Module Two

Plants and Essential Oils

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Module Two: Lesson 1

Medicinal Plants

Learning Objectives

Upon completion of this lesson, you will be able to:

1. Discuss the importance of plants in relation to aromatherapy.
2. Briefly describe how plants have historically been used as medicine.
3. Define the term “photoautotrophs”.

INTRODUCTION

You may be wondering why, as aromatherapy students, you need to learn about plants? Aromatherapy depends upon pure, unadulterated, and genuine essential oils derived specifically from the living world of plants. You won't have to become a botanist or anything of that sort, but many aromatherapists or individuals who utilize aromatherapy products may never actually interact with the plants they are derived from. It is, however, important to have an appreciation for the plant world since without it genuine and authentic aromatherapy would not be possible.

Genuine and authentic aromatherapy utilizes only essential oils derived directly from plants, avoiding, at all cost, the use of synthetics, reconstructions, perfumes, and other adulterated versions. The importance of this chapter is to develop an appreciation for our interconnected and symbiotic relationship with plants, how and why they produce essential oils, how essential oils are extracted, and how we put them to use once extracted.

WHAT IS A PLANT?

"Plants mean nothing in isolation; they are a life-form rooted in and identified by their community, by their relationships to and interactions with all other life on Earth."
Stephen Harrod Buhner[1]

Defining what a plant is has its difficulties. One could say that plants are green, have stems and roots, and normally produce flowers, resins, and/or fruits. However, this definition does not adequately define all plants nor does it convey an idea of the variations found within the plant world. There are many kinds of plants, ranging from tiny mosses and ferns to giant sequoias and eucalyptus trees. In aromatherapy, we will be studying two groups within the plant kingdom: the **angiosperms (Table 2.1)** or flowering plants, which include the vast majority of essential oils, and the **gymnosperms (Table 2.2)**, plants that lack flowers but produce seeds such as the conifers.

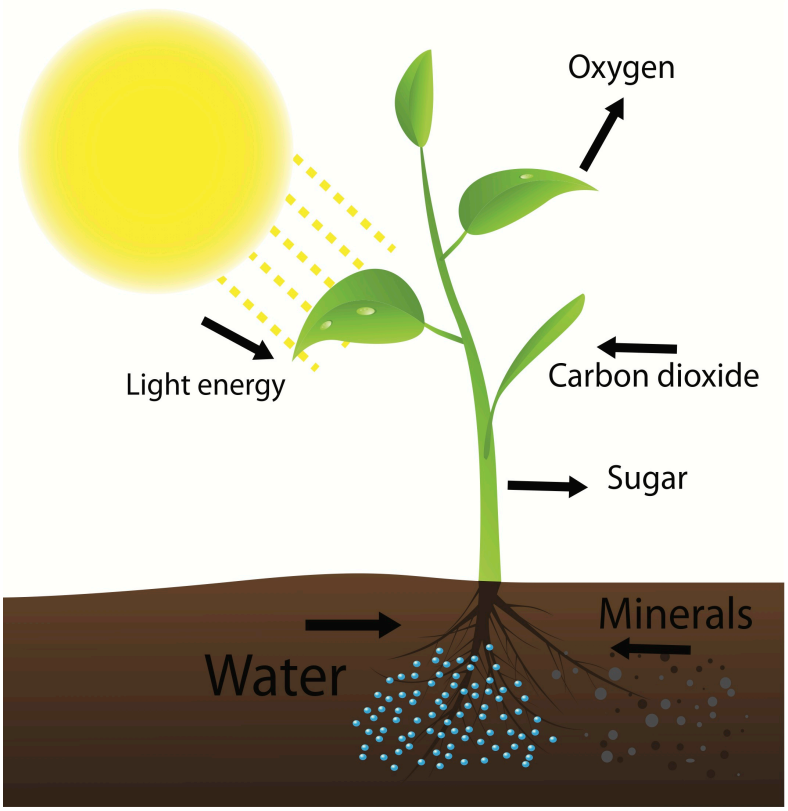
Table 2.1 Angiosperm/Flowering Plants Botanical Families and Essential Oils	
Annonaceae	Ylang ylang
Apiaceae syn. Umbelliferae	Angelica, Caraway, Carrot seed, Celery, Dill, Fennel, Parsley
Asteraceae syn. Compositae	Roman chamomile, German chamomile, Helichrysum, Inula
Betulaceae	Birch
Burseraceae	Elemi, Frankincense, Myrrh
Geraniaceae	Geranium, Rose Geranium
Lamiaceae syn. Labiatae	Basil, Catnip, Clary sage, Hyssop, Lavender, Melissa, Oregano, Patchouli, Peppermint, Rosemary, Sage, Thyme
Lauraceae	Bay Laurel, Cinnamon, Ravensara, Rosewood
Myristicaceae	Nutmeg
Myrtaceae	Clove, Eucalyptus, Myrtle, Tea tree
Piperaceae	Black pepper
Poaceae syn. Gramineae	Lemongrass, Palmarosa
Rosaceae	Rose
Rutaceae	Bergamot, Grapefruit, Lemon, Lime, Sweet Orange, Blood Orange, Tangerine/Mandarin
Santalaceae	Sandalwood
Zingiberaceae	Cardamom, Ginger

Table 2.2 Gymnosperm Botanical Families and Essential Oils	
Pinaceae	Fir, Cedar, Larch, Spruce, Pine, Douglas Fir, Hemlock
Cupressaceae	Cypress, Juniper, Thuja

Of the over 400,000 known species of plants, over half are members of the angiosperm group. The angiosperms and gymnosperms were the first groups in the plant kingdom to begin widespread production of essential oils. Early evolved plants, such as the bryophytes (e.g., mosses and liverworts) and seedless vascular plants (e.g., ferns), contained little to no essential oil. It is believed that as plant life evolved they began producing secondary metabolites, such as essential oils, in response to an increasingly changing environment.

Plants are structured in a physical body, and they depend on the soil, water, air, and sunlight to sustain life and perform complex chemical activity. This complex chemical activity produces **primary metabolites**, meaning they are vital to the plant's life, such as enzymes, protein, lipids, carbohydrates, and chlorophyll, and **secondary metabolites**, constituents that are not considered necessary for life, such as alkaloids, flavonoids, and essential oils.

Plants are **photoautotrophs**, which means they depend on the sun in order for photosynthesis to occur thereby producing complex organic compounds necessary to sustain life.



All plants need sunlight to grow, with the exception of parasitic plants that are able to grow with or without sunlight. Humans, on the other hand, are considered **heterotrophs**. Humans depend on

the release of oxygen from plants to provide the necessary energy to sustain life. Plants are responsible for their own growth and molecules by utilizing carbon dioxide, water, and various nitrates, sulfates, and other minerals found on earth and its atmosphere. Photoautotrophs are the only form of life that can transform radiant energy into chemical energy (photosynthesis).

PLANTS AS MEDICINE

In her widely acclaimed book, *Green Pharmacy*, Griggs reminds us that "there is virtually no people known to anthropology—however remote, isolated or primitive—in which some form of doctoring with plants was not practiced.[2] Plants have been used throughout history for medicine, food, clothing, and shelter. Plants provide a variety of active components including: fatty acids, essential oils, gums, resins, alkaloids, and steroids, all of which have found their way into medicine.

One example of plant-based medicine would be the *Eucalyptus* species, which is used to isolate the active constituent eucalyptol (syn. 1,8 cineole) for its expectorating action. Eucalyptol is one of three essential oil compounds that makes up the famed chest rub, Vicks™ VapoRub. The other compounds include camphor from rosemary or camphor tree and menthol from peppermint. All three oils are used for the treatment of muscular aches and pains as well. Another example is the active constituent of birch (*Betula* ssp.), methyl salicylate, used for its analgesic properties; it is the active ingredient in BenGay™ .

Other examples of important medicinal constituents from plants include the active compound salicin from the willow tree (*Salix* species), which is used as an anti-inflammatory and analgesic compound for treating headaches; the active compound digitoxin from foxglove (*Digitalis purpurea*), which is used to treat heart conditions; steroids from yams (*Dioscorea* species), which will be used to create cortisone, oral contraceptives, and hormone-based drugs; and morphine from the opium poppy (*Papver somniferum*).

Approximately 80 percent of the world's population still depends on medicinal plants for their primary healthcare, and approximately 20 percent of modern drugs have either been extracted from plants or are synthetically reproduced based upon isolated chemicals from plants.[3]

Our environment of plants is important. Indeed, humans and plants have a crucial symbiotic relationship based upon an interconnectedness and interdependence with the natural world. This relationship is crucial not only for our own survival but for the survival of the plant world. Exploring the biological role of essential oils within plants sheds light on some of the very same reasons humans use essential oils. Historically and in modern times, humans have utilized essential oils to attract and even repel other beings (consciously or unconsciously), to protect against microbial agents, to support respiration, and to defend against pests and insects such as mosquitoes.

We will explore this in the next lesson.

Module Two: Lesson 2

The Biological Role and Storage of Essential Oils within Plants

Learning Objectives

Upon completion of this lesson, you will be able to:

1. Describe four biological roles of essential oils within plants.
2. Describe the storage of essential oils within the plant.

THE BIOLOGICAL ROLE OF ESSENTIAL OILS WITHIN PLANTS

While essential oils are in the plant, they are constantly changing their chemical composition, helping the plant to adapt to the ever-changing internal and external environment. Recent scientific research has shown that plants produce essential oils for a variety of purposes including:

→ To attract pollinators and dispersal agents

Insects have been pollinating flowers for over 200 million years. Insects, like humans, are attracted to specific plants for one of three possible reasons: its aroma, its color, or its morphology or physical structure. According to Shawe, scent appears to be more ancient than flower color as an attractant to insects.[4] Various insects, including bees, butterflies, and even beetles, are known to be attracted by the aroma of a plant.

→ To play a role in allelopathy, a type of plant-to-plant competition

Allelopathy occurs when a plant releases chemicals to prevent competing vegetation from growing within its area or zone. An often cited example is in southern California, home to the dominant shrubs *Salvia leucophylla* (sage bush) and *Artemisia californica* (a type of sage). Both species release allelopathic terpenoids, eucalyptol and camphor, into the surrounding area, which effectively prevents other plant species from growing around them. This is allelopathy. Chemicals that deter competing growth (terpenes, for example), are referred to as **allelochemics**.

→ To serve as defense compounds against insects and other animals

Plants, like other living things, need to protect themselves from various types of predators. Plants use terpenoid compounds to deter insects and other animals from approaching them. Shawe pointed out that “insects are very rarely found on peppermint plants and the presence of linalol in the peel of citrus fruits confers resistance to attack by the Caribbean fruit fly.[5] The Douglas fir tree

releases a complex mixture of volatile oils, or terpenes, from their needles to defend against the spruce budworm. Even more fascinating is that the Douglas fir trees will vary the composition and production of terpenes each year thus decreasing the ability of the budworm to develop widespread immunity to specific compounds.[6]

→ To protect the plant by their antifungal and antibacterial nature

Resins and complex combinations of terpenes are released by some plants and trees, such as evergreens, to act as antimicrobial, antifungal, and antibacterial agents against a wide range of organisms that may threaten the survival of the plants. Compounds such as sesquiterpene lactones found in plants such as feverfew, yarrow, and blessed thistle, have been found to play a strong antimicrobial role as well as a protective role from herbivores.

THE STORAGE OF ESSENTIAL OIL WITHIN THE PLANT

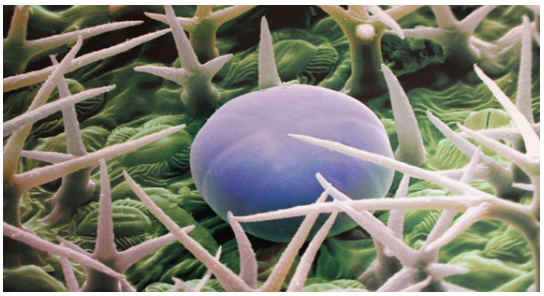
Plants store essential oils either in **external secretory structures**, which are found on the surface of the plant, or **internal secretory structures**, which are found inside the plant material. Usually with plants having external secretory structure, you just have to lightly touch them and you will notice an aroma imparted to your skin. With plants having internal secretory structures, you may need to break the leaf or seed in order to get to the aroma/essential oil.

External Secretory Structures

■ Glandular trichomes

External secretory structures in plants are called **glandular trichomes.** They can be found on the surface of the plant (such as herbaceous leaves) and are thought to be responsible for the production of chemicals that deter or attract pests or pollinators. Glandular trichomes are most commonly found in the Lamiaceae (syn. Labiatae) family. The oil storage capacity varies from species to species and also between trichomes. Biochemical experiments have shown that these volatile oils are synthesized by highly refined enzyme reactions taking place within the plant.

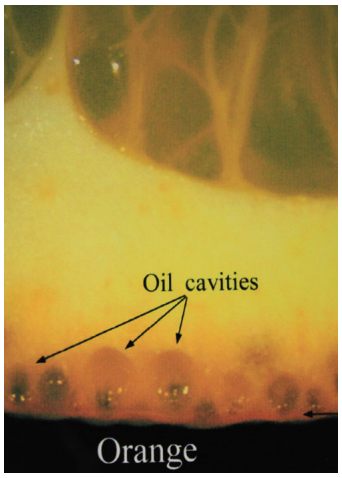
Common essential oils that have glandular trichomes: Basil, Lavender, Marjoram, Melissa, Oregano, Peppermint, Rosemary, and Spearmint.



Glandular trichome of *Lavandula angustifolia*

Internal Secretory Structures

■ Secretory cavities and ducts



Secretory cavities and ducts consist of large, intercellular spaces that are formed either by the separation of the walls of neighboring cells, or by the disintegration of cells.[7]

Families containing **secretory cavities** include: fruits and leaves of plants in the Citrus family (Rutaceae) as well as *Eucalyptus* spp. (Myrtaceae). Secretory cavities are also present in the flower buds of cloves (*Syzygium aromaticum* (L.) Merr. & L.M. Perry, Myrtaceae), and in the elongated cavities in the bark of frankincense (*Boswellia* spp., Burseraceae).[8]

Ducts are more elongated spaces and are most commonly seen in the family Apiaceae (Umbelliferae) as well as the families Asteraceae (Compositae), and Pinaceae.[9]

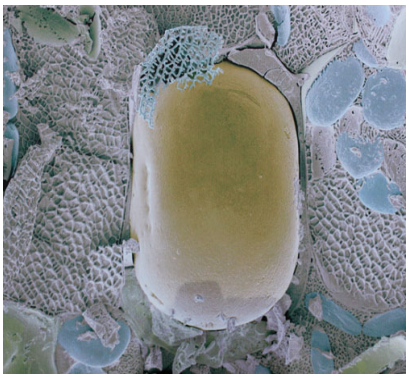
Common essential oils with secretory cavities:

- **Rutaceae family:** Bergamot, Sweet Orange, Tangerine/Mandarin, Lemon, Lime, Blood orange
- **Myrtaceae family:** Clove bud, Eucalyptus, Tea tree
- **Burseraceae family:** Frankincense, Myrrh, Benzoin

Common essential oils with secretory ducts:

- **Apiaceae family:** Angelica, Caraway, Carrot seed, Dill, Fennel,
- **Asteraceae family:** Yarrow, Roman and German chamomile, Tansy, Helichrysum, Inula
- **Pinaceae family:** Fir, Cedar, Spruce, Pine

■ Essential oil secretory cells



Essential oil secretory cells are found within the plant tissue and are unique from other cells in content and size. This cell type is found in many different plant tissues, such as in the rhizome pith and cortex of ginger (*Zingiber officinale* Roscoe, Zingiberaceae) and in the perisperm and embryo of nutmeg (*Myristica fragrans* Houtt., Myristicaceae).[10]

Common essential oils with secretory cells:

- Zingiberaceae family: Ginger
- Myristicaceae family: Nutmeg

Module Two: Lesson 3

From Plant to Essential Oil: Methods of Extraction

Learning Objectives

Upon completion of this lesson, you will be able to:

1. Draw, label, and explain the general distillation process.
2. Define the term “essential oil”.
3. Define what a hydrosol is and differentiate it from an aromatic spritzer.

METHODS OF EXTRACTION

> **Essential oils are:** highly concentrated aromatic extracts that are distilled or expressed from a variety of aromatic plant material, including flowers, flowering tops, fruits/zests, grasses, leaves, needles and twigs, resins, roots, seeds, and woods.

It is common in the mass market to refer to just about anything that is liquid in a brown bottle and smells as an essential oil. Even within the aromatherapy profession, many call absolutes and CO2 extracts essential oils. Technically, however, only distilled or expressed substances are essential oils. The International Organization for Standardization (ISO) in their Vocabulary of Natural Materials (ISO/ D1S9235.2) defines an **essential oil** as a product made by distillation with either water or steam or by mechanical processing of citrus rinds or by dry distillation of natural materials. Following the distillation, the essential oil is physically separated from the water phase.

According to Dr. Brian Lawrence "for an essential oil to be a true essential oil, it must be isolated by physical means only. The physical methods used are distillation (steam, steam/water and water) or expression (also known as cold pressing, a unique feature for citrus peel oils). There is one other method of oil isolation specific to a very limited number of essential oil plants. This is a maceration/distillation. In the process, the plant material is macerated in warm water to release the enzyme-bound essential oil. Examples of oils produced by maceration are onion, garlic, wintergreen, bitter almond, etc."[11]

In Chinese terms, essential oils are medicines for the Shen, the spiritual essence that resides in the heart and governs consciousness.
In Ayurvedic terms, they enhance the flow of prana (life force), nourish ojas (nutritional/immunological essence), and brighten tejas (mental luminosity).

– David Crow

NOTE: Gums and Resins

Resins, such as frankincense, myrrh, and benzoin, are very thick and sticky when extracted from the tree. In aromatherapy, resins such as frankincense and myrrh are distilled, resulting in an essential oil that is more fluid and easier to pour. Benzoin, although an uncommon oil, cannot be distilled and remains a thick resinoid.

Often benzoin will be diluted down with a perfume grade alcohol to make it more usable. Resins are most commonly used in perfumes as fixative agents to prolong the fragrant effects of perfumes. Frankincense and myrrh are the most commonly used resins for a wide range of therapeutic benefits in aromatherapy.

The two methods of extracting an essential oil include:

Distillation: produces essential oils and hydrosols (Hydrolat).

Expression: produces citrus oils, which can also be called essential oils.

Essential oil versus Essence: Some companies differentiate between the distilled essential oil by calling it an essence and the expressed by calling it the 'essential oil'. E.g. Sweet orange essential oil (expressed) and Sweet orange essence (distilled). Be sure to check with your supplier to make sure you are ordering what you want.

The Practice of Distillation

Distillation appears to have been practiced throughout ancient times. According to Schnaubelt, “Based upon the current interpretation Paolo Rovesti’s discovery of an earthenware distillation apparatus, the production or extraction of aromatic oils by means of steam distillation, has been known for 5000 years”.[12] During the fifth century AD, the famed writer, Zosimus of Panopolis, refers to the distilling of a divine water and panacea. Throughout the early Middle Ages and beyond, a crude form of distillation was known and was used primarily to prepare floral waters or distilled aromatic waters. These appear to have been used in perfumery, as digestive tonics, in cooking, and for trading.

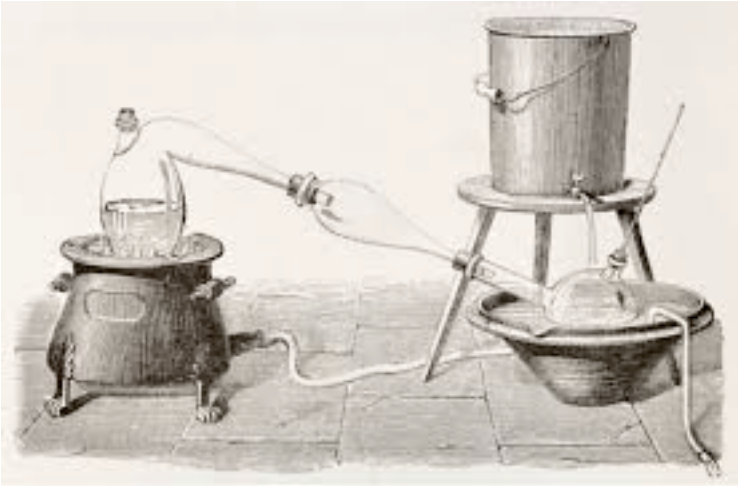
Although an extensive trade of odoriferous material has been shown to have occurred in the ancient Orient and ancient Greece and Rome, the oils used were not essential oil, “rather they were obtained by placing flowers, roots, and other plant material into a fatty oil of best quality, submitting the glass bottles containing these mixtures to the warming influence of the sun and finally separating odoriferous oil from the solid constituents.”[13] In 900 AD, Avicenna, the famous child prodigy from Arabia who wrote many documents on plants and their uses and also instructions for massage, was accredited with refining the process of distillation by improving the cooling system.

Today distillation is still the most common process of extracting essential oils from plants. The advantage of distillation is that the volatile components can be distilled at temperatures lower than the boiling points of their individual constituents and are easily separated from the condensed water.

Distillation as Alchemy

When we pick up an essential oil, we could say that we are holding a physical manifestation of Alchemy. We could describe this process of alchemy in the language of the five elements. As plant material (Earth) is placed inside a container (Space) it is then mixed with water/steam (Water)

and heated by fire/steam (Fire) which transforms water/earth (water/plant material) into a vapor. This vapor condenses down into water and essence.



Preparation of Plant Material

Some types of plant material require preparation prior to distillation. Since essences are stored in a variety of locations within the plant, such as glandular trichomes, oil cavities, ducts, and cells, it is sometimes necessary to crush, open, or in some other manner prepare the plant material in order for the plant to release its essence during the distillation process. Plants, such as those in the Lamiaceae/Labiatae family, tend not to need much preparation. However, woods, roots, and seeds do need preparation. Seeds are crushed to release their aromatic essence prior to distillation. Woods are often cut into shorter lengths in order to expose the oil glands.

The main purpose of preparing plant material is to allow easier access to the volatile constituents as the steam passes through the material. Immediately after the plant material has been prepared, it must be distilled. If the plant material is not distilled immediately, two things may occur: (1) the total quantity yielded will be reduced, and (2) the composition and hence the aroma will be altered by evaporation of some of the constituents. Once the plant material has been prepared, it then enters the distillation process.

The three types of distillation include:

- **Water Distillation**

  The plant material comes into direct contact with the water. This method is most often employed with flowers (rose and orange blossoms), as direct steam causes these flowers to clump together making it difficult for steam to pass through.

- **Water and Steam**

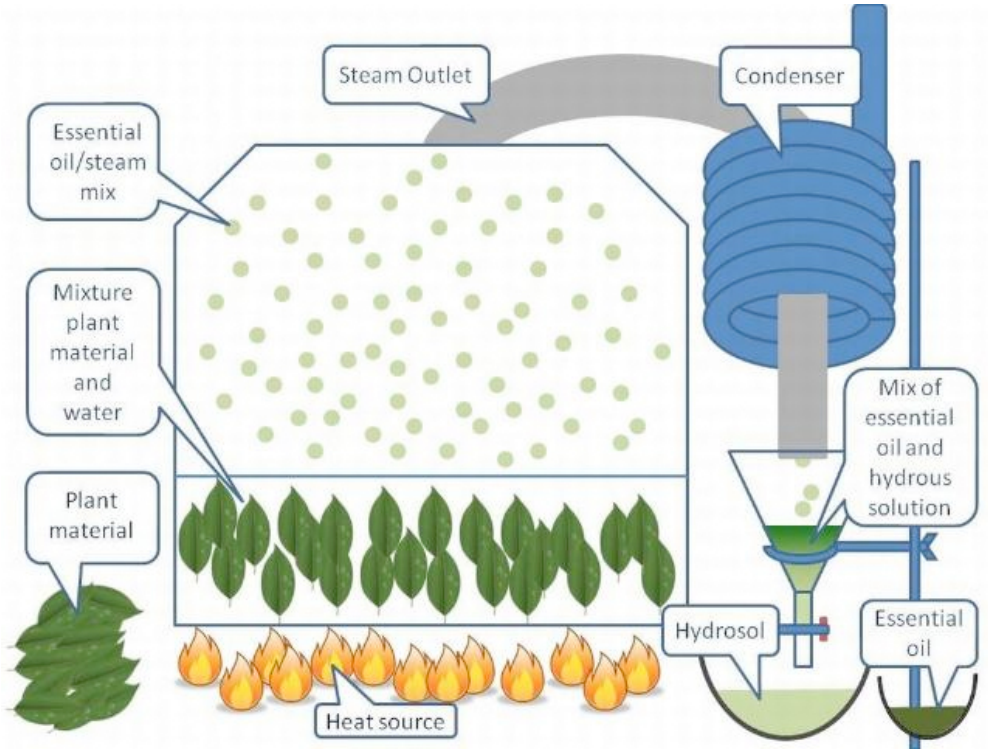
  This method can be employed with herb and leaf material. During this process, the water remains below the plant material, which has been placed on a grate while the steam is introduced from outside the main still (indirect steam).

- **Steam Distillation**

  This method is the most commonly used. During this process, steam is injected into the still, usually at slightly higher pressures and temperatures than the above two methods.

Note on Boiling Point: The boiling point represents the temperature at which a liquid is converted to a gas at a specified pressure. The fundamental nature of steam distillation is that it enables a compound or mixture of compounds to be distilled (and subsequently recovered) at a temperature substantially below that of the boiling point(s) of the individual constituent(s). Essential oils contain substances with boiling points up to 200°C or higher, including some that are solids at normal temperatures. In the presence of steam or boiling water, however, these substances are volatilized at a temperature close to 100°C at atmospheric pressure.[14]

The Distillation Process



During distillation the plant material is placed upon a grid inside the still. Once inside, the still is sealed, and, depending upon the above methods, steam or water/steam slowly breaks through the plant material to remove its volatile constituents. These volatile constituents rise upward through a connecting pipe that leads them into a condenser. The condenser cools the rising vapor back into liquid form. The liquid is then collected in a vehicle below the condenser. Since water and

essential oil do not mix, the essential oil will be found on the surface of the water where it is siphoned off. Occasionally an essential oil is heavier than water and is found on the bottom rather than the top, such as clove essential oil.

Percolation or Hydro-diffusion

This is a relatively recent method and is very similar to steam distillation except that the steam comes in through the top rather than the bottom, and there is a shorter distillation time. It is useful in extracting essential oils from woody or tough material or seeds such as fennel and dill.

Expression

Expression, also referred to as **cold pressing**, is a method of extraction specific to citrus essential oils, such as tangerine, lemon, bergamot, sweet orange, and lime. In older times, expression was done in the form of sponge pressing, which was literally accomplished by hand. The zest or rind of the citrus would first be soaked in warm water to make the rind more receptive to the pressing process. A sponge would then be used to press the rind, thus breaking the essential oil cavities, and absorb the essential oil. Once the sponge was filled with the extraction, it would then be pressed over a collecting container, and there it would stand to allow for the separation of the essential oil and water/juice. The essential oil would finally be siphoned off.

A more modern method of extraction, and less labor-intensive, has been termed the **ecuelle a piquer** process that involves a prodding, pricking, sticking action to release the essential oil. During this process, the rind of the fruit is placed in a container having spikes that will puncture the peel while the device is rotated. The puncturing of the rind will release the essential oil that is then collected in a small area below the container. The end process is the same as above. The majority of modern expression techniques are accomplished by using machines using centrifugal force. The spinning in a centrifuge separates the majority of essential oil from the fruit juice.

Fig. 9. Expression of lemon oil from the rinds (Palermo).

What is the difference between expressed and distilled citrus oils?

Some aromatherapy companies sell both a distilled and an expressed citrus essential oil from the same species. The main differences between a distilled and an expressed citrus essential oil have to do with their toxicity, volatility, and aroma. Distilled citrus oils deteriorate more quickly and are considerably more unstable than the expressed oils.

Differences between Expressed and Distilled Citrus Essential Oils		
Essential Oil	**Distilled**	**Expressed**
Lemon (*Citrus limon*)	Non-phototoxic	Phototoxic Aroma considered superior
Lime (*Citrus medix*)	Non-phototoxic Aroma considered superior	Phototoxic
Grapefruit (*Citrus paradisi*)	Low phototoxicity concern	Low phototoxicity concern
Bergamot (*Citrus bergamia*)	Phototoxic	Phototoxic Aroma considered superior
Blood Orange (*Citrus sinensis*)	Non-phototoxic	Non-phototoxic
Mandarin/Tangerine (*Citrus reticulata*)	Non-phototoxic	Non-phototoxic

Module Two: Lesson 4

Absolutes and CO2 Extracts

Learning Objectives

Upon completion of this lesson, you will be able to:

1. Distinguish between an essential oil, an absolute and a CO2 extract.
2. Discuss the main concern about using CO2 extracts and why it is important to purchase only organic co2 extracts.
3. Describe the process of enfleurage, solvent extraction and CO2 extraction in very basic terms.

EXTRACTION TECHNIQUES FOR ABSOLUTES AND CO2 EXTRACTS

Other methods that are used to produce other aromatic products include:

- **Enfleurage:** produces absolutes.
- **Solvent Extraction:** produces absolutes and resins.
- **CO2 Extraction:** produces CO2 extracts. The following methods of extraction, enfleurage, solvent extraction, and CO2 extraction, will only be briefly discussed. This textbook does not cover the therapeutic use of CO2 extracts or absolutes.

Enfleurage

Flowers were being processed via enfleurage in the Grasse region of Southern France long before the modern method of solvent extraction. In the early days of perfumery, many flower scents were extracted via enfleurage, now considered an ancient art that is passed down from father to son or from generation to generation.

Enfleurage is a cold-fat extraction process that is based upon the principles that fat possesses a high power of absorption, particularly animal fat. The fat used must be relatively stable against rancidity. It is a method used for flowers that continue developing and giving off their aroma even after harvesting (e.g., jasmine and tuberose). Today, Grasse continues to be one of the few areas in the world that continues to employ enfleurage as a method of extraction, although it is rare in the aromatherapy market due to the expense.

Solvent Extraction

Some plant material is too fragile to be distilled and an alternative method must be employed. **Solvent extraction** is the use of solvents, such as petroleum ether, methanol, ethanol, or hexane, to extract the odoriferous **lipophilic** material from the plant. The solvent will also pull out the chlorophyll and other plant tissue, resulting in a highly colored or thick/viscous extract. The first product made via solvent extraction is known as a concrete. A **concrete** is the concentrated extract that contains the waxes and/or fats as well as the odoriferous material from the plant. The concrete is then mixed with alcohol, which serves to extract the aromatic principle of the material. The final product is known as an **absolute.**

Solvent extraction is used for jasmine, tuberose, carnation, gardenia, jonquil, violet leaf, narcissus, mimosa, and other delicate flowers. Neroli and rose can be distilled or solvent-extracted. The name *neroli* typically implies the essential oil, whereas the name orange blossom is commonly used for the absolute or hydrosol of neroli. The name *rose* is used to describe either the essential oil or the absolute. Companies selling essential oils should clarify whether the product you are purchasing is an essential oil or absolute. This information should be on the label and in the product catalog.

After the solvent extraction process has been completed, the resulting absolute will have an extremely low concentration of solvent residue, approximately 5 to 10ppm (parts per million). According to Guba, the current European Union standards are for less than 10 parts per million solvent residues in a finished absolute.[15] However, even with such a potentially small residue (less than .0001%), many aromatherapists disagree with the use of absolutes for individuals with a compromised immune system due to the potential effect of the residual pesticide.

However, absolutes do have therapeutic value and are often used for psychological purposes and for animals, particularly horses. Many therapists incorporate absolutes, such as rose absolute,

jasmine, and tuberose, as a valuable part of their therapeutic applications of aromatherapy. Ultimately the decision to use absolutes is up to the practitioner and his/her own personal preferences.

Absolutes are highly concentrated aromatic substances and are obtained from delicate flowers by either enfleurage or solvent extraction. Absolutes will most often resemble the natural aroma of the plant and are normally more colored and viscous than essential oils. Absolutes are used extensively in the cosmetic and perfume industries due to their strong aromas. There are also different grades of absolutes. The top grade is the uncut, which can be a thick or semisolid substance, making them difficult to work with. Less expensive grades are diluted with alcohol to make them more user-friendly, although often the strength of aroma is slightly diminished.

CO2 Hypercritical Extraction

Hypercritical carbon dioxide (CO2) extraction is a relatively new process used for the extraction of aromatic products. The basic concept is that CO2 under pressure will turn from a gas into a liquid that can then be used as an inert liquid solvent. This liquid solvent is able to diffuse throughout the plant material thus extracting its aromatic constituents. CO2 extracts contain most of the same constituents as their essential oil counterparts, although they can contain some elements not found in essential oils.

For instance, the essential oil of ginger (*Zingiber officinale*) does not contain the bitter principles, however the CO2 extract does. Also, the CO2 extract of frankincense (*Boswellia carterii*) has immune enhancing and anti-inflammatory activity not found in the essential oil. CO2 extracts are known for their strong similarity in aroma to the actual plant aroma.

Components of plants that can be extracted via CO2 extract include essential oil components, waxes, pigments, lipids, resins, and others.

What to look for when purchasing CO2
CO2 are available as total extracts and select extracts.

Total extracts contain all the possible CO2 extracted components from the plant material which is what can make them quite thick and a bit challenging to work with. The essential oil component content can vary between 3 to 50% of the total extract with the remaining extract being composed of waxes, lipids, etc. depending on the plant material. Warming thick co2 extracts helps with

making them easier to use. Since total extracts contain the lipid components, there are some incredible co2's that act more like carriers or herbal oils then essential oils. Examples of this types of Total CO2 extract include: calendula co2, arnica co2, rosehip co2, and sea buckthorn co2. We'll be covering Calendula co2 extract in Part III.

Select extracts contain mostly the essential oil components which can make up 35-95% of the extract. Select extracts are not viscous like total extracts and hence are easier to use.

Select CO2 extracts contain many of the same constituents as their essential oil counterparts, although they may also contain some components not found in essential oils. For instance, the essential oil of ginger (*Zingiber officinale*) does not contain the bitter principles (shogaol, gingerols), however the CO2 extract does. Select CO2 extracts are known for their strong similarity in aroma to the actual plant aroma versus the essential oil which can smell slightly different from the actual plant.

Note: According to Guba, the three main disadvantages for this process are cost, potential pesticide residue, and the lack of information regarding their safety and therapeutic benefits. With regard to pesticide residue, Guba comments that carbon dioxide extraction has been demonstrated to concentrate from 7 to 53 times more pesticide residues in the final extract.[16] Therefore, it seems pertinent to only use organic plant material for CO2 extraction. Perhaps as more CO2 extracts become available and more practitioners use them, further details regarding their applications will become apparent. Two of the most common essential oils available via CO2 extraction include frankincense and ginger. More and more CO2 extracts are coming onto the market all the time.

ESSENTIAL OILS IN MODERN TIMES

Essential oils are produced for a variety of purposes, and they are distilled all over the world. They are utilized by a wide range of industries, including the cosmetic, pharmaceutical, tobacco, food and flavoring, and perfume industries. They are used as preservatives in cosmetics, flavors in food, insect repellants, fragrance compounds for perfumes and body care products, antimicrobial compounds in such products as mouthwashes, and masking agents for unpleasant odors. Essential oils and their isolated constituents have been the focus of research for their antimicrobial activity and other medicinal benefits. They offer a plethora of uses within the above industries as well as others.

This would lead one to wonder, are the essential oils used in all the above industries the same essential oils we use in aromatherapy? Most of the industries listed above are not necessarily concerned with the purity and wholeness of the essential oil, and in fact many will have fragrance oils made in a lab to maintain consistency in aroma or to reduce the cost of making a product. For genuine aromatherapy and effective applications, the purity and wholeness of the essential oil cannot be understated. We will be addressing this
issue in the next chapter.

In the words of Schnaubelt, "*Genuine and authentic essential oils from plants are necessary conditions of wholistic aromatherapy. They are fundamentally different from the industrial, semi-natural oils which are commonly offered on the market. As semi-natural or synthetic oils are materially different from authentic oils it is logical that their physiological effects are also different. Most importantly, authentic oils are much less allergenic and irritant than their industrial counterparts*."[17]

Module Two: Lesson 5

The Basics of Essential Oils

Learning Objectives

Upon completion of this lesson, you will be able to:

1. List and describe eight pieces of information to look for in purchasing an essential oil.
2. Describe the optimal storage conditions for an essential oil.
3. List and describe seven general characteristics of essential oils.

Introduction

Holistic aromatherapy begins with the quality and authenticity of the essential oils to be utilized. Optimal therapeutic and safe applications can only truly be derived from the use of whole, genuine, authentic essential oils. The use of low-quality, cheap, or inexpensive adulterated essential oils increases the likelihood of an adverse response and/or reduced therapeutic activity. Companies selling a wide range of essential oils seem to be a dime-a-dozen these days. An internet search on aromatherapy will produce over 10,000 links to this plethora of "aromatherapy" businesses. So how does one choose? What information should you look for? How do you know if it is adulterated? How should essential oils be stored? How safe are essential oils?

These are important questions, and by the end of this chapter you will be able to answer each one accurately with knowledge and experience.

ESSENTIAL OIL INFORMATION

When looking for essential oils to purchase and from what company, there are a number of factors to consider. Aromatherapy companies should provide uniform information on each essential oil they sell. This information is often found on the essential oil label and/or in their product catalog. This information should include:

➞ Common name

The common name is the most widely accepted name for a given plant species within a given culture or regional area. Common names, however, do not always correctly identify an exact botanical species because these names are often used generally for all hybrids or cultivars that belong to that species. Common names can also vary from region to region as well as in various countries throughout the world.

For aromatherapy purposes, one must be able to identify the exact essential oil being used. For instance, if one were to say "I used lavender in the blend", almost everyone would think of the type of lavender they are familiar with. Each of these essential oils has a slightly different chemical composition and is applied for different therapeutic purposes. The common name is great for the general public, but for the practitioner, it is best to document and identify each essential oil used during a session by its Latin name.

➞ Exact Botanical Species

Aromatic medicine, like aromatherapy or herbal medicine, requires that the practitioner is certain of the exact botanical species of the plant used to distill the essential oil. When referring to the botanical specificity of an essential oil, the Latin binomial, or scientific name, is used.

The **Latin binomial** is the internationally recognized identity of a specific plant, distinguished from all others.

The Latin name is made up of two parts: **genus and species.**

The genus refers to a group or category of plants that are similar in botanical structure. **The genus name is the first word and is always italicized** and capitalized: *Lavandula*.

The species name identifies the exact plant within a specific genus. Species has to do with direct characteristics of the plant, including leaf structure, flower structure, reproduction, and other characteristics within a family of plants. The species name is technically the full Latin binomial but is represented in the second part of the name: *angustifolia*. Species names are always italicized and in lower case. The full Latin binomial of lavender is *Lavandula angustifolia*.

To appreciate the importance of the Latin binomial, let's have a look at the Eucalyptus species. There are over 250 species in the *Eucalyptus* genus, of which 8 are commonly found within the aromatherapy industry. These include *Eucalyptus globulus*, *Eucalyptus dives, Eucalyptus citriodora, Eucalyptus stageriana, Eucalyptus smitthi, Eucalyptus camaldulensis, Eucalyptus polybractea* and *Eucalyptus radiata*. Although they share some common therapeutic benefits, each species has its own unique chemistry and 'personality' and therefore unique therapeutic applications.

Like eucalyptus, several species of lavender are used in aromatherapy, including *Lavandula angustifolia, Lavandula latifolia* syn. *spika*, and *Lavandula stoechas*.

The chamomiles, on the other hand, are an example of a diverse genus within a family of plants. In this case the family is Anthemideae. The Anthemideae family contains 3 genera commonly referred to as chamomiles, including *Chamaemelum*, *Matricaria* and *Eriocephalus*. The essential oils that are derived from these plants include Roman chamomile (*Chamaemelum nobile*), German chamomile (*Matricaria recutita*) and Cape chamomile (*Eriocephalus punctulatus*).

Aromatic plants may be hybrids. **A hybrid** is the result of a cross-fertilization between two different plant species or two varieties within a species. Hybrids are symbolized with a multiplication sign (x). *Lavandula* x *intermedia* is a hybrid between *Lavandula angustifolia* and *Lavandula latifolia*. The most common lavender hybrids available are *Lavandula* x *intermedia* and *Lavandula* x *burnati*.

Plants that are used to produce essential oils may be grown as cultivars. **A cultivar** is a plant that has been cultivated to display certain desirable characteristics in taste, aroma or appearance. The hybrid *Lavandula* x has two common cultivars, *Lavandula* x *intermedia* 'Grosso' and *Lavandula* x *intermedia* 'Abrialii'. (These cultivars are becoming less common as *L.* x *burnati* rises in availability). Not only are these plants cultivars, they are also hybrids as noted by the 'x'.

When purchasing essential oils, formulating products, and documenting your work, specify the exact botanical species that you use.

➝ Morphological specificity: Part of plant used

Some plants produce essential oils from more than one part, such as from the seed and the root. The parts of the plant are known as morphological structures. The bitter orange tree, *Citrus aurantium* var. *amara*, yields essential oils from three different morphological structures: Petitgrain is extracted from the leaves, neroli from orange blossoms, and bitter orange from the zest of the fruit.

When a plant produces essential oils in more than one of its parts, differences in aroma and chemical composition occur. Petitgrain and neroli are both commonly used for their antidepressant and stress-relieving properties, but each has a unique aroma and a slightly different chemical composition.

Another example is the essential oils obtained from the cinnamon tree, *Cinnamomum zeylanicum*. Cinnamon bark essential oil has the characteristic cinnamon aroma, is rich in cinnamic aldehyde, and is a major skin irritant when used undiluted or in high dosages. Cinnamon leaf, on the other hand, has a cinnamon-clove aroma, is rich in the phenol eugenol, and is less irritating to the skin. Both oils have a wide range of antimicrobial activity. Cinnamon leaf is commonly employed by western or English aromatherapists, and cinnamon bark tends to be used internally (in oil-based capsules or suppositories) by aromatic medicine practitioners.

When purchasing essential oils, formulating products, and documenting your work, specify the part of the plant when it is relevant. (Some plants have only one part that is used to distill the essential oil; in these cases, the part does not need to be noted.)

The parts of a plant an essential oil can be extracted from include:

Parts of the Plant and the Essential Oils Derived	
Seeds	Angelica, Carrot seed, Caraway, Celery, Coriander, Dill, Fennel
Roots/Rhizomes	Vetiver, Spikenard/Jatamansi, Garlic, Angelica
Wood/Bark	Cinnamon bark, Cedarwood, Sandalwood
Resin	Frankincense, Myrrh, Elemi, Benzoin
Leaves	Basil, Eucalyptus, Patchouli, Petitgrain, Tea Tree, Thyme
Needles	Fir, Pine, Cypress
Buds	Clove
Grasses	Lemongrass, Gingergrass, Palmarosa
Fruit	Bergamot, Grapefruit, Lemon, Lime, Mandarin, Sweet orange, Cardamom

Parts of the Plant and the Essential Oils Derived	
Berries	Juniper berry
Flowers	Jasmine, Rose, Neroli, Lavender, Roman chamomile, German chamomile

→ Biochemical specificity

Biochemical specificity refers to the identification of a chemotype of a specific essential oil. Many factors influence the chemical composition of essential oils, including growing conditions of the plant such as light, soil, temperature, moisture, climate and altitude as well as geographic area (country of origin). The term chemotype is used to describe an essential oil that has been extracted from one botanical species yet varies considerably from the norm in chemical composition. Catty defines a chemotype as follows:

"A chemotype occurs when a plant of a specific genus and species produces a particular chemical in a higher-than-normal amount because of geographic location weather, altitude, insect and environmental interactions, and the like. A chemotype is not a different species or genus, nor is it a type of chemical; it is merely a chemical anomaly within the plant that occurs naturally."

The term 'chemotype' was made an official designation in the European Union in 2006.
It is defined as: a distinct chemical entity within the same species.

Not all essential oils have chemotypes, nor are all chemotypes available in the market. Rosemary (*Rosmarinus officinalis*) and thyme (*Thymus vulgaris*) are the most common chemotypes available within the aromatherapy industry although more diverse essential oils enter the market. A chemotype will be noted with the abbreviation "ct.", as in Rosemary ct. verbenone or Thyme ct. linalool.

When purchasing essential oils, formulating products, and documenting your work, specify the chemotype when relevant.

→ How it is grown

Typically an aromatherapy supply company should be able to tell you how the plant was grown. There are four main types of ways a plant can be grown:

- **Ethical Wild-crafted:** plants that have been collected in the wild or in their native environment. Ethically wild-crafted means that a company or individual has taken care to ensure that the "species can withstand harvesting and still proliferate."[18]

- **Cultivated:** plants that are specifically grown to be distilled for essential oils

- **Traditional/Conventional:** plants that have been grown with the use of pesticides

- **Organic:** plants that have been grown without the use of pesticides and usually fulfill organic guidelines set out by independent agencies. Organic farming is not just the absence of pesticides, but the presence of an agricultural system that protects croplands, supports biodiversity, and respects the balance of nature rather than attempting to control it with powerful, often toxic synthetic chemicals.

The Organic Trade Association defines organic agriculture as “an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. The primary goal of organic agriculture is to optimize the health and productivity of interdependent communities of soil life, plants, animals and people.”

→ Batch number or GC/MS report

Some aromatherapy companies supply a **batch number**. This batch number is used to identify a specific batch or drum of essential oil, from a specific supplier, during a specific year. This batch of essential oil will be accompanied by a specific independent GC/MS analysis for that batch.

→ Standard safety warning on essential oils

The standard safety note on the vast majority of essential oils is Not for internal use. Keep away from children. The main reason for the "Not for Internal Use" is to protect the essential oil company from legal liability. There is growing education with regards to the Internal Use of Essential Oils and we highly recommend receiving training in this area if you are interested in learning more.

It is important to keep all essential oils out of reach of children as some can be highly toxic, especially if taken internally. Many aromatherapy companies will note in their catalog and/or on their website that caution should be taken when utilizing essential oils during pregnancy. This issue is addressed in the next lesson: Safety and Essential Oils.

➞ Size of bottle/essential oil content

Most essential oil companies use the metric system for describing the amount of essential oil within a bottle. The most common sizes found within aromatherapy are: 5 milliliters (mls) is the equivalent of 1/6 of an ounce.

10 mls is the equivalent of 1/3 of an ounce.

30 mls is equal to 1 ounce.

120 mls is equal to 4 ounces.

240 mls is equal to 8 ounces.

STORAGE INFORMATION

Essential oils have a general shelf life of two to five years depending on the individual oil and the manner in which they are stored. For instance, citrus oils tend to have a much shorter shelf life than more viscous essential oils such as vetiver or patchouli. It is wise to replace citrus essential oils every six to twelve months to avoid adverse reactions caused by oxidation of compounds found within them. Adhering to the following guidelines will enhance the longevity of essential oils.

➞ Essential oils are stored in amber or blue bottles.

Essential oils are volatile organic compounds that are sensitive to heat and light. It has been an accepted part of the aromatherapy industry that essential oils need to be in a dark-colored glass to protect them from ultraviolet rays from the sun and other similar light.

➞ Bottles must have an appropriate orifice reducer.

To reduce the impact of oxygen on essential oil degradation, all essential oil bottles must have an appropriate orifice reducer. This is a small dropper insert that fills the opening of the bottle. Eyedroppers *should not be used* as these are porous and hence allow oxygen to enter into the

essential oil. Essential oils will also slowly dissolve the plastic on an eyedropper leading to plastic (rubber) in the essential oil as well as disintegration of the dropper.

Orifice reducers serve two other important purposes in addition to reducing oxidation. These purposes include:

1. to prevent excessive/large amounts of the oil coming from the bottle in case a child has gotten a hold of the oil and

2. to allow the practitioner to count the appropriate number of drops.

→ Essential oils are best stored away from sunlight and direct heat.
Essential oils are susceptible to heat and light and hence are best stored in a relatively cool area and away from direct light. It is recommended that essential oils be stored in the refrigerator to increase shelf life. Some aromatherapists follow this guideline while others simply choose to store their essential oils in a cool area. The most important essential oils to refrigerate are the citrus oils and others rich in monoterpenes.

→ Move essential oils to smaller bottles.
If you are purchasing essential oils in 1, 2, 4, 8, 16 or 32-ounce sizes, then it is important to pour essential oils into a smaller container once a certain amount has been used. As you use an essential oil from a larger bottle, the headspace of air between the top of the bottle and the essential oil increases, which can increase oxidation of the oil. It is therefore prudent to pour the essential oil into a smaller bottle to decrease the headspace and thereby reduce to some extent the potential for oxidation.

How long should you keep your essential oils?

- **For monoterpene rich essential oils, e.g. Citrus oils, conifers (pine, spruce, hemlock), frankincense as well as lemongrass, neroli, and tea tree:** 1-2 years
- **For all other essential oils:** 2-3 years
- **For viscous essential oils, e.g. vetiver, patchouli, sandalwood:** 4-8+ years.

GENERAL CHARACTERISTICS OF ESSENTIAL OILS

Essential oils display a set of general physical characteristics that give them their identity. In general, essential oils are:

- **Highly concentrated**

This means that the therapeutic effect is considerably magnified. The fact that essential oils are highly concentrated makes them powerful agents, and often, due to their concentration, it is

typically necessary to dilute them prior to use. Many aromatherapists believe that it is due to their incredibly high concentration that only a small amount is necessary to have therapeutic effects.

- **Volatile substances**

Volatility refers to the ability of an essential oil to turn from liquid to vapor. An essential oil as a whole is volatile, and individual chemical constituents within an essential oil will volatize more or less quickly than others. For example, lemon is more volatile than vetiver, and limonene (a hydrocarbon terpene) is more volatile than borneol (an oxygenated hydrocarbon alcohol).

- **Light and non-greasy**

The name essential oil can be deceptive. Essential oils are not vegetable or fatty oils, rather they are light, volatile substances that are referred to as "oils." They have a consistency more like water (although they are insoluble in water) than oil and lack the oily texture of vegetable oils (with the exception of viscous essential oils, such as sandalwood, vetiver, and myrrh).

- **Mostly clear in color**

Most oils have a slight hint of color from clear to light yellow. A few essential oils do have some color, for example, German chamomile, tansy, and yarrow are all a deep rich blue; patchouli can be dark brown; and bergamot can have a light green tint. Absolutes tend to be richer in color due to the chlorophyll and other plant pigments drawn out by the solvent. Resinoids, such as benzoin, myrrh, and frankincense, tend to be dark in color unless they are distilled.

- **Lipophilic**

Essential oils are **lipophilic** substances, which means they are attracted to and soluble in fatty substances. Essential oils have a strong affinity for lipids and are therefore soluble in:

  - **Vegetable oils:** Sweet almond, Sunflower, Apricot kernel, etc.
  - **Herbal oils:** Calendula, St. John's wort, Comfrey, and Arnica
  - **Full fat milk, cream, or honey**
  - Essential oils are also soluble in **alcohol and ether.**

- **Viscosity**

Viscosity is the measurement of an essential oil's thickness. Viscous essential oils are less volatile than low-viscosity oils. Viscosity of an essential oil may slow down absorption through the skin. Viscous essential oils also tend to have a heavier aroma. For example, vetiver essential oil is very viscous compared to tangerine essential oil.

- **Highly complex chemically**

Essential oils are made up of different combinations of a variety of chemical constituents. Some essential oils are considered to be simple in their chemistry, such as wintergreen or birch that contain up to 99 percent of one active constituent. Other essential oils are highly complex and

contain over 100 different main constituents and hundreds more trace components. According to Schnaubelt, “the therapeutic potential of essential oils arises from the synergistic action of the complex mixture of all its components.”[19]

- **Dynamic substance that exhibits a wide range of therapeutic activity**

Essential oils exhibit a wide range of therapeutic activity, including psychological, physiological, spiritual, and energetic. One of the most researched aspects of essential oils is their antimicrobial and antiseptic activity. It is beyond doubt that essential oils are effective antifungal, antiviral, and antibacterial agents and that their natural aroma has an impact on our emotions, spirituality, perception, and behavior.

Module Two: Lesson 6

The Quality of Essential Oils

Learning Objectives

Upon completion of this lesson, you will be able to:

1. Describe common adulterations of essential oils.
2. Perform four basic purity tests.
3. Discuss the value and the pitfalls of a GC/MS analysis.
4. Discuss why quality is of such importance for essential oils.

INTRODUCTION

The concept of pure and natural or genuine and authentic within the aromatherapy profession is perhaps one of the most difficult concepts to ascertain. A pure essential oil is one that has been produced from a specified botanical source and has not been modified in any way whatsoever. According to Schnaubelt, a genuine essential oil means it is completely unaltered and authentic means it is from a specified plant only.[20] The adulteration of an essential oil may alter its unique therapeutic benefits as well as lead to increased risk of adverse reactions.

The aromatherapy industry worldwide has adopted terms such as: pure and natural, genuine and authentic, aromatherapy grade, true aromatherapy grade, therapeutic grade, and probably some others I am not yet familiar with. These terms are used by both discerning and non-discerning companies making it difficult to judge an essential oil merely by the marketing material a company puts forth. All the terms above are loosely defined, and there are absolutely no regulations at this time that govern the aromatherapy essential oil industry.

Common Adulterations of Essential Oils

A number of methods may be employed to stretch, reconstruct, or otherwise alter an essential oil, and this is what is meant by adulteration. Adulterated essential oils pose a number of potential problems for aromatherapy such as: the potential increase in adverse dermal reactions (dermal irritation or sensitization) and the potential decrease in psychological benefits. Melissa, rose, sandalwood, and birch offer examples of essential oils that are commonly adulterated.

In Practice 3.1:
Signs of Poor Quality

Signs of poor quality to watch for when purchasing essential oils include:

1. Essential oils are being sold at unreasonably low prices or all at the same price.

2. Rose, jasmine, sandalwood and melissa being sold in 1/2 to 1-ounce sizes. The average price of 1/2 ounce of rose otto essential oil is $195-200 and an ounce would be $400 or more. This makes it almost impossible to retail these oils in such a large quantity. Due to the expense of all of these essential oils, most aromatherapy companies will offer them either by the drop or in 1ml, 2ml, or 5ml quantities.

According to Burfield, “As far as adulteration is concerned, producers and distributors of essential oils are frequently painted as ‘the bad guys,’ but it should be pointed out that their oil customers frequently demand oils below the market price while still wanting to be told that they are authentic.

In this climate, the honest oil trader may find it virtually impossible to survive on the margins he is allowed to make (many have already gone bust). For example, in the late 20th Century, lavender oil (*Lavandula angustifolia*) was being sold almost as a lost leader by many French producers as the market was unwilling to pay a realistic price; currently, the aroma industry is dominated by a handful of large and powerful international houses whose corporate buyers often attempt to drive raw material prices to impossibly low levels, not allowing workable profits to be made. This sets the scene for unethical practices."[21]

Common adulterations to essential oils include such techniques as:

- Alcohol or a vegetable oil is added to stretch the volume of essential oil.

- A synthetic chemical constituent is added to the main oil to increase its volume. Arctander (1994) reports that bergamot and lavender are commonly adulterated by adding synthetic linalylacetate or synthetic linalool, respectively.

- A cheaper essential oil is added to or distilled with the main essential oil. According to Arctander, melissa (Melissa officinalis) essential oil is often distilled with lemon, verbena, lemongrass, or citronella essential oil to increase the overall quantity of commercial melissa essential oil.[22] The plant, melissa or lemon balm, contains less than .01 percent essential oil so it takes a vast amount of plant material to produce a small amount of melissa, making it an expensive oil to purchase.

- A completely synthetic product is produced in a laboratory and can be marketed as natural. This is common for both wintergreen and birch essential oils that are typically 100 percent synthetic methyl salicylate.

- A cheaper essential oil is substituted, for example, lavendin for lavender.

Basic Purity Tests

There are a number of ways in which you can test your essential oils for basic purity. The following are four basic tests you can do at home.

1. Place a drop of essential oil on a clean white sheet of blotting or watercolor paper. The essential oil should evaporate completely within a twenty-four to forty-eight-hour period, leaving no stain (unless the essential oil is colored, such as with some citrus oils and German chamomile) or reminiscent aroma. This method should not be employed with viscous essential oils, such as vetiver and sandalwood, as the more viscous the essential oil the longer evaporation will take. Citrus oils and others with a relatively high volatility are best suited to this basic test.

2. Place a drop of essential oil in a clear glass of water. If the water becomes discolored or turns milky, then the essential oil has been diluted with water and an emulsifier has been used to keep the essential oil and water together.

3. Place a drop of essential oil between two fingers on one hand and a drop of carrier or base oil between two fingers on the other hand and compare viscosity. There should not be the same oily texture to the essential oil as there is to the base oil. If it feels the same, then it is possible that the essential oil has been extended in a carrier or base oil. This process must be done by comparison and should not be utilized with the more viscous essential oils.

4. Our sense of smell is often underrated as a tool in determining the quality of an essential oil, but it is perhaps the most powerful tool we have, particularly once it has been trained and exercised. We are not typically accustomed to paying attention to our sense of smell so sometimes it takes practice and attention to strengthen it. In order to be able to effectively smell the quality of an essential oil, one could spend time smelling diverse aromas in the environment and a range of qualities of essential oils. For instance, first smell an excellent quality essential oil, then immediately smell a questionable or low quality essential oil (such as one sold for cheap in grocery stores or on-line). There should be a distinct difference in the quality and effect of the aroma. In time and with practice, your nose will become a great tool in determining the quality of an essential oil.

HOW TO SMELL AN ESSENTIAL OIL

Always approach essential oils with the awareness that they are very powerful. It is best to begin by holding the bottle or smell strip approximately four to five inches away from your nose and then move it upward toward your nose, depending on how much you can smell and how close you need it to be in order to enjoy its aroma. As you hold the smell testing strip or the bottle of essential oil below your nose, gently move it back and forth from the left nostril to the right or right to left. This way you receive the full spectrum of aroma the oil has to give. The aroma will expand as you continue to smell, with several layers to the aroma.

Natural, high-quality, genuine essential oils will be pleasant to the nose, whereas synthetics tend to attack the nose with a strong odor and then die off. Genuine essential oils continue to expand and develop as you smell them.

Chemical Analysis

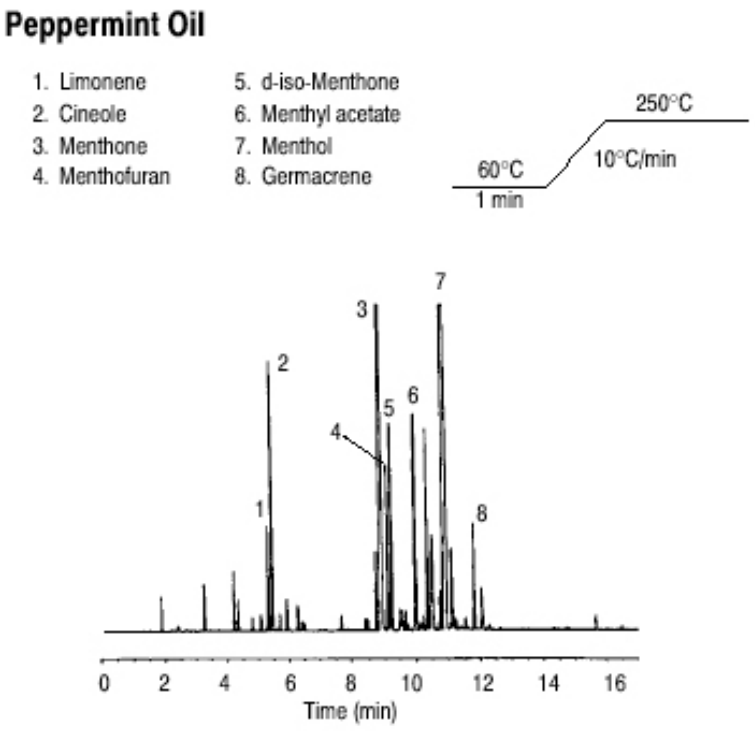
The four basic tests for purity that you can practice at home are not considered full-proof methods by any means. Instead, essential oil buyers and sellers alike depend on a variety of scientific analysis to determine the composition and purity of an essential oil. We will discuss the two most common tests that are used to ensure the basic purity of essential oils via a chemical analysis of what the oil contains quantitatively and qualitatively.

Gas Chromatography

A gas chromatograph is a chemical analysis instrument used to separate and identify individual constituents found within a given essential oil. Each chemical constituent of an essential oil will pass through the gas chromatograph instrument at different times and speeds. As each chemical is registered, it will produce some type of peak, from very short to very tall. A gas chromatography report reveals the peaks of different chemical constituents within a given oil; it does not, however, name the specific chemical constituent (e.g., linalool); for this a mass spectrometer must be used.

Mass Spectrometry

Mass spectrometry is a technique that allows for the detection of compounds (chemical constituents) by separating ions by their unique mass. Mass spectrometry is utilized to identify specific compounds registered on the gas chromatography report. A typical mass spectrometer has three basic parts: an ion source, a mass analyzer, and a detector. Different molecules have different masses, and this fact is used to determine what molecules are present in a sample. An individual trained in reading GC/MS data will then clearly identify the exact constituents and their quantity (e.g., 5% linalol, 25% camphor, and so on) present within a given essential oil sample.



Sample:	Neat
Carrier:	Helium, 40 cm/sec, 11.7 psi (60°C), 2.5 ml/min constant flow
Column:	HP-INNOWax (Cross-Linked PEG), 30 m x 0.32 mm x 0.5 μm (Part No. 19091N-213)
Injection:	Split (60:1), 0.5 μl, inlet 220°C
Oven:	Temperature program listed above
Detector:	FID 275°C

According to Burfield, “aromatherapists should not be too over-awed by the claims of essential oil traders, to the effect that GC-MS is the ultimate analytical tool. This simply is not true. When properly used it is certainly a powerful technique, but when used sloppily by untrained operators, the interpretation of results may be of limited value.”[23] Interpretation of the information gained depends on the skill, experience, and knowledge of the individual who does the analysis. A GC-MS report may fail to reveal the age and quality of an essential oil, particularly in relation to the quality an aromatherapist is looking for. So, in general, although a GC-MS report on a given essential oil is incredibly helpful, it should not be used as the sole definitive guide to purchasing a high-quality, pure, unadulterated essential oil. Instead, it should be used along with an olfactory appraisal, confidence in the supplier and their intentions as a supplier (e.g., are they selling inexpensive essential oils to a general market or are they selling high-quality, typically high-priced essential oils specifically to practitioners of genuine aromatherapy?).

If you are interested in learning more about GC/MS, you can watch the following video:

http://www.youtube.com/watch?v=dffeiLgeKx8&feature=related

For Examples of GC/MS reports

A company that offers exemplary information about each essential oil they sell would be Florihana in France. Here is a link to Clary sage. You can view the GC/MS on the right-hand column where it says “Chromatography”.

Module Two: Lesson 7

Safety and Essential Oils

Essential Oils Are Safe

when selected and used appropriately.

www.aromaticstudies.com

Learning Objectives

Upon completion of this lesson, you will be able to:

1. Describe potential dermal reactions and apply knowledge of safety information when utilizing essential oils.
2. List and describe five general safety precautions and three safety measures.
3. Discuss the importance of safety when using essential oils.

A Positive Approach to Essential Oil Safety

A therapeutic, knowledge, and experiential-based model for safety

With so much emphasis these days on safety and essential oils, it seems that the challenge isn't really about 'more safety' but rather how shall we relate to it? how shall we interpret it so that it makes sense in our practice or general use of essential oils? And how shall we find balance within the extremes that appear on social media?

I like to begin with this idea: **Essential oils are safe.** It seems simple enough, right? And yet, there are three caveats:

1. Essential oils are safe when selected appropriately for the client or purpose of the product (includes target audience).

2. Essential oils are safe when the appropriate route of administration (oral, cutaneous, inhalation/diffusion) as well as the method of application (baths, herbal eo capsules, inhaler, etc.) is chosen correctly for the client or purpose of product.

3. Essential oils are safe when the dilution/dosage, length of time, and intensity of treatment is based upon the individual's constitution, the essential oils being used, the nature of the condition, and the goal of the treatment.

Essential oils are powerful. They speak on multiple levels (physiologically and emotionally) to the human organism and are capable of widely diverse yet complementary therapeutic actions (antispasmodic, anti-inflammatory, etc.). We need to respect them and yet we also need to appreciate that we have a long history, that we actually co-evolved with aromatic plants, and that they have been our allies as food, as shelter, in magic or ritual, as aromas and olfactory delight, and as medicine. We have a symbiotic relationship. But like all relationships, we must cultivate our inherent respect for their power, their potency and to use them accordingly.

With this in mind, we have adopted Peter Holmes approach to safety and essential oils. Like us, Peter is reframing aromatherapy with a model utilizing Traditional Chinese medicine (TCM) as his language. We are using Western herbal energetics. The goal is the same. To offer another way of viewing and being in relationship with essential oils, how we use them, how we relate to them, and how we practice or frame imbalances in the body.

Moving along with safety, I very much like the way Peter Holmes has created three general therapeutic status categories. The *general therapeutic status* is a system which allows us to present essential oils in three unique categories based upon *their individual 'nature as a natural remedy in terms of its therapeutic applications at the most basic level'*.[24]

We will be using these categories to inspire a new way of viewing and relating to the safety of essential oils: one through the lens of the *knowledgeable, responsible, reflective*, and *empowered* aromatherapist and essential oil therapist.

We must understand both the essential oils benign qualities
as well as it potential for toxicity.

- Peter Holmes

Category 1: Mild essential oils

The essential oils included in this category do not present any significant risk of toxic accumulation in any part or system of the body, even when administered over a long period of time. Aside from the essential oils which may be dermal irritants, sensitizers or photosensitizers, this group of essential oils poses little concern even for the small amounts of various components that may be absorbed via the cutaneous route into general blood circulation. The vast majority of essential oils are included in this category.[25]

Mild Essential oils: Lavender (*Lavandula angustifolia*), Petitgrain (*Citrus* x *aurantium* var. amara), Citrus essential oils (*Citrus limon*, *C. paradisi*, *C. reticulata*, *Citrus bergamia*, etc.), Coriander seed (*Coriandrum sativum*), Peppermint (*Mentha* x *piperita*), Tea tree (*Melaleuca alternifolia*), Ginger (*Zingiber officinale*), Roman chamomile (*Chamaemelum nobile*), Frankincense spp., Sweet marjoram (*Origanum marjorana*), *Melissa officinalis*, *Litsea cubeba*, Black spruce (*Picea mariana*), Cedarwood (*Cedrus atlantica*), Vetiver (*Vetiveria zizanioides*), Sandalwood (*Santalum* sp.), German chamomile (*Matricaria recutita*), Lavandin (*Lavandula* x *intermedia*), Clary sage (*Salvia sclarea*), Neroli (*Citrus aurantium* var. *amara*), etc. etc.

Category 2: Medium-strength essential oils

This group of essential oils presents some potential or risk of toxic accumulation of certain components, even when taken at the accepted therapeutic dose. The essential oils below should be used with caution. For internal route, only short-term (less then 3 months) use is recommended. Caution is assumed for cutaneous route, avoid daily long-term application. *Specific components have been reviewed in the chemistry module.

The most common toxicity concern is neurotoxicity, regardless of route of administration. Essential oils in this category are contraindicated during pregnancy or while breast-feeding.

Essential oils with potential to become neurotoxic

- Sage (*Salvia officinalis*) - thujone (α- and β-) and camphor
- Rosemary ct. verbenon (*Rosmarinus officinalis*) - verbenone
- Hyssop ct. pinocamphone (*Hyssopus officinalis*) - pinocamphone
- Spearmint (*Mentha spicata*) - carvone
- Rosemary ct camphor (*Rosmarinus officinalis*) - camphor[26]

Category 3: Strong essential oils

Essential oils in this group can cause acute poisoning regardless of route of administration. The oral use of these essential oils should be avoided due to potential for liver and nervous system toxicity.

Essential oils with potential for acute toxicity:

- Wormwood (*Artemisia absinthium*) - thujone
- Cedar leaf (*Thuja occidentalis*) - thujone
- Penny royal (*Mentha pulegium*) - pulegone[27]

Along with these categories, it is important to also known
any safety concerns for each individual essential oil you are formulating
with as well as dermal safety covered below.

Let's begin by putting safety into context.

SAFETY AND ESSENTIAL OILS

Safety involves a state of being free from risk or occurrence of injury, harm, or danger. Individuals who practice aromatherapy need to be aware of the safety issues involved with using essential oils in order to avoid potential adverse effects. Although many essential oils are potentially hazardous materials, if handled in the appropriate manner, the risks involved in their use can be very small. So therefore, most commercially offered essential oils are safe to use for the purpose intended in a domestic/ professional or clinical environment.[28] Schnaubelt states that the "*informed use of essential oils may create occasional irritation or minor discomfort, but it is extremely unlikely to create serious injury or lasting physical problems*,"[29] particularly when basic guidelines are followed.

Factors which influence the safety of essential oils include:

1. Quality of essential oil being utilized: As stated in the beginning of this unit, adulterated essential oils increase the likelihood of an adverse response and hence the need for pure, authentic, and genuine essential oils is of the utmost importance. This is not to say that organic authentic essential oil are incapable of triggering an adverse reaction but simply to highlight that adulterated essential oils are more likely to increase the likelihood of an adverse reaction/response.

2. Chemical composition of the oil: Essential oils rich in aldehydes (e.g., citronellal, citral) and phenols (e.g., cinnamic aldehyde, eugenol) may cause skin reactions. Oils rich in these constituents should always be diluted prior to application to the skin. According to Schnaubelt, "*diluting such oils so that the resulting solution becomes non-irritant, may require diluting them to concentrations much lower than in normal circumstances. Another option is to blend such irritant oils asymmetrically with other essential oils, which mitigate their irritant effects.*"[30] For further details, Module 4: An Introduction to the Chemistry of Essential Oils.

3. Method of application: Essential oils may be applied on the skin (dermal application), inhaled, diffused, or taken internally. The potential safety concerns with dermal application will be discussed below. With regards to inhalation, inhalation, from a safety standpoint, presents a very low level of risk to most people. Even in a relatively small closed room, and assuming 100% evaporation, the concentration of any essential oil (or component thereof) is unlikely to reach a dangerous level, either from aromatherapy massage, or from essential oil vaporization.[31]

The only likely risk would be from prolonged exposure (perhaps 1 hour or more) to relatively high levels of essential oil vapor which could lead to headaches, vertigo, nausea and lethargy.[32] With regard to internal use, this method of application is not discussed in this foundations aromatherapy program and further training is recommended prior to using essential oils internally. (See our Internal Use of Essential Oils program)

4. Dosage/dilution to be applied: Most aromatherapy blends for massage and bodywork will be between 1 and 5 percent dilutions, which typically does not represent a safety concern. As one increases dilution, potential dermal (skin) reactions may take place depending on the individual essential oil, the area in which the oil is applied, and other factors related to the client's own sensitivity levels. Any excessive usage of essential oils may cause irritation or other undesired effects due to their lipophilic nature.[33]

5. Integrity of skin: Damaged, diseased, or inflamed skin is often more permeable to essential oils and may be more sensitive to dermal reactions. It is potentially dangerous to put undiluted essential oils on to damaged, diseased or inflamed skin. Under these circumstances the skin condition may be worsened, and larger amounts of oil than normal will be absorbed. Sensitization reactions are also more likely to occur.[34]

6. Age of client: Infants, toddlers, and young children are more sensitive to the potency of essential oils and safe dilutions include .5 - 2.5% depending on condition. Also, some essential oils should simply be avoided for this population, e.g. Birch or Wintergreen which are both rich in methyl salicylate. Elderly clients may also have more sensitive skin so a reduced concentration /dosage may be indicated.

Possible Dermal Reactions

Of primary importance to the aromatherapists is the safety of essential oil application to the skin. Skin reactions take three main forms: irritation, sensitization and phototoxicity.[35]

Dermal Irritant

A dermal irritant will produce an immediate effect of irritation on the skin. The reaction will be represented on the skin as blotchy or redness, which may be painful to some individuals. The severity of the reaction will depend on the concentration (dilution) applied.

General safety guidelines include: avoid application of known dermal irritant essential oils on any inflammatory or allergic skin condition; avoid undiluted application; avoid application on open or damaged skin; and dilute known dermal irritants with appropriate vegetable oil or other carrier. If you suspect a client has sensitive skin, perform a skin patch test (see below). Table 2.1 lists some common essential oils considered to be dermal irritants.

Table 1.1 Dermal Irritants	
Essential Oil	**Latin Name**
Bay	*Pimento racemosa*
Cinnamon bark or leaf	*Cinnamomum zeylanicum* (Bark is more irritating than leaf)
Clove bud	*Syzygium aromaticum*
Citronella	*Cymbopogon nardus*
Cumin	*Cuminum cyminum*
Lemongrass	***Cymbopogon citratus***
Lemon verbena	*Lippia citriodora* syn. *Aloysia triphylla*
Oregano	*Origanum vulgare*
Tagetes	*Tagetes minuta*
Thyme ct. thymol	*Thymus vulgaris*
All citrus oils have the potential to be skin irritants if used in high dosages.	

Dermal Sensitization

The most common skin reaction to fragrance materials is sensitization, or ACD, which show on light-colored skin as a bright red rash, and on darker colored skin as a darker area. This is the visible sign of tissue damage caused by substances such as histamine released in the dermis due to an immune response. Two types of sensitization happen with essential oils: Immediate hypersensitivity and delayed hypersensitivity.[36]

With immediate hypersensitivity: the reaction occurs rapidly after 'fragrance' has been applied to the skin. The reaction is mediated by IgE antibodies, which bind to the surface of mast cells. Within minutes of skin contact by an antigen, the mast cells release histamine and other factors, causing an inflammatory reaction.

With delayed hypersensitivity: little or no effect is evident on first exposure to a substance. On subsequent exposure to the same material, an inflammatory reaction occurs, just as rapidly as for the immediate hypersensitivity.

The problem with dermal sensitization is that once it occurs with a specific essential oil the individual is most likely going to be sensitive to it for many years and perhaps for the remainder of his/her life. The best way to prevent sensitization is to avoid known dermal sensitizers and avoid applying the same essential oils every day for lengthy periods of time (e.g. every day for over 3 months). Tisserand and Balacs note that "sensitization is, to an extent, unpredictable, as some individuals will be sensitive to a potential allergen and some will not."[37]

The following oils listed in Table 2.2 are considered to be dermal sensitizers.

Table 2.2 Dermal Sensitizers

Essential Oil	**Latin Name**
Cassia	*Cinnamomum cassia*
Cinnamon bark	*Cinnamomum zeylanicum*
Clove leaf (moderate)	*Eugenia caryophyllata*
Peru balsam	*Myroxylon pereirae*
Verbena absolute (moderate)	*Lippia citriodora*
Absolutes of: oakmoss, treemoss, lavender, and lavandin	
Turpentine oil	*Pinus spp.*
Backhousia	*Backhousia citriodora*
Oxidized oils from Pinaceae family (e.g., Pinus and Cupressus species) and Rutaceae family (e.g., citrus oils) Low risk.	

Photosensitization

Photosensitization, is a reaction to a substance applied to the skin that occurs only in the presence of UV light in the UVA range.[38] An essential oil that exhibits this quality will cause burning or skin pigmentation changes, such as tanning, on exposure to sun or similar light (ultraviolet rays). Reactions can range from a mild color change through to deep weeping burns. *Do not use or recommend the use of photosensitizing essential oils prior to going into a sun tanning booth or the sun. Recommend that the client say out of the sun or sun tanning booth for at least twelve hours after treatment if photosensitizing essential oils were applied to the skin.*

Certain drugs, such as tetracycline, increase the photosensitivity of the skin, thus increasing the harmful effects of photosensitizing essential oils under the necessary conditions. Table 2.3 lists some common essential oils considered to be photosensitizers and Table 2.4 lists non-phototoxic citrus essential oils**.**

Table 2.3 Photosensitizers

Essential Oil	Latin Name
Angelica root	*Angelica archangelica*
Bergamot	*Citrus bergamia*
Cumin	*Cuminum cyminum*
Distilled or Expressed Grapefruit (low risk)	*Citrus paradisi*
Expressed lemon	*Citrus limon*
Expressed lime	*Citrus medica*
Expressed Bitter Orange	*Citrus aurantium*
Rue	*Ruta graveolens*

Table 2.4 Non-phototoxic Citrus Oils

Essential Oil	Latin Name
Bergamot: Bergapteneless (FCF: Furanocoumarin Free)	*Citrus bergamia*
Distilled lemon	*Citrus limon*
Distilled lime	*Citrus medica*
Mandarin/Tangerine	*Citrus reticulata*
Sweet orange	*Citrus sinensis*
Expressed tangerine	*Citrus reticulata*
Yuzu (expressed or distilled)	*Citrus juno*

Idiosyncratic irritation or sensitization

Idiosyncratic irritation or sensitization is an uncharacteristic or unusual reaction to a commonly used essential oil. This type of reaction is difficult to predict and rarely occurs but is a possibility.

Mucous Membrane Irritant

A mucous membrane irritant will produce a heating or drying effect on the mucous membranes of the mouth, eyes, nose, and reproductive organs. It is recommended that mucus membrane irritating essential oils not be used in a full body bath unless placed in a dispersant first (e.g., milk, vegetable oil). Bay, clove, cinnamon bark, lemongrass, and thyme ct. thymol essential oils should be avoided in baths completely. Table 1.5 lists some common essential oils considered to be mucous membrane irritants.

Table 2.5 Mucous membrane irritants

Essential Oil	Latin Name
Bay	*Pimento racemosa*
Caraway	*Carum carvi*
Cinnamon bark or leaf	*Cinnamomum zeylanicum*
Clove bud or leaf	*Syzygium aromaticum*
Lemongrass	*Cymbopogon citratus*
Peppermint	*Mentha* x *piperita*
Thyme ct. thymol	*Thymus vulgaris*

Other Safety Considerations

Safety During Pregnancy

The use of essential oils during pregnancy is a controversial topic and one that is yet to be fully understood. The main concern during pregnancy appears to be the risk of essential oil constituents crossing over into the placenta. According to Tisserand, “crossing the placenta does not necessarily mean that there is a risk of toxicity to the fetus; this will depend on the toxicity and the plasma concentration of the compound.”[39] Burfield states “it is probable that essential oil metabolites cross the placenta due to the intimate (but not direct) contact between maternal and embryonic or fetal blood.”[40] He goes on to say, “to my thinking the responsible attitude is to discourage the use of essential oils completely during the first few months of pregnancy.”[41]

Buckle comments that "*the use of essential oils in pregnancy is a contentious subject, especially during the vital first 3-month period. It is extremely unlikely that a nightly bath containing a few drops of essential oils will cause any problems for the unborn child*" and later states "*there are no records of abnormal fetuses or aborted fetuses due to the 'normal' use of essential oils, either by inhalation or topical application*."[42]

According to Wildwood, "A common myth in aromatherapy is that massage oils containing essential oils such as Clary sage, rose or even rosemary can cause a miscarriage and hence should be avoided throughout pregnancy." Authors such as Ron Guba, Kurt Schnaubelt, and Chrissie Wildwood have all pointed out that there have been '*no recorded cases of miscarriage or birth defect resulting from aromatherapy massage using therapeutic applications of any essential oil*.'[43]

Guba points out that toxicity during pregnancy is "almost exclusively due to pregnant women taking large, toxic doses of essential oils, notably pennyroyal (rich in the ketone, pulegone, which is metabolized to the highly toxic furan epoxide, menthofuron) and parsley seed (rich in the dimethyl ether, apiol) in an attempt to abort the fetus."[44] And Battaglia shares this insight: "the judicious use of essential oils together with appropriate forms of massage by a skilled therapist can help ease the discomforts of pregnancy and provide a sense of nurturing that will comfort the mother at times she is likely to be feeling rather fragile."[45]

Due to the lack of clear information regarding the toxicity of essential oils during pregnancy, it would be best to adhere to general safety guidelines. According to Tisserand, the following essential oils should not be used during pregnancy: wormwood, rue, oak moss, *Lavandula stoechas*, camphor, parsley seed, sage, and hyssop.[46]

Essential oils that appear to be safe include: cardamon, German and Roman chamomile, frankincense, geranium, ginger, neroli, patchouli, petitgrain, rosewood, rose, sandalwood, and other nontoxic essential oils.[47] It would also be prudent to avoid the internal or undiluted application of essential oils throughout pregnancy or only under the guidance of a healthcare practitioner who is trained to practice in this way.

Table 1.6 Essential oils to Avoid throughout Pregnancy, Labor, and while Breastfeeding	
Essential Oil	**Latin Name**
Star Anise	*Illicium verum*
Aniseed/Anise	*Pimpinella anisum*
Basil ct. estragole	*Ocimum basilicum*
Birch	*Betula lenta*
Blue Cypress	*Callitris intratropica*
Camphor	*Cinnamomum camphora*
Fennel, Sweet	*Foeniculum vulgare*
Ho leaf	*Cinnamomum camphora*
Hyssop ct. pinocamphone	*Hyssopus officinalis*
Mugwort or Wormwood	*Artemisia vulgaris* and *A. absinthium*
Myrtle	*Myrtus communis*
Parsley seed or leaf	*Petroselinum sativum*
Pennyroyal	*Mentha pulegium*
Sage	*Salvia officinalis*
Spanish lavender	*Lavandula stoechas* ssp. *stoechas*
Tansy	*Tanacetum vulgare*
Tarragon	*Artemisia dracunculus*
Thuja	*Thuja occidentalis*
Vitex	*Vitex agnus-castus*
Wintergreen	*Gaultheria procumbens*
Reference: Tisserand, R. and Young, R. (2014) *Essential Oil Safety*, 2nd Edition. Churchill Livingstone Elsevier.	

General Safety Precautions

1. Keep all essential oils out of reach of children.

2. Do not use or recommend the use of photosensitizing essential oils prior to going into a sun tanning booth or the sun. Recommend that the client say out of the sun or sun tanning booth for at least twenty-four hours after treatment if photosensitizing essential oils were applied to the skin.

3. Avoid prolonged use of the same essential oils.

4. Avoid the use of essential oils you know nothing about on your clients. Research and get to know the oil prior to using it on others.

5. Avoid the use of undiluted essential oils on the skin, unless otherwise indicated.

6. If you suspect your client may be sensitive to specific essential oils or if your client has known allergies or sensitivities, it may be wise to perform a skin patch test.

7. Know the safety data on each essential oil and place into context of use and knowledge.

8. Use caution when treating a female client who suspects she is pregnant or has been trying to become pregnant.

9. Keep essential oils away from the eyes.

10. Essential oils are highly flammable substances and should be kept away from direct contact with flames, such as candles, fire, matches, cigarettes, and gas cookers.[48]

11. Make sure your treatment room has good ventilation.

12. Do not use essential oils internally unless trained to do so.

Safety Measures

1. According to Schnaubelt, "if essential oils droplets accidentally get into the eye (or eyes) a cotton cloth or similar should be imbued with a fatty oil, such as olive or sesame, and carefully swiped over the closed lid."[49] With that said, I have found that flushing the eye with cold water is exceptionally helpful and it is what is recommended on a material safety data sheet.

2. If an essential oil causes dermal irritation, apply a small amount of vegetable oil or cream to the area affected.

3. According to Buckle, if a child appears to have drunk several spoonfuls of essential oil, contact the nearest poison control unit (often listed in the front of a telephone directory). Keep the bottle for identification and encourage the child to drink whole or 2% milk. Do not try to induce vomiting.[50]

REMINDER:

Dosage safety

The dosage (dilution) you choose to use for any given formulation depends on:

- The constitution of the client
- The condition being treated, and whether it is in an acute or chronic state
- The method of application (internal, cutaneous, diffusion, etc.)
- The safety information of each essential oil to be used, the experience and confidence of the practitioner, and established guidelines when applicable
- The integrity of the skin, if administered via the cutaneous route
- The age of the client or patient who will be using the formulation
- The specific goal of treatment
- The medication an individual is taking
- The knowledge and confidence of the practitioner
- The current commonly or generally accepted dosage

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