

ESSENTIAL OIL CERTIFICATION: What Are Essential Oils?

What Are Essential Oils?

- Volatile Aromatic Compounds
- Essential Oils Are Lipid-Soluble
- Chemical Constituents Give an Oil Its Benefits

Where do Essential Oils Come From?

- Why Don't All Plants Produce Essential Oil?

How Much Oil Does a Plant Contain?

WHAT ARE ESSENTIAL OILS?

You've probably heard of essential oils, but did you know they're actually all around us? They can be found in everyday products you use, like perfumes and shampoos. They flavor candy and toothpaste. They're hidden in the zest of lemons, the needles of pine trees, and the petals of roses. Essential oils are the essence of a plant, distilled into a usable oil.

VOLATILE AROMATIC COMPOUNDS

Scientifically, essential oils are mixtures of natural chemicals that give plants their scents. We call those chemical molecules volatile aromatic compounds. Obviously, there are a lot of chemicals in everything, so what makes volatile aromatic compounds different? It sounds complicated, but don't worry—the concept is simple. Volatile compounds are small organic molecules with distinct smells that easily change from their solid or liquid state to a gas at room temperature. This ability to quickly change to a gas gives an essential oil its powerful scent. When a bottle is opened, you can smell it almost immediately, thanks to the quick-moving molecules reaching your nose.

ESSENTIAL OILS ARE LIPID-SOLUBLE

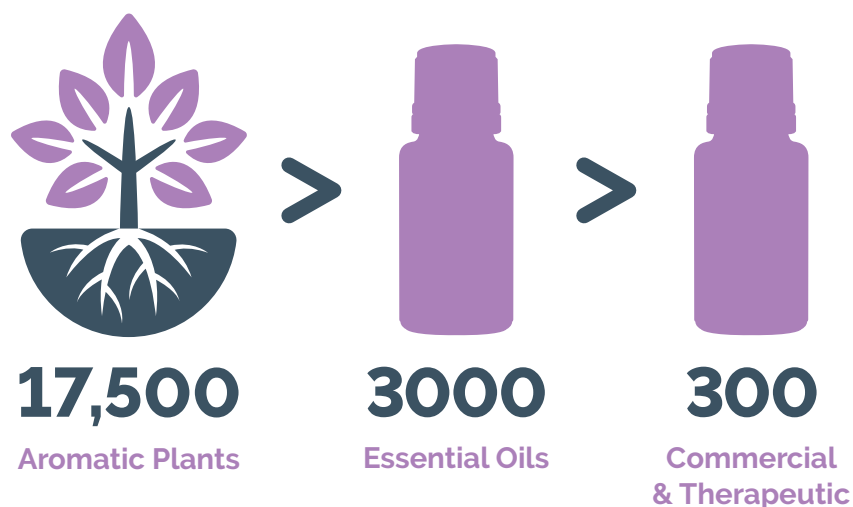
Another quality of volatile aromatic compounds is that they're lipid-soluble—or lipophilic. That means they dissolve in fats as opposed to water. Oil is a lipid, for example, and you know oil and water don't mix no matter how hard you try, but oil will easily dissolve in other oils.

CHEMICAL CONSTITUENTS GIVE AN OIL ITS BENEFITS

Each essential oil is made up of various chemical constituents that give it a unique aroma and beneficial properties. There are a lot of different chemicals, and you're probably already familiar with some of them, like alcohols and esters. Just know that the chemical makeup of an essential oil is what gives the oil its benefits (for example, soothing and rejuvenating the skin or providing feelings of clear airways). The chemical makeup of an essential oil is why it can affect your body so powerfully.

WHERE DO ESSENTIAL OILS COME FROM?

Essential oils are extracted from plants, but not every plant produces an essential oil. Out of the enormous number of plant species on Earth, fewer than 5% are known to do so. So far, 17,500 aromatic plants have been investigated to see whether they can produce essential oils. Of those plants, 2,000 are used to produce 3,000 different essential oils. That difference means some plants are used to create multiple oils. For instance, coriander and cilantro, two favorite kitchen herbs, come from the same plant. They're two completely different essential oils from their smell to their chemical makeup—the difference is that coriander comes from the seed and cilantro from the leaf. Of these 3,000 essential oils, only 300 are commonly produced. Essential oils are quickly growing in popularity, so hopefully we'll see a wider variety make their mark in the future!



WHY DON'T ALL PLANTS PRODUCE ESSENTIAL OIL?

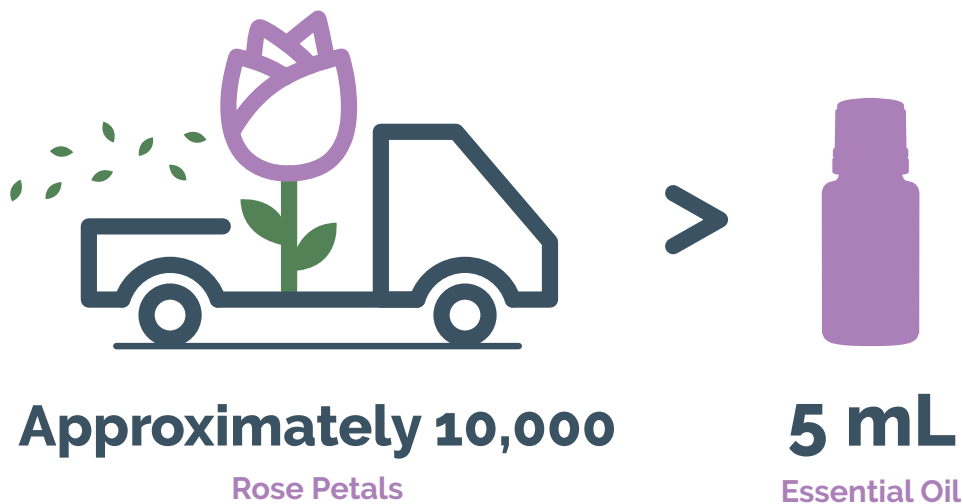
You might be wondering why all plants don't produce essential oils. It takes a lot of energy for a plant to do it—imagine having to sprint everywhere you go—so they only produce essential oils sparingly. Plants reserve production of essential oils for times when they're most needed: for defense, healing, and growth. Essential oils can be a defense mechanism against infections and predators, like insects and animals. Plants release

more aromatic compounds when their leaves or stems are damaged. They do this to deter threats and prevent further damage, allowing the plant to heal. A plant also uses essential oils to communicate with other plants, slowing the growth of competing nearby species. This little trick is called allelopathy. Another way essential oils help plants is by attracting pollinators like bees, butterflies, and hummingbirds. Other animals are drawn to the plant and help disperse seeds. You inadvertently contribute to this when you carry burrs home on your socks after a hike.

HOW MUCH ESSENTIAL OIL DOES A PLANT CONTAIN?

Not all plants will produce the same amount of essential oil. You can experience this for yourself. When you, say, squeeze an orange peel, enough oil is released to coat your hand, but crushing a peppermint leaf only results in a small amount. This is called yield. You can calculate yield by looking at the amount of oil produced compared to the amount of the original plant material.

Rose, for example, is considered a low-yield essential oil. It can take around 10,000 blossoms to produce a 5 milliliter (mL) bottle of rose oil. On the other hand, sandalwood is a high-yield oil. It only takes around a quarter pound of sandalwood to make a 5 mL bottle. Yield can vary, even within the same species. A rose bush in one environment will produce more oil than another, depending on things like climate, predators, and pollination.



ESSENTIAL OIL CERTIFICATION: History of Essential Oils

History of Essential Oils

Essential Oils in Ancient History

- Egypt
- Indus Civilizations
- China
- Greece

Developments in Essential Oil Science

HISTORY OF ESSENTIAL OILS

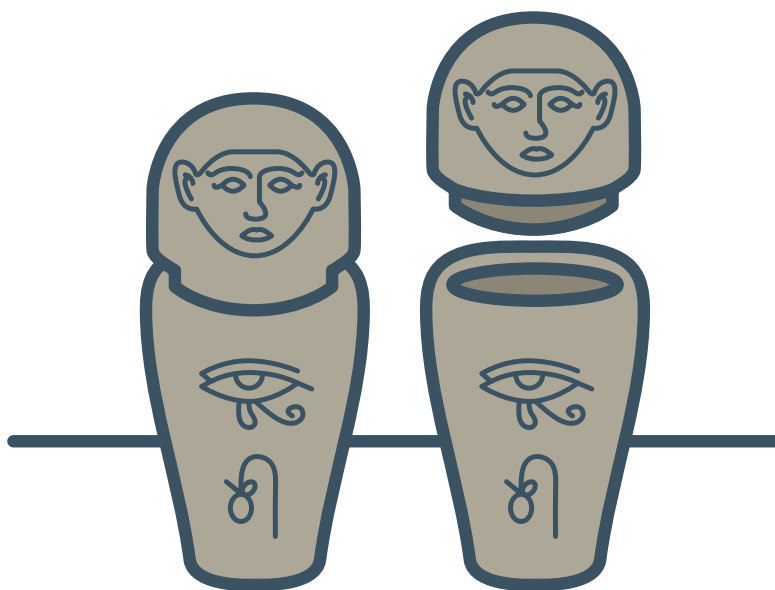
Did you know that crude forms of essential oils have been used for thousands of years? Archaeologists have found evidence of the use of these essential oil forerunners in many ancient societies. We don't know exactly which culture was the first to use them, but records indicate it could've been the Egyptians, Chinese, or Indus civilizations. Throughout history, people all over the world have used the power of plant extracts for things like health practices, religious ceremonies, cultural rituals, and food. Essential oil plant material, like frankincense resin, was even used as a form of currency at certain times. One of their most famous uses was as perfume. If you ever want to smell like Cleopatra, a safe bet would be rose, myrrh, cardamom, or cinnamon, as these scents were popular in ancient Egypt. Egyptian, Indus, Chinese, and Greek civilizations all contributed to what we now know about the powerful uses of essential oils.

ESSENTIAL OILS IN ANCIENT HISTORY

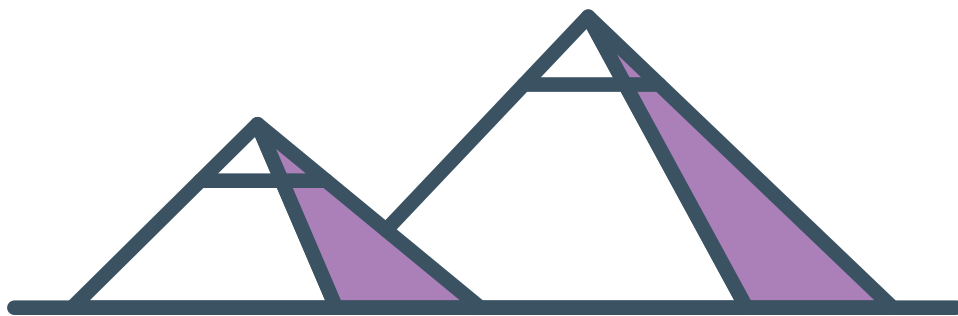


The first use of aromatics likely occurred in ancient Egypt, China, or Indus

EGYPT



When you think of Egypt, tombs and mummies tend to be some of the first things that come to mind. Burial traditions in Egyptian culture were of the utmost importance. The Egyptians observed specific rituals and sought to give as many luxuries to the deceased as they could afford. Researchers have found that one such luxury was precious plant extracts. Aromatic residues have been found in unearthed jars in Egyptian tombs, as well as on actual mummies. The walls of Egyptian temples are decorated with images depicting the use of potent plant extracts. Historical records suggest that Egyptian healers also recommended them for health purposes.



INDUS CIVILIZATIONS

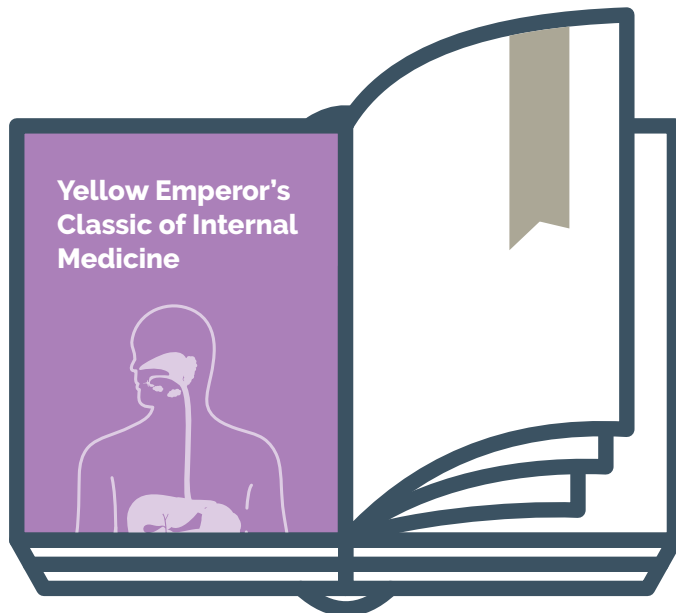
Indus civilizations—in the area where India, Pakistan, and Afghanistan are today—left behind clues of plant use. The people of this era were some of the first to attempt their own method of extracting essential oils from plants. Archaeologists have found a rudimentary invention made of terracotta pottery that they believe was used to create early plant extracts around 3000 BC. Keep in mind that this would have been roughly the time when humans first developed writing, before the Old Kingdom of Egypt was founded and around when Stonehenge was being built! More than a thousand years later, Indus civilizations still used plant extracts for various purposes. Cinnamon, ginger, myrrh, sandalwood, and coriander extracts are listed in an ancient Indian book of plant uses called the Vedas. From the Vedas, the ancient tradition of Ayurvedic medicine was born. This practice continues to this day.



CHINA

Between 500 and 1300 AD, China was a leading world power, with advances in science and technology far ahead of any other civilization of the time. They conducted extensive research, leading to many advances in the usage of plants. For example, references to aromatic plants are in the widely read and highly influential book *Yellow Emperor's Classic of Internal Medicine*. Some believe this guide was originally written about 2600 BC.

Protocols based on experiences and research done in ancient China have been passed down through generations and still influence modern healthcare to this day.

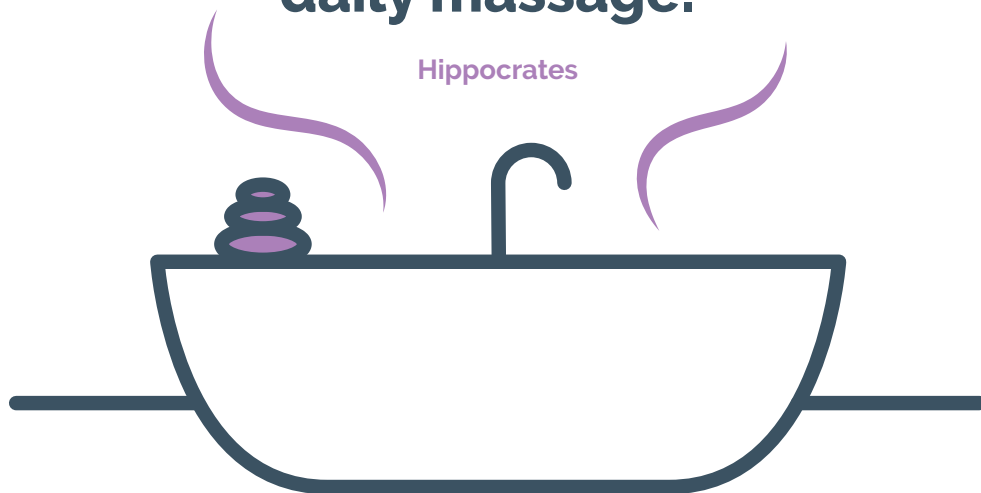


GREECE

Historical accounts suggest ancient Greek physicians Hippocrates, Theophrastus, Dioscórides, and Galen each used the aromatic power of plants for health solutions. The Romans famously employed Greek physicians at the Colosseum, where they used plant extracts when performing surgeries on injured gladiators. The research of these physicians influenced many health practices throughout Greek culture.

**“Healing begins with
an aromatic bath and
daily massage.”**

Hippocrates



DEVELOPMENTS IN ESSENTIAL OIL SCIENCE

Though basic forms of essential oils and aromatics have been used for thousands of years, it was quite some time before modern essential oils emerged. We had to wait until the late tenth to early eleventh century before true essential oil distillation was developed by a Persian physician and alchemist named Avicenna. His compiled writings, *The Canon of Medicine*, list the use of hundreds of plants, including plant distillations for wellness. His book was so renowned that people were still reading it 900 years later. In 1913, one physician called it "the most famous medical textbook ever written." We owe a lot to Avicenna for giving us what we now know as essential oils.

More developments in essential oil science followed Avicenna. During the thirteenth century, the Spanish physician Arnaldus de Villanova distilled rosemary, spike lavender, juniper, clove, cinnamon, nutmeg, and anise for various purposes. From the fifteenth to the twentieth century, European scientists distilled, analyzed, and recorded the properties of essential oils. This systematic analysis of essential oils was critical in paving the way for them to become valuable therapeutic solutions.

René-Maurice Gattefossé, a French chemist, is credited as the first to coin the term aromatherapy. He studied and researched essential oils in the 1800s. If you've ever read about the history of essential oils, you've probably heard the story of Gattefossé realizing the usefulness of lavender essence after an incident in his lab one day.

ESSENTIAL OIL SCIENCE TODAY

Ancient civilizations first made the case for essential oils and plant-based therapeutic practices. From China to Egypt, the people of these early cultures helped create a foundation that scientists and physicians later built upon.



Our scientific understanding of essential oils has come a long way since then. There are now thousands of peer-reviewed studies that contribute to our understanding and use of essential oils. The twenty-first century has brought essential oils out of fringe groups and into popular society, perpetuating their study. With advancements in technology and years of research, we can finally tap into the full power of essential oils.

ESSENTIAL OIL CERTIFICATION: Distillation

Extracting Essential Oils from Plants

Distillation

Steam Distillation

- Temperature
- Pressure
- Time

Hydrosol

Hydrodistillation

- Steam Distillation Versus Hydrodistillation

Fractional Distillation

- Ylang Ylang

EXTRACTING ESSENTIAL OILS FROM PLANTS

The process of turning a plant into an essential oil is called extraction. Effectively separating an essential oil from its plant isn't quite as simple as squeezing an orange peel in your hand or crushing a mint leaf.

The extraction of essential oils from plants is as much an art as a science. Yes, you need the right equipment and good plant material to work with, but even with the best equipment and plant materials in the world, a great deal of love and care is required to produce a high-quality essential oil.

Extracting essential oils is more than just throwing a plant into a machine and getting an oil at the end. This delicate process begins the moment a farmer holds lavender seeds in her hand. She knows the best time to plant, the perfect soil conditions for the growing seedlings, and the ideal moment to harvest. When she delivers her lavender harvest to the distiller, the yield enters the next phase in its transformation.

DISTILLATION

The most common extraction method is distillation. This can get pretty science-y, but it'll make sense by the end! Distillation is a process that involves separating a substance into its constituent parts, based on boiling points or volatility.

Okay, let's break that down.

Remember how we talked about volatile aromatic compounds earlier? Those compounds are what we try to get out of the plant. We want those little molecules that give plants their aroma. When the leaf, flower, root, or bark is exposed to high temperatures, the aromatic molecules hidden inside of it are released. And because they're volatile, they quickly change to their gaseous state. The tricky thing is that each constituent boils at a different temperature. If you don't carefully control the temperature of the machinery, you'll miss out on some of the important chemical constituents in the plant. Go too high, and you'll accidentally create a chemical reaction that ruins the natural chemistry of the essential oil. A good distiller knows exactly how to get all the compounds out without altering them, giving the finished essential oil its potent benefits.

STEAM DISTILLATION

Oils can be distilled in a few different ways. The most common method is steam distillation, because it yields exceptionally pure and clean products. So, how exactly does it work? It starts by suspending the plant matter above boiling water. The steam forces its way through the plant material and breaks the small glands that hold the essential oil. Once released, the essential oil is carried up by the steam into a tube, where it cools and condenses. Imagine the lid on a boiling pot—steam cools and condenses into liquid droplets. It's the same with essential oils. The (now) liquid essential oil and condensed steam drips down into a collection container, where it separates, ready for the distiller to bottle it up. Usually, the essential oil rises to the top of the separator and the water sinks to the bottom, though some oils like clove, cinnamon, and wintergreen are heavier than water and will thus separate to the bottom.

Steam distillation is a delicate and time-intensive process. It involves a pressurized system, which allows essential oils to be extracted at temperatures well below their normal boiling point. This protects the integrity of their delicate and complex chemical profiles. Remember what we mentioned earlier about accidentally creating chemical reactions?

TEMPERATURE

When steam distilling an oil, the temperature of the system must remain within a strict range. Optimal temperatures usually fall between 140 °F and 212 °F (60 °C and 100 °C). If the temperature is too low, the essential oil isn't extracted efficiently. This is less than ideal because you'd miss out on some of the important chemical compounds that make an oil powerful. Too high of temperature risks damaging the essential oil or extracting unwanted compounds.

Thermal Degradation and Hydrolysis

When we don't adhere to these strict temperature guidelines, a lot can go wrong. Some compounds are particularly heat-sensitive—also known as *thermolabile*. When compounds that are heat-sensitive are exposed to high temperatures, they may be destroyed. This is called *thermal degradation*. Or, if the compounds aren't destroyed, there's still a chance that they could be molecularly modified and transformed into something else. There are also occurrences where the compounds are broken down because of a reaction with the heated water. Scientists refer to this as *hydrolysis*. Finally, at high temperatures, there's also a risk that the compounds will be completely lost because they turn into a vapor, which is known as *volatilization*.

For example, lavender is primarily made up of two compounds: linalyl acetate and linalool. Excess heat during distillation can convert some of the linalyl acetate into linalool. Similarly, furanodiene—one of the compounds in myrrh essential oil—can be transformed into curzerene if excess heat is used during steam distillation. While some extra linalool or curzerene may not seem like a problem, the oil no longer represents the original chemical composition of the plant, which will potentially change the essential oil's effectiveness. Poor temperature control changes the chemical makeup of the oil, which can significantly influence therapeutic value. In other words, if heat isn't controlled properly during this process, you'll end up with a low-quality oil that has lost some of its benefits.

PRESSURE

Equally as important as temperature, pressure must be strictly controlled. Increasing the pressure of the distillation system can significantly reduce the distillation time—by up to a fourth if a pressurized system is used. If you want to introduce pressure to steam distillation, you need a closed system. This means your whole distillation system has to be pressurized to a level that's higher than the normal air around you.

Enough pressure must be applied to the plant material to soften plant cells and allow the essential oil to escape in vapor form. Too little pressure and the precious volatile molecules aren't released, yet too high pressure and the plant material is destroyed or the essential oil modified. The required pressure varies from plant to plant, but typically falls between 15 pounds/inch² (PSI) and 20 PSI. Car tire pressure, as a reference, usually falls between 30 and 35 PSI.

TIME

In addition to pressure and temperature, distillation time is also important. Each plant is unique, requiring anywhere from just a few hours to more than an entire day to fully distill. Wood oils typically have the longest distillation times, requiring up to 36 hours or more to fully distill. Lavender, on the other hand, can be distilled in just two hours.

HYDROSOL

After the steam distillation process is complete, what happens to all the water that was used? Well, the leftover water is called hydrosol, hydrolat, or floral water. You may have heard of rose water (while it may not sound as lovely, the more accurate term would be rose hydrosol). Many companies will quite happily call any product that's a blend of essential oils and water a "floral water," so you'll want to confirm that what you're buying is truly hydrosol.

Hydrosols contain bits of plant material and even small amounts of aromatic compounds. A liter of hydrosol typically contains between 0.05 mL and 0.2 mL of essential oil, which is between one to four drops.¹ Hydrosols have therapeutic value but aren't nearly as potent as essential oils. Their most common use is in skincare products due to their toning, hydrating, restorative, and soothing properties.

HYDRODISTILLATION

Now back to different types of distillation—let's talk about hydrodistillation next. Though often confused with steam distillation, hydrodistillation does differ slightly. Sometimes called water distillation, hydrodistillation involves putting the plant material in boiling water rather than above it—an important distinction. To keep the plant matter from settling on the bottom and burning, it's swirled around constantly. The rest of the process is similar to steam distillation, with the steam carrying the essential oil out of the plant matter and up into the condenser.

Hydrodistillation is used to extract essential oils like frankincense and myrrh, because these oils are derived from resin. Since steam distillation doesn't effectively penetrate the hard resin chunks from a frankincense or myrrh tree, they require something a little more intensive than steam to distill the essential oils.

STEAM DISTILLATION VERSUS HYDRODISTILLATION

Knowing the best method to extract the key volatile molecules is important for producing the highest quality essential oils. For example, even though steam distillation and hydrodistillation are similar, they can produce quite different essential oils from the same material. Plant material can be distilled in two distinct ways, and the end product will have different ratios of aromatic compounds. For instance, one study comparing steam-distilled and hydrodistilled thyme essential oil found that steam distillation extracted greater amounts of thymol and carvacrol—two important molecules of therapeutic value.²

FRACTIONAL DISTILLATION

Before we leave the topic of distillation, we should talk about multiple or fractional distillations. During fractional distillation, fractions of the essential oil are removed throughout the process. What's the benefit of this? Taking out fractions or portions of an essential oil as it's distilled allows the distiller to isolate specific properties of the oil. This is possible because essential oil compounds evaporate at different rates, making each fraction or portion of the oil chemically different. This type of distillation is typically used for specific purposes, such as for creating perfumes.

YLANG YLANG

Ylang ylang is an essential oil that's sometimes fractionally distilled. It undergoes a lengthy distillation of about 24 hours, where fractions of the essential oil are removed at specific times throughout the process. During the first hour of distillation, a fraction of ylang ylang essential oil is removed from the batch—this fraction is called Ylang Ylang Extra, or Ylang Ylang Super. Ylang Ylang Extra is mostly used for high-class perfumes because it has a coveted aroma.

As the distillation process continues, another fraction is removed between the second and third hour. This fraction is called Ylang Ylang I, and it's also frequently used for perfumes.

As you might've guessed, the next fraction—removed between the third and fifth hour—is called Ylang Ylang II. Fractions I and II are often used in cosmetics, soaps, and detergents.

The fraction of oil removed between hours eight and twenty-four is called Ylang Ylang III.

Ylang ylang oil that comes from an uninterrupted distillation (the entire day-long process) is called Ylang Ylang Complete. Ylang Ylang Complete contains all of the previously described fractions of Extra, I, II, and III and is considered ideal for therapeutic use because of its well-rounded chemical profile and rich sesquiterpene content. Remember the word sesquiterpene, because you'll learn more about it later.

ESSENTIAL OIL CERTIFICATION: Expression and Other Extraction Methods

Expression or Cold-Pressing

Steam Distilling Citrus Oils

Citrus Oils and Photosensitivity

A Zero-Waste Process

Other Extraction Methods

- Extracting with Solvents
- Absolutes

Carbon Dioxide (CO₂) Extraction

Enfleurage

Comparing Different Extraction Methods

EXPRESSION OR COLD-PRESSING

Did we mention there are a lot of ways to extract essential oils? This next method is called expression. It's mostly used for citrus oils and is pretty straightforward. You take, for example, an orange and put it through a machine that squeezes out the essential oil from the peel. Unlike steam distillation, expression doesn't need heat. That's why you'll often hear it referred to as cold-pressing.

Let's imagine life hands you lemons, and you want to make lemonade—no, actually lemon essential oil. The first step is putting the lemon into the expression machinery. It's rolled across cylinders that pierce the peel and break the small sacs where the essential oil is contained. Then you spray the fruit with water, which washes the essential oil out into a container. What you get is essential oil mixed with particles from the rind. To separate the essential oil, you filter and centrifuge the oily mixture. And voila! You have lemon essential oil.

Expression produces potent essential oils that smell nearly identical to the fruit. It's no wonder that everyone loves citrus oils. Honestly, they smell fantastic.

STEAM DISTILLING CITRUS OILS

Expression is the most common method for extracting citrus essential oils, but you can steam distill citrus fruit too. You'll get a slightly different oil when you do. Because expression is a physical process, it can extract heavier compounds along with the aromatic molecules. When you compare expressed orange oil with a distilled orange oil, the expressed oil will be a light orange in hue because it contains some orange pigment. The distilled orange oil, on the other hand, will be clear. In general, steam-distilled citrus oils smell slightly sweeter than the tart cold-pressed citrus oils.

Expressed essential oils can also have some minor chemical differences from their distilled versions. For example, distilled bergamot essential oil usually contains less linalyl acetate and more linalool than expressed bergamot. This is because some of the linalyl acetate in steam-distilled bergamot oil is exposed to heat and converted to linalool.

CITRUS OILS AND PHOTSENSITIVITY

Another difference between cold-pressed and steam-distilled citrus oils is the presence of furanocoumarins (say that 10 times fast!) in expressed essential oils like lemon and bergamot. Furanocoumarins are a type of chemical constituent that reacts with ultraviolet rays. They're found in trace amounts in some expressed citrus oils. Distilled citrus oils generally don't contain furanocoumarins, because they're some of those heavier molecules mentioned before that don't come through in distillation.

You should be mindful of using cold-pressed oils topically, especially bergamot, and then exposing your skin to UV light, whether from the sun or a tanning bed. When these chemicals are present on the skin and exposed to UV light, a chemical reaction takes place that causes the skin to be photosensitive, which means it'll be extra sensitive to the light. This can result in a sunburn, discoloration, or even blistering of the skin. While we'd all love to be smelling of sweet citrus in the summer sun, it's better to play it safe and only apply citrus oils to your skin at night when you know you won't be going into the sunlight for at least 12 hours.

A ZERO-WASTE PROCESS

One final thing about expressed citrus oils is that they're a zero-waste product! Citrus oil is frequently a byproduct of the juice or food industry. Millions and millions of pounds of fruit are grown to create fruit juices, but only the flesh of the fruit is needed for juice. Many of these companies cold-press the leftover rinds to make citrus essential oils. After the process is complete, the excess rinds and pulp usually become fertilizer or help feed cattle.

Every bit of citrus fruit is used, and, in the end, you get at least three useful products: the juice or fruit itself, the essential oil that comes from the rinds, and the leftovers for fertilizer or feed! No waste is a way of thanking Mother Earth for her gifts.

OTHER EXTRACTION METHODS

Steam distillation, hydrodistillation, and cold-pressing are the most common ways of extracting essential oils, but there are some less common ones, such as solvent, carbon dioxide, and enfleurage. Let's take a quick look at these specific methods.

EXTRACTING WITH SOLVENTS

While solvent extraction can be used on most plant materials, it's most often used for delicate plant materials like flowers that cannot otherwise endure the conditions required for steam distillation. What's a solvent, you may ask? It's a substance that can dissolve other substances. Some examples of solvents are alcohol, methanol, and ethanol.

With solvent extraction, plant materials are placed in a shallow tray and washed with a solvent. This breaks the essential oil out of the plant. You then filter it to remove the plant material. The result is a waxy substance called a concrete. The concrete is further processed with another solvent, usually ethanol. Next, you need to reduce the pressure in the equipment to allow the solvent to evaporate.

ABSOLUTES

What's left is something called an absolute. Essential oils are volatile aromatic compounds extracted from a plant. Absolutes are similar to essential oils, but they're obtained through a different process. Jasmine is a great example. Technically speaking, what you may know as jasmine "essential oil" is actually jasmine absolute. Most essential oils are produced through steam distillation or cold-press (expression) methods, but Jasmine absolute is produced by solvent extraction.

Absolutes are different from essential oils because they usually contain both aromatic and nonaromatic compounds. The easiest way to think of absolutes is that they're aromatic molecules extracted using a solvent, where some of the solvent remains in the end products.

CARBON DIOXIDE (CO₂) EXTRACTION

Another uncommon extraction method is carbon dioxide (CO₂) extraction. This process of using carbon dioxide is also called supercritical fluid extraction (SFE). CO₂ has the unique ability of reaching a supercritical state—meaning it possesses the properties of both a gas and liquid simultaneously—at relatively low temperatures and pressures. This

is useful to preserve the important volatile molecules that are more sensitive to heat.

Before we go into the science of this process, here's why CO₂ extraction is cool:

1. It's really clean. It doesn't leave solvent residue in the essential oil.
2. It protects the chemical structure of volatile compounds, preventing them from changing during the extraction process. No more turning linalyl acetate into linalool!
3. You have better control of extracting the aromatic compounds, so you can get heavier molecules that otherwise might be left out, like diterpenes in frankincense.
4. It produces a highly concentrated essential oil that smells like the original plant material.

HOW IT WORKS

So, with CO₂ extraction you get cleaner, more complex essential oils that are closer to the plant's natural composition. The equipment for this type of extraction is expensive, but the overall process is pretty fast and efficient and often produces higher yields than steam distillation.

Now, here's how it works.

First, the CO₂ is heated and pressurized, which turns it into an excellent solvent. Next, you put the liquid CO₂ in with the plant material. This pulls out the essential oil, and you can get rid of the now oil-less plant material. Once the plant material is filtered out of the mixture, the heat and pressure are turned off. When that happens, the CO₂ turns back into a gas, evaporates out of the oil, and is captured to use in the next batch. The result? The pure essence of the plant in a bottle.

ENFLEURAGE

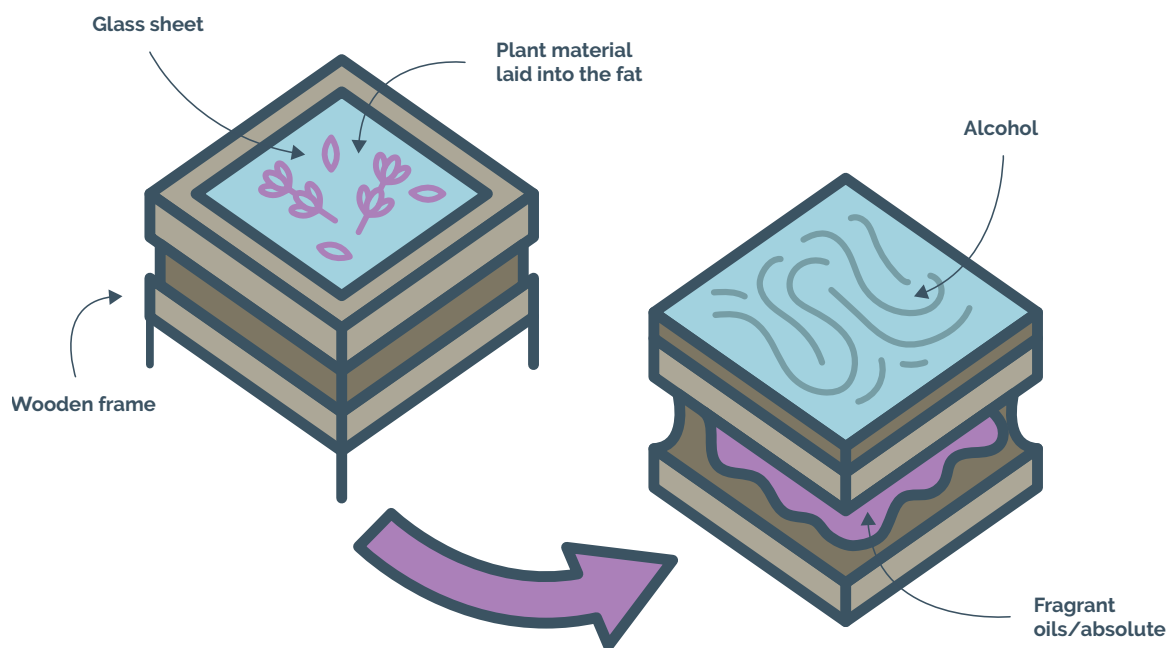
The last extraction technique we'll discuss here is enfleurage. This is one of the oldest methods known—it was used to extract aromatic compounds before distillation was even invented. Imagine Cleopatra's perfumer extracting rose oil for her to use. This is how he did it.

HOW IT WORKS

He used lard. Okay, that's a little simplistic. There's some interesting science behind it. Enfleurage really highlights the lipid-soluble nature of volatile aromatic compounds. You'll remember that if something is lipid-soluble, that means it dissolves in fats. With enfleurage, the plant material is crushed and pressed into animal or vegetable fat. The lipid-soluble compounds—that's to say the essential oil—of the plant dissolve into the fat. After you've pressed the plant materials you're left with a greasy, waxy mixture called an enfleurage pomade. Sounds nice, right? The pomade is then further processed with a solvent (usually hexane) to separate the fat from the essential oil. The finishing touch is washing the product a second time, typically with alcohol.

In the end, you're left with an absolute . . . but not a really clean one. Enfleurage produces impure products, so it's not considered an acceptable method for producing therapeutic-grade botanical extracts. While enfleurage is historically important, there are so many ways of extracting essential oils that are way more efficient, so it's not that relevant today.

Enfleurage



COMPARING DIFFERENT EXTRACTION METHODS

So, which extraction method is the best? Well, it really depends on what outcome you're looking for. If you're trying to obtain essential oils for fragrance purposes, then absolutes, expression, and CO₂ essential oils produce the most authentic aromas. But when it comes to therapeutic-grade essential oils, having the optimal ratio of key volatile molecules is what matters. To determine the best method for producing the right ratio of aromatic compounds, you can compare different methods of extraction on the same batch of plant material.³ You probably don't have time to do this, so we took a batch of roses and did it for you:

Rose Extraction Method Comparison

CONSTITUENT	STEAM DISTILLATION	SOLVENT (ABSOLUTE)	CO ₂
2-Phenylethanol	1.7%–10.0%	28.3%	5.0%–6.7%
Citronellol + Nerol	26.1%–36.6%	3.8%	10.0%–11.4%
n-Nonadecane	10.0%–15.0%	15.2%	3.9%–7.8%
2-Phenylethyl Acetate	0.2%–14.8%	2.4%	0.3%–7.5%
Geraniol	0.0%–17.0%	0.0%	0.0%–4.2%
N-Heneicosane	1.7%–5.0%	12.0%	0.1%–3.4%

Another big thing to consider is pesticides. If the plant matter was sprayed with pesticides, the solvents tend to carry and concentrate those pesticides into the end product—obviously not a good thing. If you're using a solvent extraction method (including CO₂), you have to make sure the plant matter is free of pesticides.

In the end, qualified scientists and health professionals need to carefully evaluate and compare the various extraction methods for each plant to determine the preferred extraction method. Going the extra mile to do this maximizes the efficacy of the essential oils produced so you can expect consistent and reliable results.

ESSENTIAL OIL CERTIFICATION: Chemistry 101

Chemistry 101

- What's Chemistry
- What's a Molecule?

Basics of Essential Oil Chemistry

- Carbon Backbone
- Chemical Bonds
- Molecules Matter!

The Chemistry of Essential Oils

- Main Chemical Constituents

Chemistry in Plants

Essential Oil Chemotypes

Terpenes

Monoterpenes

Sesquiterpenes

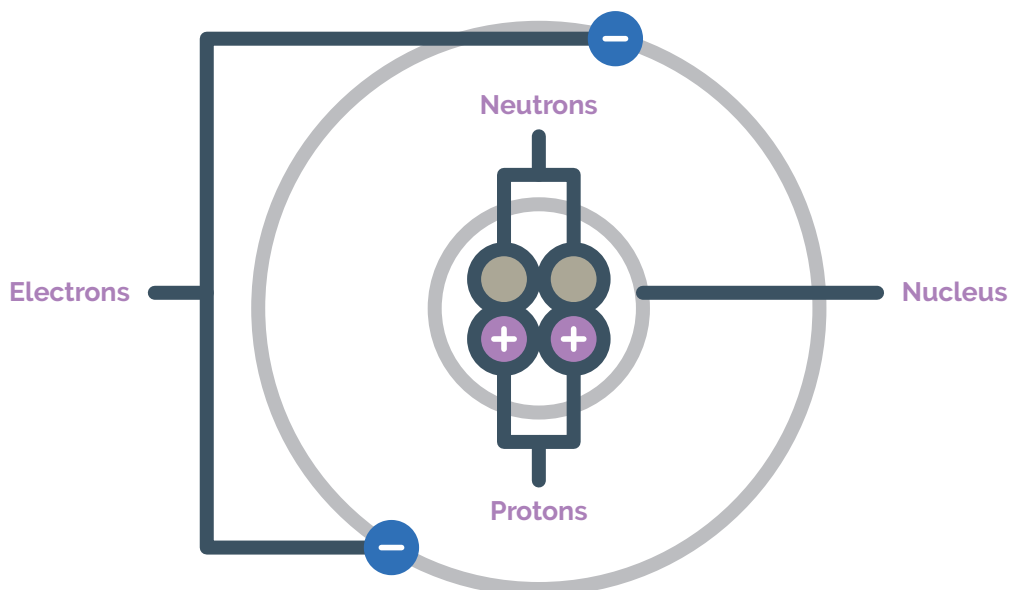
HOW DO ESSENTIAL OILS AFFECT ME AROMATICALLY?

Now that you've got a deeper understanding of what essential oils are and the basics of extraction processes, we're going to move on to essential oil chemistry. Once you understand the chemistry behind essential oils, you'll be able to use them safely and more effectively.

WHAT'S CHEMISTRY?

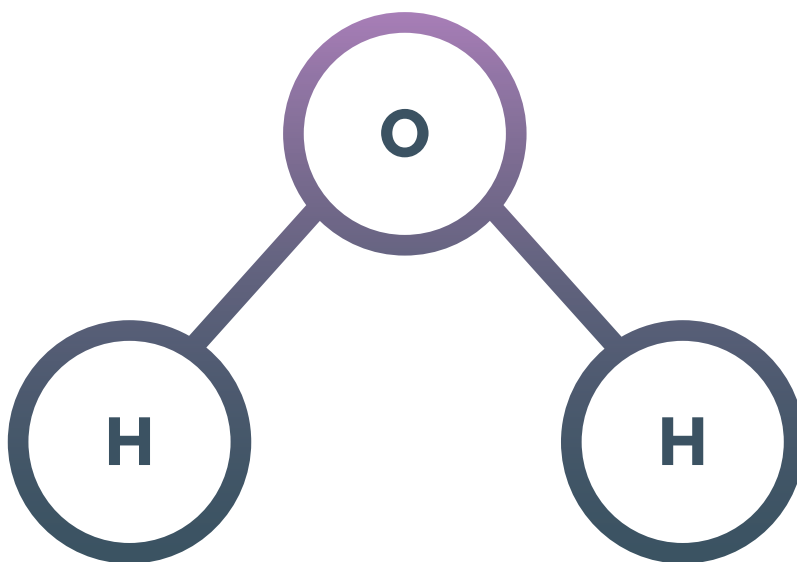
First, let's talk about what chemistry actually is. Everything around you, from the air you breathe to the clothes you wear, is made up of different substances. And substances consist of tiny particles called atoms, which are made up of even tinier particles called electrons, protons, and neutrons. Chemistry studies substances at this tiny, atomic level.

There are a lot of different types of atoms, and how many electrons, protons, and neutrons an atom has determines what element it is. You've probably heard of elements such as oxygen, hydrogen, and helium. The atoms making up these elements have different numbers of protons, neutrons, and electrons. Altogether, there are 118 different elements, all with unique combinations of protons, neutrons, and electrons.



WHAT'S A MOLECULE?

When two or more atoms link together, it creates a molecule. Water, for example, is a molecule. You've probably heard it referred to as H₂O, because it has two hydrogen atoms and one oxygen atom linked together. This molecule is what you drink to stay hydrated every single day.



H₂O/WATER

Chemical structure

BASICS OF ESSENTIAL OIL CHEMISTRY

When it comes to essential oils, we focus on organic chemistry. Organic chemistry is the study of molecules that have carbon in them. If a molecule has carbon, it's considered an organic molecule. Carbon gets a lot of attention because it's so good at building molecules. It loves bonding with other atoms and is stable enough to make the complicated molecules necessary to create life. Without carbon, you can't have DNA, and then where would we be?

CARBON BACKBONE

An important feature of carbon is its ability to make large or complex chains. These chains of carbon atoms are referred to as a carbon backbone. Other atoms will build on this backbone to create the whole world of carbon-based molecules. We'll talk more about carbon backbones in a bit.

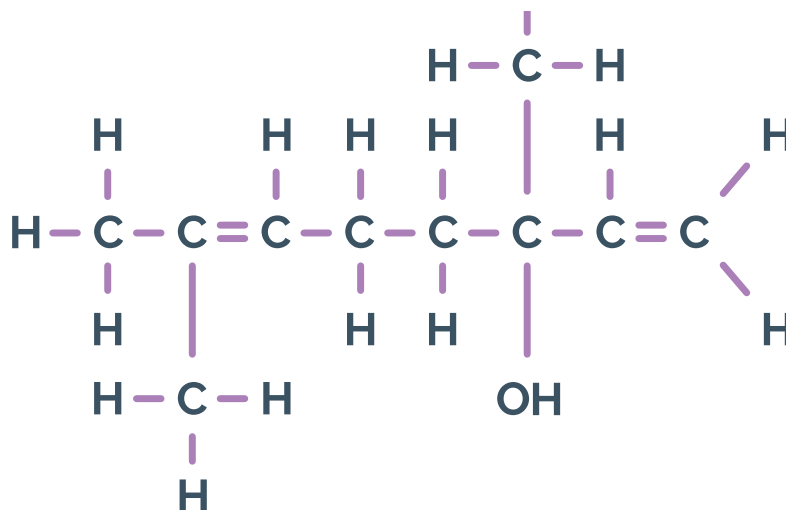
But now, let's take a look at a carbon-based molecule. Remember how we talked about the chemical compound linalool in lavender essential oil? Here's a basic diagram of the atoms that make up linalool.



Carbon Skeleton

LINALOOL

In this graphic, you can see the letters C, H, and O. These letters represent the different atoms in a linalool molecule. In this example, C stands for carbon, H for hydrogen, and O for oxygen.



Lewis Structure

LINALOOL

Chemical structure

CHEMICAL BONDS

Another thing you ought to be aware of is the number of chemical bonds between atoms. This molecule has both single and double bonds, which are represented in this diagram by one or two lines joining the atoms. Don't worry about this too much, but it'll come up again later, and we wanted to make sure you have some background.

MOLECULES MATTER!

The different molecules found in essential oils are what give them their therapeutic value and aroma. The chemical makeup of an essential oil affects how the oil interacts with your body.

Each essential oil also has a different number of molecules. Wintergreen, for example, is almost entirely made up of one kind of molecule called methyl salicylate. Spikenard, on the other hand, has hundreds of different molecules.

Few people truly appreciate the complexity of essential oils, particularly the oils that contain hundreds of molecules. Too much or too little of any given molecule can affect the aroma and properties of the essential oil.

THE CHEMISTRY OF ESSENTIAL OILS

So we've established what chemistry is and the importance of molecules in different essential oils, now let's take it a step further. Remember how we talked about how mol

ecules are atoms linked together through a chemical bond? Well, if the atoms that are connected are different types of atoms, they're not only a molecule, but also a compound. Water, because it has both hydrogen and oxygen, is both a compound and a molecule. Ozone, which is just three oxygen atoms joined together, is only a molecule.

Essential oils are filled with all different kinds of compounds. What these compounds have in common is that they're volatile. We defined what volatile means in the first module, but just in case you need a refresher, volatile means that a substance can change from a liquid to a gas really quickly.

MAJOR CHEMICAL CONSTITUENTS

Now that you know what a molecule and a compound are, and you understand the importance of carbon in building compounds, it's time to really dive into the chemical structure of essential oils.

CHEMISTRY IN PLANTS

Now here's something interesting—no two plants will produce essential oils with the exact same chemistry. Even two plants from the same species will have variations in their chemical composition. Many things can affect the chemical makeup of an essential oil, including the region the plant was grown in, the time and season it was harvested, and the quality of the soil. This means that lavender grown in Bulgaria actually has a different chemical composition than lavender grown in the Himalayas. In the same species, however, the main difference between two plants is usually the amount or percentage of the major compounds for that species. For example, lavender from the Himalayas and lavender from Bulgaria will both have the compounds linalool and linalyl acetate, but they'll have differing amounts.^{4,5} This is important to understand because, as we talked about earlier, the amount of any given chemical constituent in an oil affects the benefits of that oil.

Five Major Constituents of Bulgarian and Himalayan Lavender Essential Oil

BULGARIAN (HEBAR) LAVENDER	HIMALAYAN LAVENDER
36.4% Linalyl Acetate	39.1% Linalyl Acetate
30.6% Linalool	29.7% Linalool
6.2% (z)-Beta-Ocimene	4.4% Alpha-Terpineol
4.2% (E)-Beta-Ocimene	3.8% Beta-Caryophyllene
2.6% Lavandulyl Acetate	2.0% Geranyl Acetate

ESSENTIAL OIL CHEMOTYPES

Sometimes, the growing environment can impact a plant so much that it produces a totally different chemical composition. Two plants can have the same genus and species but diverge within the species into different subspecies, which scientists call chemotypes. Even though two plants look and grow the same, inside their chemistry is so different that they're categorized as a different chemotype. The chemotype of an essential oil is important because it can influence its effectiveness and safety.

So, what causes plants to have different chemotypes? The chemical constituents of the plant are different because of minor changes in the makeup of their DNA and how the plant's genes are expressed. Think identical twins—same DNA, but slightly different appearances.

This comparison of two chemotypes of basil⁶ shows how different their chemistry can be:

Basil Major Chemotype Comparison

COMMON NAME	SWEET BASIL	EXOTIC/TROPIC BASIL
Botanical Species	<i>Ocimum basilicum</i>	<i>Ocimum basilicum</i>
Country of Origin	Egypt	Vietnam, India, USA, Madagascar
Chemotype	CT Linalool	CT Methyl Chavicol (Estragole)
Major Constituents	40%–60% Linalool	75%–90% Methyl Chavicol
	2%–12% 1,8-Cineole	1%–m5% 1,8-Cineole
	1%–8% Eugenol	< 4% Methyl Eugenol
	< 5% Methyl Chavicol	0.1%–5% Linalool

TERPENES

When we talk about the chemistry of essential oils, we start with something called a terpene. This is a type of aromatic molecule created by plants.

So why are terpenes important? Well, out of the three different kinds of terpenes relevant to essential oils (monoterpenes, sesquiterpenes, and diterpenes), monoterpenes and sesquiterpenes are the main compounds present in essential oils. Terpenes are basically the building blocks of essential oils. Diterpenes aren't frequently found in essential oils because they are heavier and don't easily evaporate during steam distillation.

MONOTERPENES

Monoterpenes have a 10-carbon atom backbone arranged in either a ring or a straight chain. They're found in virtually all essential oils.

Monoterpenes come in all different kinds of shapes. They can be circular, straight, or branched. They are also clear, fluid, and aromatic. Each possesses its own unique function.

Monoterpenes are small, which means they react quickly to air and heat. Their small size also allows them to absorb better into tissue and fit through the small spaces of cell membranes. Remember that—monoterpenes have an easier time getting inside of cells.

SESQUITERPENES

Sesquiterpenes are heavier than monoterpenes. They have a backbone of 15-carbon atoms. Their larger size makes them less volatile, which means that they don't evaporate as quickly. This also makes it a little more difficult for them to cross through into cells, but they're still below the molecular weight that allows them to do so. Their superpower is their unique shapes, which allows them to adhere to proteins and activate receptors on the surface of cells. The fact that sesquiterpenes can interact with proteins is significant, because proteins are what facilitate pretty much everything that happens in a cell. And cells are the building blocks of your body. So . . . sesquiterpenes affect proteins, which run the show in your cells, which therefore impact the health of your whole body.

An essential oil can have both monoterpenes and sesquiterpenes, giving it a broad range of benefits. For example, frankincense oil has both monoterpenes and sesquiterpenes, which allows it to interact with cells in a variety of ways, inside and out.

ESSENTIAL OIL CERTIFICATION: Essential Oil Chemical Families

Essential Oil Chemical Families

The Alcohol Family

- What do Alcohols Do for an Essential Oil?

The Phenol Family

- What do Phenols Do for an Essential Oil?

The Aldehyde Family

- Oxidation
- Aroma
- What do Aldehydes Do for an Essential Oil?

The Ketone Family

- What do Ketones Do for an Essential Oil?

The Alkane Family

- What Do Alkanes Do for an Essential Oil?

The Alkene Family

- What Do Alkenes Do for an Essential Oil?

The Ester Family

- Oxygenated Compounds
- What Do Esters Do for an Essential Oil?

The Ether Family

- What Do Ethers Do for an Essential Oil?

The Oxide Family

- What do Oxides Do for an Essential Oil?

The Phenylpropene Family

- What Do Phenylpropenes Do for an Essential Oil?

ESSENTIAL OIL CHEMICAL FAMILIES

In addition to terpenes, essential oil compounds have another molecular group called a chemical family. The chemical families are alcohols, aldehydes, alkanes, and so forth (more on them in a minute). The compounds that make up essential oils can be both a monoterpene and an alcohol at the same time, or a sesquiterpene alkene, or a monoterpene aldehyde, and so on. Think of it like sticking a chemical family building block on a terpene building block to make something new. Every possible combination of terpene and chemical family represents its own unique class of molecules.

There are nine main chemical families in essential oils, and we'll talk about each briefly.

THE ALCOHOL FAMILY

An alcohol is a molecule with a specific arrangement of atoms: an oxygen atom bound to the carbon backbone on one end and a hydrogen atom on the other end.



Alcohol

GERANIOL

Chemical structure

There are multiple alcohols, but they all share this same group of atoms. It might be easiest to imagine alcohol molecules as a certain shape—let's say a triangle. You can have different angles, but it always has the same basic structure, and any time you see it, it's recognizable as a triangle. Each chemical family has its own basic "shape" made up of a unique group of atoms.

But back to alcohols. In general, alcohols have names that may start with the parent terpene they were derived from and end in "-ol." Examples include menthol, geraniol, linalool, cedrol, khusimol, terpinene-4-ol, and citronellol.

WHAT DO ALCOHOLS DO FOR AN ESSENTIAL OIL?

Keep in mind, you can have monoterpene alcohols and sesquiterpene alcohols. So, what do alcohols do for an essential oil? Essential oils with alcohols are known to serve as powerful cleansing agents, provide antioxidants, support restful sleep, support a healthy cardiovascular system, and provide an uplifting aroma.

Not all alcohols have these exact properties, but these are commonly found in various alcohols. This principle is true for the other chemical families we'll discuss.

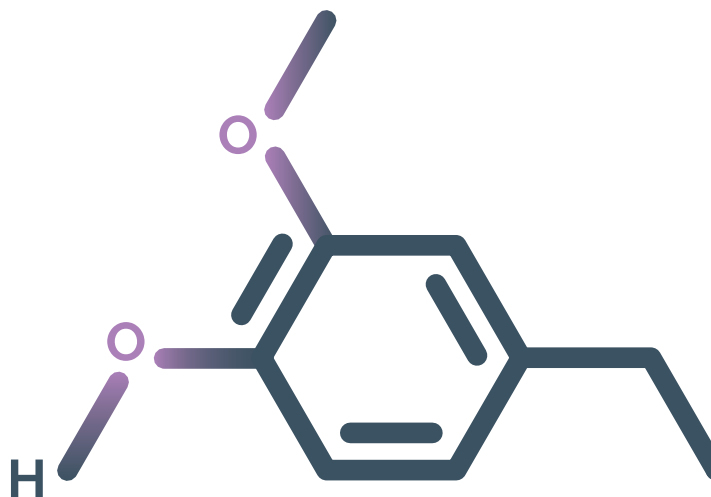
Which essential oils contain alcohols? Oils that are high in monoterpene alcohols include tea tree, geranium, coriander, basil, jasmine, and lavender.

Essential oils that are high in sesquiterpene alcohols include sandalwood, vetiver, cedarwood, and patchouli.

THE PHENOL FAMILY

Phenols—also sometimes referred to as phenolics—are a special subtype of alcohols. They're made up of an alcohol group, which as we talked about earlier is made up of oxygen and hydrogen, attached to a benzene ring.

Now a benzene ring is made up of six carbon atoms arranged in a hexagon pattern with exactly three double bonds inside the ring.



Phenol

EUGENOL

Chemical structure

Phenols are quite potent, and because of this, essential oils that contain phenols may cause skin irritation. Like alcohols, their names end in “-ol.” Common phenols include carvacrol, eugenol, and thymol.

You can have monoterpene phenols and sesquiterpene phenols, but sesquiterpene phenols aren't commonly found in essential oils.

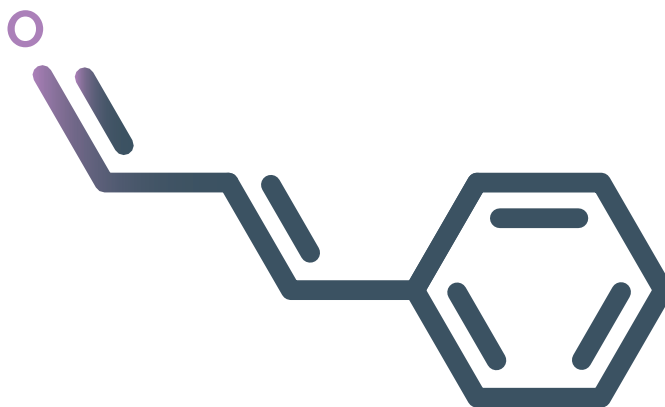
WHAT DO PHENOLS DO FOR AN ESSENTIAL OIL?

Essential oils containing phenols are known to offer antioxidants, repel insects, aid immune function, and be cleansing.

Essential oils that are high in monoterpene phenols include thyme, oregano, clove, cinnamon bark, cinnamon leaf, and basil.

THE ALDEHYDE FAMILY

Aldehydes have a carbon atom that's double bonded to an oxygen and is also bonded to a hydrogen and a separate carbon in the molecules' carbon backbone.



Aldehyde

CINNAMALDEHYDE

Chemical structure

OXIDATION

Aldehydes are unstable and susceptible to oxidation when exposed to oxygen and low heat, making it important to store them properly. This is important because oxidized oils will irritate the skin far more than non-oxidized oils. Oxidation can also potentially change the aroma and even the therapeutic benefits of an oil.

AROMA

They're known for their distinct, potent fragrances and are often key contributors to the overall aroma of an essential oil. Aldehydes usually end in "-al" or "-aldehyde." Aldehydes commonly found in essential oils include cinnamaldehyde, geranial, neral, decenal, and cuminal.

You can have monoterpene aldehydes and sesquiterpene aldehydes, but sesquiterpene aldehydes aren't commonly found in essential oils.

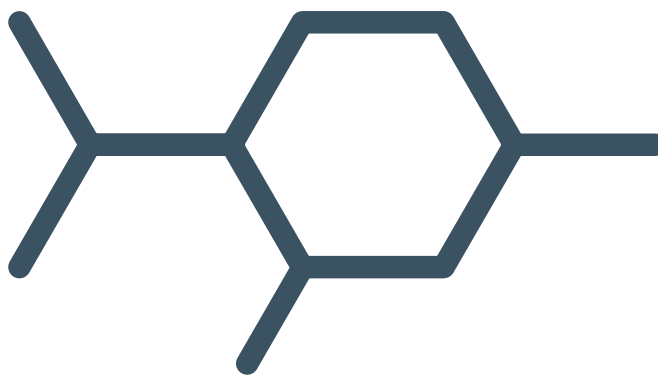
WHAT DO ALDEHYDES DO FOR AN ESSENTIAL OIL?

Aldehydes are known for several health benefits, including offering antioxidants and supporting healthy digestion and gastrointestinal function.

Essential oils that are high in monoterpene aldehydes include cassia, cinnamon, lemon-grass, melissa, and cilantro.

THE KETONE FAMILY

Similar to aldehydes, ketones are molecules with a carbon atom double bonded to an oxygen atom and the carbon atoms flanking this carbon, but not bonded to any atoms other than carbon and hydrogen.



Ketone

MENTHONE

Chemical structure

Most ketones end in “-one.” Examples of ketones include camphor, carvone, davanone, jatamansone, leptospermone, menthone, mustakone, and rotundone.

WHAT DO KETONES DO FOR AN ESSENTIAL OIL?

Essential oils with ketone molecules may improve the appearance of the skin, support healthy respiratory function, and promote healthy digestion.

Oils high in monoterpene ketones include spearmint, dill, peppermint, geranium, and caraway.

Spikenard is an oil that's high in sesquiterpene ketones.

THE ALKANE FAMILY

The simplest organic molecules, alkanes consist entirely of single-bonded carbon and hydrogen atoms.



Alkane

PENTADECANE

Chemical structure

Few essential oils contain alkanes, and those that do typically contain small quantities. Examples of alkanes include nonadecane, heneicosane, heptadecane, tricosane, eicosane, nonane, undecane, pentadecane, and pentacosane.

WHAT DO ALKANES DO FOR AN ESSENTIAL OIL?

Essential oils containing alkanes are known to soothe the skin, promote relaxation, and be balancing and grounding.

THE ALKENE FAMILY

An alkene is a molecule with no chemical families present and at least one double bond between any two of the carbons on its backbone. They also have many double bonds and structural rings, which makes them excellent receivers of unpaired electrons in free radicals. This is helpful because we don't want free radicals—or unstable atoms, if you're feeling scientific—bouncing around in our cells, causing problems and breaking things.



Alkene

BETA-CARYOPHYLLENE

Chemical structure

Alkene molecules usually end with “-ene,” such as alpha-pinene, beta-pinene, limonene, sabinene, gamma-terpinene, germacrene D, beta-caryophyllene, zingiberene, and alpha-cedrene.

WHAT DO ALKENES DO FOR AN ESSENTIAL OIL?

Essential oils that include alkenes can help to rejuvenate skin, promote an uplifting environment, provide antioxidants, and support a healthy inflammatory response.

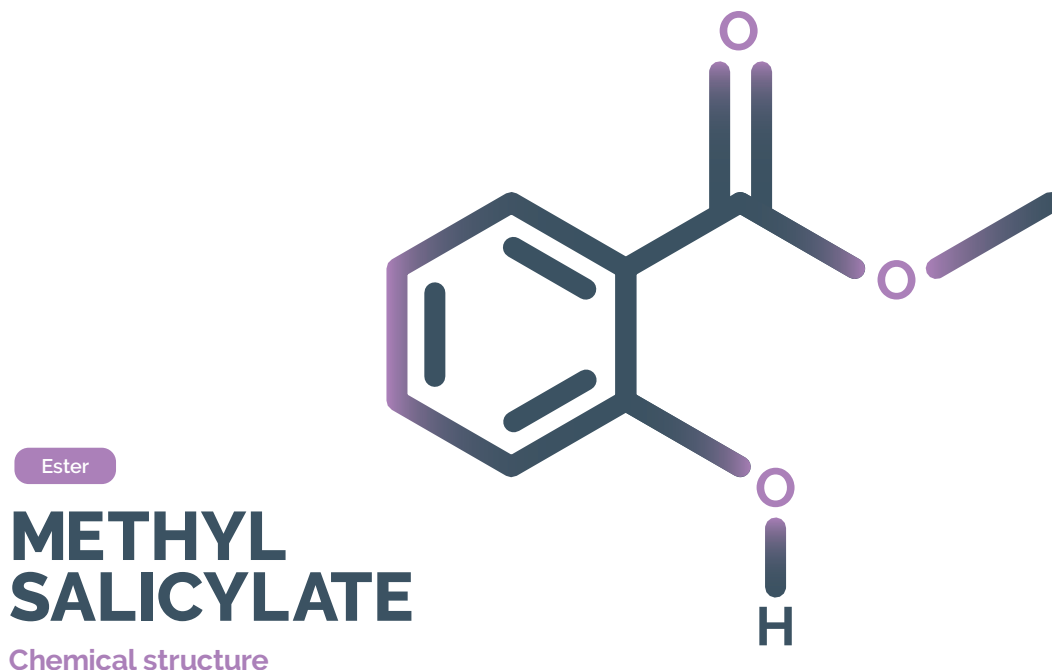
Essential oils that are high in monoterpene alkenes include frankincense, douglas fir, blue tansy, green mandarin, lemon, lime, pink pepper, red mandarin, tangerine, and wild orange.

Essential oils high in sesquiterpene alkenes include ylang ylang, black pepper, copaiba, melissa, and ginger.

THE ESTER FAMILY

Esters are a chemical family that results from the reaction between an alcohol and a carboxylic acid. This reaction is called esterification.

Esters have a central carbon atom double bonded to an oxygen atom, single bonded to the carbon backbone, and single bonded to a second oxygen atom.



OXYGENATED COMPOUNDS

Esters are oxygenated compounds, which means that they have oxygen as part of their chemical structure. They also usually contain two carbon chains. Esters normally have two-word names, with the second word ending in “-ate.” Some examples of common esters are linalyl acetate, bornyl acetate, methylamyl angelate, methyl thujate, methyl salicylate, and neryl acetate.

You can have monoterpene esters and sesquiterpene esters, but sesquiterpene esters aren't commonly found in essential oils.

WHAT DO ESTERS DO FOR AN ESSENTIAL OIL?

Essential oils containing esters are generally calming, relaxing, and balancing; reduce skin blemishes; and are soothing when applied topically.

Oils high in monoterpene esters include lavender, clary sage, bergamot, jasmine, Roman chamomile, helichrysum, arborvitae, and wintergreen. Sesquiterpene esters aren't commonly found in essential oils.

THE ETHER FAMILY

Ethers are molecules with an oxygen atom bonded to two carbon atoms. Those carbon atoms are bonded to either another carbon or a hydrogen.

Ether

**1,8-CINEOLE
(EUCALYPTOL)**

Chemical structure



Ethers end in various suffixes, but many end in “-ole,” like the most common ether 1,8-cineole (also called eucalyptol). Other ethers include anisole, curzerene, and fura-noeudesma-1,3-diene.

WHAT DO ETHERS DO FOR AN ESSENTIAL OIL?

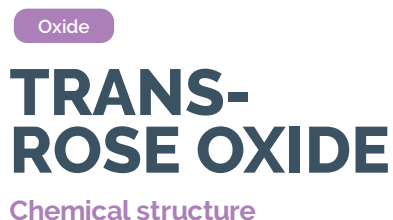
Essential oils with ether molecules in them can help promote feelings of clear airways, improve the appearance of the skin, provide cleansing benefits, and support proper immune function.

Oils high in monoterpene ethers include cardamom, eucalyptus, rosemary, tea tree, and peppermint.

Oils high in sesquiterpene ethers include myrrh and vetiver.

THE OXIDE FAMILY

Oxides are oxygenated compounds that include an oxygen atom and a part of a hydrocarbon ring structure.



You can identify an oxide based on its proper name, which generally ends in the suffix “-oxide” or “-ole.” Common oxides found in essential oils are eucalyptol, rose oxide, linalool oxide, caryophyllene oxide, and pinene oxide. You might notice that eucalyptol is also in the ether family. Because of their structure, it’s not uncommon for some constituents to belong to multiple chemical families.

WHAT DO OXIDES DO FOR AN ESSENTIAL OIL?

Essential oils that contain oxides provide antioxidant support, promote a sense of clear breathing, aid healthy respiratory function, and are soothing to sore muscles.

Oils that are high in monoterpene oxides include eucalyptus and rosemary.

Oils that are high in sesquiterpene oxides include copaiba and melissa.

THE PHENYLPROPENE FAMILY

Phenylpropenes are molecules with a benzene ring attached to an allyl group (three carbon atoms and five hydrogen atoms).



Phenylpropene

TRANS-ANETHOLE

Chemical structure

Examples include safrole, estragole, trans-anethole, elemicin, and myristicin. Unlike the other chemical families that typically end in similar suffixes, phenylpropenes can be difficult to recognize because they tend to have unique names.

WHAT DO PHENYLPROPENES DO FOR AN ESSENTIAL OIL?

Phenylpropenes may support healthy brain and cardiovascular system function, provide antioxidants, and aid in digestion.

Essential oils that are high in monoterpene phenylpropenes include fennel, myrtle, anise, star anise, and basil.

Whew. That was a lot, but it's super important to get a grasp on the molecules that make essential oils work. Now that you've got that stuff down, we'll dive into how these molecules are identified and how to test for purity.

ESSENTIAL OIL CERTIFICATION: Contamination and Adulteration

Essential Oil Purity

- How Important Is It to Test Essential Oils?

What is Contamination?

- Causes of Contamination

What is Adulteration?

- Why Adulterate an Essential Oil?
- Adulteration Can Happen at Any Point in the Process

Adulteration with Natural Compounds

- Mixing and Substitutions

Adulteration with Carrier Oils

- Dilution Versus Adulteration

Adulteration with Synthetic Chemicals

- Wintergreen
- Lavender

How to Know if an Oil is Adulterated

ESSENTIAL OIL PURITY

The purity of an essential oil is its most important characteristic. Using an essential oil that isn't pure means you run the risk of germs, plastics, heavy metals, or contaminants entering your body. These can cause irritation, adverse effects, or even illness. So how do you know if an essential oil is pure?

The answer's simple: testing. Purity and testing go hand in hand because testing validates purity and potency. Quality testing ensures that every bottle of essential oil contains nothing but 100% pure and volatile aromatic compounds for maximum efficacy and safety of use.

HOW IMPORTANT IS IT TO TEST ESSENTIAL OILS?

Unfortunately, as the market's demand for essential oils has continued to grow, so has contamination and adulteration. Both contaminated and adulterated oils result in products that are impure, less effective, and potentially even dangerous. Quality testing helps identify and detect contamination and adulteration before they can harm someone.

WHAT IS CONTAMINATION?

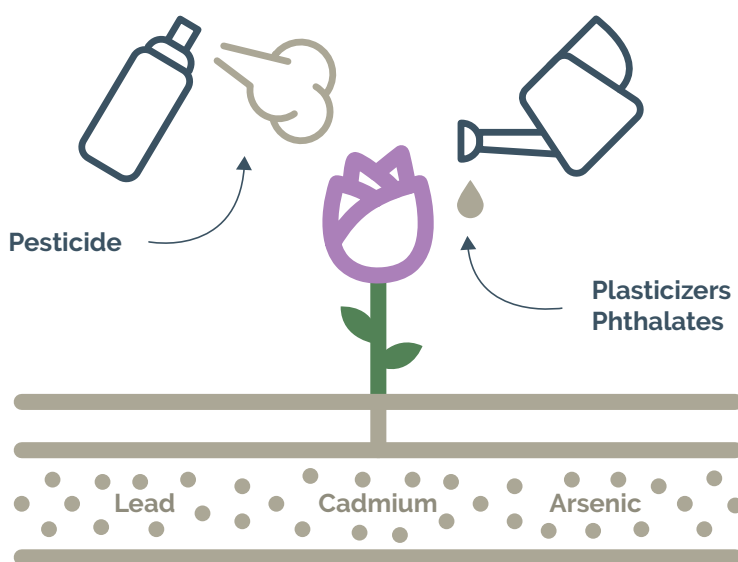
Contamination is often—despite the connotation of the word—unintentional. It happens when impurities like heavy metals, plastics, and pesticides aren't caught and removed during the distillation or supply chain process. Thankfully, it's relatively easy to detect contamination through basic testing methods.

CAUSES OF CONTAMINATION

So, how exactly does an essential oil become contaminated? Contamination occurs when impurities inadvertently make it into a batch of oil. There are a few different ways this can happen. If the distillation or expression equipment isn't cleaned between batches, you could end up with lavender in your rose oil or mixtures of other oils. High-quality distilling facilities have strict cleaning protocols in place to avoid this type of contamination.

In addition to unclean machinery, contamination can often occur due to a lack of resources or proper equipment. For example, some plants are harvested and distilled by growers in rural areas and developing countries, where resources are limited. There have been cases when these growers distill plant material and collect the essential oil in plastic soda bottles because that's all they have available. This isn't highly common, but it does happen. The problem with this practice is that some essential oils—for example, lemon—can break down the plastic of the soda bottle, which leaches plastic chemicals like plasticizers and phthalates into the oil, contaminating the batch.

Contamination



Contaminants can be introduced during the plant's growing process, such as when pesticides are sprayed on the plant or heavy metals are present in the soil. Along the way, essential oils can be exposed to other substances and synthetic chemicals like chloroparaffins, which are chemicals used in paints, flame retardants, lubricants, and other products. Contamination can be avoided by carefully monitoring the process from beginning to end.

WHAT IS ADULTERATION?

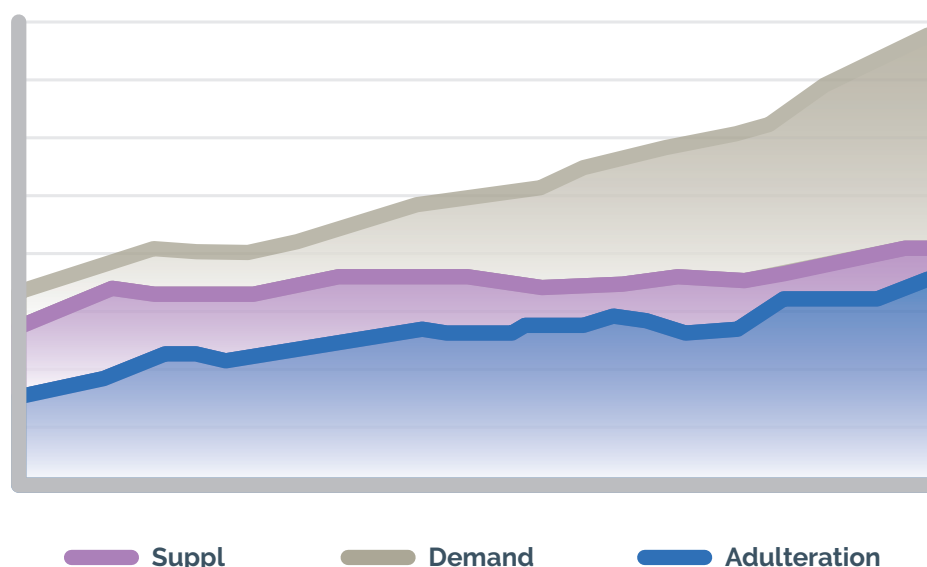
Adulteration is the intentional inclusion of compromising substances—natural or synthetic—that affect the safety or effectiveness of a product. These can be found in essential oils, as well as food, cosmetics, fuel, and lots of other everyday items. Common adulteration practices include adding isolated aromatic chemicals, substituting or adding less expensive oils, diluting with another substance, or adding synthetic chemicals.

Unlike contamination, the adulteration of essential oils doesn't happen by accident. Adulterating an oil takes purposeful planning, and unfortunately it can be difficult to detect. Basic testing can't always spot adulteration, and the untrained eye usually doesn't see it.

WHY ADULTERATE AN ESSENTIAL OIL?

So why would someone adulterate an oil? What's in it for them? Some essential oils are intentionally adulterated to increase the company's profits by lowering the cost and increasing the supply. Pure essential oils can be costly to produce, and unscrupulous suppliers might try to lower their costs by adding other substances to the essential oil.

Adulteration of essential oils is dramatically increasing as demand significantly outpaces supply.



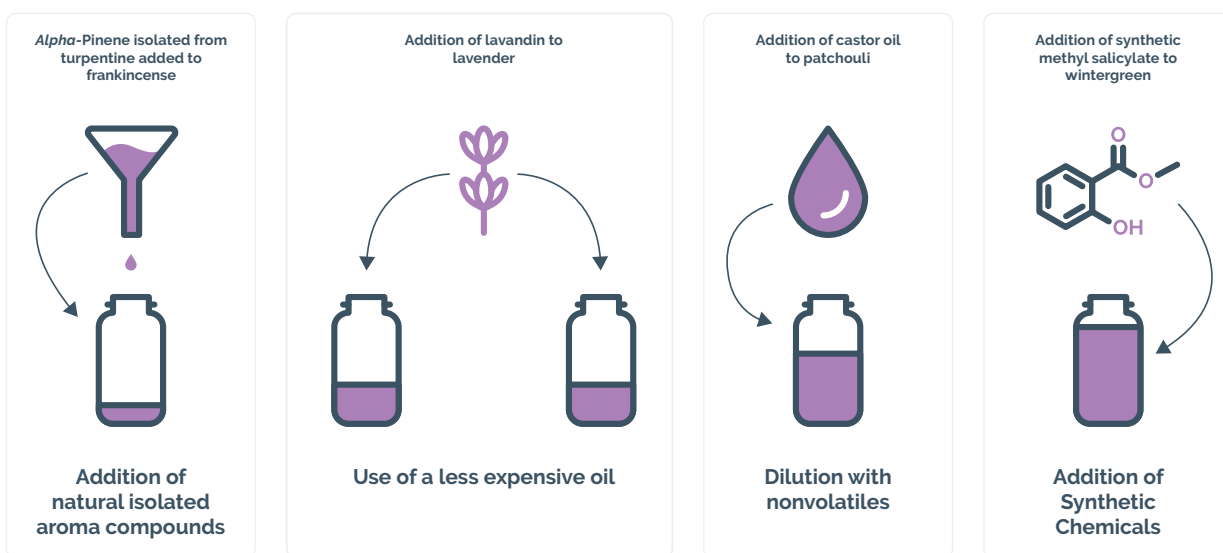
This can be done by diluting with vegetable oil or adding synthetic chemicals that were created artificially. Another adulteration tactic is to try passing off less expensive oils as rare ones or adding the cheaper oil to stretch the amount of the expensive one—cassia instead of the more expensive cinnamon, or spike lavender instead of lavender, for example. Lemongrass oil is widely produced and pretty inexpensive. It's similar to melissa oil, which is one of the most rare and precious essential oils. It's possible to convince somebody who isn't trained that the lemongrass oil is melissa oil, and then sell it for several times the price.

ADULTERATION CAN HAPPEN AT ANY POINT IN THE PROCESS

Adulteration is usually the result of brokers. Often, the essential company may not even know that the oils they're selling are adulterated. They buy from a broker they trust, not realizing they're being duped because they don't have the resources or expertise to test for the most sophisticated kinds of adulteration. They unknowingly and innocently advertise their oils as 100% pure, when in fact this is not the case.

Now that you have a better idea of what adulteration is, let's talk about some of the specific methods that are used to adulterate essential oils.

Common Adulteration Methods



ADULTERATION WITH NATURAL COMPOUNDS

One of the most difficult kinds of adulteration to detect is the addition of natural isolated volatile organic compounds. Natural isolates are chemical compounds present in plants from the get-go, but they've been isolated and removed from their natural source, then added to an oil. Someone could also isolate, say, linalool from an inexpensive oil like ho wood, and then add it to a more expensive oil such as rosewood.

For instance, alpha-pinene may be extracted from turpentine in pine wood, and then added to an essential oil that naturally contains alpha-pinene, like frankincense. Turpentine is a byproduct of the paper-making industry. Alpha-pinene is easily extracted from it, which provides a natural source of alpha-pinene (from trees) that's then added to frankincense. Frankincense is 45–50 times more expensive than alpha-pinene isolated from turpentine.

Detecting this type of adulteration requires a qualified chemist who has significant experience analyzing essential oils and a massive database built up over years of analyzing thousands of samples. Not many companies have these two important resources.

MIXING AND SUBSTITUTIONS

Some essential oils are less expensive than others, so producers may mix two or more essential oils to cut costs. An example of this is the addition of lavandin to lavender essential oil, and another is the mixture of clove stem essential oil with clove bud essential oil. It's also possible that a less expensive oil has been substituted; for example, someone might disguise cassia oil as cinnamon oil.

We detect adulteration with natural isolates by carefully looking at the presence or absence of naturally occurring volatile molecules and incorrect molecular ratios. Again, this takes expertise beyond the norm. Without expert-level testing, this type of adulteration often slips under the radar.

ADULTERATION WITH CARRIER OILS

Another method of adulteration is the addition of a carrier oil like castor oil or coconut oil to take up space in the essential oil bottle.

In some cases, a company might predilute an essential oil with a carrier oil for those who want to avoid skin sensitivity. This is common and isn't considered adulteration because the company is being transparent about the contents of the bottle. The type of adulteration we're talking about here consists of adding a carrier oil to an essential oil and not listing it on the label, making consumers think they're receiving a non-diluted oil.

For instance, castor oil can be added to frankincense or patchouli in small quantities so that it's cheaper to produce. While this cuts costs, it's misleading. Someone might think they're using pure frankincense oil, when in reality their bottle includes a great deal of carrier oil that simply looks like frankincense.

DILUTION VERSUS ADULTERATION

Again, there are some cases when adding a carrier oil can be beneficial to avoid skin sensitivities; however, if a carrier oil is being added simply to cut costs and without the customer's knowledge, it's extremely misleading.

Fortunately, the addition of carrier oils leaves obvious markers when tested. If a carrier oil has been added at any point in the production process, an essential oil company should be able to tell with basic testing.

ADULTERATION WITH SYNTHETIC CHEMICALS

One of the most concerning types of adulteration is the addition of synthetic chemicals, because they can be especially harmful. Some naturally occurring volatile compounds are easily synthesized in a lab. Carvone (a major component of spearmint) and carvacrol (the primary component in oregano) can be synthesized from limonene. When these synthetic chemicals are cheaper than the natural isolate, they may be added to an essential oil to raise profit margins.

Synthetic chemicals similar to their natural equivalents are easily made from common petroleum products. There are millions and millions of tons of castoff byproducts from the petroleum industry. From these castoff byproducts, you can take raw material phenols and other things that come from gas and oil and, through simple chemical processes, turn them into just about any chemical constituent.

WINTERGREEN

Wintergreen is a good example. Wintergreen essential oil is hard to produce, and it's not uncommon to pay a couple hundred dollars for one kilogram of genuine wintergreen. Knowing that wintergreen essential oil is almost entirely methyl salicylate, some producers purchase synthetic methyl salicylate for less than \$10 per kilogram and mix it with small quantities of genuine wintergreen oil to sell as "pure" wintergreen.

It smells exactly the same and would pass most testing standards, but you can tell through carbon dating that it isn't pure wintergreen. Because it's been produced with petroleum products, carbon dating will show that it's actually seven million years old, which obviously is too old to be from a wintergreen plant. Testing will also show the absence of naturally occurring monoterpenes along with identifiable markers, again confirming that it's a petroleum byproduct rather than pure wintergreen.

LAVENDER

Another oil that's commonly adulterated with synthetic chemicals is lavender. This is because linalyl acetate naturally occurs in lavender in large quantities, and synthetic linalyl acetate is an easy compound to create. Turning a small amount of real lavender oil into a large amount of adulterated oil is a simple matter of adding the synthetic compound.

Some essential oils like neroli and ylang ylang may be completely reconstructed with synthetic chemicals. The creation of synthetic chemicals inevitably leaves markers or impurities that originate from the starting material. These markers may go unnoticed by the untrained chemist or a chemist who's not using a robust database with these chemical standards present.

HOW TO KNOW IF AN OIL IS ADULTERATED

When testing for adulteration, a chemist needs to look at more than just the major constituents of the oil. Instead, she must know what to look for in each oil that indicates adulteration, because these show up in trace amounts—often less than 0.5%. One example is peppermint and cornmint essential oil. If cornmint (*Mentha arvensis*) is treated to remove some of its menthol content, the chemist would see the major components of peppermint (menthol and menthone) in the right ratios. But when the chemist looks closely at minor components—like isopulegol and menthofuran—she would note the telltale signs of the cornmint substitution.

ESSENTIAL OIL CERTIFICATION: Testing Essential Oils

Testing Essential Oils

- What Do the Tests Look At?
- Verifying an Essential Oil's Chemistry

Identifying an Essential Oil's Chemistry

- GC/MS Testing
- Chocolate Cake
- Gas Chromatography
- Mass Spectrometry

Detecting Synthetic Chemicals

- Inductively Coupled Plasma Spectrometry

Testing for Pesticides, Carrier Oils, and Other Contaminants

Testing the Physical Characteristics of an Essential Oil

- Colorimeter
- Fourier-Transform Infrared Spectroscopy
- Optical Rotation
- Density
- Refractive Index

Ruling Out Contamination

The Final Test: Stability Testing

Not All Essential Oils Are Created Equal

- Sustainable and Responsible Sourcing
- Rigorous Testing
- Transparency

TESTING ESSENTIAL OILS

Remember how we said that essential oil purity and testing go hand in hand? Now that we've discussed some of the ways that essential oils become contaminated or adulterated, let's talk about the testing methods used to detect those impurities. You'll remember that some types of adulteration and contamination are relatively easy to detect, while others can be subtler and trickier to identify. Either way, to produce safe, quality essential oils, rigorous testing is key.

Not every essential oil company employs the in-depth testing methods required to verify that their oils are high quality. Testing takes time and costs money, so some companies skip this step to save on resources. Though there's some variation between companies when it comes to testing, there are a few testing methods that are considered "best practices."

Since there aren't clear industry standards for testing essential oils, we'll walk through the dōTERRA Certified Pure Therapeutic Grade® (CPTG) testing process as an example of how in-depth testing works. We'll explore a wide variety of testing methods and explain why each is important.

WHAT DO THE TESTS LOOK AT?

Generally speaking, the testing process investigates four different things. First, it needs to verify that the chemistry of the essential oil is correct. Second, it looks at the physical characteristics of the oil, like its density, color, and even molecular structure, to be sure the sample is an authentic essential oil. Third, it checks for contaminants. And fourth, the testing process makes sure the oil is stable and won't lose its efficacy within a certain amount of time.

VERIFYING AN ESSENTIAL OIL'S CHEMISTRY

We've spent a lot of time looking at the chemistry of essential oils because chemistry is the foundation of pure, high-quality essential oils. There's actually a set of chemical standards for each type of essential oil. In order for a lavender oil to be considered true lavender oil, it needs to have the correct chemical compounds in the correct ratios. Each lab should be able to check the ratios and chemical compounds against their own database.

After the aromatic compounds are distilled from the plant material, you need to confirm that each batch meets the chemical composition standards, according to the essential oil database, using a series of tests. It's best to conduct the testing with scientifically validated pharmacopeia standards, which are established official publications that provide information about therapeutic solutions—in other words, the same standard of scientific testing used established by qualified organizations.

IDENTIFYING AN ESSENTIAL OIL'S CHEMISTRY

GC/MS TESTING

Perhaps you've heard the term GC/MS while watching a crime show on TV, but what actually is a GC/MS test and what does it do? Well, to put it simply, it tests a substance and tells you what it's made of.

The test actually uses two different instruments. GC stands for gas chromatography and MS for mass spectrometry. We're going to look at them separately to see the part each of them plays in a GC/MS test.

CHOCOLATE CAKE

Essentially, the gas chromatographer separates an essential oil sample into its various compounds. An analogy for this is putting a chocolate cake into a machine, and it comes out on the other side as a bunch of ingredients. Then the mass spectrometer analyzes those ingredients and tells you exactly what they are: eggs, flour, sugar, and cocoa powder.

When used to test essential oil rather than reverse-engineered cakes, it separates an oil into its individual components and turns them into ions, which are electrically charged molecules. Once an oil has been broken down, the test can be specific and identify exactly which volatile aromatic compounds are there and precisely how much of each compound is present.

GAS CHROMATOGRAPHY

The gas chromatograph was invented in the 1940s and quickly became a highly used tool in analytic chemistry. The GC portion of the test is where the whole process starts. A sample of an essential oil gets added to the machine and is vaporized or turned into a gas—hence the name gas chromatograph. This process of vaporization occurs in an inert carrier gas like helium. An inert carrier gas is used to make sure the vaporized essential oil gets where it needs to go but doesn't affect the testing results.

With the essential oil completely vaporized, it's ready to go to the next area of the GC machine, which is a hair-thin tube coated with compounds that possess specific properties. Each of the aromatic constituents in the essential oil interacts with the tube walls in a different way. As a result, each individual constituent will elute (or move through the tube) at a different speed. A compound will move quicker if it has little interaction with the compounds coating the tube or slower if it has a lot of interaction. A detector at the end of the tube identifies when and how much of a compound exits the tube. This provides a detailed report of which chemical constituents are present in the essential oil, as well as at what levels.

MASS SPECTROMETRY

Once the oil sample is through the gas chromatographer, it goes in the mass spectrometer. How this machine works is complicated, but what you need to know is that this test identifies the exact chemistry of a compound. When the results come back, we can see exactly which chemical compounds are in the essential oil sample. It's like running someone's fingerprint to find out his or her identity.

The mass spectrometer contains three basic parts: a source of ions, a mass detector, and an analyzer. When the essential oil sample gets to this stage, it's already been separated into individual compounds by the gas chromatographer. MS B ROLL Now, it gets ionized. This means the compound is struck by a stream of electrons, causing the neutral molecule to break apart and become charged. These ions are then sent into a series of magnetic fields, where they interact based on molecular mass and charge. The instrument reads each constituent based on quantity, mass, and charge. The person running the test gets those readings and can tell exactly which compounds are in the sample.

DETECTING SYNTHETIC CHEMICALS

Once the GC/MS test has verified that the sample of essential oil is what we thought it was, more tests can detect adulterations and synthetic chemicals.

One of these tests is chiral GC analysis. Chiral is a word used in chemistry to describe the pattern in which some molecules are put together. Essential oils contain constituents with expectable distribution ratios of enantiomers, or a pair of molecules that are mirror images of each other—like how your hands are reflections of one another. A chiral GC analysis can identify the distribution ratios of these different enantiomers. These ratios are important when testing essential oils because they can help us detect adulteration that has happened through the addition of synthetic chemicals.

A true, pure Melissa essential oil should have an enantiomeric ratio of 99% (3R)-(+)-methyl citronellate and 1% (3S)-(-)-methyl citronellate. Authentic lavender oil contains 99% (4R)-(-)-linalyl acetate and 1% (4S)-(+)-linalyl acetate, as well as from 5–15% (4S)-(+)-linalool. Above 15% (4S)-(+)-linalool is a telltale sign of the addition of synthetic linalool because it has an enantiomeric ratio of 50% (4R)-(-)-linalool and 50% (4S)-(+)-linalool. Analyzing these ratios can help the chemist determine if synthetics have been added to a sample.

INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY

An additional test that's used to detect the presence of synthetic chemicals like heavy metals is the inductively coupled plasma mass spectrometry, which is abbreviated as ICP/MS. This highly sensitive and versatile test is used to detect trace elements, such as potentially dangerous heavy metals: lead, mercury, cadmium, and arsenic. It atomizes the essential oil sample to create atomic (containing only one atom) and small polyatomic (containing more than one atom) ions. The ions are the elemental form of the essential oil and through this test can be detected with great speed, precision, and sensitivity.

An essential oil sample is introduced into the instrument via a pump. The sample is nebulized into an aerosol that's transported by a plasma torch. Metal ions in the sample are subjected to intense heat and are transported from plasma through a vacuum interface into a mass separation device called a quadrupole, where they're separated based on mass to charge ratio. This test quantifies the elements in the essential oil. Any sample that fails to meet specifications is rejected rather than sent out for secondary processing to remove the heavy metals. Once a batch is determined to meet chemical profile guidelines, it can move on to the next stage of testing.

TESTING FOR PESTICIDES, CARRIER OILS, AND OTHER CONTAMINANTS

Remember when we talked about GC/MS? While GC/MS searches for adulteration, LC/MS—or liquid chromatography mass spectrometry—looks for contaminants such as pesticides or carrier oils. Contaminants in essential oils are heavier, larger compounds, and LC/MS helps us detect them.

This test is performed in a similar way to GC/MS. However, instead of testing the essential oil in its gas form, LC/MS tests the oil in its liquid form. The essential oil is pumped into a machine that separates and identifies each of its individual components. The liquid chromatography part of this test separates the components, and the mass spectrometry part identifies the components and tells us how much of each one there is (think of the chocolate cake analogy we provided earlier). With this test, we can identify if there are contaminants in the essential oil. It's tests like this one that help ensure you consistently receive pure and potent essential oils.

TESTING THE PHYSICAL CHARACTERISTICS OF AN ESSENTIAL OIL

Beyond looking at the chemistry of each essential oil, it's also important to test their physical characteristics. These tests include fourier-transform infrared spectroscopy (FTIR), optical rotation, specific gravity, and refractive index.

COLORIMETER

Organoleptic assessments make sure each essential oil has the right appearance, aroma, feel, color, and—sometimes—taste.

When it comes to appearance tests, for example, a special instrument called a colorimeter can be used to test the amount of light that can pass through an essential oil. Colorimeters can compare the amount of light coming through an oil with the amount of light comes through a sample of pure solvent, which can be used to make sure that each essential oil is consistent in its appearance.

FOURIER-TRANSFORM INFRARED SPECTROSCOPY

FTIR is an additional method of analyzing the composition of essential oils. Different frequencies of infrared light are shined through an oil sample, with the amount of light absorbed by it being measured. These results are compared to a database of typical FTIR readings for approved samples—the infrared spectrum is unique for each essential oil—to determine the quality, potency, and presence of therapeutic compounds.

Again, this is to test the physical properties of the essential oil. If the way the light is absorbed by the essential oil is inconsistent with the approved database sample, the chemist will know that more tests need to be performed.

OPTICAL ROTATION

Using equipment called a polarimeter, optical rotation measures the direction and degree that light bends as it passes through a polarizer—a filter—and then through the essential oil. We should know before starting exactly how the light will bend in a pure oil, so if the light behaves differently, it's immediately clear that something's wrong with the sample.

The orientation of the essential oil molecules will predictably bend light in a specific and consistent direction. This change in light direction is called optical rotation. This test establishes whether the molecular structure of a given essential oil complies with the determined standard for purity. Optical rotation can identify synthetic additives that GC/MS testing wouldn't detect. If the light isn't bent according to the determined standard, that indicates adulteration or inauthenticity.

DENSITY

Another way to test an oil's purity is to determine how dense it is. To do this, a densitometer measures the specific gravity of an essential oil in comparison to water. Specific gravity readings are measured at precise temperatures and pressures, as these two factors can impact measurements. We know what the density of each oil should be from years of collected data, so if the sample differs, we can tell it isn't pure.

REFRACTIVE INDEX

Lastly, regarding physical testing, a refractometer is used to determine an essential oil's refractive index. The refractive index of an oil measures how the speed of light is altered when passing through an oil sample in comparison to its speed in a vacuum. For instance, water has a refractive index of 1.3330, which means light travels 1.33 times slower in water than it does in a vacuum. An oil's refractive index can be compared to that of a known pure sample to identify any adulteration.

RULING OUT CONTAMINATION

Oil batches that make it through the chemical and physical testing are then run through a series of tests to confirm that there are no harmful contaminants. This stage includes testing for microorganisms and pesticides to ensure every essential oil is safe for use. How it works is microbiologists swab a sample of oil across a plate and carefully monitor it for any growth of microorganisms. This testing process allows experts to detect any possible kinds of contamination that may have occurred throughout the process, as far back as distillation.

A sample of essential oil is sent to a specialized lab to ensure it's free of harmful pesticides. Following United States Pharmacopeia (USP) methodology, scientists test for

more than 70 pesticides, comparing the oil to stringent governmental standards. Based on this testing, the oil sample is either accepted or rejected.

THE FINAL TEST: STABILITY TESTING

The final step in all of this is stability testing, which ensures that an essential oil will maintain its purity and efficacy for the entire shelf life of the product. Stability testing is ongoing, examining not only the integrity of an essential oil, but also its packaging. In stability testing, a bottle of essential oil is exposed to different kinds of temperature and humidity in chambers that can alter atmospheric conditions. The essential oil is analyzed to determine what happens to it when exposed to different climates and conditions, in both short-term and long-term studies. This testing protocol ensures essential oils will continue to provide safe and effective health benefits for years after they've been manufactured.

Each of the tests we've talked about has limitations, which is why it's so, so important to perform multiple tests, layering them on top of one another for a more complete picture. The end result? Pure, unadulterated, uncontaminated essential oils you can trust.

Not All Essential Oils Are Created Equal

Because so many companies cut corners to reduce costs, expand inventory, and speed up production times, not all essential oils are created equal. Now that we've learned a little more about the process of producing essential oils and all of the ways it can potentially go wrong, it's easy to see that high standards must be enforced every step of the way, from planting and distilling all the way to testing and bottling.

So, how do you protect yourself as a consumer and avoid buying contaminated or adulterated essential oils? After all, we know it isn't too difficult to create synthetic oils and pass them off as "pure." You'll need to do a little research before buying, but now that you know what it takes to produce a truly pure essential oil, you won't be easily duped by companies that are offering low-quality oils.

As you start your research, there are a few questions you can ask to determine if a company is offering truly pure essential oils.

SUSTAINABLE AND RESPONSIBLE SOURCING

First, does the company you plan to buy from use sustainable and responsible sourcing practices? In other words, do you know where their oils come from? If a company is committed to essential oil purity, they should be able to answer where they source their oils.

For example, dōTERRA created the Co-Impact Sourcing[®] Initiative to help promote transparency from the beginning of the production process to the end. This initiative ensures dōTERRA knows where their oils come from—down to every last detail. dōTERRA knows where the plants are grown, when they're harvested, where they're distilled and by whom, and so on. With involvement at every step, dōTERRA knows their oils are being responsibly and sustainably sourced.

RIGOROUS TESTING

The second thing to ask during your research is whether the company uses proper testing methods to ensure oil purity. Does the company test their oils for adulteration and contamination? Do they employ the help of experienced chemists to ensure that testing is done properly? Remember, some forms of adulteration are difficult to detect. It takes a trained eye and more than just run-of-the-mill testing equipment to spot subtler forms of adulteration.

When rigorous testing methods aren't observed, it can result in lower-quality oils or—even worse—oils that could harm the consumer. As we discussed, some essential oil companies are unaware that they're selling adulterated or contaminated oils because they have third-party partners who simply pass the oils along for final sale.

TRANSPARENCY

When investigating essential oil companies, it's best to find one that's transparent about their testing processes, so you can feel confident you're using safe, effective oils. Does the company use reliable testing methods? Do they make these test results public? For example, you can easily look up the GC/MS test results of any batch of dōTERRA oil on the Source to You[®] website using the batch number on the bottom of your oil bottle. If you can't find any information about how a company tests their oils, it could mean that the oils haven't been thoroughly tested—or even that the company doesn't know if they've been tested.

One way dōTERRA guarantees essential oils free from adulteration and contamination is through the CPTG[®] testing process. Without a universally accepted standard for essential oil quality, dōTERRA created this testing process to ensure the purity of their oils. It involves a series of tests and meticulous protocols to maintain purity, potency, and consistency from batch to batch. When combined with responsible sourcing practices, the CPTG process guarantees that no added fillers, synthetic ingredients, or harmful contaminants enter the essential oils at any point during the production process. Plus, this guarantees that the ideal ratio of volatile compounds is present for maximum efficacy and reliability.



The key to ensuring that your essential oils are safe and pure is transparency. If you can answer questions like “Where do my oils come from?” and “Have my oils been properly tested?”, then you can enjoy peace of mind about the quality and purity of your essential oils.

ESSENTIAL OIL CERTIFICATION:

Module 4 Introduction

HOW ESSENTIAL OILS ENTER THE BODY

Now that you've learned more about the chemistry and testing of essential oils, we can move on to how you most effectively use them. There are three main ways to use essential oils: you can inhale them aromatically, apply them topically, or take them internally.

Using an essential oil in different ways can give you different results. Take lavender. If you're looking to create a more relaxing environment, you can diffuse lavender. If you want to soothe occasional skin irritations, apply lavender topically. If you'd like to reduce anxious feelings, you can take lavender in a veggie capsule.* With all of the essential oils and the different ways of using them, the possibilities are endless.

You can even accelerate and increase the benefits of an essential oil by using it in multiple ways at the same time. Say you just finished an intense workout. To complement rubbing Deep Blue[®] on topically, you could also take two capsules of the Deep Blue Polyphenol Complex[®]. With the essential oil supporting your body in multiple ways, you may experience quicker and improved results.

ESSENTIAL OIL CERTIFICATION: Aromatic Use

How Do Essential Oils Affect Me Aromatically?

- The Limbic System

Using Essential Oils Aromatically

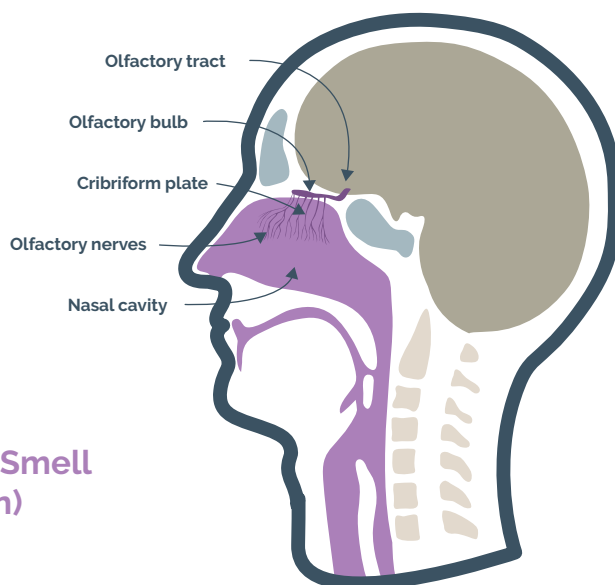
- Endless Possibilities

HOW DO ESSENTIAL OILS AFFECT ME AROMATICALLY?

The sense of smell—known as olfaction—is one of the most powerful connections to your surroundings. It's actually the only sense directly connected to your brain. Through reactions with the brain, smells can produce significant mental, emotional, and physical responses.

Interestingly, scientists have discovered that olfactory receptors (the sensors in the body that create responses to smells) aren't just in your nose. They have been found in the kidneys, gastrointestinal tract, muscles, heart, pancreas, liver, lungs, and skin.⁸ This means your sense of smell might play a more important role in your physiology and well-being than we thought. Inhaling essential oils is one of the simplest but most powerful ways to enjoy their benefits.

So how does the olfactory system work? Well, when a scent enters your nose, it's detected by the olfactory sensors there. These sensors create an electric response, which travels through the olfactory nerves to the olfactory bulb. The bulb receives the neural input and sends that information to the brain through a bundle of nerve fibers and cells called the olfactory tract.



The Sense of Smell (Olfaction)

The olfactory system is connected to the limbic system, where emotions and memories are stored. When you use essential oils aromatically, the molecules travel through your nose to the olfactory system, where they're processed and intensified. The intensified odors trigger responses from the limbic system.

THE LIMBIC SYSTEM

The limbic system includes parts of your brain you may have heard of, like the hippocampus and the hypothalamus. What goes on in the limbic system? This system is responsible for controlling your endocrine system, which regulates your hormones and your nervous system, transmitting signals throughout your body. Equally important, the limbic system helps to control your memory, learning ability, and emotions.

Inhaling essential oils affects more than just your olfactory and limbic systems. When you breathe in the aroma of an essential oil, some of the oil's molecules are absorbed in the respiratory tract and lungs, and then circulated through the bloodstream.

Remember how essential oils are volatile, meaning they can change quickly from a liquid to a gas? This is what allows them to be so effective when they're inhaled. Because of their small weight and size, they can travel many places in the body.

USING ESSENTIAL OILS AROMATICALLY

With a better understanding of what's actually happening behind the scenes when you open a bottle and inhale an essential oil, you're ready to try it for yourself. Here are a few ways to easily use essential oils aromatically every day.

- Open the bottle and pass it under your nose to inhale the aroma and volatile molecules.
- Rub one or two drops on your palms and inhale.
- Add several drops to a diffuser and enjoy.

ENDLESS POSSIBILITIES

Once you've experienced the basics of using essential oils aromatically, there are endless possibilities. Here are a few other ideas for aromatic use.

- Add one to three drops to a bowl of hot water and place a towel over your head and the bowl. Close your eyes and inhale the steam. Blow on the water to stir up the mixture.
- Add a few drops to a diffuser necklace or bracelet and breathe in as needed.

ESSENTIAL OIL CERTIFICATION: Topical Use

Why Is Topical Use Effective?

Topical Application Is Simple

Dilution

- Carrier Oils
- What Kinds of Oils Are Used as Carrier Oils?

General Dilution Guidelines

Essential Oils and Sensitive Skin

- Babies
- Aging Skin

Taking Precautions

WHY IS TOPICAL USE EFFECTIVE?

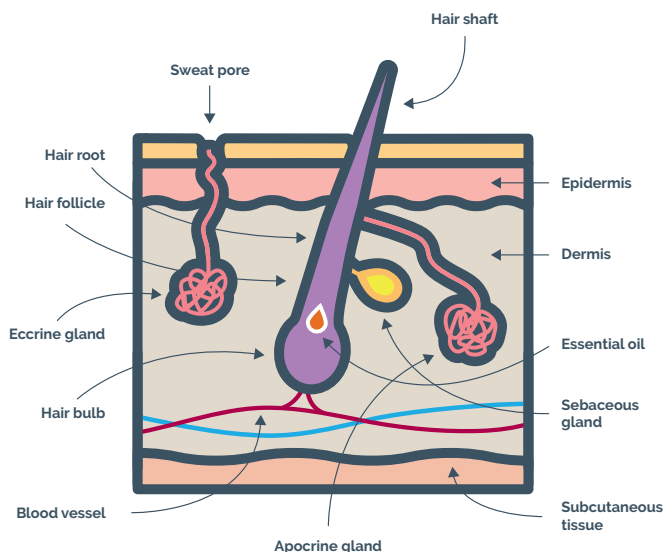
Topical application is another simple, fast, and effective way to experience the benefits of essential oils. When used correctly, essential oils can be extremely beneficial for your skin, soothing to your body, and useful for massages and overall bodily support. Something that makes topical application unique is that, while it does provide whole-body support, it also allows you to target specific areas of your body by applying an oil directly.

Did you know your skin is actually your largest organ? It protects and regulates your body and gives you the sense of touch.

Because essential oils are lightweight and lipophilic—dissolvable in fats—they absorb into your skin through hair shafts and pores. At the end of hair follicles are capillaries, and when an essential oil reaches the capillaries, it's distributed through the body by way of the bloodstream. While some of the oil makes its way through the bloodstream, a part of it gets absorbed into the deepest layer of the skin, the subcutaneous tissue—or hypodermis. Because of this, you can experience benefits from topical use of an essential oil in the applied area and potentially throughout your entire body.

Many essential oils are known for their cleansing and purifying properties, which makes them great options for promoting clean, healthy-looking skin. Others produce a warming or cooling effect when applied topically. This al

Absorption of Essential Oils After Topical Application



allows them to soothe tired and sore tissues. Not only that, the aroma of some essential oils can linger on your skin, which lets you experience the aromatic benefits simultaneously.

TOPICAL APPLICATION IS SIMPLE

Topical application is super simple. Usually, you just apply the essential oil directly to the area you want to support.

While there are many areas of the body to apply essential oils topically, certain ones react especially well to topical application.

- To promote relaxation and a sense of concentration, apply to the temples, forehead, and base of the skull.
- Apply and massage into the chest to promote a sense of clear breathing.
- For extremely potent oils—and to leverage reflex points on the feet—dilute and apply to the bottoms of the feet.

But really, these are just the basics. There are many more ways to enjoy these benefits.

- Apply to the abdomen in a clockwise circular motion to help relieve digestive discomfort.
- Dilute in a carrier oil and apply to the lower abdomen as a soothing massage during menstruation.
- In hot weather, apply a cooling oil to the shoulders, back of the neck, and even the tips of the ears, making sure to avoid the inner ear.
- Massage onto the arms, legs, and back to soothe the body after physical activity.
- Add five to ten drops to a cup of Epsom salt or sea salt to create an aromatic bath.

As you can see, when it comes to topical use, there are so many wonderful ways to enjoy the pure benefits of essential oils.

DILUTION

If you're familiar with essential oils, you've probably heard of dilution. When it comes to using essential oils topically, dilution is one of the most important principles to understand for maximized benefits and safe usage.

Dilution is when you take an essential oil and mix it with a carrier oil. But what are carrier oils?

CARRIER OILS

A carrier oil is an oil that literally carries the essential oils to the desired area on the skin. They dilute the potency of an essential oil, but also increase absorption into the skin, which makes essential oils more effective.

Some people worry that diluting an essential oil makes it weaker; however, because it helps your skin absorb the essential oil better, a carrier oil can, truthfully, extend the benefits of an essential oil. Research suggests that when you use an essential oil without a carrier oil, only about 4% of it gets absorbed. But if you use a carrier oil, 10% of it is absorbed, which is a big difference!

A tip you may want to try is covering the area where you've applied essential oil. This slows down the evaporation rate even more and can increase the absorption to about 75%! Basically, when you apply an essential oil with a carrier oil, it won't evaporate as quickly.

WHAT KINDS OF OILS ARE USED AS CARRIER OILS?

Normally, carrier oils are things like avocado, olive, sweet almond, apricot, and macadamia oil, because they easily dissolve with the essential oil without altering its chemical makeup.

While those other types of carrier oils are commonly used, fractionated coconut oil is an ideal carrier oil to use with essential oils because it has great shelf life, feels light and silky, provides good absorption, and is odorless.

What's the difference between regular coconut oil and fractionated coconut oil? Fractionated coconut oil is coconut oil, but most or all of the long-chain fatty acids and lauric acid have been removed. This is why fractionated coconut oil is able to stay a liquid at room temperature while regular coconut oil is solid. What's left behind are predominantly saturated medium-chain fatty acids (capric, caprylic, decanoic, and octanoic), which have great benefits for your skin. Additionally, fractionated coconut oil is much more shelf stable than regular coconut oil, meaning it can last for years.

Overall, if you plan on using essential oils topically, it's a good idea to invest in a carrier oil so you can enjoy the benefits of essential oils to their fullest.

GENERAL DILUTION GUIDELINES

So, how should you dilute essential oils? Generally, you dilute one drop of essential oil in three drops of carrier oil.

You might remember when we talked about how essential oils that are high in phenols can be potentially irritating to the skin due to their potent chemistry. Some of these essential oils—such as cassia, cinnamon, clove, cumin, geranium, lemongrass, oregano, and thyme—should always be diluted before topical use and may require more carrier oil than usual.

When diluting, a good practice is to adjust your dilution ratio according to your body size, age, and health. For example, essential oils being used on babies, young children, elderly individuals, or anyone with extra sensitivity could require more dilution.

Here's a tip: if you think you're going to use a specific essential oil a lot, it's really convenient to predilute the essential oil in a roller bottle. If you want to give this a shot, here are some helpful ratios.

- General use: 8–20 drops of essential oil per 10 mL bottle, filling the rest with fractionated coconut oil

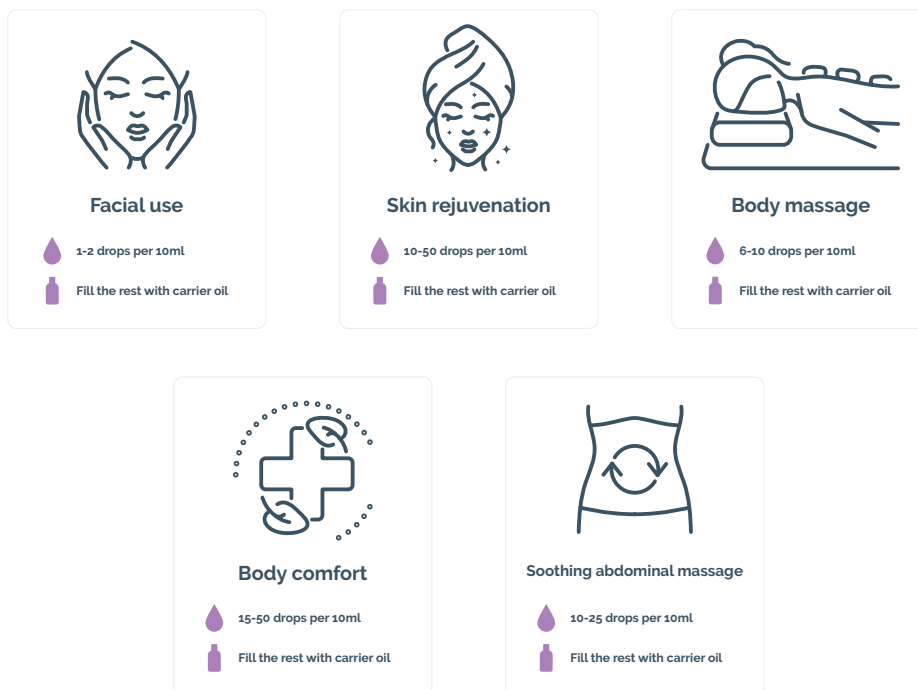
ESSENTIAL OILS AND SENSITIVE SKIN

If you're applying an essential oil for the first time, perform a sensitivity test to see how your skin reacts. You can do this by applying a small dab of the essential oil, mixed in carrier oil, to an inconspicuous area of your skin. Continue to check the area each hour for a few hours to make sure no irritation has occurred.

Something you should know is if you have sensitive skin or skin conditions (like eczema and psoriasis), you may be more sensitive to topical application. You could also be more sensitive if you have a compromised immune system (for example, food or seasonal allergies and autoimmune disorders). If you have any doubts about how you'll react to a certain essential oil, it's always good to perform the sensitivity test and talk to your healthcare provider.

BABIES

Babies have more sensitive skin than adults. A baby's epidermis (the outer layer of the skin) is up to five times thinner than an adult's and is made up of smaller cells. This



means a baby's skin will absorb substances into her bodies more easily and quickly. Essential oils can have many benefits for young children, but you'll just want to keep their skin sensitivity in mind. When applying an essential oil topically to a baby's skin, you'll want to use less essential oil and more carrier oil than you would normally use on, say, yourself.

AGING SKIN

Skin isn't only more sensitive when we're young. It becomes more sensitive as we age. When we get older, our epidermis thins. Skin also begins to lose strength and elasticity. Additionally, blood vessels become more fragile, glands in the skin produce less oil, and the layer of fat under the skin begins to thin. As a result, essential oils can more easily penetrate the skin. This is another case where you should apply less essential oil and more carrier oil in order to avoid irritating sensitive skin.

TAKING PRECAUTIONS

When it comes to sensitivity, the skin is affected not only by age or health concerns—it's also more sensitive in different areas of the body. You'll want to avoid applying essential oils topically to these sensitive areas: the eyes (and the skin around the eyes), the inner ears, genitals, and any part of your skin that's recently been injured, broken, or damaged.

Remember that essential oils can remain on the fingers and hands following topical application. This means, for example, if you rub your eyes after massaging Deep Blue[®] onto your knee, you could accidentally transfer the oil to this sensitive area. Ouch! To avoid this, remember to wash your hands well with soap and water after you apply an oil topically.

If you do get essential oils in a sensitive location, you should apply a carrier oil to reduce the irritation. If you accidentally get oils in your eyes, apply a carrier oil (though milk can be used in a pinch) and pat dry with a paper towel. You can repeat this until the irritation stops. Also, remember that because essential oils don't mix with water, trying to wash the oil out with water won't be terribly effective. If the irritation persists, make sure to get medical attention.

Now you know the best practices for enjoying the benefits of essential oils topically, let's move on to the final way to experience essential oils: internal use.

ESSENTIAL OIL CERTIFICATION: Internal Use

Using Essential Oils Internally

- Is Ingesting Essential Oils Safe?
- Which Oils Are Safe to Ingest?
- What Are the Benefits?
- Examples of Internal Use

What Happens When I Ingest Essential Oils?

- How Much Essential Oil Should I Ingest?
- Guidelines for Internal Use

Ingesting Essential Oils Safely

- Taking Essential Oils on or Under the Tongue
- What Are the Signs of Essential Oil Sensitivity?

USING ESSENTIAL OILS INTERNALLY

IS INGESTING ESSENTIAL OILS SAFE?

A common question you might have heard a lot is, "Is it safe to ingest essential oils?" There's been some confusion on this, so let's clear it up.

Decades of traditional thought focused on using essential oils topically and aromatically. While some traditionalists completely abandoned ingestion as a suitable method, scientists and health professionals continued to evaluate and explore the wellness benefits of essential oil ingestion. There's a substantial amount of research in the form of clinical studies that supports the safety and effectiveness of using essential oils this way.

The truth is humans have been ingesting aromatic molecules since the beginning. Remember when we talked about the constituents of essential oils? Well, limonene is a common constituent found in citrus essential oils, but we also ingest this beneficial constituent when we consume citrus fruit or juice, carrots, some baked goods, and a variety of beverages. Another common constituent is eugenol, which is found in clove essential oil, as well as in coffee, peaches, and bananas.

As you can see, essential oil constituents are regularly a part of diets, and our bodies are familiar with metabolizing small amounts of these molecules.

WHICH OILS ARE SAFE TO INGEST?

Before you take essential oils internally, it's important to understand that not all oils are ingestible, just as some plants aren't safe to ingest. This is why it's a good idea to check the label on the essential oil bottle to determine guidelines for internal use.

Here's a list of essential oils that are safe for internal use.

Essential Oils Considered Safe For Ingestion:



Basil	Ginger	Peppermint
Bergamot	Grapefruit	Petitgrain
Black Pepper	Green Mandarin	Pink Pepper
Cardamom	Hawaiian Sandalwood	Roman Chamomile
Cassia	Helichrysum	Rosemary
Celery Seed	Juniper Berry	Sandalwood
Cilantro	Lavender	Siberian Fir
Cinnamon Bark	Lemon	Spearmint
Clary Sage	Lemongrass	Tangerine
Clove	Lime	Thyme
Copaiba	Marjoram	Turmeric
Coriander	Melissa	Vetiver
Fennel	Myrrh	Wild Orange
Frankincense	Oregano	Ylang Ylang
Geranium	Patchouli	

WHAT ARE THE BENEFITS?

Research has shown that internal use of essential oils offers unique effects that the other methods do not. For example, essential oils can be used internally for the following benefits.

- Promote healthy cell function.*
- Aid gastrointestinal health.*
- Maintain healthy immune function.*
- Support respiratory system function.*
- Provide antioxidant support.*
- Assist with healthy cardiovascular system function.*
- Calm the nervous system.*
- Aid in the body's normal cleansing activities.*

Those are some impressive benefits!

EXAMPLES OF INTERNAL USE

You may be wondering how to take oils internally. Here are some simple ways to incorporate internal use into your essential oil routine.

- Add one to two drops to a glass of water. Be sure to use a metal or glass container, because certain essential oils can break down plastic.
- Add a few drops to an empty veggie capsule.
- Place a drop or two directly on or under the tongue.
- Add a drop to your morning smoothie.

And here are a few examples of other creative ways you can use essential oils internally.

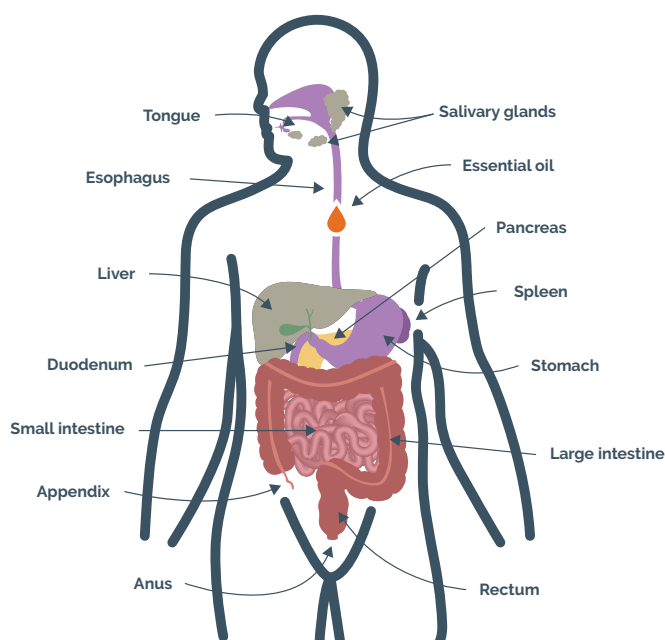
- Mix one to two drops in almond milk, rice milk, coconut milk, or natural honey.
- Add a drop to your favorite food dishes or baked goods. Keep in mind, the smallest amount of essential oil can enhance the flavor of entrees, beverages, desserts, and marinades.

WHAT HAPPENS WHEN I INGEST ESSENTIAL OILS?

As we learned in the previous modules, essential oils are just highly concentrated amounts of the natural compounds that we as people have been metabolizing for centuries. While some oils shouldn't be taken internally like wintergreen, there are plenty that can be safely consumed.

When an essential oil is ingested, it's transported through the gastrointestinal tract, where it's absorbed in the small intestine and moved to the liver via a portal vein. The liver metabolizes and processes the molecules before releasing a portion of them into the bloodstream so they can travel to cells throughout the body. Some of the oil is sent to be excreted as well. Like we talked about earlier, essential oils are lipid-soluble and have a low molecular weight. This makes it possible for essential oils to be transported to various cells and organs—even the brain.

Transportation of Essential Oils Through The Gastrointestinal Tract



HOW MUCH ESSENTIAL OIL SHOULD I INGEST?

When it comes to using essential oils internally, consider the chemical makeup of the oil, the appropriate amount to take, the oil's potency, your personal health, and any medications you're taking. It's always a good idea to consult with your healthcare professional.

Our bodies are designed to metabolize and process a limited amount of essential oil in a given time period, which makes the amount you use important. The limit of how much you should take will vary based on the oil and your personal circumstances.

Guidelines for Internal Use

Generally speaking, you should start with the smallest amount possible: one to two drops. Typically, no more than 20 drops of essential oils should be consumed internally within 24 hours, but this maximum can be lower or higher based on age, size, the health of the individual, desired benefit, and the oil itself.

It's usually safe to take one to five drops every four to six hours as needed. If you're going to use an essential oil consistently for more than a couple of weeks, lower amounts—one to three drops—are suggested.

INGESTING ESSENTIAL OILS SAFELY

TAKING ESSENTIAL OILS ON OR UNDER THE TONGUE

A common method for taking essential oils internally is putting a drop directly on or under your tongue. An advantage of direct use under the tongue is the essential oil is absorbed directly into circulation via the rich capillaries under the tongue.

Before you start using oils this way, let's be clear that some essential oils are particularly strong—or “hot”—which may be unpleasant to take directly on your tongue. Essential oils like cassia, cinnamon, clove, cumin, oregano, and thyme are safe to use internally, but it's best to take them in a veggie capsule.

If you're unsure whether an oil is too strong, a good guideline is to look at the topical dilution recommendation. If it's recommended to dilute the oil before applying to the skin, you'll want to be careful putting it directly in your mouth.

Remember, the safe use of essential oils differs from individual to individual. One essential oil may affect one person and not another or produce a different effect altogether.

WHAT ARE THE SIGNS OF ESSENTIAL OIL SENSITIVITY?

Watch for signs of sensitivity, such as gastrointestinal discomfort, skin irritation, or difficulty breathing. These are rarely experienced, but it's good to be aware of them. In the most extreme cases, exceeding suggested amounts can lead to toxicity. Toxicity is when a substance reaches a point that it becomes harmful or damaging to the body. Any substance—even natural, seemingly harmless ones like water, vitamins, and minerals—can become toxic if used in excessive amounts.

Though essential oils have a potential for toxicity when used incorrectly, the toxic amount of an essential oil always far exceeds the suggested amounts. You'd have to consume far beyond the suggested amount to put yourself within a dangerous range of toxicity.

ESSENTIAL OIL CERTIFICATION: Contamination and Adulteration

Now What?

Lavender

- How Is Lavender Essential Oil Made?
- Why Bulgaria and France?
- The Science behind Lavender Essential Oil
- Benefits of Lavender Essential Oil
- How to Use Lavender Essential Oil

Lemon

- How Is Lemon Essential Oil Made?
- Why Italy and Brazil?
- The Science behind Lemon Essential Oil
- Benefits of Lemon Essential Oil
- How to Use Lemon Essential Oil

Peppermint

- How Is Peppermint Essential Oil Made?
- Why the Pacific Northwest?
- The Science behind Peppermint Essential Oil
- Benefits of Peppermint Essential Oil
- How to Use Peppermint Essential Oil

Copaiba

- How Is Copaiba Essential Oil Made?
- Why Brazil?
- The Science behind Copaiba Essential Oil
- Benefits of Copaiba Essential Oil
- How to Use Copaiba Essential Oil

Oregano

- How Is Oregano Essential Oil Made?
- The Science behind Oregano Essential Oil
- Benefits of Oregano Essential Oil
- How to Use Oregano Essential Oil

Frankincense

- How Is Frankincense Essential Oil Made?
- Why These Areas?
- The Science behind Frankincense Oil
- Benefits of Frankincense Essential Oil
- How to Use Frankincense Essential Oil

NOW WHAT?

Now that you've learned about essential oil chemistry, purity testing, and usage, let's take that knowledge and apply it practically. While the sheer number of essential oils available may seem intimidating, we suggest starting with simple essential oils that have a variety of uses and benefits. Let's dive in with 12 powerful essential oils and blends for self-directed healthcare.

As with all essential oils, it's really important to use good judgment and carefully read labels for recommended doses, dilution, and age reservations. You might encounter possible skin sensitivity and should always avoid contact with your eyes, inner ears, and sensitive areas. If you're pregnant, nursing, or under a doctor's care, consult your physician. And, of course, be careful to keep your essential oils out of reach of children.

LAVENDER (LAVANDULA ANGUSTIFOLIA)

Even if you've never used it before, you've probably heard of Lavender essential oil. Lavender is a hero in the world of essential oils, and with good reason. Why do people love it so much? From helping to promote a restful sleep to soothing skin and improving your ability to cope with stress, Lavender essential oil has dozens of practical uses.

ESSENTIAL OIL CERTIFICATION: Contamination and Adulteration

Tea Tree

- How Is Tea Tree Essential Oil Made?
- Why Australia and Kenya?
- The Science behind Tea Tree Essential Oil
- Benefits of Tea Tree Essential Oil
- How to Use Tea Tree Essential Oil

dōTERRA On Guard[®] Protective Blend

- What Is in the dōTERRA On Guard Blend
- The Science behind dōTERRA On Guard
- Primary Benefits of dōTERRA On Guard
- How to Use dōTERRA On Guard

dōTERRA Breathe[®] Respiratory Blend

- What Is in the dōTERRA Breathe Blend?
- The Science behind dōTERRA Breathe
- The Benefits of dōTERRA Breathe
- How to Use dōTERRA Breathe

DigestZen[®] Digestive Blend

- What Is in the DigestZen Blend?
- The Science behind DigestZen
- Benefits of DigestZen
- How to Use the DigestZen Digestive Blend

Deep Blue[®] Soothing Blend

- What Is in the Deep Blue Blend?
- The Science behind Deep Blue
- Benefits of Deep Blue
- How to Use Deep Blue

Adaptiv[™] Calming Blend

- What is in Adaptiv?
- The Science Behind Adaptiv
- Benefits of Adaptiv

How Is Lavender Essential Oil Made?

Lavender oil is extracted from the flower, stem, and leaf of the lavender plant. It's steam-distilled to create an essential oil with a powdery, floral, and light aroma.

Lavender can be grown in many areas throughout the world; however, dōTERRA chooses to source Lavender from Bulgaria and France, which are both known for producing exceptional Lavender essential oil.

Why Bulgaria and France?

Bulgaria is an agricultural haven for growing aromatic plants, and the people are rich in expertise. Near the Black Sea, the sunny and dry climate—coupled with the well-drained, sandy soil—make the growing conditions in the country ideal.

France is famous for producing exceptionally high-quality lavender plants. Some historians estimate that lavender production in France dates back as far as 600 BC.

The Science behind Lavender Essential Oil

We already know the chemical makeup of an essential oil determines its benefits.

Lavender oil is high in the chemical constituent linalool. Linalool has been widely researched for its cleansing properties, as well as its ability to promote calmness and relaxation, as well as support several body systems.* Lavender also has a high amount of linalyl acetate, which provides similar benefits like relaxation and cleansing properties; plus, it gives a slightly fruity note to the aroma of Lavender.

Benefits of Lavender Essential Oil

Lavender can be characterized as a soothing oil. Whether you're trying to soothe the skin, ease feelings of tension, or create a relaxing atmosphere before going to sleep, Lavender is your go-to oil.

- Soothes occasional skin irritations and rejuvenates the skin.
- Promotes restful sleep.*
- Creates a calming and relaxing atmosphere.
- Eases feelings of tension.*
- Improves the ability to cope with stress.
- Alleviates minor discomforts of menstruation (when combined with other oils).

How to Use Lavender Essential Oil

So, we've hyped up Lavender as a champion of the essential oil universe. Now let's talk about how to actually use it.

Suggested Uses:

- To promote restful sleep, add a few drops of Lavender to pillows, bedding, or the bottoms of feet at bedtime.
- Soothe occasional skin irritations by keeping Lavender on hand.
- Take two drops in a veggie capsule twice daily to reduce occasional anxious feelings.*
- Freshen your linen closet, mattress, car, or the air around by combining Lavender in a spray bottle with water.
- Combine with other soothing oils and massage into your lower abdomen to soothe minor menstrual discomfort.
- Diffuse five to six drops to unwind at the end of the day.
- Combine a few drops with aloe vera gel and apply after a day in the sun for some extra comfort.
- Add one drop to your shampoo to encourage a healthy-looking scalp.

LEMON (CITRUS LIMON)

Lemon is a wonderful and immensely popular essential oil. For many people, it's the first essential oil they ever experienced. In addition to a cheerful aroma, it has incredible properties and can be used aromatically, topically, and internally.

How Is Lemon Essential Oil Made?

Lemon oil is created by cold-pressing the peel of the fruit. This produces a clean, fresh, and bright essential oil. Citrus fruits are grown in many regions, and dōTERRA sources Lemon from Italy and Brazil, where the plants thrive in the warm climate and fertile soil.

Why Italy and Brazil?

Lemons in Italy can grow to the size of softballs, thriving in the warm climate and fertile soil. Most of the lemons sourced by dōTERRA for essential oil are from the island of Sicily. A small portion of lemons are also sourced in southern Brazil. The climate is similar to that of southern Italy, and so citrus fruits—including lemons—thrive. We work with farmers who have been cultivating citrus fruit for generations. They're experts at growing high-quality lemons that go on to become gorgeous essential oils with excellent chemistry.

The Science behind Lemon Essential Oil

Lemon essential oil is high in the chemical constituent limonene, which is powerfully cleansing, both internally and externally.* It also contains beta-pinene, a constituent known to help reduce anxious feelings and support both the immune and respiratory systems.* Another constituent in Lemon is gamma-terpinene, a monoterpene that helps protect against environmental threats.*

Benefits of Lemon Essential Oil

Lemon is a cleaning oil. It has a fresh aroma that cleanses and purifies the air, but it can also clean surfaces. When you take it internally, it can aid detoxification.*

- Aids detoxification.*
- Cleanses and purifies the air and surfaces.
- Supports digestion.*
- Supports healthy respiratory function.*
- Soothes occasional nausea.*
- Supports healthy immune responses.*
- Cleanses mouth and teeth.

How to Use Lemon Essential Oil

If you want to use Lemon essential oil, there's a wide range of ways to implement it into your day. But remember, citrus oils can increase your skin's sensitivity to the sun—so if you're using it topically, it's best to avoid sunlight and UV rays for at least 12 hours after applying.

Suggested Uses:

- To employ Lemon's cleansing properties, add one to three drops to your water in the morning for antioxidant support and a gentle internal cleanse.*
- Lemon is also fantastic for nontoxic household cleaning, whether you use it to remove sticky residues or put it in a spray bottle with water to make your own surface cleaner.
- Add to your water for a splash of flavor and antioxidant support, as well as to promote digestive comfort.*
- Diffuse several drops to create an uplifting environment.
- Put one to two drops in a mug with honey and warm water for a homemade tea to soothe the throat.
- Take two drops each of Lemon, Lavender, and Peppermint in a veggie capsule to promote seasonal respiratory comfort.*
- Use a cloth soaked in Lemon to preserve and protect your leather furniture.
- Add to a spray bottle of water to clean surfaces.
- Add a few drops to olive oil to clean, protect, and shine wood surfaces.
- Mix a few drops with baking soda to scrub dirty pots and pans.
- Use to polish silver and other metals in the early stages of tarnish.
- Remove sticky residues or substances from surfaces, carpet, or hair.

PEPPERMINT (MENTHA PIPERITA)

Peppermint is another major crowd-pleaser. It has a refreshing, minty aroma that makes it a fantastic complement to many other oils. Don't be fooled, though, Peppermint has impressive benefits that let it stand on its own as well.

How Is Peppermint Essential Oil Made?

Peppermint oil is created by steam-distilling the entire peppermint plant. dōTERRA sources Peppermint from the Northwestern United States and a few other parts of the world that are known to have high levels of rainfall.

Why the Pacific Northwest?

Different climates and soils impact the chemical profile of the peppermint plant. The Pacific Northwest is an ideal climate for growing the plant because of the high and consistent amounts of rainfall each year, as well as the nutrient-rich soil. This contributes to a high menthol content, which gives Peppermint oil its minty aroma and flavor.

The Science behind Peppermint Essential Oil

There are some valuable chemical constituents in Peppermint essential oil. It's 20%–60% menthol, which contributes to its cooling effect and boosts its cleansing properties.

Benefits of Peppermint Essential Oil

Peppermint is a refreshing essential oil. It can help with everything from promoting feelings of clear breathing to enhancing a soothing massage on tired muscles.

- Promotes healthy respiratory function and clear breathing.
- Aids in digestion.*
- Cools down the body topically.
- Repels bugs.

How to Use Peppermint Essential Oil

Peppermint is another one of those versatile oils that can be used aromatically, topically, and internally. With the many ways you can use this oil, it's an easy one to incorporate into your everyday life.

Suggested Uses:

- Peppermint can be used to relieve occasional head tension when applied to the temples, forehead, and back of the neck.
- It also makes an excellent pick-me-up. Put a drop in your palm, rub your hands together, cup them over your nose, and breathe in.
- For Peppermint's digestive benefits, take three drops in a veggie capsule before meals.*
- Add one drop to water for a refreshing mouth rinse.
- Apply a trace amount to the tips of your ears (avoiding the inner ear) to cool the body.
- Diffuse several drops to promote an environment of alertness and mental clarity.
- Place one drop on your toothbrush to freshen your breath and support oral hygiene.
- Dilute two drops of this essential oil in four drops of dōTERRA Fractionated Coconut Oil and massage into sore muscles after strenuous activity.
- Take in a veggie capsule to promote healthy respiratory function and feelings of clear breathing.*

- Add one drop to your water to reduce occasional nausea.*
- Add a few drops to ice cream to give it a natural mint flavor.
- Mix with rubbing alcohol and spray around the garden for a nontoxic way of repelling insects.

COPAIBA (COPAIFERA SPECIES—COPAIFERA RETICULATA, C. OFFICINALIS, C. LANGSDORFFII)

Many essential oil users have made Copaiba oil their new best friend. With a spicy, woody aroma, it has many benefits that make it an essential oil staple. Plus, it can be used topically, aromatically, and internally, giving it even more possible uses.

How Is Copaiba Essential Oil Made?

Copaiba is another essential oil created through steam distillation; however, this time it's the resin from the tree that's distilled. dōTERRA sources Copaiba essential oil from Brazil, where the trees thrive along the Amazon River.

Why Brazil?

Copaiba trees grow in tropical South America, especially along the Amazon River in Brazil. The river's basin experiences about 80–85% humidity year-round, with an average of 90 inches of rain per year. Because of its position on the equator, the Amazon rainforest experiences 12 hours of sunlight every day of the year. These conditions are exceptional for plant growth, and copaiba trees thrive in this unique climate.

The Science behind Copaiba Essential Oil

Copaiba has a fascinating and powerful chemical makeup. Its primary constituent is beta-caryophyllene, a sesquiterpene found in hundreds of different plant species. It's also known as a cannabinoid, because it interacts directly with receptors in the endocannabinoid system, soothing tissues and helping to manage healthy inflammatory responses.* Also prominent in Copaiba oil are the chemical compounds alpha-bergamotene and alpha-copaene, which are both antioxidants.

Benefits of Copaiba Essential Oil

Copaiba is a powerful antioxidant, calming and soothing the nervous system, as well as supporting healthy cellular function, among other things. It's helpful for enhancing the topical effect of other essential oils, making just about everything better with Copaiba.

- Promotes clear and rejuvenated skin.
- Supports a healthy inflammatory response.*

- Supports healthy cellular function.*
- Soothes sore muscles after exertion.*
- Promotes healthy cardiovascular, immune, digestive, and respiratory function.*

How to Use Copaiba Essential Oil

Suggested Uses:

There are many, many ways to use Copaiba, and you'll probably figure out your own favorites.

- Take three to five drops in a veggie capsule twice a day to promote a healthy inflammatory response and to provide antioxidant support.*
- Dilute two to three drops of Copaiba in five to seven drops of dōTERRA Fractionated Coconut Oil, and then massage into tired muscles.
- Use with other oils topically to enhance their absorption and improve their benefits.
- Add one to two drops on or under the tongue to reduce occasional anxious feelings.*
- Add one or two drops to tea to support healthy respiratory function.*
- Diffuse several drops to promote a calm environment.
- Add one to two drops of this essential oil to water, juice, or tea to support the health of the cardiovascular, immune, digestive, nervous, and respiratory systems.*
- Add one drop to your daily facial lotion application to rejuvenate the skin and promote a clear complexion.
- Add two to three drops to a veggie capsule and consume to support normal immune function.*

Oregano (Origanum vulgare)

Oregano is a superstar for the immune system. It has a strong aroma, and some people prefer to primarily use it internally because of that.

How Is Oregano Essential Oil Made?

Oregano oil is steam-distilled from the leaves of the oregano plant. It has a sharp, herbaceous aroma. dōTERRA sources Oregano in Turkey and Kenya. Oregano grows wild in Turkey, because the plant thrives in the temperate western and southwestern Eurasia and Mediterranean region.

The Science behind Oregano Essential Oil

The main constituent in Oregano oil is carvacrol. This compound has powerful surface-cleansing abilities and provides antioxidants.* Oregano also contains para-cymene, a monoterpene alkene that promotes healthy cellular function.* Like Lemon oil, Oregano has gamma-terpinene, which helps protect against environmental threats.*

Benefits of Oregano Essential Oil

Oregano is a cleansing oil that you can use inside and out to support several healthy functions in your body.

- Supports healthy immune, digestive, and respiratory function.*
- Acts as a powerful antioxidant.*
- Supports a healthy inflammatory response.*

How to Use Oregano Essential Oil

Okay, so you've got background on Oregano essential oil. Now onto how you can actually use it. This is considered a "hot" oil—if you want to apply it topically, then dilute it with a carrier oil.

Suggested Uses:

- Add one to two drops to a veggie capsule to support healthy immune, respiratory, and digestive function.*
- Add a toothpick's amount in place of dried oregano for spaghetti sauce, for pizza sauce, or on a roast.
- Add one to two drops to a veggie capsule and consume for antioxidant support.*
- Dilute with dōTERRA Fractionated Coconut Oil and apply to the feet, especially during times when seasonal threats are high.
- Add one drop to a glass of salt water and gargle the mixture to soothe an irritated throat.
- Combine 10 drops with a 50/50 mixture of water and white vinegar for a powerful surface cleaner. Tip: add 10 drops of Lemon oil to improve the aroma.
- Add one to two drops to a half cup of Epsom salts. Mix with warm water for a soothing foot soak.

FRANKINCENSE (BOSWELLIA SPECIES—BOSWELLIA CARTERII, B. PAPYRIFERA, B. FREREANA, B. SACRA)

Frankincense is known as the king of essential oils. It's considered one of the most prized and precious essential oils available and can be used aromatically, topically, and internally. Whether you're trying to promote healthy cellular function, soothe the soul, or support the skin, Frankincense is a powerful oil to turn to.

How Is Frankincense Essential Oil Made?

Frankincense is hydrodistilled from the resin of the Boswellia tree and has a warm, spicy aroma. The tree itself is native to the northern Africa region. dōTERRA sustainably source

es Frankincense from Somaliland, Ethiopia, and Oman. By sourcing from multiple locations, dōTERRA can ensure that the resin is being responsibly sourced from the places where Boswellia tree species grow best.

Why These Areas?

Frankincense essential oil from dōTERRA is a proprietary blend of four different Boswellia species of resins: Boswellia carterii, Boswellia papyrifera, Boswellia frereana, and Boswellia sacra. Different frankincense trees thrive in different environments and soil types. For example, Boswellia carterii trees grow best in sandy soils, while Boswellia frereana trees grow best in dry, rocky terrain. Boswellia frereana trees also produce the largest resin tears of the Boswellia species.

The Science behind Frankincense Oil

One of the main constituents of Frankincense oil is alpha-pinene. Experimental studies suggest that this constituent may support oral health, reduce the appearance of blemishes when applied topically, and support healthy immune function when taken internally.*

It also contains limonene, which is a main constituent in citrus oils as well. It's known for its cleansing properties and may support a healthy metabolism when consumed internally.*

Benefits of Frankincense Essential Oil

As the king of essential oils, Frankincense can give you the royal treatment, inside and out.

- Supports healthy cellular function.*
- Promotes a relaxing environment.
- Improves the appearance of the skin.
- Supports healthy immune, nervous, and digestive function.*

How to Use Frankincense Essential Oil

Frankincense is an oil that can be used in so many ways. It's easy to experience its benefits in your everyday life.

Suggested Uses:

- Diffuse several drops to promote a relaxing atmosphere.
- Take two to three drops in a veggie capsule to support the immune system.*
- Apply topically to reduce the appearance of skin imperfections.
- Apply one to two drops to the bottoms of your feet to promote feelings of relaxation.

- Diffuse several drops to enhance meditation.
- Take one to two drops in a veggie capsule to support healthy cellular function.*
- Add one to two drops of Frankincense to water, juice, or tea and consume to support healthy nervous and immune system function.*
- Apply to the upper chest with dōTERRA Fractionated Coconut Oil and enjoy the soothing aroma.
- Apply one drop to the crown of your head as you set your intentions for the day.

TEA TREE (MELALEUCA ALTERNIFOLIA)

Tea Tree essential oil is a purifying powerhouse. With benefits for skin and hair—plus properties that make it effective for household cleaning—Tea Tree is an oil you'll always want to keep on hand.

How Is Tea Tree Essential Oil Made?

Tea Tree oil is made by distilling the leaves of the Melaleuca tree to produce an herby, green aroma. dōTERRA sources Tea Tree essential oil from Kenya and its native Australia.

Why Australia and Kenya?

The tea tree plant is native to Australia. It thrives in sunny conditions and moist soil. In Australia, tea tree grows all spring, summer, and fall. Parts of Kenya have growing conditions similar to those in Australia, making it another optimal place for tea tree to flourish.

The Science behind Tea Tree Essential Oil

Terpinen-4-ol is one of the main constituents found in Tea Tree oil. Research has shown that this monoterpene alcohol may support skin and hair health, which is why so many people use it as part of their self-care routine.

Benefits of Tea Tree Essential Oil

With its powerful purifying properties, this oil is useful for cleansing the skin, purifying surfaces and the air, and protecting against environmental and seasonal threats.*

- Cleanses and rejuvenates the skin.
- Helps purify and freshen the air.
- Soothes irritated skin.

How to Use Tea Tree Essential Oil

Are you ready to learn how to use Tea Tree oil? Tea Tree oil can easily be used aromatically and topically. Here are a few ways you can use this powerhouse oil daily.

Suggested Uses:

- Enjoy a cleansing foot bath with five drops of Tea Tree added to a half cup of Epsom salts, mixed in warm water. Soak for twenty minutes for best results.
- Add one drop to the tongue, swish in the mouth for 30–60 seconds, and spit to promote oral cleanliness.
- Combine 30 drops with 12 ounces of water and 4 ounces of white vinegar. Use on surfaces to protect against environmental threats.
- Combine one to two drops with your facial cleanser for added cleansing properties.
- Combine two drops with a dollop of shampoo when washing your hair and massage into your head for a healthy scalp.
- Apply Tea Tree to fingernails and toenails after showering to purify the nails and keep them looking healthy.
- Blend one drop with a 50/50 solution of water and apple cider vinegar (enough to cover a cotton ball) on a cotton ball. Apply to your face to improve the skin's appearance.
- For occasional skin irritations, apply one to two diluted drops onto affected area.
- Clean your washing machine by adding 10 drops and a cup of white vinegar to your detergent dispenser. Run a complete cycle; follow this by running another cycle at the hottest water temperature with a half cup of baking soda and 15 drops of Tea Tree.

dōTERRA ON GUARD[®] PROTECTIVE BLEND

If you want something to support your immune system and help protect against environmental threats, look no further than dōTERRA On Guard[®]. A warm, spicy, and woody essential oil blend, its cleansing and protecting properties make it ideal for immune support. It can be used aromatically, topically, and internally.

What Is in the dōTERRA On Guard Blend?

dōTERRA On Guard includes some of the most powerful immune-supporting essential oils. Wild Orange, Clove, Cinnamon, Eucalyptus, and Rosemary all lend their cleansing and supportive benefits.

The Science behind dōTERRA On Guard

dōTERRA On Guard has the primary chemical constituents limonene, eugenol, (E)-cinnamaldehyde, and eucalyptol. Limonene is cleansing. Eugenol provides antioxidant properties and promotes a healthy immune response. Cinnamaldehyde is a powerful antioxidant and provides cellular support. And eucalyptol is supportive of the respiratory system.

Primary Benefits of dōTERRA On Guard

dōTERRA On Guard supports healthy immune and respiratory function, protects against environmental threats, and supports the body's natural antioxidant defenses.* It can cleanse and purify the air and household surfaces to protect against environmental threats.

- Supports healthy immune and respiratory function.*
- Protects against environmental threats.*
- Supports the body's natural antioxidant defenses.*
- Promotes healthy circulation.*
- Provides an energizing and uplifting aroma.
- Cleanses surfaces.

How to Use dōTERRA On Guard

This blend is absolutely amazing and can be used for many different purposes.

Suggested Uses

- Add two to three drops to a veggie capsule and consume for an immune boost.*
- Diffuse three to five drops to cleanse and purify the air.
- Soak sliced apples in water and a few drops for a healthy immune-boosting snack.
- Mix 30 drops with 1¾ cups of water and ¼ cup of white vinegar. Use as an all-purpose cleaner.
- Rub one to two drops diluted with dōTERRA Fractionated Coconut Oil into the bottoms of your feet during winter months for seasonal support.
- Take one to three drops in a veggie capsule to support the body's natural antioxidant defenses.*
- Mix one drop in a tablespoon of honey and take to soothe the throat.
- Add three to four drops to a cotton ball and place anywhere in the home to eliminate unpleasant odors.
- Mix a few drops in baking soda for a natural cleaning scrub.

dōTERRA BREATHE® RESPIRATORY BLEND

With its clean, airy scent, dōTERRA Breathe® is a refreshing essential oil blend. It can be used aromatically and topically to promote feelings of clear airways and minimize the effects of seasonal threats.

What Is in the dōTERRA Breathe Blend?

dōTERRA Breathe includes essential oils such as Eucalyptus, Peppermint, Tea Tree, Lemon, and Ravintsara. These ingredients work together to create the blend you know and love.

The Science behind dōTERRA Breathe

One of the most valuable constituents in dōTERRA Breathe is menthol. Menthol is found in Peppermint—a key oil in the dōTERRA Breathe blend—giving it cleansing properties and a cooling sensation.

The Benefits of dōTERRA Breathe

Whenever you need a breath of fresh air, dōTERRA Breathe is there for you. Beyond helping you to maintain feelings of clear airways, it can promote a restful night's sleep and help minimize the effects of seasonal threats.

- Maintains a sense of clear airways and easy breathing.
- Promotes a restful night's sleep.
- Helps minimize the effects of seasonal threats.

How to Use dōTERRA Breathe

Even though dōTERRA Breathe can't be ingested, there are a variety of ways to enjoy its benefits aromatically and topically.

Suggested Uses:

- Apply to the chest with dōTERRA Fractionated Coconut Oil to minimize the effects of seasonal threats.
- Diffuse three to five drops at night to promote a sense of open airways and a restful environment.
- Diffuse three to five drops when seasonal and environmental threats are high.
- Add one to two drops to a bowl of hot water and cover your head and the bowl with a towel. Close your eyes and deeply inhale to promote a sense of open airways.
- Place one to two drops of dōTERRA Breathe on your palms and rub them together. Cup your hands over your nose and mouth and breathe deeply to promote the feeling of clear airways.
- Before a run, apply one to two drops, diluted with dōTERRA Fractionated Coconut Oil to promote a sense of easy breathing.
- Add three to five drops of the blend to a cotton ball and place under the driver's seat in your car to freshen the environment.

DIGESTZEN[®] DIGESTIVE BLEND

If you're used to dealing with unpleasantness like stomach upset, gas, and bloating, you know how miserable they can make everyday life. The DigestZen[®] Digestive Blend was created for people who are looking for a natural solution to these discomforts.

What Is in the DigestZen Blend?

DigestZen includes powerful essential oils that are known to aid with digestive health. This blend includes Peppermint, Ginger, Coriander, and Fennel.

The Science behind DigestZen

Because it incorporates Peppermint, DigestZen has the chemical constituent menthol. Menthol is used extensively as a flavoring agent in candy and even toothpaste, but its internal benefits far exceed its powerful minty taste. Experimental research suggests that menthol taken internally may support the digestive system.*

Benefits of DigestZen

When you're looking for a natural way to approach digestive health, DigestZen should be your go-to. Whether you want to support healthy digestion, soothe occasional stomach upset, or ease the effects of motion sickness, DigestZen will be your new best friend in times of need.*

- Supports healthy digestion.*
- Soothes occasional stomach upset.*
- Helps reduce bloating, gas, and occasional indigestion.*
- Aids healthy metabolism.*
- Eases occasional motion sickness.*

How to Use the DigestZen Digestive Blend

So, how can you use this blend to help promote good digestive health? It's easy! DigestZen can be used aromatically, topically, and internally, giving you plenty of options for naturally supporting the digestive system.

Suggested Uses:

- Rub one to two drops of diluted DigestZen into the abdomen (in a clockwise circular motion) for a calming aroma.
- Take two to three drops in a veggie capsule before traveling to minimize motion sickness.*
- Add one to two drops to tea or water and consume before a big meal to promote healthy digestion and metabolism.*

- Take two to three drops in a veggie capsule to maintain a healthy gastrointestinal tract.*
- Take DigestZen internally when trying new foods to soothe occasional stomach upset.*
- Add to water, tea, or other beverages to maintain a healthy gastrointestinal tract.*

DEEP BLUE® SOOTHING BLEND

Daily life can be tiring for your body, and when you add physical exercise to your routine, sometimes you need a little extra comfort. Deep Blue® essential oil blend brings together comforting oils for a product that provides real soothing when you need it most.

What Is in the Deep Blue Blend?

What kind of soothing essential oils are included in the Deep Blue blend? Wintergreen, Peppermint, Ylang Ylang, Helichrysum, and Blue Tansy come together to make this blend the king of comfort.

The Science behind Deep Blue

Among many chemical constituents, Deep Blue contains methyl salicylate, which can be soothing after strenuous activities. This is why applying Deep Blue to your skin after exercise can be so beneficial.

Benefits of Deep Blue

Formulated to soothe and cool, the enriched oils in the Deep Blue blend are the perfect recipe for a comforting massage.

- Soothes and cools.
- Provides a comforting sensation as part of a massage.

How to Use Deep Blue

Deep Blue is an essential oil blend that can only be applied topically, but that doesn't limit the many ways you can use it. Deep Blue is an absolute necessity for physical activity.

Suggested Uses:

- Dilute with dōTERRA Fractionated Coconut Oil and apply to your limbs and joints before and after exercise.
- Use as part of a soothing massage after a long day.

- Rub Deep Blue and dōTERRA Fractionated Coconut Oil onto your wrists, shoulders, neck, and fingers after a long day in front of a computer.
- Massage Deep Blue and dōTERRA Fractionated Coconut Oil onto the legs of growing children before bedtime.
- Massage the feet with Deep Blue and dōTERRA Fractionated Coconut Oil after a long day of walking or standing.
- Ask your massage therapist to incorporate this blend into a soothing massage.
- Apply Deep Blue and dōTERRA Fractionated Coconut Oil and elevate your legs after a busy day of errands.

ADAPTIV™ CALMING BLEND

Adaptiv is the oil you want on hand for the stressful moments of life. You want to use it on days when you have a lot going on and you're worried about getting through all of it. Use it when you want something to help you feel comfortable with changing circumstances and situations.

What is in Adaptiv?

Wild Orange, Lavender, Copaiba, Spearmint, Magnolia, Rosemary, Neroli, and Sweetgum come together to make this sweet, citrusy, and floral blend that's ideal for aromatic and topical use.

The Science Behind Adaptiv

Adaptiv has a lot of heavy-hitting chemical constituents. It brings together the cheerful aroma of Wild Orange and Spearmint's limonene with the more calm and subtle scent of Lavender and Magnolia's linalool. Linalyl acetate, beta-caryophyllene, and carvone round out the soothing and relaxing aroma of this incredible blend.

Benefits of Adaptiv

Adaptiv is a powerful blend designed to create a peaceful and uplifting environment. It provides a tranquil and relaxing aroma that complements effective work and study.

Suggested Uses:

- Diffuse three to four drops in the diffuser of your choice to promote a centered and calm mindset.
- Soak in a relaxing bath by adding three to four drops and Epsom salt and mixing with your bath water.
- Apply one drop to your hands, rub together, and inhale deeply—as needed throughout the day.
- Mix three to four drops in dōTERRA Fractionated Coconut Oil for a soothing massage.

- Mix one drop in three drops of dōTERRA Fractionated Coconut Oil and apply to the shoulders and neck when acclimating to new surroundings.
- Apply a drop—diluted in three drops of dōTERRA Fractionated Coconut Oil—to the wrists or the base of the skull when navigating stressful situations.
- Dilute two drops in six drops of dōTERRA Fractionated Coconut Oil and massage over the heart for a day filled with smiles.

ESSENTIAL OIL CERTIFICATION: Building Cellular Vitality with Essential Oil-Infused Supplements

Essential Oils in Everyday Life

Digestion

- Essential Oils and Nutrient Bioavailability
- What Does Bioavailability Mean?

Enzymes and Digestion

- What Are Enzymes?
- How Do Enzymes Help the Body?

DigestZen TerraZyme®

- How Can DigestZen TerraZyme Help Me?
- How to Use DigestZen TerraZyme

The Importance of Gut Health

Your Gut

- Your Immune System and Your Gut

The Gut-Brain Connection

Bacteria Is the Key to a Healthy Gut

- The Microbiome and Villi

The Importance of Microbes

- The Microbiome and Nutrients
- The Microbiome and Infants
- The Microbiome and Lifestyle

PB Assist®+

- Primary Benefits of the Numbered Strain Probiotics in PB Assist+
- How to Use PB Assist+

Lifelong Vitality Pack®

ESSENTIAL OILS IN EVERYDAY LIFE

With these 12 foundational oils and blends under your belt, let's explore how essential oils can help us achieve vitality. The true measure of health encompasses physical, mental, emotional, and spiritual well-being. In life, vitality is expressed by excitement, energy, aliveness, exuberant physical strength, positive mindsets, and sharp mental and cognitive capabilities—a connection with something greater than yourself.

From a holistic point of view, optimal wellness requires daily nutrients, lessened exposure to harmful and toxic chemicals, physical activity, and healthy, functioning body systems. You cannot ignore any aspect of your well-being and expect to thrive.

For the rest of the course, we're going to focus on things you can do to achieve vitality and work toward wellness.

DIGESTION

The first key aspect of optimal wellness is the digestive system. There's a lot to look at here, and we'll talk about several aspects, including enzymes, probiotics, and the gut-brain connection. But since we were just talking about essential oils, let's start with how essential oils can help digestion.

ESSENTIAL OIL CERTIFICATION: Building Cellular Vitality with Essential Oil-Infused Supplements

Overall Health

- The Plight of the Modern Diet
- Side Effects of Poor Nutrition
- The dōTERRA Lifelong Vitality Pack

Microplex VMz[®]

- Glycoprotein Matrix
- Why Whole-Food Supplements Are Best
- Optimized Absorption
- Benefits of Microplex VMz

xEO Mega[®]

Fatty Acids

- Most Common Fatty Acids
- Health Benefits of Essential Fatty Acids

Supplementing Omega-3 Fatty Acids

Astaxanthin

The Importance of Vitamin

The Power of Essential Oils

Cellular Health

- Why Is Cell Health Important?
- Cells and Metabolic Waste
- Maintaining Youthful Cellular Function
- The Danger of Free Radicals
- Antioxidants

Alpha CRS^{®+}

- Key Ingredients in Alpha CRS+
- Cellular Energy Blend
- What Contributes to the Cellular Energy Blend in Alpha CRS+?

Supporting Your Brain Health

Essential Oils and Nutrient Bioavailability

A fascinating thing about essential oils is that they make superb companions for other vital nutrients and substances. For decades, scientists have known that the aromatic volatile compounds in essential oils improve how nutrients and plant-based ingredients are absorbed by the body. For example, menthol from peppermint oil and carvone from caraway and spearmint oils enhance the absorption of nutrients and substances.¹⁰ Or take ginger oil, which contains constituents that help facilitate the bioavailability of other oils and nutrients when ingested.¹¹

What Does Bioavailability Mean?

Bioavailability means the amount of something that actually makes it to the bloodstream when introduced into the body. This is a particularly important idea when discussing supplements, because many on the market present nutrients that aren't bioavailable, and your body has a hard time actually using them. Essential oils can enhance the bioavailability and activity of other beneficial ingredients, positively impacting health down to the cellular level.

ENZYMES AND DIGESTION

Keep the idea of bioavailability in the back of your mind, because it's going to come up again. For now, let's dive into another aspect of digestion: enzymes.

What Are Enzymes?

Enzymes are specialized proteins that serve as catalysts in almost all cellular functions and chemical reactions in the body. They play a crucial role in growth, healing, and reproduction. They're vital for breathing, thinking, hormone regulation, immune function, detoxification, and thousands of other biochemical functions. Enzymes are also necessary for proper digestion and the conversion of food nutrients into energy.

Enzymes can originate inside or outside the body. Those enzymes produced by the body are called endogenous enzymes. They're metabolic enzymes, meaning they're active in the blood, tissues, and organs that regulate metabolic activities, like glucose control and energy homeostasis. Or they're digestive enzymes, which are secreted by the pancreas to help convert food to usable nutrients. Enzymes that originate outside the body are called exogenous and are obtained from food or supplements. These enzymes help break down nutrients during digestion.

How Do Enzymes Help the Body?

Fresh, raw foods naturally contain enough enzymes for proper digestion to occur. However, cooking or processing food (with practices like pasteurization, sterilization, and so on) destroys these naturally occurring enzymes. Eating fresh, raw, plant-based foods can reduce the demand and production requirements for endogenous enzymes—those produced by the body.

Proper digestion is essential to health. Without it, your body won't break down foods into nutrients that are key to cellular function and communication. But our capacity to properly digest is limited by the availability of enzymes from both internal production and external sources. Digestion can slow down if insufficient enzymes are consumed from food sources, or if your body simply doesn't make enough endogenous enzymes.

For example, if you don't have enough lactase (the enzyme that digests the milk sugar lactose), the undigested lactose will go to the colon, where it allows excess water to enter, and more gas is produced by the bacteria there. Eventually, you experience gastrointestinal (GI) discomfort in the form of bloating, flatulence, and diarrhea. To make matters worse—believe it or not—the body may shift enzyme production from metabolic enzymes to digestive ones, meaning vital metabolic activities in the body may become sluggish. The result? You don't feel your best.

DIGESTZEN TERRAZYME[®]

So it's pretty apparent that enzymes are incredibly important for your health. And if you're searching for a natural way to support your body's production of enzymes, DigestZen TerraZyme might be just what you're looking for.

DigestZen TerraZyme is a proprietary blend of 10 active whole-food enzymes that are often deficient in cooked, processed, and preservative-laden foods. And as you know, these kinds of foods are everywhere. It's also a comprehensive enzyme, meaning it contains enzymes necessary for the digestion of proteins, fats, complex carbs, sugars, fibers, and other food nutrients.

How Can DigestZen TerraZyme Help Me?

Together, this powerful group of enzymes supports overall health by promoting more efficient digestion of food nutrients and reducing the demand on the body to produce digestive enzymes. This allows your body to focus on the production of metabolic enzymes. If you know that certain foods give you digestive discomfort, DigestZen TerraZyme can support your digestive system.

DigestZen TerraZyme also uses the power of Peppermint, Ginger, and Caraway essential oils, which are known to provide digestive support. As mentioned, these oils also contain beneficial constituents that improve the absorption and bioavailability of other nutrients. In other words, they make the supplements work better. This tummy tamer blend of essential oils is soothing to the gastrointestinal system and helps optimize digestion and assimilation of key nutrients.

How to Use DigestZen TerraZyme

Take one to three veggie capsules with meals throughout the day. The number of capsules should be adjusted according to individual needs and the types and amounts of food you're consuming.

For example, if your meal includes lots of fresh, raw foods, one capsule may work just fine. But if you're eating highly processed foods, cooked foods, or foods you know cause gastrointestinal discomfort, you may want to take two or three capsules.

You should know that some people may experience an initial change to their digestive schedules and functions when they begin using enzyme supplements. For most people, these adjustments are mild and should disappear after a few days.

THE IMPORTANCE OF GUT HEALTH

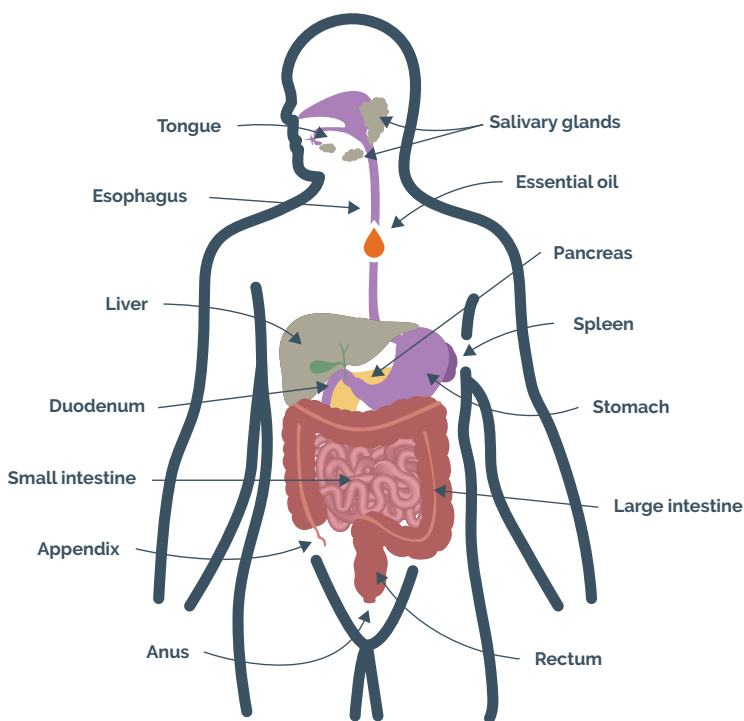
YOUR GUT

The important role that our gastrointestinal tract—or GI tract or gut—plays in our health is a hot topic today. Your gut is responsible for digesting and absorbing the nutrients in the foods you eat—and it's actually 25 feet long! It's also a vital organ of elimination. But what most people don't understand is that the gut has a much greater impact on overall health than one might expect. The reality is that your gut is involved in your entire well-being and plays an integral role in immune function and mood.

Your Immune System and Your Gut

Your GI tract, especially in the intestines, has an interesting job. Your intestines are in charge of what leaves your gut and enters your bloodstream. When your intestines are working well, they are permeable enough to let nutrients enter the bloodstream, but also tight enough to prevent larger molecules like toxins from leaving the area.

Transportation of Essential Oils through the Gastrointestinal Tract



This leads us to the gut's connection to the immune system. An immune response may be triggered if larger molecules escape the GI tract. Did you know that about 80% of your immune system is located within your gut? As the largest immune organ in the

body, the gut-associated lymphoid tissue (GALT) identifies foreign substances that trigger immune responses in the body (antigens). The gut is heavily fortified with cells that participate in immune responses, since it's an area of our bodies where people are particularly exposed to antigens.

THE GUT-BRAIN CONNECTION

But the gut plays an important role in more than just the immune system. It also has interesting similarities to the brain. The gut is often called the "second brain" because it contains as many neurons as the spinal cord and has its own nervous system (the enteric nervous system, or intrinsic nervous system). It's a complex network of lymphoid tissue that constantly monitors the GI tract, assimilates information, and forms plans to keep the GI tract and the entire body healthy.

The enteric nervous system in your gut contains extensive neural circuits that actually let it act independently of your central nervous system (CNS). Even though it can be independent from the CNS, both nervous systems usually work in harmony. There's a two-way communication between the CNS and the enteric nervous system called the gut-brain axis that lets them work together to regulate the gastrointestinal, immune, endocrine, and nervous systems.

BACTERIA IS THE KEY TO A HEALTHY GUT

So, what helps make your gut healthy? Though it may sound strange, one of the most important factors in your gut's health is the diversity of bacteria that live there. These bacteria are known as the gut microbiome. Scientists estimate that more than 500 species and 100 trillion microbes live in your gut. The bacteria in there affect all sorts of things: intestinal integrity, mood, bowel regularity, the inflammatory response, skin health, metabolic activity, cognition, and much more.

The Microbiome and Villi

The walls of our intestines are covered with millions of hair-like microstructures called villi and microvilli. They're important because they transport nutrients from the food you eat out of your GI tract and into your bloodstream.

This is where the importance of bacteria comes in. Microbes live on the villi and support their vital functions. Friendly microbes have a mutually beneficial relationship with the villi (a symbiotic one). They reduce the adherence and colonization of undesirable microbes that can disrupt the overall well-being of the GI tract. How do they do this? Friendly microbes compete with the undesirable ones for nutrients and space to colonize. They also produce chemical byproducts that create an unfavorable environment for the undesirable microbes.

THE IMPORTANCE OF MICROBES

The Microbiome and Nutrients

The gut microbiome also participates in the breakdown and absorption of carbohydrates and nutrients like calcium, magnesium, and iron. It also helps with the production of nutrients like vitamins K and B. For example, some friendly microbes called probiotics produce an enzyme your body doesn't naturally create on its own. This enzyme helps break down carbohydrates into short-chain fatty acids (SCFAs). SCFAs are a major source of energy and metabolism for microbes and help support healthy cardiovascular system function.

The Microbiome and Infants

The process of developing a microbiome begins as infants. A baby's GI tract begins with a significant population of microbes during vaginal delivery. As a baby grows, his or her gut continues to accumulate microbes. By the time a child is two years old, the gut microbiome is similar to an adult's own.

Friendly microbes play an important role in an infant's immune system. They basically train an infant's immune system to differentiate between and respond to friendly and undesirable microbes. This is why establishing a healthy gut microbiome early in life has a lasting impact and is one of the major factors in a healthy life.

The Microbiome and Lifestyle

Even though you develop a microbiome early on in life, your lifestyle can affect the health of your gut. What you eat can significantly influence the delicate balance of microbes. Fiber-rich foods like fruits and vegetables increase friendly microbes. Prebiotic fiber is also a nutritional source of friendly microbes. You can get probiotics from eating fermented foods like kefir, yogurt, sauerkraut, and kombucha, but most people don't eat enough of these to sufficiently populate the GI tract.

There are also things that can negatively affect the microbiome. Large quantities of animal fats and proteins encourage the colonization of undesirable microbes. Other things like stress, physical exertion, toxins in diet, exposure to unfriendly microorganisms, and other factors can make it difficult for friendly microbes to colonize your gut.

Research also shows that as you grow older, the number of microbes in your gut declines. To help maintain a healthy microflora balance, you can use probiotic supplements, which contain strains of friendly microorganisms.

PB ASSIST[®]+

dōTERRA recognizes the importance of gut health and so created PB Assist+, a proprietary formula of prebiotic fiber and six active probiotic strains, which come together to support a healthy gut microbiome. The supplement has a unique double-layer vegetable capsule, which makes sure that the six billion colony-forming units of active probiotics is safely transported past your stomach and into your gut.

The six probiotic strains in PB Assist+ are *Lactobacillus acidophilus* (La-14), *Lactobacillus salivarius* (Ls-33), *Lactobacillus casei* (Lc-11), *Bifidobacterium lactis* (Bl-04), *Bifidobacterium bifidum* (Bb-06), and *Bifidobacterium longum* (Bl-05). The first three promote the healthy colonization and function of microflora in the upper GI tract. The latter three support healthy digestive and immune function of the lower intestine. Each of these strains was selected for its stability, potency, viability, and extensive benefits. Research has shown that they don't compete for space in the GI tract and thus won't compete against each other.

You may be wondering what the letters and numbers after a strain mean. They denote the strain of that particular probiotic, which is important because it means it's not a generic probiotic that hasn't been studied.

Each of these proprietary strains has demonstrably shown superior propensity for intestinal adhesion and colonization. By supporting a healthy gut microbiome, probiotics assist the gut in all its important activities, which keeps you healthy.

Primary Benefits of the Numbered Strain Probiotics in PB Assist+

- La-14 is a unique form of *Lactobacillus acidophilus*. It promotes bowel regularity, supports a healthy immune response, aids normal respiratory function, and—together with other bacteria (*Lactobacillus casei* and *Bifidobacterium bifidum*)—supports overall gastrointestinal health.
- Ls-33 has a stabilizing effect on the immune system.
- Lc-11 supports healthy immune function and alleviates minor GI discomfort.
- Like *Lactobacillus acidophilus*, Bl-04 helps to alleviate environmental stresses, soothe minor GI discomfort, and support a healthy immune system.
- Bb-06 has been used with other probiotics (like *Lactobacillus casei* and *Lactobacillus acidophilus*) to support a healthy gut microbiome and healthy metabolic activity.
- Bl-05 has demonstrated its ability to adhere to the GI tract. Together with *Lactobacillus acidophilus* and other probiotics, it also supports healthy immune function.

How to Use PB Assist+

Take one double-layer capsule three times daily with food for 10 days each month. This will help promote the colonization of friendly digestive flora. PB Assist+ can be used more frequently and for extended periods of time when digestive flora has been compromised by digestive stressors or in order to maintain a healthy balance of said flora. It can also be used when traveling to boost digestive immunities or once a day as an ongoing maintenance program for people with occasional digestive discomfort.

LIFELONG VITALITY PACK[®]

OVERALL HEALTH

The Plight of the Modern Diet

Despite having plenty to eat, a significant portion of the world's population is burdened with poor health. Due to current eating habits, most of the world is, in fact, starving for nutrients. Much of what we eat today is highly processed and loaded with harmful ingredients. All the empty calories—devoid of vital nutrients—lead to the impairment of key system functions. Our bodies and minds rely on a steady stream of nutrients like vitamins, minerals, healthy fats, protein, and healthy carbohydrates to function optimally. When we don't get enough of these, it can result in cellular starvation, sluggish organ function, unsatisfied appetites, overeating, and a lack of vitality.

Side Effects of Poor Nutrition

Beyond the poor food options available, modern agricultural practices have decreased the nutritional value of vegetables and fruits, which have always been our most nutrient dense foods. Researchers have measured a loss of key nutrients in our produce, like protein, calcium, phosphorus, iron, riboflavin/vitamin B2, vitamin A, and vitamin C. It has gotten to the point where you would need to eat 21 oranges to obtain the same amount of vitamin A that was found in one orange from the 1950s and 100 apples to get the same amount of vitamin C that an apple had in 1950.^{12,13} Reports show that most adults fail to get the required vitamins for good health from food and most people have almost three nutrient deficiencies.¹⁴ Severe symptoms of these deficiencies aren't common in industrialized nations, but there are many signs of suboptimal nutrient statuses, such as a lack of vitality. The evidence unmistakably shows that people simply aren't getting the nutrients they need from diet alone.

Combine this with high stress levels, a lack of physical activity, poor sleep, and daily exposure to toxins, and you have a perfect storm for cellular nutrient starvation. When you look at the data, it's clear that most of us should be supplementing our diet with a bioavailable food nutrient complex each day. Without it, our cells may not have the nutrients they need to produce the state of vitality we all seek.

The dōTERRA Lifelong Vitality Pack

And that's why dōTERRA introduced a vital group of supplements known as the dōTERRA Lifelong Vitality Pack[®]. These supplements are central to looking and feeling younger, as well as living longer and healthier. This pack contains Microplex VMz[®], xEO Mega[®], and Alpha CRS[®]+ to give your cells the assistance they need to promote vitality.

Adults should take four capsules of each supplement per day with a meal. They're formulated to be taken together daily.

MICROPLEX VMZ[®]

Microplex VMz is a formula of vitamins and minerals that are commonly deficient in modern diets. The formula includes a balanced blend of antioxidant vitamins A, C, and E, as well as an energy complex of B vitamins. In order to increase bioavailability, Microplex VMz uses minerals derived from actual foods.

Glycoprotein Matrix

All of these vitamins and minerals are presented in something called a glycoprotein matrix. Usually, when you eat a piece of food, it contains a variety of nutrients that are recognized and absorbed by your body. Isolated or synthetically created vitamins, on the other hand, are more difficult for the body to recognize and assimilate. To overcome this, Microplex VMz uses a patented process that makes the vitamins glycoprotein compounds. What that means is a vitamin is introduced to a culture of *Lactobacillus* and yeast. As it grows, the yeast metabolizes and binds the vitamin into its protein matrix, which makes the vitamin more recognizable as food in the digestive process.

Why Whole-Food Supplements Are Best

The food-derived minerals in Microplex VMz are similarly cultured in yeast to promote bioavailability. Microplex VMz uses a special process to combine minerals like calcium, iron, and magnesium with amino acids to form complexes. This allows the body to identify, process, and assimilate the minerals more like as if they're being consumed as a food. Evidence suggests that minerals are absorbed better in this form. Iron is absorbed two to four times better, in fact.^{15,16}

Similarly, the unique form of calcium in Microplex VMz demonstrated improved absorption and the ability to remain present in the bloodstream for longer when compared to other common forms of calcium.¹⁷ Greater absorption means your cells have the minerals they need to perform at their best.

A whole-food blend of nutrient- and phytochemicals-rich foods—kale, dandelion, parsley, broccoli, Brussels sprout, cabbage, and spinach—is also included. This also helps improve the body's recognition and assimilation of nutrients.

Optimized Absorption

As mentioned earlier, certain essential oils contain constituents that work in synergy with other ingredients, enhancing their absorption and efficacy. Microplex VMz contains Peppermint, Ginger, and Caraway essential oils to further improve bioavailability, while also simultaneously helping calm the stomach for those who may experience stomach upset with other vitamin and mineral products. Lastly, a blend of active digestive enzymes and mineral cofactors are included for proper assimilation of food nutrients.

Benefits of Microplex VMz

Making the extra effort for the vitamins and minerals to be bioavailable means that Microplex VMz is more effective at:

- Supporting bone health with calcium, magnesium, zinc, and vitamin D.
- Fighting free radicals with the antioxidant vitamins A, C, and E.
- Supporting healthy metabolism and cellular energy.
- Supporting healthy digestion and immune function.
- Providing whole-body benefits of vitality and wellness associated with optimal intake of essential nutrients.

XEO MEGA[®]

FATTY ACIDS

You've probably heard of fatty acids before, but what exactly are they? Essential fatty acids (EFAs) are nutrients required for many key functions, including cell growth, brain development, muscle activity, immune function, joint health, and many others. The thing is your body produces only some fatty acids. You have to get the other essential fatty acids from your food.

Most Common Fatty Acids

The most common EFAs are omega-6—like vegetable oils, foods cooked in vegetable oils, nuts, and seeds—and omega-3 fatty acids, which comes from foods like fish, walnuts, flaxseeds, and chia seeds. The ratio of omega-6 to omega-3 EFAs can significantly influence your health. Evidence suggests that we should be consuming a one-to-one ratio of omega-6 to omega-3 EFAs for optimum health.

What's interesting is before the advent of the modern diet, records indicate that humans met this ratio for hundreds of years. But since the average modern diet today includes a

significant increase in fried foods, fatty foods, and vegetable oils, we aren't meeting this ratio. We get an abundance of omega-6, but not near enough omega-3—about a fifteen-to-one ratio!¹⁸ This disproportionate ratio is linked to poor health.

Health Benefits of Essential Fatty Acids

There's scientific evidence that shows you can experience health benefits by increasing the omega-3s you take in. Some of the benefits include a positive effect on cardiovascular function, brain health, immune responses, skin health, visual acuity, and joint health and mobility.

So what can you do to balance the ratio and get more omega-3s in your diet? The simple answer is to limit the omega-6s in your diet and add more foods that are rich in omega-3s. As mentioned above, some of these foods are fish, flaxseeds, chia seeds, and walnuts.

SUPPLEMENTING OMEGA-3 FATTY ACIDS

dōTERRA xEO Mega[®] is an easy, toxic-free way to increase your intake of omega-3 EFAs. This unique formula of CPTG[®] essential oils, marine EFAs, and land-sourced EFAs helps support joint, cardiovascular, and brain health, as well as healthy immune function.

One serving of xEO Mega offers 900 milligrams (mg) of marine lipids (providing 300 mg of EPA, 300 mg of DHA, and 70 mg of other omega-3s), plus a blend of 250 mg of plant-sourced fatty acids. xEO Mega also includes 800 IU of natural vitamin D and 60 IU of natural vitamin E. It has a milligram of astaxanthin, a powerful antioxidant carotenoid harvested from microalgae. All these beneficial ingredients are encapsulated in a vegetarian-friendly softgel.

The ultra-pure marine oils in xEO Mega are molecularly distilled and microfiltered to remove impurities. The fish oil is tested for over 250 contaminants and certified sustainable by the prestigious Friend of the Sea organization in Europe. xEO Mega also delivers a unique source of land-based oils derived from echium (*Echium plantagineum*) seed. Echium provides a beneficial omega-6 fatty acid called gamma linolenic acid (GLA), which may help support the health of the joints, lungs, and nervous system.

ASTAXANTHIN

Beyond containing these fatty acids, xEO Mega also contains astaxanthin. Astaxanthin is a powerful antioxidant found in algae. It serves to protect the delicate lipids in the brain by traveling throughout the circulatory system to fight against free radical oxidation.

Astaxanthin also provides powerful antioxidant and circulatory benefits, supports eye health, improves muscle strength and endurance, aids the liver and digestive system,

supports skin health, and promotes healthy immune function. Coupled with vitamin E, these antioxidants provide benefits for your entire body.

THE IMPORTANCE OF VITAMIN D

Vitamin D is one of the most important vitamins for overall well-being, immunity, bone and teeth health, regulation of calcium maintenance, brain health, metabolism, lung function, cardiovascular health, nervous system function, and healthy cell renewal. It's estimated that the vitamin D receptor controls up to 5% of the human genome, or about 1,250 genes.^{20,21} xEO Mega includes 800 IU of natural vitamin D.

THE POWER OF ESSENTIAL OILS

xEO Mega contains a proprietary blend of CPTG[®] essential oils—Clove, Frankincense, Thyme, Cumin, Wild Orange, Peppermint, Ginger, Caraway, and German Chamomile—that enhance the activity of the other ingredients in this one-of-a-kind supplement.

Clove, Thyme, and German Chamomile oils are potent antioxidants that provide protection against oxidation. Frankincense, Wild Orange, and Cumin support healthy cellular responses to oxidative stress (an imbalance of free radicals to antioxidants to neutralize them) and healthy immune function. The tummy tamer blend of Peppermint, Ginger, and Caraway promote digestive comfort and improve absorption and bioavailability. Lastly, the essential oils in xEO Mega also function as a natural preservative system that protects the omega-3 fatty acids and lipid-soluble vitamins from oxidizing and going rancid.

ALPHA CRS^{®+}

CELLULAR HEALTH

Cells are the basic building blocks of all life. Healthy tissues, organs, and ultimately organisms depend on cellular reproduction and specialized function and energy production. As we age, cellular function can deteriorate, and we gradually begin to experience decreased energy and performance. Conversely, maintaining the cellular function of youth can preserve vitality well into your mature years.

Cellular stressors such as oxidative stress to cellular DNA and other key cell structures and toxins challenge the health of your cells. Providing them with essential nutrients and metabolic factors supports healthy cell function, vitality, and wellness.

Why Is Cell Health Important?

The healthy lifespan of cells is a key factor in maintaining vitality. When certain cells aren't functioning at optimal levels, the body systems depending on those cells begin to

ing. Your body has millions of specialized cells that are in constant communication with each other through complex chemical pathways. They receive and process information from their external environment, such as temperature changes, nutrient availability, and variations in light levels.

All of this activity is regulated by the DNA in the nucleus of every cell, which acts as the storage center for information. Healthy cells reproduce, perform specialized functions, and set in motion a sequence for self-destruction when their usefulness declines, which makes way for new, healthy cells. If cellular DNA or other critical cell structures are damaged, this process of renewal can be compromised.

Cells and Metabolic Waste

DNA also regulates the proliferation of mitochondria in cells. Mitochondria are cellular structures where oxygen and food nutrients are metabolized to create energy. Healthy mitochondria work like well-tuned engines, producing efficient power with less exhaust (metabolic waste). If too much “exhaust” builds up, the body’s antioxidant defense system takes care of it.

The number and efficiency of cellular mitochondria can decrease as one ages, resulting in decreased energy and performance. Unhealthy mitochondria also put out more toxic waste products in the form of free radical molecules that can damage cellular DNA. If this occurs, it initiates a cascade of events that can damage critical cell structures and disrupt healthy cell function.

Maintaining Youthful Cellular Function

As people age, cells have a hard time managing healthy cellular function. Accumulative failures in cellular function over years is almost always associated with a decline in the activity of a special enzyme called AMP-activated protein kinase (AMPK). This enzyme is present in all cells and acts as the major regulator of how long a cell lives and how well it produces energy. Cellular waste and damaged proteins accumulate in cells as we age due to a decline in AMPK activity. Interestingly, overeating can have a similar effect on cells. The outward manifestations of diminished AMPK activity include unwanted weight gain, poor metabolic activity, and decreased longevity. The good news is that AMPK activity can be boosted to promote overall cellular health and healthy metabolism and maintain youthfulness.

The Danger of Free Radicals

Free radicals are unstable molecules that wreak havoc in cells. Normally, molecules contain even numbers of electrons, bonded as pairs. Free radical molecules are missing one or more paired electrons, and those spare electrons steal electrons from stable

molecules, turning them into free radicals. In turn, the newly formed unstable molecules go on an electron-stealing search, and this pattern continues. This cascading process of free radical damage is called oxidation. When cellular DNA and other critical cell structures are damaged by free radicals, cells don't function optimally.

Antioxidants

Antioxidants are nature's defense against free radicals. They are electron-rich molecules that can safely neutralize free radicals by donating an electron to them before they can damage vital molecules.

Cells defend against DNA damage from free radicals by employing antioxidants. The cells obtain antioxidants from the foods you eat and the supplements you take. Or they manufacture other antioxidants—called endogenous antioxidants—to keep oxidative stress in check. Unfortunately, many of the antioxidants produced by the body have short life cycles, limiting their ability to neutralize a great number of free radicals.

Polyphenols are a particularly powerful group of antioxidants that provide protection against free radical damage to cellular DNA. They have a high capacity to neutralize free radical molecules and have been studied for several longevity health benefits.

ALPHA CRS+

Alpha CRS+ is a proprietary dietary supplement formulated with potent levels of powerful polyphenols that support healthy cell function by providing antioxidant protection to cellular DNA and other critical cell structures. It also includes ingredients that support the body's internal production of endogenous antioxidants.

Key Ingredients in Alpha CRS+

Here are some of the key ingredients in Alpha CRS+:

- Baicalin from Scutellaria root has a long tradition of use in China and supports healthy cell function with its antioxidant activity. It also supports a healthy inflammatory response, joint mobility, and healthy lipid profiles, as well as protects cells against oxidative stress.
- Resveratrol, extracted from Japanese knotweed, is a powerful antioxidant that rejuvenates cellular function.
- Ellagic acid is a naturally occurring substance found in pomegranates, strawberries, raspberries, cherries, and walnuts. It has antioxidant benefits and supports healthy metabolic function, intestinal health, and inflammatory response.

- Grape seeds are rich in antioxidant polyphenols. The antioxidant benefits of these phytochemicals are associated with a wide range of possible health benefits, including support to the nervous, cardiovascular, ocular (eye), and musculoskeletal systems.
- Curcumin from turmeric herb is one of the most well-researched naturally occurring compounds with an array of documented benefits. Chief among its benefits is its powerful antioxidant activity and support of a healthy inflammatory response throughout the aging process.
- Silymarin from the milk thistle herb supports healthy liver function, protects cellular function with its antioxidant activity, and helps maintain mitochondrial integrity. Silymarin also aids in the natural production of a key endogenous antioxidant.
- Boswellic acids extracted from frankincense are best known for their support of healthy immune and inflammatory responses.

Cellular Energy Blend

Alpha CRS+ includes a cellular energy blend of important metabolic factors to help your mitochondria produce energy more efficiently. Basically, mitochondria are in charge of taking in nutrients from the cell, breaking those nutrients down, and then turning them into energy that the cell will use to perform different functions. When you provide the body with a steady stream of metabolic factors, it helps the mitochondria produce energy efficiently, allowing you to maintain youthful energy levels.

What Contributes to the Cellular Energy Blend in Alpha CRS+?

Several ingredients help make the cellular energy blend in Alpha CRS+ effective. Let's take a look at a few of them.

Coenzyme Q10—also known as CoQ10—is crucial to mitochondrial function because it not only supports their activity, but it also acts as a powerful antioxidant within mitochondrial membranes. In addition, CoQ10 supports healthy cardiovascular function and reduces fatigue. Another ingredient known as alpha-lipoic acid also helps to optimize energy production by mitochondria.

Quercetin, a major dietary bioflavonoid found in fruits and vegetables, is one of the most healthy and beneficial molecules with potent antioxidant activity. It stabilizes and protects cellular membrane integrity and neutralizes free radicals to protect some of your body's most delicate tissues (like the eyes, breast, colon, heart, prostate, and lungs) from oxidative damage. In addition, quercetin supports healthy immune and cardiovascular function.

Together, this cellular energy blend supports efficient energy conversion by the mitochondria so that you have the energy needed to maintain your vitality.

SUPPORTING YOUR BRAIN HEALTH

Mental health influences how you feel, think, and behave. This is why it's so important to take care of your brain and your body. Did you know that the brain requires a great deal of oxygen to operate? In fact, it uses about 20% of your oxygen supply to maintain normal function.

The Alpha CRS+ formula includes a botanical extract called Ginkgo biloba, which is known to support healthy oxygen flow to the brain. Healthy oxygen flow to the brain helps maintain normal brain and cognitive function, as well as a positive mindset. An added bonus is that Ginkgo helps maintain mental energy and stamina.

ESSENTIAL OIL CERTIFICATION: Reducing Your Toxic Load with Natural Products

The Introduction of Synthetic Chemicals

Toxicity in Everyday Life

dōTERRA On Guard[®] Foaming Hand Wash

dōTERRA On Guard[®] Sanitizing Mist

Household Cleaning

dōTERRA On Guard[®] Cleaner Concentrate

dōTERRA On Guard[®] Natural Whitening Toothpaste

THE INTRODUCTION OF SYNTHETIC CHEMICALS

Every day, we're exposed to dozens of synthetic chemicals. You might be thinking, But I try so hard to be healthy. Unfortunately, there are a large number of toxic chemicals lurking in the seemingly harmless products that we use every day. The average adult uses nine personal care products each day. Specifically, women use about 12 personal care products per day, which can expose them to up to 168 different ingredients; men typically use six per day, potentially exposing them to about 85 ingredients.

While not all those ingredients are harmful, there are many synthetic chemicals found in products like toothpaste, creams and lotions, soaps and detergents, makeup, shampoo, and more. There are tens of thousands of synthetic chemicals, but only a fraction of them have been adequately tested. This means many of the ingredients in our everyday products haven't yet been tested for toxicity, carcinogens, or possible birth defects. Estimates suggest that one in five adults may be exposed to harmful impurities (things like formaldehyde and ethylene dioxide) from personal care products every single day.

With synthetic chemicals popping up all around us, how do we manage this toxic load and protect our bodies, homes, and families? The answer is to find natural products that are free from synthetic chemicals and questionable ingredients.

TOXICITY IN EVERYDAY LIFE

You've probably heard the word toxicity before. What does it mean? It refers to the ability of a substance to damage organs and tissues, disturb enzyme systems, or disrupt biological processes. Remember, even seemingly harmless substances like water can reach toxic levels. Toxicity is typically dependent on the amount and length of exposure. Plus, some substances simply have a greater propensity to cause harm.

Unfortunately, some of the chemicals we're exposed daily have the potential to disrupt hormone function, cause body systems to operate sluggishly, and put people at a greater risk of ill health. Before you panic about the seemingly inescapable presence of synthetic chemicals, it's important to know that there is a simple solution. By being more conscious about the products you use every day, you can help reduce the toxic load on yourself and others.

dōTERRA ON GUARD[®] FOAMING HAND WASH

On average, adults wash their hands ten or more times a day. While washing your hands is a healthy practice, it's important to know that chemicals aren't just a threat when they're ingested—they can also enter the body and bloodstream through the skin. When you use commercial hand soap, you're often exposing to potentially harmful chemicals like parabens and formaldehyde.

So, how do you avoid toxins if they're potentially entering your bloodstream every time you wash your hands? The dōTERRA On Guard[®] Foaming Hand Wash uses the power of essential oils to give you a safe and natural solution for clean hands.

We already know that the essential oils in the dōTERRA On Guard blend are revered for their natural cleansing and purifying properties, so why not use those powerful properties to keep your hands clean? This is the idea behind dōTERRA On Guard Foaming Hand Wash. This hand wash is a gentle, healthy alternative to harsh soaps that may dry and irritate sensitive skin. Fortified with the power of natural and safe essential oils, dōTERRA On Guard Foaming Hand Wash provides the protective benefits of one of the most popular proprietary essential oil blends. In addition to powerful essential oils, this formula is balanced with pH levels to serve as a protective barrier for this skin, meaning your hands won't dry out after washing.

How to Use dōTERRA On Guard Foaming Hand Wash

Pump the dōTERRA On Guard Foaming Hand Wash Dispenser once or twice to dispense foam onto your hands. Work to a lather with warm water and rinse thoroughly.

dōTERRA ON GUARD[®] SANITIZING MIST

The power of the dōTERRA On Guard Foaming Hand Wash can help you keep your hands clean when at home, but what about when you're on the go? If you hate the feeling of touching the dirty handle of a public restroom door or pushing around a shopping cart that's already been used by dozens of people, then dōTERRA On Guard Sanitizing Mist is for you.

Again, the powerhouse oils from the dōTERRA On Guard Blend here create a sanitizing mist that can eliminate 99.9% of bacteria and other germs on the skin. Fun fact for you: this sanitizing mist contains moisturizing apple extract to help your hands feel smooth and soft.

How to Use dōTERRA On Guard Sanitizing Mist

Apply dōTERRA On Guard Sanitizing Mist after touching or using any of the following:

- Door handles
- Shopping carts
- Airline armrests and tray tables
- Yoga mats and gym equipment
- Public restrooms

Shake well before use. Apply one to two mists directly to your hands. Rub together until dry.

HOUSEHOLD CLEANING

One of the main areas you'll find synthetic chemicals lurking is in your cleaning cabinet. We've all experienced it—walking into a freshly cleaned room and being assaulted by the pungent chemicals left behind. Many household cleaning supplies can irritate the eyes, throat, or skin, causing headaches, respiratory problems, chemical burns, or worse.

Ingredients with highly acute toxicity include chlorine bleach and ammonia (especially if they react together or produce lung-damaging gases), which should be especially avoided by people with asthma or lung and heart problems. Fragrances added to household products like laundry detergents and fabric softeners can cause short-term respiratory irritation, headaches, sneezing, and watery eyes. Other cleaners pose long-term risks—like cancer, brain damage, or hormone disruption—because they contain

harmful ingredients. Fortunately, you can limit your exposure to those risks by choosing greener, more natural household products.

Another factor to consider is the environmental effects of synthetic chemicals. Cleaners don't magically disappear after they bubble down the drain. They're treated along with sewage and other waste at municipal treatment plants, then discharged into nearby waterways. While some of the chemicals break down into harmless substances during or shortly after treatment, many remain in the environment, reducing the quality of drinking water and threatening wildlife, plants, and people. Volatile organic chemicals can also escape into the air, contributing to smog and pollution. We can each do our part to protect the environment by rejecting products with harmful chemicals and investing in natural products.

dōTERRA ON GUARD[®] CLEANER CONCENTRATE

dōTERRA On Guard Cleaner Concentrate is designed to be the ideal multipurpose natural cleaner. It's fortified with the proprietary dōTERRA On Guard Protective Blend, which provides natural protection against certain environmental factors, while also elevating overall cleaning capability.

Why use dōTERRA On Guard Cleaner Concentrate instead of the host of cleaning products you already have under your sink or in your closet? For starters, this natural cleaner is nontoxic and biodegradable. It includes plant-based surfactants so you can clean effectively without exposing your family to harsh chemicals. Plus, it's a multipurpose cleaner, so you won't need a dozen products to clean the kitchen, bathroom, and rest of the house.

How to Use dōTERRA On Guard Cleaner Concentrate

As mentioned, this powerful cleaner can be used in several rooms across different surfaces. One of the simplest ways to use this product is to mix about two spoonfuls of dōTERRA On Guard Cleaner Concentrate with 24 ounces of water to create a multipurpose cleaner that's perfect for countertops, bathroom sinks, and other common areas throughout the home.

- For a multipurpose cleaner, mix two tablespoons of dōTERRA On Guard Cleaner Concentrate per 24 ounces of water.
- For bathrooms, mix three tablespoons of the cleaner per 24 ounces of water.
- For dishes, mix three tablespoons of the cleaner per gallon of water.
- For tough jobs, apply the cleaner directly on designated area, and then let soak.

You should avoid direct use of this cleaner on hardwood floors and natural stone.

dōTERRA ON GUARD[®] NATURAL WHITENING TOOTHPASTE

If you follow the recommendations to brush at least twice daily, you likely use about six tubes of toothpaste each year. Many people scrutinize food labels but have no problem buying personal care products like toothpaste without even a glance at the ingredients. Though you aren't supposed to swallow it, some of the chemicals in toothpaste do make it into the bloodstream because of the high absorption rate of oral cavity. Some commercial toothpastes include harmful ingredients that can disrupt hormones, cause thyroid issues, and more.

What's better than a toothpaste that doesn't contain a long list of mystery ingredients? How about a natural toothpaste that also reduces plaque and whitens teeth? dōTERRA On Guard Natural Whitening Toothpaste combines the protective benefits of the dōTERRA On Guard blend with other natural ingredients that help give teeth an extra cleaning boost. Don't settle for questionable toothpaste formulas any longer—switch to a natural solution and still enjoy a bright, clean smile.

How to Use dōTERRA On Guard Natural Whitening Toothpaste

After flossing, apply a pea-size amount of paste to a moistened toothbrush. Brush gently but thoroughly, preferably after each meal and in the morning and at night. For best results, don't rinse, eat, or drink for approximately 30 minutes after brushing. Use as directed by a dentist or physician.

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