Essential Oil Chemistry Notes

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The Chemistry of Essential Oils Made Simple
God's Love Manifest in Molecules
By
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The outline given on the next fourteen pages is the CARE course guide to Essential Oil Chemistry based on the book: **The Chemistry of Essential Oils Made Simple** by Dr. Stewart. This outline references the information in the book to which it corresponds to in Part One and Part Two of this book. A Review of Chemistry Literature and History, basic information on chemical compounds and their role in essential oils is given in Part One of this book. Supporting data and information for the class is given in Part Two of this book. Except for brief comments on quantum physics, Part Three of this book is not part of the material presented in this class. In addition to this outline you will receive two additional pages: a copy of the Periodic Table and a copy of the CARE Structural Drawings (also found in The Chemistry book).

We hope you have fun browsing and studying this book. The actual classes are a lot of fun. We hope by attending this class that you will find the book as enjoyable and that, in the process, you gain an appreciation and feeling for the chemistry of essential oils and what wonderful gifts they are, created especially for you and me by God himself.

Course Outline

INTRO TO CHEMISTRY OF ESSENTIAL OILS
CHEM I

(The First Three Hours: 9:00 am – 12:00 noon)

I. INTRODUCTION 9:00–9:45

A. Essential Oils can assist in recall and in overcoming traumatic obstacles in learning. These blocks may be mental and/or emotional perhaps placed there by authority figures. We use the following essential oils to assist us in learning: ***Valor®*** (for courage to learn chemistry), ***Peppermint*** and ***Lemon*** (to increase alertness and retention), and ***Cedarwood*** (to be applied to the right thumb and roof of mouth) to help remove any mental blocks to acquiring new information and learning science.

B. **INTRODUCTION & PART ONE** *(pp xxx – 493)*
The purpose of this class is to provide a basic understanding of how instrumental God's hand is in the creation of the molecules of essential oils. You will discover, that the properties of essential oils that bring healing and maintain health cannot be explained by materialistic science alone. God's presence is visibly manifest in his grand and infinite forms and in the infinitesimally small. Atoms, which come together, make up the molecules which proclaim his handiwork. God is both mightily and minutely active in his creation- all living processes.

C. PART TWO – Tables, Catalogs & Indexing *(pp. 494-611)*

1. **Table 32. (***pp. 509-558*) This table indexes both common and scientific names. **Yarrow** (*Achillea millefolium), (p.510*), is an example of multiple names.
2. **Table 32A**, (*p. 558*) Legacy and the Average Oil.
3. **Tables 33 & 34***.(pp. 559-563).* Plant families & plant parts.
4. **Table 50**. (*p. 573).* Top 40 List. α-pinene
5. **Table 67.** (*p. 585).* Representative Oils
6. **Table 68**. (*p. 586).* PMS oils.

D. PART THREE.*(pp. 616-737*)

1. **Quantum Physics and Uncertainty Principle**. (*pp. 714-717.*) Classical physics deals with particles of atomic size and larger. Quantum physics deals with subatomic particles, i.e. electrons, protons, neutrons, quarks, neutrinos, etc. In classical science there are definite laws and predictable outcomes independent of the experimenter or observer. In quantum physics there are probabilities and, unpredictable outcomes, dependent on the thoughts of the experimenter or observer. Science has shown that human thought influences electron behavior.

2. **The Mind-Body-Oil Connection**. All bodily processes involve electron behavior. It is at the level of electrons that the body and mind connect and psychosomatic effects begin. It is also where the human mind connects and influences the behavior of essential oils. When asked, "*What will this oil do for me*?" give two answers: one based on classical chemistry (mentioning phenols, monoterpenes, sesquiterpenes, etc. and their actions) and another based on quantum physics saying, "*What do you want it to do?" (See p. 716).*

3. **Peter Gormon's Story** *(pp735-736)*

Job 12:8 "or speak to the earth and let it teach you"

4. This class has been carefully "distilled" from a mass of chemical information in order to provide you with the relevant material required to understand the chemistry of essential oils. By understanding the basic concepts of chemistry we will learn the language of the plants so we can have a deeper understanding of what they'll teach us.

II. REVIEW & CRITIQUE OF RESOURCES- CH 1 9:45 –10:05

A. **What is a Therapeutic Grade Oil?** *(pp. 6–9)*

B. **Four portals** for essential oils to enter body. *(p. 2)*

1. Lungs 2. Skin 3. Digestive Tract 4. Rectum/Vagina

C. **The Three schools** of aromatherap**y** *(p3-6)*

a. German b. British c. French

D. The Pitfalls of the British school

1. Forbidden Oils *(pp. 18–20)*

2. Animal vs. human and isolated compounds vs. whole oil *(p22)*

3. Examples of misusing scientific data. *(pp. 22–24)*

E. **Resource Books** (*p 49)*

RECESS 10:05–10:20

III. CHEMISTRY MADE EASY – CH 3 10:20 –10:45

A. Aromas & Therapeutic Effects

1. Chemical Analysis of Essential Oils

a. Main Ingredients (>1%),these are the vehicles and coordinators for the aromas and therapeutic effects.

b. Minor Ingredients (0.1%), these are what determine the aroma and therapeutic effects

c. Trace Ingredients (< 0.1%) these are what determine the aroma and therapeutic effects

B. **The Scent of Grapefruit.** *(p124)*

1. All citrus rind oils are composed mostly of a monoterpene compound called **d-limonene** (grapefruit is composed of over 90% d-limonene)
2. Grapefruit also contains something not found in any citrus oil – a sulfur compound called **1-p-menthen-8-thiol (**0.1%) that gives its distinctive fragrance.
3. Just because a compound is present as only a trace (less than 0.1%) doesn't mean it isn't important and may, perhaps, be the key ingredient for the aroma and therapeutic action of the oil.
4. One must always use therapeutic grade oils that are complete with all trace compounds carefully preserved in the extraction and bottling process.
5. Our noses can be quite sensitive to a trace compound in an oil even when comprising less than a billionth of the total oil.

C. Basic Chemistry Concepts:

1. The Scope of chemistry as the "Study of Matter." *(p. 78)*

2. Three basic particles of matter: electron, proton & neutron

3. Hydrogen, heavy hydrogen, deuterium, tritium, helium, carbon, and oxygen. *(pp. 79–81)*

4. All chemical reactions are electrical, involving only electrons in the outer shells of atoms. Any process involving changes in the nucleus of an atom is physics, not chemistry. *(pp. 80–81)*

5. God's Plan for Creation in a Table: *Periodic Table of Elements (pp. 82–84, 100-101)* . There are seven levels with repeating chemical characteristics. Elements are arranged in vertical columns with similar chemical properties and can replace each other in compounds.

6. There are 27 elements we need for human life. Beginning with the lightest, smallest element: #1 Hydrogen -H and ending with the heaviest element: #53 Iodine -I *(p. 91)*

7. Atomic weights, Molecules, Compounds and Molecular weights and their relationship to viscosity, volatility and half-life (*pp107-112)*
Which are more aromatic (volatile) and which are the thickest (viscous):
a. ***Myrrh*** *or* ***Sandalwood*****:** large sesquiterpene molecules
b. ***Frankincense*** *or* ***Cypress*****:** smaller monoterpene molecules.

What does this have to do with their molecular weights?

V. THE CHOSN ONES – CH 4 10:45–11:10

A. **FIVE life sustaining elements: C H O S N**
Carbon, Hydrogen, Oxygen, Sulfur, Nitrogen
(The Chosen Ones*). (pp. 121–123)*

B. **Valence defined**: a numerical value which represents the number of electrons in the outer shell of an atom which makes itself a whole functioning atom, with a desire to 'share' their electrons with other atoms without losing its 'identity'.
(pp. *132–136)* Valences of the CHOSN Ones are as follows:
Carbon-4 Hydrogen-1 Oxygen- 2 Sulfur -2 Nitrogen-3

C. Note that **Oxygen** and **Sulfur** have the same valence because they are in the same vertical column of the periodic table. This illustrates why all elements in same vertical column in Periodic Table have similar chemical properties—all have same valences.*(p. 82, 134–135)*

D. **Sulfur and Nitrogen** are not major players in essential oils but when sulfur is present, it almost always influences the aroma (examples: garlic, onion, and grapefruit) (*pp. 123–128)*

E. **Essential Oils do not contain amino acids** and are devoid of protein molecules which are too large to pass through distillation. However, oil compounds often do start out in plants as amino acids before they are metamorphosed into the hydrocarbons and oxygenated hydrocarbons that comprise essential oils. (*pp. 127–131)*

F. **Allergies and nitrogen compounds.** It is impossible to have an allergic reaction to an essential oil because they contain no peptides, polypeptides, amino acids, or proteins, which are the sources of allergens. Carrier oils and expressed oils, which are not distilled, can be allergenic because they do contain traces of protein, etc. Some people are allergic to Valor because of the almond oil, not because of the essential oils in that blend. (see *Chapter Twelve, pp. 451-470*).

The chemistry of essential oils consists of simple hydrocarbons, oxygenated hydrocarbons, and their isomers.

V. ORGANIC CHEM MADE EASY – CH 5 11:10–11:35

A. Organic chemistry
1. Carbon is the basis of all living life forms.
2. The word, "organic" to a chemist means anything made up of Carbon and to the public at large in considering "organic" products for purchase it means something that is pesticide/ GMO free. *(pp. 142–144)*

B. **Simple Hydrocarbons: C H** *(pp. 146–153)*
1. **Alkane Series**: a family of compounds consisting of Hydrogen and Carbons atoms.

The general formula for alkane is: # carbon atoms, multiply by 2 and add 2 to get the number of Hydrogen atoms in a molecule of an alkane: **C_nH_{2n+2}** (*see table 7 p148).*

2. The 'simplest' Alkane is called **Methane CH_4**
(decomposed vegetable matter)

3. Another "simple Hydrocarbon is **Octane C_8H_{18}**
(main ingredient in gasoline)

4. There are a number of alkanes that are found in oils but usually only in trace amounts (<0.1%) **Ginger**

5. The highest concentration of alkanes in an oil is 11-19% **Rose**

C. **Introducing the 'Radical Sisters'** *(pp. 153–155)*

1. A radical is an incomplete molecule looking to attach themselves to complete their valence – they do not 'share' their electrons.
Methyl: CH3 Ethyl: C2H6 Propyl: C3H7 Butyl: C_4H_9

D. **Oxygenated Hydrocarbons: C H O** *(pp. 156–159)*

1. When you add an **Oxygen** to an alkane it turns the alkane into an alcohol, which is an "Oxygenated Hydrocarbon".
2. An Alkane mixed with an OH molecule is a piece of a water molecule that is missing an H atom. It is called a "hydroxyl radical." Radicals are "incomplete parts of molecules."
3. Carbohydrate vs. ***Hydrocarbon***
A Hydrocarbon is a compound composed purely of hydrogen and carbon atoms. Oils of all kinds are either mixtures of hydrocarbons or oxygenated hydrocarbons .
4. Don't confuse Hydrocarbon with Carbohydrate.
Carbohydrates are composed only of carbon atoms and water molecules, as the name implies. Starches and sugars are examples of Carbohydrates, which are soluble in water. **Hydrocarbons** are composed only of carbon and hydrogen atoms, as their name implies. Certain oils, fuels, and petroleum products are examples of Hydrocarbons, which do not dissolve or mix with water.

E. **Isomers (*Greek Iso = same meros =parts)***. *(pp. 165–166)*

1. Molecular compounds with the same chemical formula but have differently structured molecules.
2. Propyl alcohol and **isopropyl alcohol** are isomers. Their chemical formulas are: **C_3H_8O.**
3. We can illustrate the many possibilities which exist for isomers by using 16 different color Legos as our molecular structure.
5 – Yellow 8 –Red 3 – Blue
4. Our chemical formula (using the Legos) would be: **$Y_5R_8B_3$**

VI. LORD OF THE RINGS – CH 6 11:35–12:00

A. **Kuekele's Dream: The Dancing Snakes** *(pp 172-175)*

1. Benzene Aromatic Ring: a ring of 6 Carbons forming a hexagon
2. Benzene's chemical formula : **C6H6**
3. Besides the hexagonal Benzene Ring, essential oils contain numerous forms of rings (closed arrangements of carbons) including triangles, quadrilaterals, pentagons, and even large rings involving 9, 10, and even 16 carbons. They are all called "Aromatic Rings."

B. **Aromatic Rings and Non-localized electrons** (*pp. 176–177*)

1. **Non-localized electrons** are the origin of electromagnetic frequencies in oils, the aromatic rings cease to have the properties of particles (matter) only, but also take on the properties of a wave (energy) as well.
2. Aromatic Rings, including Benzene Ring gives Essential oils their 'frequency' and aromas.
3. The rainbow colored representation on the back cover of the *Chemistry Made Simple* book depicts a benzene ring as a wave form with resonance energy.

C. **Phenol molecules & Functional Groups (***pp. 191–195)*

1. *Phenol Molecule* = Benzene Ring + OH **C_6H_6O**
2. *Phenolpropanoids* = Phenol Molecule + Propyl Radical
$C_9H_{12}O$

3. Phenolic Compounds cleanse the receptor sites and detoxify the the body *(see table 48 p 571)*

D. **Reading Structural Formulas** (*pp. 195-196*)
This is a 'fun' practice session learning how to read structural formulas.

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End of Chem I

CHEM II

(*The Second Three Hours: 9:00 am – 12 noon)*

VII. REVIEW CHEM ONE CONCEPTS 9:00–9:20

A. **Snake oil** *(p.246)*
1. *Melaleuca alternifolia* commonly referred to as: 'Tea Tree Oil'or "snake oil"
2. Native to Australia is a genus of evergreen trees.
3. YLEO blend , *Purification*®, contains: *Melaleuca alternifolia*

B. **A Quick Review** of: Valence, molecular weight, phenols and isomers.

C. **Practice reading formulas from structures**: Choose from formulas given on (*pp. 750-751)*. This is a confidence building exercise and helps them to not be bewildered when structural formulas are flashed up during Power Point presentations at YLEO functions.

VIII. BIOCHEMISTRY MADE EASY – CH 7 9:20–9:45

A. **Biochemistry** is the chemistry of organisms and life processes which are more complex and intuitive.

B. **Organic chemistry** is the study of carbon compounds in a lifeless environment (lab).

C. **Chiral molecules** *(Greek cheir=hand). (pp. 212–215)*
1. Chiral molecules are right and left handed isomers (same parts different structures). They have the same chemical formula but different structures.
2. An example of this is d-Carvone and l-Carvone, **$C_{10}H_{14}O$,** found in the essential oils of : **Spearmint** (d-Carvone) and **Dill (**l-Carvone)
3. How sensitive is your nose to this difference?

D. **Receptor Sites** *(pp216-221)*
1. There are literally thousands of receptor sites on our cells.
2. They function like doors, only opening if the right "key" fits its lock.
3. That is why the Carvone molecule in Dill and Spearmint will only fit into the specific 'locks' on the corresponding organs.
4. Another example is on page 218. Take note of the different placements of the OH radical and how although they have similar shapes, each essential oil has a different fragrance.

E. **Practice Reading Formulas** of six molecules just shown on p. 218. Take note of the bent symbols for menthol.

IX. SPECIES & CHEMOTYPES - CH 8 9:45–10:00

A. **Genus and Species.** *(pp. 234–239)*
1. **Genus** (1st Latin botanical name & 1st letter is capitalized) a category or subgroup of a family of plants (close relatives)
2. **Species** (2nd Latin botanical name & 1st letter is in lower case) same seed, same DNA
3. **Chemotypes:** a variation within the chemistry of an oil that is produced from the same <u>*botanical species*</u>.
4. Chemotypes are to essential oils what vintages are to wines.

X. ISOPRENES & PMS - CH 9

A. **Isoprene and Terpene Units.** *(pp. 255–266)*
1. The Isoprene Unit is the building block of all the compounds found in essential oils.
2. Its chemical formula is: **C_5H_8** *(see drawing on p 255)*

3. Two Isoprene Units make a Terpene Unit which is the most common class of chemical compounds found in essential oils.
4. Turn to page 260 and note the classes of Terpenes found in essential oils *(table 12)*
5. Rubber molecules are composed of many Isoprene units, this is why it is used in many items of clothing ('neoprene') to prevent water from absorbing. *(p 261)*
6. Notice when you add more Terpene molecules together their molecular weight becomes heavier and their fragrance is less apparent. *(see p 264)*
7. Turn to the drawing on page 257 and see if you can see the two Isoprene units which make up a Terpene unit in the CARE logo.

B. **PMS—Phenolics, Monoterpenes, Sesquiterpenes.** *(pp290 – 304)*
The Triple Whammy of Essential Oils.

1. **Phenolics** cleanse receptor sites.
2. **Sesquiterpenes** delete bad information in DNA memory.
3. **Monoterpenes** reprogram or reinstate the correct information (God's image) for proper cellular function.
4. PMS oils can work together to bring about permanent healing, sometimes instantaneously, because together they can remove the root source of some problems at a cellular level.

C. **Chemistry of Raindrop Technique** *(pp297 -301)*

1. Raindrop Technique is a protocol for applying oils to the feet and back in a sequence involving various hands-on techniques.
2. The technique consists of a certain percentage of Phenols, Sequiterpenes and Monoterpenes. *(see p 298 & table 68 on p 586)*

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RECESS 10:25–10:40

XI. COMMON COMPOUNDS IN OILS – CH 10 10:40–11:25

A. **Oil Compounds Behave like People.** *(p. 311–312)*

1. Part of the chemistry of an oil's reaction to a person has to do with that particular person's own chemistry.
2. The behavior of a specific compound in an oil varies according to the influence of its companions in the oil.
3. Essential oils exist as packets of probabilities until applied to a person at which time the intents of the anointer and the anointed determines which probabilities actually manifest.

B. **Six Important Types of Oxygenated Hydrocarbon** *(table 17 p 314)*

1. Alcohols & Ethers
2. Aldehydes & Ketones
3. Carboxylic Acids & Esters

Take notice of the similar pairs of these compounds and see what makes them similar - notice their aromas.

C. **Oxides** (*pp. 362-368)*

1. Created in oils when other compounds (terpenes, alcohols or ketones) are oxidized.
2. The Cineol Sisters *(p 366)*

D. Lactones and Coumarins. *(pp. 375-79*)

1. **Lactone**: an ester with a single bonded O atom part of a hydrocarbon ring (see molecular drawing p.1 **Hibiscus seed**)
2. **Coumarin**: a lactone with a benzene ring. A natural blood coagulant (Vitamin K)
3. The synthetic drug 'Coumadin' has the 'coumarin' molecule in it, yet it is used as a blood thinner . *(see p 375)*
4. Drug companies take generic or natural substances and alter them slightly to create patentable drugs and obtain a monopoly.

E. Furan, Furanoids, and Furanocoumarins *(pp 379–383*)

1. Mostly found in citrus oils, but not in all citrus oils.
2. They are a 5-sided molecules **C4H4O**
3. They resonate with UV light thereby being phototoxic if there are no other compounds in the oil to quench it.
4. They also play a role in ripening fruit.
5. A list of essential oils considered phototoxic is found on p.381

6. **Bergamot** (a citrus oil) is an example of a phototoxic oil. It contains 1-4% furanocoumarins.
7. **Myrrh** is not a phototoxic oil yet it contains up to 27% furanoids.

XII. 16 PRACTICAL ANSWERS ON OILS – CH 12 11:25–11:45
On p. 430 there is a list of 16 topics on essential oils. Let's pick out a few that 'spike your interest'**.**

XIII. A LIST OF TOPICS COVERED IN THIS COURSE

1. Review of Literature
2. Basic Chemistry
3. The Chosen Ones
4. Basic Organic Chemistry
5. Aromatic Rings and Phenols
6. Basic Biochemistry
7. Chemotypes
8. Terpenes
9. PMS
10. Twenty-Two Categories of Compounds in Essential Oils
11. Practice reading structural formulas
12. Practical Answers to Frequently Asked Questions

XIV. CONCLUSION **11:45–12:00**

The chemistry of essential oils consists of simple hydrocarbons, oxygenated hydrocarbons, and their isomers.

…But their behavior cannot be explained by chemistry, alone.

A. **Part Three** in the Chemistry book will take you "Beyond Chemistry". From the limits of science to the nature of matter, Part Three will introduce you to a deeper realm to truly understand how aromatic oils accomplish their healing and spiritually uplifting properties.

B. This course begins to lay the foundation to show that both Science and Scripture support the same conclusions. God's consciousness is present in all creation even at the level of the atoms.

Science is really the art of seeing forces and elements invisible to the normal senses.

Faith is the substance of things hoped for,
the evidence of things not seen. *~Hebrews 11:1*

C. The healing knowledge of the plants is once again being revealed and brought to light at this time in history.
What has been is what will be, and what has been done is what will be done, there is nothing new under the sun. ~Ecclesiastes 1:9

D. A proper understanding of science truly "tells the glory of God" and truly "proclaims his handiwork" and that "God's nature is revealed in what he has made." (Psalm 19:1 and Romans 1:20)

In Conclusion:

1. According to the *Bible*, God created plants (and their oils) on the third day (Genesis 1:11–13), but didn't create man and woman until the sixth day (Genesis 1:26–31). Plants came before people.

2. If one subscribes to the Geologic Model for creation, plants and people happened in the same order. Plants were growing on earth long before people came to dwell.

3. As for learning how oils extracted from plants respond to human thought and intent, a good way is to study how plants respond to human thought and intent. The book The Secret Life of Plants by Tompkins and Bird is a good way to start.

4. What this means is as long as there are living plants the knowledge of their healing powers (including their oils) can never be lost…they will always be there in the plants themselves.

5. Their silent language is one of the Spirit and can only be heard through the Spirit.

6. The molecules of essential oils fit human receptor sites so perfectly and our bodies accept and metabolize them so readily and with such benefits, that one can only conclude that God created them with his children in mind.

7. In other words, God loved us before he ever created us. The chemistry of essential oils is God's love manifest in molecules.

End of Chem II