>
<tr>
<td>Mate, 51</td>
</tr>
<tr>
<td>Matricaria chamomile, 35, 419</td>
</tr>
<tr>
<td>Maydol, 210</td>
</tr>
<tr>
<td>Mayflower, 164</td>
</tr>
<tr>
<td>Mayonnaise, 429</td>
</tr>
<tr>
<td>color, 219</td>
</tr>
<tr>
<td>flavor formula, 320–321</td>
</tr>
<tr>
<td>Mazola oil, 210</td>
</tr>
<tr>
<td>Meat, flavor formula, 321</td>
</tr>
<tr>
<td>Medicine, uses in, 15–16</td>
</tr>
<tr>
<td>Melaleuca leucadendron, 30</td>
</tr>
<tr>
<td>M. viridiflora, 54</td>
</tr>
<tr>
<td>Melilotus alba, 160</td>
</tr>
<tr>
<td>M. indica, 160</td>
</tr>
<tr>
<td>M. officinalis, 160</td>
</tr>
<tr>
<td>Melissa (Melissa), 27</td>
</tr>
<tr>
<td>M. officinalis, 27, 416</td>
</tr>
<tr>
<td>Melon, 429</td>
</tr>
<tr>
<td>flavor, 179</td>
</tr>
<tr>
<td>flavor formula, 321–322</td>
</tr>
<tr>
<td>Mentha (Mentha), 429</td>
</tr>
<tr>
<td>M. arvensis, 60</td>
</tr>
<tr>
<td>M. citrata, 52</td>
</tr>
<tr>
<td>M. piperita, 60, 429, 432</td>
</tr>
<tr>
<td>M. pulegium, 59</td>
</tr>
<tr>
<td>M. spicata, 66, 429</td>
</tr>
<tr>
<td>camphor, 402</td>
</tr>
<tr>
<td>cream, flavor formula, 322</td>
</tr>
<tr>
<td>p-Mentha-1,8-diene, 399</td>
</tr>
<tr>
<td>p-Menthanol, 402</td>
</tr>
<tr>
<td>3-p-Menthanol, 402</td>
</tr>
<tr>
<td>1-p-Menthan-3-one, 402</td>
</tr>
<tr>
<td>3-p-Menthanone, 402</td>
</tr>
<tr>
<td>p-1-Menthen-8-ol, 155, 411</td>
</tr>
<tr>
<td>p-8-Menthen-1-ol, 155, 411</td>
</tr>
<tr>
<td>Menthol, 112, 203, 402</td>
</tr>
<tr>
<td>Menthol acetic ester, 112, 403</td>
</tr>
<tr>
<td>Menthone, 112, 402</td>
</tr>
<tr>
<td>Menthyl acetate, 112, 403</td>
</tr>
<tr>
<td>Methanedicarboxylic acid, 401</td>
</tr>
<tr>
<td>Methanedicarboxylic acid, 401</td>
</tr>
<tr>
<td>Methanol, 113</td>
</tr>
<tr>
<td>4-Methoxybenzaldehyde, 378</td>
</tr>
<tr>
<td>p-Methoxybenzaldehyde, 87, 133, 378</td>
</tr>
<tr>
<td>Methoxybenzene, 87</td>
</tr>
<tr>
<td>p-Methoxybenzyl acetate, 88</td>
</tr>
<tr>
<td>p-Methoxybenzyl alcohol, 87</td>
</tr>
<tr>
<td>Chemical Name</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>p-Methoxybenzyl formate</td>
</tr>
<tr>
<td>3-Methoxy-4-hydroxybenzaldehyde</td>
</tr>
<tr>
<td>Methoxynaphthalene</td>
</tr>
<tr>
<td>2-Methoxynaphthalene</td>
</tr>
<tr>
<td>p-Methoxy phenylbutyl acetate</td>
</tr>
<tr>
<td>1-Methoxy-4-(1-propenyl) benzene</td>
</tr>
<tr>
<td>p-Methoxypropenyl benzene</td>
</tr>
<tr>
<td>2-Methoxy-4-(2-propenyl) phenol</td>
</tr>
<tr>
<td>2-Methoxy-4-propenylphenol</td>
</tr>
<tr>
<td>Methoxy protocatechuic aldehyde</td>
</tr>
<tr>
<td>Methyl acetate</td>
</tr>
<tr>
<td>Methylacetic acid</td>
</tr>
<tr>
<td>Methyl alcohol</td>
</tr>
<tr>
<td>Methyl 2-aminoacetate</td>
</tr>
<tr>
<td>Methyl α-aminoacetate</td>
</tr>
<tr>
<td>Methyl anisate</td>
</tr>
<tr>
<td>p-Methylanisole</td>
</tr>
<tr>
<td>Methyl anthranilate</td>
</tr>
<tr>
<td>Methyl α-anthranilate</td>
</tr>
<tr>
<td>Methyl benzaldehyde</td>
</tr>
<tr>
<td>α-Methylbenzaldehyde</td>
</tr>
<tr>
<td>3-Methylbutanoic acid ethyl ester</td>
</tr>
<tr>
<td>3-Methylbutanoic acid methyl ester</td>
</tr>
<tr>
<td>1-Methylbutanol</td>
</tr>
<tr>
<td>3-Methyl-1-butanol</td>
</tr>
<tr>
<td>Methyl butyrate</td>
</tr>
<tr>
<td>Methyl cinnamate</td>
</tr>
<tr>
<td>Methyl cinnamylate</td>
</tr>
<tr>
<td>Methyl p-cresol</td>
</tr>
<tr>
<td>2-Methylendecanal</td>
</tr>
<tr>
<td>3,4-(Methylene dioxy) benzaldehyde</td>
</tr>
<tr>
<td>Methylene ether allyl dioxybenzene</td>
</tr>
<tr>
<td>Methylene ether m-allylprocatechin</td>
</tr>
<tr>
<td>Methyl ether protocatechuic aldehyde</td>
</tr>
<tr>
<td>Methyl eugenol</td>
</tr>
<tr>
<td>Methyl glycol</td>
</tr>
<tr>
<td>6-Methyl-5-heptene-2-one</td>
</tr>
<tr>
<td>Methyl heptenone</td>
</tr>
<tr>
<td>Methyl heptyne carbonate</td>
</tr>
<tr>
<td>Methyl hexyl carbinyl acetate</td>
</tr>
<tr>
<td>Methyl α-hydroxybenzaldehyde</td>
</tr>
<tr>
<td>Methylhydroxyisopropylcyclohexane</td>
</tr>
<tr>
<td>Methyl ionone</td>
</tr>
<tr>
<td>Methyl isoegenol</td>
</tr>
<tr>
<td>1-Methyl-4-isopropenyl cyclohexan-1-ol</td>
</tr>
<tr>
<td>Methylisopropylbenzene</td>
</tr>
<tr>
<td>1-Methyl-4-isopropylcyclohexan-3-one</td>
</tr>
<tr>
<td>1-Methyl-4-isopropyl-1-cyclohexen-8-ol</td>
</tr>
<tr>
<td>Methyl isovalerate</td>
</tr>
<tr>
<td>Methyl p-methoxybenzaldehyde</td>
</tr>
<tr>
<td>5-Methyl-2-(1-methyl) cyclohexanol acetate</td>
</tr>
<tr>
<td>1-Methyl-4-(1-methylethenyl)cyclohexene</td>
</tr>
<tr>
<td>Methyl (1-methylethyl) benzene</td>
</tr>
<tr>
<td>5-Methyl-2-(1-methylethyl) cyclohexanol</td>
</tr>
<tr>
<td>5-Methyl-2-(1-methylethyl)cyclohexanone</td>
</tr>
<tr>
<td>Methyl β-naphthyl ether</td>
</tr>
<tr>
<td>Methyl naphthyl ketone</td>
</tr>
<tr>
<td>Methyl nonyl acetdehyde</td>
</tr>
<tr>
<td>Methyl n-nonyl acetalddehyde</td>
</tr>
<tr>
<td>Methyl 2-octynoate</td>
</tr>
<tr>
<td>Methyl phenyl acetate</td>
</tr>
<tr>
<td>Methyl phenyl carbinyl acetate</td>
</tr>
<tr>
<td>Methyl phenyl ether</td>
</tr>
<tr>
<td>Methyl phenyl glycidate</td>
</tr>
<tr>
<td>Methyl phenyl ketone</td>
</tr>
<tr>
<td>Methyl 3-phenyl propenoate</td>
</tr>
<tr>
<td>Methyl 3-phenyl propionate</td>
</tr>
<tr>
<td>Methyl propanoic acid ethyl ester</td>
</tr>
<tr>
<td>Methyl protocatechuic aldehyde</td>
</tr>
<tr>
<td>p-Methyl quinoline</td>
</tr>
<tr>
<td>6-Methyl quinoline</td>
</tr>
<tr>
<td>Methyl salicylate</td>
</tr>
<tr>
<td>Methyl styril ketone</td>
</tr>
<tr>
<td>Methyl α-toluate</td>
</tr>
<tr>
<td>Methyl α-toluate</td>
</tr>
<tr>
<td>Methyl tolyl ether</td>
</tr>
<tr>
<td>2-Methylundecanal</td>
</tr>
<tr>
<td>Mezial</td>
</tr>
<tr>
<td><em>Michelia champaca</em></td>
</tr>
<tr>
<td>Mignonette</td>
</tr>
<tr>
<td>perfume formula</td>
</tr>
<tr>
<td>Milk, flavor</td>
</tr>
<tr>
<td>caramel, flavor formula</td>
</tr>
<tr>
<td>Mimosa</td>
</tr>
<tr>
<td><em>M. acacia</em></td>
</tr>
<tr>
<td>perfume formula</td>
</tr>
<tr>
<td>Mineral oil</td>
</tr>
<tr>
<td>Mint, color</td>
</tr>
<tr>
<td>flavor formula</td>
</tr>
<tr>
<td>Mirabelle</td>
</tr>
<tr>
<td>flavor formula</td>
</tr>
<tr>
<td>Mock orange</td>
</tr>
<tr>
<td>Monard</td>
</tr>
<tr>
<td><em>Monarda</em></td>
</tr>
<tr>
<td><em>M. didyma</em></td>
</tr>
<tr>
<td><em>M. punctata</em></td>
</tr>
<tr>
<td>Moon flower</td>
</tr>
</tbody>
</table>
INDEX

Morus alba, 179, 430
M. nigra, 179, 430
M. rubra, 179, 430
Moschus moschiferus, 53, 430
Moss, 166, 430
perfume formula, 243
Muguet, 164, 430
for cream, flavor formula, 324
perfume formula, 244
Mulberry, 430
flavor, 179
flavor formula, 324
Musa paradisiaca, 182, 416
M. sapientum, 416
Mushroom, flavor formula, 324–325
Musk, 53, 166
ambrette, 115, 150
as fixative, 173
deer, 166, 430
ketone, 115, 151
malman, 151
perfume formula, 244–245
xylene, 151
xylol, 116, 151
Musky odors, 158
Mustard, 53
flavor, 192
Müller, 13
Myrcene, 116
Myristaldehyde, 83
Myristica fragrans, 50, 55, 431
Myrocarpus frondosus, 30
Myroxylon balsamum, 68
M. pereirae, 61
Myrrh, 53
Myrrhis odorata, 420
Myrtle, 53
Myrtus communis, 53
β-Naphthol ethyl ether, 407
β-Naphthol isobutyl, 205
β-Naphthyl methyl ether, 131, 413
β-Naphthyl ethyl ether, 205, 407
perfume formula, 247
β-Naphthyl methyl ether, 413
perfume formula, 247
Narcole, 142
Narcissus (Narcissus), 54, 167, 430
N. jonquilla, 164, 427
N. odoratus, 164, 427
N. poeticus, 54, 167, 430
N. pseudo-narcissus, 167, 430
N. tazetta, 167, 430
perfume formula, 245–246
Nectarine, 180, 430
flavor formula, 325
Nepeta cataria, 54
Neral, 96, 140
Neroli, 116, 152, 205, 407
Neroli, 54, 167, 430, 431
oil, artificial, 148, 403
perfume formula, 246–247
Nerolin 11, 116, 205, 407
perfume formula, 247
Neryl acetate, 117
Neutroleum deodorizing perfume, perfume for-
mula, 247
New mown hay, 160, 430
perfume formula, 248
Niaouli, 54
Nicotiana affinis, 169
N. petunoids, 169
N. tabacum, 68, 169, 437
Niobe oil, 113, 404
Nitro compounds, 74, 76
Nitrogenous compounds, 23
Noisette, 430
flavor formula, 325
γ-Nonalactone, 84, 152, 376
Nonanal, 81, 205
n-Nonanoic acid, 117
Nonanoic acid ethyl ester, 390
Nonanol, 205
1-Nonanol, 79
Nonanolid-1,4, 84, 376
3-Nonanyl acetate, 102
Nonoic acid, 117
n-Nonyl acid, 117
Nonyl acetate, 77, 375
Nonyl alcohol, 79
n-Nonyl alcohol, 205
Nonyl aldehyde, 205
n-Nonyl aldehyde, 81
n-Nonylic acid, 117
γ-Nonyl lactone, 152
Nougatine, 431
flavor formula, 325
Nut, color, 219
flavor formula, 326
pistachio, flavor formula, 341–342

465
Nutmeg, 50, 55, 431
flavor formula, 325

Oakmoss, 55, 166
Ocimum basilicum, 27
γ-Octalactone, 117, 407
Octanal, 81
Octanoic acid, 93
Octanoic acid ethyl ester, 387
1-Octanol, 79
Octene, 117
Octyl acetate, 77, 206, 375
Octyl alcohol, 79
n-Octyl alcohol, 206
α-Octyl aldehyde, 206
Octyl butyrate, 206
Octylene, 117
Ocymene, 118

Odor, aperitif, 12
balsamic, 12, 157
body, 12
citrus, 157
classification, general, 13–16
classification, historical, 4–11
classification, historical, Amoore, 11
classification, historical, Aristotle, 4
classification, historical, Billot, 11
classification, historical, Cerbelaud, 9
classification, historical, Croker and Henderson, 9
classification, historical, Fourcroy, 4
classification, historical, Gattefosse, 9–10
classification, historical, Henning, 8
classification, historical, Linnaeus, 4
classification, historical, Piesse, 5, 6
classification, historical, Redgrove, 11
classification, historical, Rimmel, 5
classification, historical, Zwaardemaker, 7
concentration, 14
determination, 14
disgusting, 12
fatty, 158
flowery, 157
grassy, 158
green-floral, 158
harsh-pungent, 158
herb-like, 158
history of, 1–2, 4–11
irritating, 13
leaf-green, 158
musky, 158
odorless-faint, 158
subjective classification, 12–13
taste, 14
waxy, 159
woody, 159
Odorless-faint, odors, 158
Oenanthaldehyde, 81
Oenanthic acid, 106
Oenanthic ether, 389
Oenanthol, 81, 201
Oenanthic acid, 106
Oil garlic, 84
Oil of grapes, 389
Oleum vitis viniferae, 389
Olibanum, 55
Onion, 56, 431
flavor, 193
flavor formula, 326
Opopanax, 56, 431
perfume formula, 248–249
Optal, 122
Orange, 431
bitter, 56, 326
blossom, 167
blossom, perfume formula, 249
color, 219
flavor, 179
flavor formula, 326–329
flower, 57
flower, perfume formula, 249–250
mock, 169
sweet, 57, 327
Orange liquid, 406
Orchid, 167, 431
perfume formula, 250
Oregano, 57
flavor formula, 329
Orgeat, flavor formula, 303
Origanum dictamnus, 422
O. marjorana, 51
O. vulgare, 57, 429
Origin of extraction, 13
 Orris (Orris), 58, 426
O. pallida, 58
 root, 431
 root, perfume formula, 250–251
Osmanthus (Osmanthus), 58
O. fragrans, 58
Oxalic acid, 118
3-Oxobutanoic acid ethyl ester, 100, 385
1,1-Oxybisbenzene, 144
INDEX

Palatone, 402
Palmarosa, 58
  flavor formula, 305
Pansy, 170
Papaya, flavor, 183
Paprika, 217
  flavor, 193
Parsley, 58
 Parsnip, 59
Pasteurization, 191
Pastinaca sativa, 59
Patchouli, 59, 167, 432
  perfume formula, 251
Pea, 432
  sweet, 436
  sweet, flavor formula, 336–337
Peach, 432
  color, 220
  flavor, 180
  flavor formula, 329–333
  kernel, flavor formula, 337
Peach aldehyde, 83, 155, 376
Peanut, flavor, 185
Pear, 432
  flavor, 180
  flavor formula, 333–336
  oil, 377
Pecan, flavor, 185
Pectin, 223
Pelargol, 99
Pelargonaldehyde, 81
Pelargonic acid, 117
Pelargonic alcohol, 79
Pelargonium domesticus, 162, 424
  P. erodium cicutarium, 162
  P. graveolens, 162, 424
  P. odoratissimum, 45
  P. peltatum, 162, 424
  P. robertianum, 162, 424
Pennyroyal, 59
n-Pentanoic acid, 130
Pentanoic acid ethyl ester, 388
1-Pentanol, 377
2-Pentanol, 377
Pentyl acetate, 377
Pentylcarbinol, 394
α-Pentyl cinnamaldehyde, 85
α-Pentyl cinnamic aldehyde, 133
Pepper, black, 60
  black, flavor formula, 279–280
Peppermint, 432
arvensis, 60
  camphor, 402
  flavor formula, 337, 357
  piperita, 60
Perfume, early history of, 2
  fixatives for, 173
  formulas, for cologne, 245
  formulas, for cosmetic cream, 253
  formulas, for powder, 244, 245, 251, 252,
  253, 260
  formulas, for soap, 227, 228, 229, 230, 231,
  232, 234, 235, 237, 241, 242, 243, 245,
  246, 247, 249, 251, 254, 256, 257, 259,
  260, 261
  formulation, 173
  industry, 3
  industry products, 3
  new suggested, 172
Perilla (Perilla), 61
  P. frutescens, 61
Pernambuco, 217
Persea americana, 182, 416
Persic oil, 432
Persicol, 155, 376
Persicot, flavor formula, 337
Peru balsam, 61
Petit muguet, 72
Petitgrain, 61, 431
Petrolol, 212
Petroselinum hortense, 58
  P. sativum, 58
Phenethyl acetate, 118, 153, 408
β-Phenethyl acetate, 118
Phenethyl alcohol, 154, 207, 408
Phenethyl anthranilate, 119, 409
Phenethyl butyrate, 119, 409
Phenethyl cinnamate, 120
Phenethyl formate, 120
Phenethyl phenyl acetate, 120
Phenethyl propionate, 120, 409
β-Phenethyl propionate, 120
Phenethyl salicylate, 121
β-Phenethyl salicylate, 121
Phenol esters, 23
Phenols, 23, 76
Phenoxybenzene, 100, 144
Phenyl acetaldehyde, 118, 152
Phenyl acetate, 407
Phenyl acetic acid, 118, 153, 408
Phenylacrolein, 140
β-Phenyl acrylic acid, 139
γ-Phenyllallyl alcohol, 139
Phenyllallic alcohol, 139
4-Phenyl-3-buten-2-one, 137
Phenyl carbinol, 135, 380
α-Phenyl cinnamic aldehyde, 133
2-Phenylethanol, 154, 408
1-Phenylethanone, 132
Phenyl ether, 100, 144
Phenyl ethyl acetate, 118, 153, 206, 408
2-Phenyl ethyl acetate, 408
β-Phenylethyl acetate, 153
sec-Phenylethyl acetate, 126
Phenyl ethyl alcohol, 119, 154, 207, 408
β-Phenyl ethyl alcohol, 154
Phenylethyl α-aminobenzoate, 119, 409
Phenyl ethyl anthranilate, 119, 409
Phenyl ethyl butyrate, 119, 409
Phenyl ethyl cinnamate, 120
Phenyl ethyl formate, 120
Phenyl ethyl phenyl acetate, 120
Phenyl ethyl propionate, 120, 207, 409
Phenyl ethyl salicylate, 121
Phenyl ethyl α-toluolate, 120
Phenyl formic acid, 379
Phenyl methanol, 135, 380
Phenyl methyl acetate, 89, 134, 379
Phenyl methyl ester, 136
Phenyl methyl ketone, 132
3-Phenylpropenal, 383
3-Phenyl-2-propenal, 140
3-Phenyl propenoic acid, 139
3-Phenyl-2-propenoic acid, 136
3-Phenyl-2-propenoic acid ethyl ester, 102
3-Phenyl-2-propenoic acid phenyl methyl ester, 89
3-Phenyl-2-propen-1-ol, 139
3-Phenyl-2-propen-1-yl acetate, 95
3-Phenyl-2-propen-1-yl formate, 95
Phenyl propyl acetate, 121
3-Phenyl-1-propyl acetate, 121
Phenyl propyl alcohol, 121
Phenyl propyl aldehyde, 201
Phenyl propyl butyrate, 121
Phenyl propyl formate, 122
3-Phenyl-1-propyl formate, 122
Philadelphus virginalis, 169, 436
Phoenix dactylifera, 177, 422
Phylum cyanophyta, 171
P. phacopyta, 171
P. rodophyta, 171
Physeter macrocephalus, 24
Phytolacceae americana, 217
Picea alba, 66
P. nigra, 66
Pickle, 432
spice, flavor formula, 338
Pieplant, 434
Piesse, G., 4
Pimenta officinalis, 61, 414, 433
Pimento, 61, 414, 433
Pimpinella anisum, 25, 415
Pine, 62, 433
dwarf, 40
perfume formula, 251
Pine needle, 62, 167
perfume formula, 251
Siberian, perfume formula, 252
Pineapple (ananas), 433
flavor, 183
flavor formula, 338–341
Pinene, 122
Pinus banksiana, 167, 433
P. heterophylla, 69
P. lamberiana, 167, 433
P. palustris, 62, 69, 167, 433
P. ponderosa, 62, 167, 433
P. pumilio, 40
P. strobos, 167, 433
P. sylvestris, 62
Piper cubeba, 39
P. nigrum, 60
Pipernol, 145
Piperonal, 106, 145, 201, 394
Piperonyl aldehyde, 106, 145, 394
Pistachio, 433
color, 220
flavor, 185
flavor formula, 341–342
Pistacia vera, 185, 433
Pisum sativa, 432
Plantain, 182, 416
Plum, 429
color, 220
flavor, 180
flavor formula, 343–345
Plumeria acutifolia, 161, 423
P. alba, 161, 423
P. rubra, 161, 423
POE (20) sorbitan oleate, 213
Pogostemon cablin, 59, 432
P. hyeneanus, 167, 432
Pokeyberry, 217
INDEX

*Polianthes tuberosa*, 69, 169, 437
Polysorbate 80, 213
Pomegranate, 425
flavor, 181
flavor formula, 345–346
Potato, 433
flavor formula, 346
sweet, 433
Pound cake, flavor formula, 346
Powdered flavors, formula, 346
Praline, flavor formula, 303, 347
Propanoic acid diethyl ester, 389
Propanedioic acid, 401
1,2-Propanediol, 213
1,2,3-Propanetriol, 212, 393
1,2,3-Propanetriol triacetate, 212
Propanoic acid, 122
Propanoic acid propyl ester, 410
Propanol, 122
1-Propanol, 122
2-Propanol, 212
2-Propanone, 209
*p*-Propenyl anisole, 378
5-(2-Propenyl)-1,3-benzodioxole, 410
Propenyl guaiacol, 204, 405
4-Propenyl guaiacol, 398
Propenyl hydrate, 393
*p*-Propenylphenyl methyl ether, 378
Propenylveratrole, 405
Propionic acid, 122
Propyl acetate, 409
Propyl alcohol, 122
Propylene glycol, 213
Propyl formate, 123
Propyl formic acid, 382
Propionic alcohol, 122
Propyl propionate, 410
Proteinic flavor formula, 347
Protocatechualdehyde-3-methyl ether, 130, 156, 412
Protocatechuic aldehyde methylene ether, 106, 145, 394
Prune, 180–181, 433
color, 220
Prunelle, 433
flavor formula, 347
Prunolide, 84, 376
*Prunus amara*, 414
  *P. americana*, 180, 425, 429
  *P. amygdalus*, 414
  *P. armeniaca*, 175, 415
  *P. avium*, 176, 420
  *P. cerasifera*, 180, 425, 429
  *P. cerasum*, 420
  *P. cerasus*, 176
  *P. communis*, 24, 414
  *P. domestica*, 180, 425, 429, 433
  *P. inquisit*ia, 180, 425, 429
  *P. myrobolan*, 425, 429
  *P. ornamental*, 180
  *P. persica*, 180, 432
  *P. persica nectarina*, 430
  *P. salicina*, 180, 425, 429
Prussic acid, 184
*Psidium brazili*, 183
  *P. castilianum*, 183
  *P. guava*, 183, 425
  *P. lemon guava*, 183
  *P. strawberry*, 183
*Pterocarpus marsupium*, 217
Pulegone, 123
Pulque, 190
*Punica granatum*, 181, 425
Pura nut, 184
Pyroacetic ether, 209
Pyroligneous acid, 123
liqueur, 123
vinaigre, 123
*Pyrus calleryana*, 180, 432
  *P. communis*, 180, 432
  *P. pyrifolia*, 180, 432
  *P. usuriensis*, 180, 432
Quassia (*Quassia*), 433
*Q. amara*, 433
Queensland nut, 185
Quinaldine, 149
Quince, 434
color, 220
flavor, 181
flavor formula, 347–348
Raisin, 434
flavor formula, 348
Raldeine, 405
Raspberry, 434
color, 220
flavor, 181
flavor formula, 348–353
Raspberry aldehyde, 84
Ratafia, 353
Red currant, flavor, 181
HANDBOOK OF PERFUMES AND FLAVORS

Redgrove, H.S., 11
Reseda (Reseda), 52, 165
    R. odorata, 52, 165, 429
Reuniol, 410
Rhamnus cathartica, 215
Rheum rhaponticum, 434
Rhodinol, 123, 207, 410
Rhodinyl acetate, 124, 207
Rhodinyl butyrate, 207
Rhodinyl formate, 124
Rhodium, flavor formula, 353
Rhubarb, 434
Ribes grossularia, 177, 425
    R. hirtillum, 177, 425
    R. nigro, 176, 422
    R. odoratum, 422
    R. physalis, 425
    R. rubrum, 181, 422
    R. uva-crispa, 425
Ricinus communis, 419
Rimmel, E., 5
Robinia kelseyi, 222
    R. neomexicana, 222
    R. pseudoacacia, 222
    R. viscose, 222
Roman chamomile, 35
Root beer, 434
    color, 220
    flavor formula, 353
Rosa centifolia, 168, 434
    R. damascena, 62
    R. eglanteria, 422
    R. gallica, 62
    R. muscosa, 434
    R. rubiginosa, 422
    R. setigera, 434
Rosacetol, 154
Rose, 62, 168, 434
    crystals, 154
    flavor formula, 353
    oxide, 155
    perfume formula, 252-256
    wild, 422
Rosemary, 63, 434
    flavor formula, 353
Roseol, 410
Rosewood, 63
Rosmarinus officinalis, 63, 434
Rubricalis galbaniflora, 44
Rubus idaeus, 181, 434
    R. neglectus, 181, 434
R. occidentalis, 176, 181, 417, 434
R. strigosus, 181, 434
R. ursinus, 179
Rue, 63
Rum, 434
    flavor, 188
    flavor formula, 353-355
    Jamaica, flavor formula, 354
Ruta graveolens, 63
Sabinene, 124
Saccharum officinarum, 411, 436, 439
Safflower, 217
Saffron, 63, 217, 434
    flavor, 193
Safrole, 124, 410
Sage, 64, 434
    clary, 37
    color, 220
Saint John’s Bread, 435
    flavor formula, 355
Sake, 190
Sal ethyl, 103, 390
Salicylic acid, 125
Salicylic acid benzyl ester, 137
Salicylic acid ethyl ester, 390
Salicylic ether, 103, 390
Salvia officinalis, 64, 435
    S. sclarea, 37
Sambucus canadensis, 422
Sandalwood, 64, 218, 435
    perfume formula, 256
Santal, perfume formula, 256
Santalene, 125
Santalol, 125
Santalum album, 64, 218, 435
Santaly acetate, 125
β-Santaly acetate, 125
Santene, 126
Sargassum baccaferum, 171
Sarsaparilla, 64, 435
    color, 220
    flavor formula, 355
Sassafras (Sassafras), 65
    S. officinalis, 65
    flavor formula, 355-356
    perfume formula, 257
Satureja hortensis, 65
Sauce, flavor formula, 356
    soy, flavor formula, 356
Worcestershire, flavor formula, 373

470
Index

Saussurea lappa, 38
Savin, 65
Savory, 65
flavor formula, 356
Scotch, 435
smoke, flavor formula, 357
Seaweed, 171, 221
Sebacic acid, 126
stabilizer, perfume formula, 257
Sense of smell, 1, 14
Shaddock, 46
Shenut, 184
Shikimol, 410
Silver fir needle, 65
Sinapis oil, 53
Skatole, 126
Skimmia, 129
Smell, sense of, 1, 14
Smilax aralia hispida, 435
S. aralia nudicaulis, 435
S. aristolochiifolia, 64, 435
S. indicus, 435
S. medica, 435
Smoke, flavor, 193–194
flavor formula, 357
Smoking, 185, 193–194
Soap perfume, perfume formula, 257
Solanum tuberosum, 433
Solution, 209
Solvents, 209–213, 374
Soya hispida, 213
Soybean oil, 213
Soy oil, 213
Sparkling wines, 189
Spartium genista, 29
Spearmint, 66
Spearmint-wintergreen-peppermint, flavor formula, 357
Spice, 435
flavor formula, 357
Spike lavender, 66
Spirit, 385
Spirit of wine, 385
Spruce, 66
Stabilizer, 221–224
for perfume, 257
Star anise, 26, 435
Stearoptenes, 18
Sterculia (Sterculia) gum, 222
S. urens, 222
Storax, 67
Strawberry, 435
color, 220
flavor, 182
flavor formula, 358–362
Strawberry aldehyde, 84, 376
Styracin, 95
Styrallyl acetate, 126
Styrallyl carbinol, 139
Styrax (Styrax), 67
S. benzoin, 416
Styrene, 126
Styrol, 67, 126
Styrolene, 126
Styrone, 139
Styrallyl carbinol, 139
Succinic acid, 127, 410
Sucrose, 411
Sugar, 411, 436
Sulfurous compounds, 74, 76
Sumatra camphor, 381
Sweet birch oil, 150, 406
Sweet brier, 422
Sweet carbohydrate, 411
Sweet flag, 31
Sweet pea, 168, 436
blossom, perfume formula, 258
flavor formula, 336–337
Synthetic essences, 74
Syringa (Philadelphus virginalis), 169, 436
perfume formula, 258
Syringa vulgaris, 164, 427
Syrup, flavor formula, 362
pancake, flavor formula, 362
Tagetes glandulifera, 67
Tamarind, 67, 436
flavor formula, 362
Tamarindus indica, 67, 436
Tanacetum hormone, 67
T. vulgare, 67
Tangerine, 436
flavor formula, 363
Tannic acid, 127
Tansy, 67
Tar oil, 30
Tarragon, 41, 436
flavor, 193
flavor formula, 363
Tartaric acid, 127, 411
Tartrazine, 218
Tea, 436
flavor, 188
flavor formula, 363–364
Teaberry oil, 150, 406
Terpenes, 20, 74, 75
Terpinelol, 411
Terpinene, 402
Terpineol, 128, 155, 411
α-Terpineol, 155, 207
β-Terpineol, 155
γ-Terpineol, 155
Terpinyl acetate, 128, 412
Terpinyl formate, 128
Terpinyl propionate, 128, 208
Tetradecanoic acid ethyl ester, 389
n-Tetradecyl aldehyde, 83
Tetrahydrogeraniol, 99
Tetyl formate, 397
Teucrium chamaedrys, 424
Theobroma cacao, 187, 418
Theobroma oil, 412
Thiolyl ether, 84, 376
3,3′-Thiobis (1-propene), 84, 376
Thistle, 436
Thuja (genus), 34, 419
T. occidentalis, 34
Thyme, 68, 437
Thymol, 128
Thymus vulgaris, 68, 437
Tiglic acid, 129
Tilia americana, 165
T. cordata, 165
T. lacimata, 165
T. platy phylllos, 165
Tincture, 374
Titanium dioxide, 218
Tobacco, 68, 169, 437
flavor formula, 364–366
perfume formula, 258
species, 364
α-Tolu aldehyde, 118, 152
Tolu balsam, 68
α-Toluic acid, 153, 408
α-Toluic acid ethyl ester, 390
α-Toluic aldehyde, 118, 152
Tolufera balsamum, 68
p-Tolyl aldehyde, 208
p-Tolyl acetate, 98, 142
p-Tolyl phenyl acetate, 98
Tomato, flavor, 193
Tonka bean, 69
Tonka bean camphor, 97, 142
Tragacanth gum, 224
Tree moss, 69, 166
Treflé, 169, 437
perfume formula, 259
Trefoil, 169, 437
perfume formula, 259
Triacetin, 212
Triacetyl glycerin, 212
Trichloromethane, 383
α-(Trichloromethyl) benzyl acetate, 154
Trichloromethyl phenyl carbinyl acetate, 129, 154
Trifolium alsike, 160
T. crismont, 160
T. hybridum, 160
T. incarnatum, 160
T. pratense, 160
T. repens, 160, 437
Trigonella foenumgraecum, 43, 423
Trihydric (polyhydric) alcohol, 393
Trihydroxy propane, 212, 393
endo-1,7,7-Trimethylbicyclo (2,2,1) heptane-2-ol, 138, 381
1,7,7-Trimethylbicyclo (2,2,1) heptan-2-ol acetate, 138, 381
Trimethyl-2-cyclohexenyl)-2-buten-2-one, 4-(2,6,6-), 395
4-(2,6,6-Trimethyl-1-cyclohexenyl)-3-buten-2-one, 395
4-(2,6,6-Trimethyl-2-cyclohexenyl-1-yl)-3-buten-2-one, 147
Trinitro-butyl-m-cresyl methyl ether, 150
Trinitro-butyl xylene, 151
2,4,6-Trinitro-t-butyl-m-xylene, 151
2,4,6-Trinitro-1,3-dimethyl-5-t-butyl benzene, 151
Tsuga canadensis, 66
Tuberose, 69, 169, 437
perfume formula, 259
Turmeric, 39, 218
flavor, 194
Turpentine, 69, 168
Tutti frutti, flavor formula, 367
Tween 80, 213

Ultramarine, 218
Umbelliferone, 129
γ-Undecalactone, 83, 155
Undecanal, 82
1-Undecanol, 80
Undecanolide-1,4, 155, 376

472
INDEX

10-Undecen-1-ol, 80
10-Undecen-1-yl acetate, 78, 375
Undecenal, 82, 208
Undecenyl acetate, 78
Undecyl alcohol, 80
Undecylenaldehyde, 82
Undecylenic acid, 129
n-Undecylenic alcohol, 80
Undecylenic aldehyde, 82, 208
Undecyl alcohol, 82
γ-Undecyl lactone, 155
γ-Undelactone, 155, 376
n-γ-Undelactone, 208
Uny cologne, perfume formula, 259
Urnea barbata, 69, 166

Vaccinium corymbosum, 176, 417
V. macrocarpon, 177, 422
V. myrtillus, 417
V. oxyccoccus, 177, 422
V. pennsylvianum, 176, 417
V. whortleberry, 417
Valerian, 70, 437
flavor formula, 367
Valeriana officinalis, 70, 437
Valerianic acid, 130
Valerian acid, 130
Vanilla (Vanilla), 70, 437
V. planifolia, 70, 187, 437
beans, flavor, 187
beans, flavor formula, 368
color, 220
flavor formula, 367
Vanillal, 391
Vanillic aldehyde, 130, 156, 412
Vanillin, 130, 156, 208, 412
flavor formula, 368–369
Vanzoate, 136, 380
Vaporous perfume, perfume formula, 259–260
Vassoura, 70
Vegetable, fortified extract, flavor formula, 303
oil, 374
Veitol, 402
Venzonate, 136, 380
Verbena (Verbena), 49, 70, 170, 437
V. erinooides, 170
V. hybrida, 170, 437
Vermouth, 438
flavor, 189
flavor formula, 369–370
Vetiver, 71
Vetiver acetate, 130
Vetiveria zizanoides, 71
Vetiverol acetate, 130
Vetivert acetate, 130
Vetiveryl acetate, 130
Vinegar, 438
flavor formula, 370
naphtha, 211, 385
Vinylbenzene, 126
Viola canina, 170, 438
V. odorata, 71, 170, 438
V. papilionacea, 170, 438
V. pedata, 438
V. tricolor, 170, 438
Violet, 71, 170, 438
flavor formula, 370
perum formula, 260–261
Vitis aestivalis, 425
V. labrusca, 425
V. rotundifioria, 425
V. vinifera, 177, 425, 438
V. vulpina, 425
Vodka, 190
Volatilie oil, 374
Wallflower, 71, 170, 438
perum formula, 261
Walnut, 438
flavor, 185
flavor formula, 370–371
Water, distilled, 213
Watermelon, 429
flavor, 179
Waxoy odors, 159
Whiskey, color, 220
flavor, 190
Wine, 438
color, 220
ether, 390
residue, 412
sparkling, 189
Wintergreen, 18, 71, 171, 438
artificial, 150
flavor formula, 357, 372
oil, 150, 406
oil, synthetic, 406
perum formula, 261
synthetic, 150
synthetic oil, 115
Wisteria (Wisteria), 171
W. sinensis, 171

473
<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Page Numbers</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood alcohol</td>
<td>113</td>
<td></td>
</tr>
<tr>
<td>spirit</td>
<td>113</td>
<td></td>
</tr>
<tr>
<td>vinegar</td>
<td>123</td>
<td></td>
</tr>
<tr>
<td>Woodbine</td>
<td>163</td>
<td></td>
</tr>
<tr>
<td>Woodruff</td>
<td>72, 438</td>
<td></td>
</tr>
<tr>
<td>flavor</td>
<td>187</td>
<td></td>
</tr>
<tr>
<td>flavor formula</td>
<td>372</td>
<td></td>
</tr>
<tr>
<td>Woody odors</td>
<td>159</td>
<td></td>
</tr>
<tr>
<td>Worcestershire sauce</td>
<td>438</td>
<td></td>
</tr>
<tr>
<td>flavor formula</td>
<td>373</td>
<td></td>
</tr>
<tr>
<td>Wormseed</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>Wormwood</td>
<td>72, 414</td>
<td></td>
</tr>
<tr>
<td>Wort</td>
<td>439</td>
<td></td>
</tr>
<tr>
<td>Yara yara</td>
<td>131, 413</td>
<td></td>
</tr>
<tr>
<td>perfume formula</td>
<td>247</td>
<td></td>
</tr>
<tr>
<td>Yellowwood</td>
<td>218</td>
<td></td>
</tr>
<tr>
<td>Ylang ylang</td>
<td>72, 171, 439</td>
<td></td>
</tr>
<tr>
<td>perfume formula</td>
<td>261–262</td>
<td></td>
</tr>
<tr>
<td>Yogurt</td>
<td>191</td>
<td></td>
</tr>
<tr>
<td>Zea mays</td>
<td>210</td>
<td></td>
</tr>
<tr>
<td>Zedoary</td>
<td>439</td>
<td></td>
</tr>
<tr>
<td>Zinc oxide</td>
<td>219</td>
<td></td>
</tr>
<tr>
<td><em>Zingiber officinalis</em></td>
<td>45, 424</td>
<td></td>
</tr>
</tbody>
</table>