



Myth Busting Essential Oil Safety

FACT VS. FICTION

Defining an Essential Oil

The International Standards Organization (ISO) gives this definition:

An essential oil is a product obtained from natural raw material, either by distillation with water or steam, or from the epicarp of citrus fruits by mechanical processing, or by dry distillation. The essential oil is subsequently separated from the aqueous phase by physical means.

This describes how the essential oil is obtained, but provides no information on its nature.

Defining an Essential Oil

Drs. Franchomme and Pénéol use the terms of photosynthesis to describe an essential oil:

Plant essences, in the physiological meaning of the term are most certainly true life essences, elaborated by the secretory cells of the plants that have tapped the photo-electric-magnetic energy of the sun and have converted it, with the intervention of enzymes, into biochemical energy in the form of highly diversified aromatic molecules.

What Are Essential Oils?

- ▶ An essential oil is the distilled, or expressed, product of the volatile components synthesized by various plant tissues of a single plant species.
- ▶ The alchemist Paracelsus (1493-1541) coined the term *essence, which equated to spirit*. In alchemy, the term spirit refers to the personality or extract of something that retains the qualities of the original substance.
- ▶ The term *essential* was applied to these oils because they held the essence or fragrant part of the plant.

Concentration and Potency

- ▶ Essential oils are **highly concentrated forms of the plant or herb part** from which they are derived.
- ▶ For perspective, 1 drop of essential oil can equal around 30 cups of herbal tea in terms of concentration.
- ▶ Essential oils can be **up to 75 or 100 times more concentrated than the fresh herb**.
- ▶ It takes 30 hand-picked blossoms or 2,000 petals to produce 1 drop of rose (*Rosa damascena*) essential oil.

Secondary Metabolites

- ▶ Are not necessary for the growth and propagation of the plant; however, plants would not survive without them
- ▶ Attract pollinators
- ▶ Attract beneficial insects to prey on the plant's predators
- ▶ Provide protection by repelling harmful insects and herbivores
- ▶ Serve as antibiotics and antimicrobial compounds for plants
- ▶ **Allelopathy**: prevent the growth of competing vegetation
- ▶ **Antitranspirant**: reduce the rate of the loss of water

Where are essential oils found?

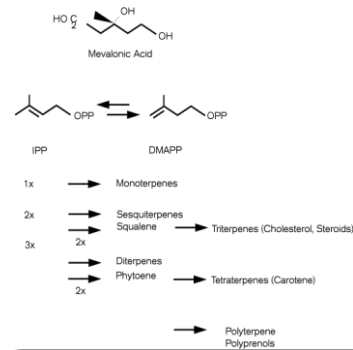
- ▶ **Flowers:** jasmine, rose, ylang ylang, neroli
- ▶ **Leaves:** citronella, lemongrass, petitgrain, peppermint
- ▶ **Bark:** cinnamon
- ▶ **Inner bark or wood:** sandalwood, cedarwood, rosewood
- ▶ **Resin:** myrrh
- ▶ **Seed:** fennel
- ▶ **Fruit peel:** bergamot, lemon, lime, orange, mandarin
- ▶ **Root:** ginger, vetiver, valerian
- ▶ **Berries:** juniper

Our Definition of Essential Oil

- ▶ **Extracted by various means**, including steam and dry distillation or expressing from the plant material of a single species
- ▶ Secondary plant metabolites – serving various roles
- ▶ Volatile components of aromatic plants:
 - ▶ Can be flammable
 - ▶ Generally less dense than water
 - ▶ Generally non-polar and insoluble in water
 - ▶ Can be found in many plant parts depending on the species
 - ▶ Highly concentrated forms of the plant or herb

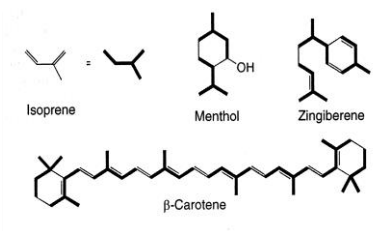
Mevalonic Acid Pathway

The biosynthesis of terpenes, sesquiterpenes, and ultimately cholesterol and carotenoids is often referred to as **Mevalonic Acid Pathway**.

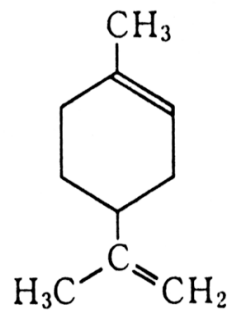


Isoprene Unit

Isoprene Example



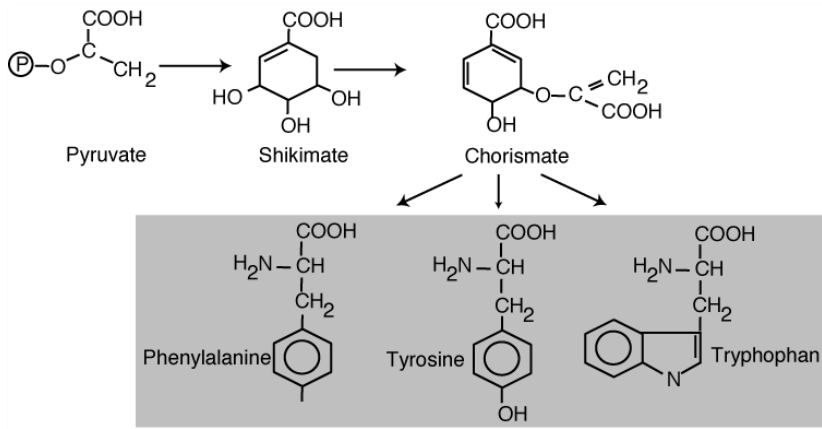
Limonene Example



Functional Group Families Derived From Mevalonic Acid Pathway

- ▶ Monoterpenes
- ▶ Sesquiterpenes
- ▶ Diterpenes
- ▶ Triterpenes
- ▶ Oxides
- ▶ Esters
- ▶ Aldehydes
- ▶ Ketones
- ▶ Lactones
- ▶ Chemopreventative
- ▶ Anti-inflammatory
- ▶ Anti-infectious
- ▶ Chemopreventative
- ▶ Antinociceptive
- ▶ Sedative
- ▶ Anti-infectious
- ▶ Wound healing
- ▶ Anti-inflammatory

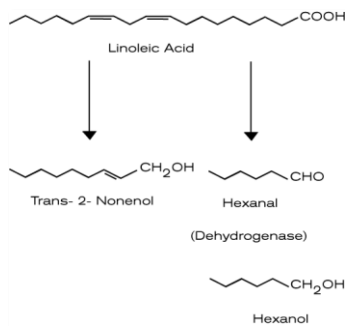
Phenyl Propanoids: Primary Metabolites



Functional Groups Derived From Shikimic Acid Pathway

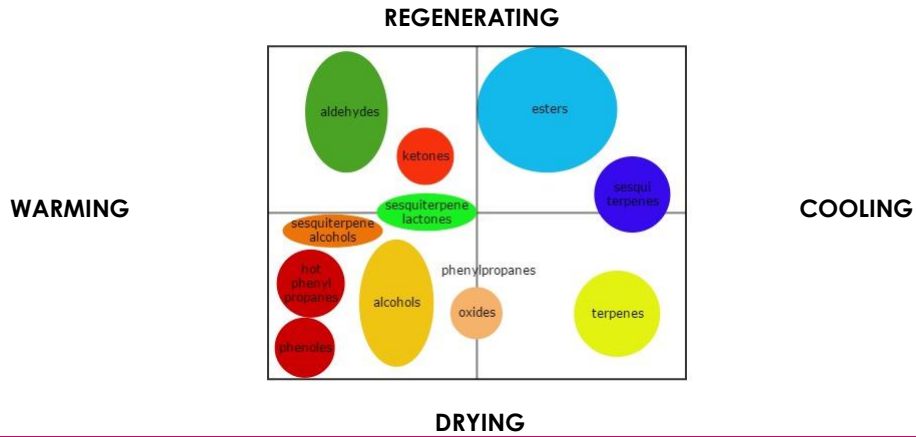
- ▶ **Phenols**-rubefacient, anti-infectious
- ▶ **Phenyl methyl ethers**-antispasmodic, anti-nociceptive
- ▶ **Coumarins**-antilymphoedemic
- ▶ Thymol, Carvacrol
- ▶ Eugenol, safrole, methyl chavicol, methyl eugenol
- ▶ Furanocoumarins- bergaptene

Fatty Acid Metabolism



Molecules found in essential oils also arise from other biosynthetic pathways, e.g. [certain high-impact trace components originate from the fatty acid metabolism.](#)

The 12 Main Classes of Compounds



What is Essential Oil Safety?



SAFETY: "THE CONDITION OF BEING PROTECTED FROM OR UNLIKELY TO CAUSE DANGER, RISK, OR INJURY."

"SAFETY CAN ALSO BE DEFINED TO BE THE CONTROL OF RECOGNIZED HAZARDS TO ACHIEVE AN ACCEPTABLE LEVEL OF RISK."

“The Difficult Art of the Therapist” ~Dr. Jean Valnet, MD

“All is poison, nothing is
poison.”

~ Paracelsus



Key Areas Around Essential Oil Safety

- ▶ Identification of species, origin, chemotype, extraction method, date of production
- ▶ General understanding of essential oil constituents, pharmacokinetics, and pharmacodynamics
- ▶ Safety guidelines for application methods: Dermal, Inhalation, Oral, and Internal
- ▶ Dilution rates, dosage, and duration, especially for children, the elderly, or frail
- ▶ Potential drug interactions
- ▶ Potentially hazardous essential oils
- ▶ Allergies
- ▶ Sensitizers
- ▶ Recognizing adverse reactions

Pharmacology

- ▶ Pharmacology is the study of the actions and effects of drugs on living organisms.
- ▶ The World Health Organization defines a drug as 'any substance or products that is used or intended to be used or modify or explore physiological systems or pathological states.'
- ▶ This would include essential oils, when used in the context of aromatherapy.

Two Branches

**PHARMACODYNAMICS –
WHAT THE DRUG DOES TO THE BODY**

**PHARMACOKINETICS –
WHAT THE BODY DOES TO A DRUG**

Pharmacodynamics

- ▶ **Pharmacodynamics – what the drug does to the body**
- ▶ **Focuses on:**
- ▶ **How drugs bind to targets,**
- ▶ **Biochemical, physiological and possible adverse effects of drug binding**
- ▶ **Potency, specificity and efficacy of drugs**
- ▶ **Drug binding affinity for target site.**
- ▶ **Using these qualities to determine the usefulness of a drug.**

c. Terracino Amanda Lattin 2009

Pharmacodynamics of Essential Oils

- ▶ Drug molecules work by binding or interacting with target molecules.
- ▶ Essential oil molecules are active with several types of target molecules, these include:
 - ▶ Cell membranes, neuronal and muscular ion channels, neurotransmitter receptors, G-protein coupled and second messengers, enzymes, even DNA molecules (rarely)
- ▶ **Binding affinity – how prone a drug molecule is to bind to another molecule, specifically target molecules.**
- ▶ **Agonist – binds to the same receptor and has the same action as the molecules produced by the body.**
- ▶ **Antagonist – binds to the same receptor, but has no effect or the opposite effect.**

c. Terracino Amanda Lattin 2009

Selectivity

- ▶ Lock and Key Model
- ▶ In reality, drugs, including EOs bind to many sites.
- ▶ Want some selectivity or drug is not useful.
- ▶ Essential Oils generally have low selectivity
- ▶ Diverse components of essential oils show potent selective effects. Also, the large number of constituents found in EO allows one 'drug' to address many aspects of one disease. Ex: Nervous anxiety and eczema
- ▶ Lavender can reduce anxiety on CNS level and provide topical anti-inflammatory actions

c. Terracina Amanda Lattin 2009

Potency and Efficacy

- ▶ Potency – shown by the amount required to achieve the desired action or effect. The lower the dose required, the higher the potency.
- ▶ There is a range of potency within EOs
- ▶ Efficacy is the extent of the ability of a drug to produce the desired effect. Again, dosage is a determinate factor here.
- ▶ Also, choosing the appropriate essential oil, dosage, and delivery mechanism will affect efficacy.

c. Terracina Amanda Lattin 2009

Essential Oils Actions Relevant to Pharmacodynamics and Safety

- ▶ **Hypotensive effects** via calcium ion channel interaction.
- ▶ **Convulsant effects**, due to interaction with nervous tissue, "neurotoxicity".
- ▶ **Sedative effects**, due to depression action on the CNS.
- ▶ Blood clotting interaction due to **anti-platelet activity**.
- ▶ **Possible** interaction with the endocrine system due to **possible** estrogenic effects.
- ▶ **Irritation** to the integumentary system due to irritation, sensitization, photosensitization.



Potential Drug Interactions

Pharmacokinetics

PHARMACOKINETICS – WHAT THE BODY DOES TO A DRUG

ABSORPTION, DISTRIBUTION, METABOLISM, EXCRETION OF DRUGS.

THE EFFECTIVENESS OF A MOLECULE AS A DRUG IS DETERMINATE ON THE RATES OF THESE ACTIONS.

c. Terracina Amanda Lattin 2009

Essential Oil Absorption



"Starr 050125-3235 Eucalyptus globulus" by Forest & Kim Starr.
Licensed under CC BY 3.0 via Wikimedia Commons -

- ▶ Essential oils can be absorbed into the body via several pathways. However, they all involve the essential oil constituents passing into the blood stream through a membrane.
- ▶ Essential oils can be absorbed via the skin, the lungs, orally through the intestinal tract, rectally, and vaginally.

c. Terracina Amanda Lattin 2009

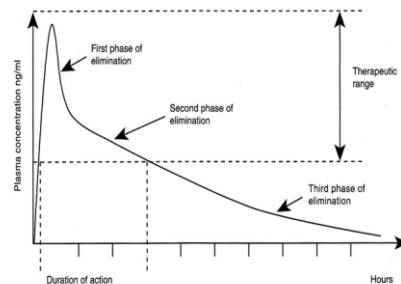
Drug Metabolism and Elimination

- ▶ As soon as an essential oil (or any drug) is in the bloodstream, the body begins to modify it.
- ▶ The main strategy to take a molecule and break it down into smaller more polar molecules.
- ▶ This will make it easier for the kidneys to process and eliminated the drug via these new 'metabolites' of itself.
- ▶ Sometimes it is these metabolites that produce the therapeutic or toxic actions of a drug.

c. Terracina Amanda Lattin 2009

Plasma Concentration

- ▶ Often used to measure the quantity of a drug that is present in the body at a particular time.
- ▶ Units of measurement are usually: ng or mg of substance per ml of plasma
- ▶ May not be an accurate measurement of the quantity of drug in the body.
- ▶ Plasma concentration curves used to measure proportion of the initial dose absorbed.



c. Terracina Amanda Lattin 2009

Absorption

- ▶ Two application methods used (safely) by aromatherapists with no medical training are inhalation and dermal application.
- ▶ This delivers doses to either the skin or respiratory membranes.
- ▶ Both methods will eventually deliver EO doses to the circulatory system – at different speeds and in different amounts.



"English Lavender" by The original uploader was Webserendipity at English Wikipedia - Transferred from en.wikipedia to Commons.. Licensed under CC BY 2.5 via Wikimedia Commons -

c. Terracing Amanda Lattin 2009

Absorption via the Skin

- ▶ Essential oils are applied dermally either neat or diluted in carrier oil.
- ▶ Carrier oil reduces or slows evaporation of essential oil constituents and may help their penetration of the skin.
- ▶ The blend is left on the skin for several hours – this enables a slow extended absorption – compared to the rapid absorption via the lungs.
- ▶ The concentration of essential oil present on an area of skin can change the effect produced.



"XN Matricaria recutita 00" by Guido Gerding - Personal photograph taken by Author, URL: Ex :: Natura - Freies Portal für Umweltbildung (Environmental Education). Licensed under CC BY SA 3.0 via Wikimedia Commons -

c. Terracing Amanda Lattin 2009

Absorption via the Skin

- ▶ The constituents of essential oils have different binding affinities for the plasma lipoproteins and tissues of the body – this will decide their plasma concentration and if they have multiple phases.
- ▶ Essential oil constituents are very likely to be compartmentalized into the high lipid areas of the body such as the adipose tissue layers and the brain.
- ▶ Terpenoid constituents readily move into the sebaceous layer that cover the skin because they are highly lipophilic.
- ▶ Different constituents absorb at different rates.
- ▶ Again, molecular size, polarity and solubility are factors.

c. Terracina Amanda Lattin 2009

Absorption via the Skin

- ▶ Terpenoid constituents can dry the skin by absorbing the sebaceous layer.
- ▶ Terpenoids may also affect the lipids between the cells of the stratum corneum thus allowing larger drug molecules to pass.
- ▶ However, the keratinised cells found in the stratum corneum limit the rate of absorption more than the thin epithelium found in the lungs.
- ▶ Where the stratum corneum is thinnest is where the higher rates of absorption occur. Face, scalp

c. Terracina Amanda Lattin 2009

Final Aspect of Skin Absorption

- ▶ Once the molecules have passed through the Stratum Corneum, they pass into the epidermis and the dermis.
- ▶ Although the absorption rates from dermal applications directly into the adipose layers (without entering the blood stream) have not been researched – they do exhibit anti-inflammatory and analgesic effects on muscle and joints.
- ▶ Sesquiterpenoids are absorbed in the skin, but not rapidly cleared into the blood stream.

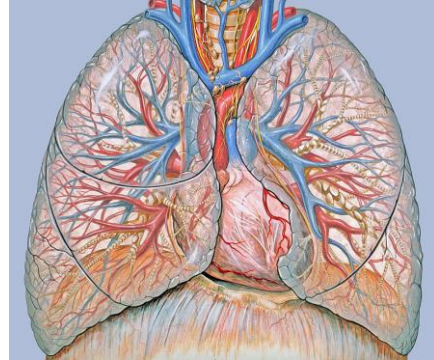
© Terracina Amanda Lattin 2009

Monoterpenes and Sesquiterpenes in Sheep's Blood and Milk

- ▶ A mixture of the following terpenes was applied to sheeps' skin on their back for a period of 18 days. α -pinene, limonene, and β -caryophyllene.
- ▶ Blood and milk samples were taken throughout the administration period.
- ▶ Limonene and α -pinene were found in all blood and milk samples after a lag-phase of 2 days.
- ▶ β -caryophyllene was detected in all milk samples, but only a few blood samples.

Absorption via the Respiratory System

- ▶ Lungs – large absorption area. Thin epithelial layer and lipophilic surface.
- ▶ High blood flow – will increase the rate of absorption in the blood stream.
- ▶ Monoterpenes absorb faster than sesquiterpenes due to smaller size.
- ▶ Other determinate factors include: molecular size, polarity, and solubility.



"Thoracic anatomy" by Patrick J. Lynch, medical illustrator - Patrick J. Lynch, medical illustrator. Licensed under CC BY 2.5 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Thoracic_anatomy.jpg#/media/File:Thoracic_anatomy.jpg

c. Terracing Amanda Lattin 2009

Half - Life

- ▶ The half life of a drug is the time it takes for its plasma concentration to decrease by half of its initial measurement.
- ▶ If the EO has high lipophilicity, then there can be bi- and tri-phased distribution. Each phase has a different half life.
- ▶ Half life can be modified by changes in the function of metabolic and excretory organs – i.e. the liver and kidneys. Also, by delivery mechanism.



"Take five" by HerbertT (original); edit by Waugsberg - Eigenproduktion. Licensed under CC BY-SA 3.0 via Wikimedia Commons -

c. Terracing Amanda Lattin 2009

Pharmacodynamics of D-Limonene

- ▶ Used "30-40 oz of Mediterranean-style lemonade with a light breakfast".
- ▶ This lemonade used the whole lemon. These large quantities delivered 596mg and 447 mg of D-limonene.
- ▶ Showed max level of perillid acid in plasma in one hour.
- ▶ Was undetectable in plasma in 24 hours.
- ▶ Other work has shown that it can take several days for limonene to completely metabolize out of the body.



"Lemon" by André Karwath aka Aka - Own work. Licensed under CC BY-SA 2.5 via Wikimedia Commons -

Essential Oils in Cow's Milk

- ▶ Due to the research into including essential oils or essential oil bearing plants into animal feed for their antibiotic properties, a 2013 study investigated the effects of essential oil administration on the content of cow's milk.
- ▶ Caraway and oregano essential oils were used.
- ▶ The cows were given either a dose of essential oil diluted in sesame oil directly into the duodenum or an inhalation of essential oil.
- ▶ Milk was tested immediately before and after essential oil exposure.
- ▶ Unaltered essential oil constituents were found in the milk immediately after essential oil exposure.
- ▶ But were not found in the milk the following morning.
- ▶ **Caraway:** limonene, carvone, and carvacrol **Oregano:** carvacrol, p-cymene
- ▶ "Terpene content for treatment milk samples was characterized by the same terpenes found in the treatment essential oil used for that animal, regardless of pathway of exposure."

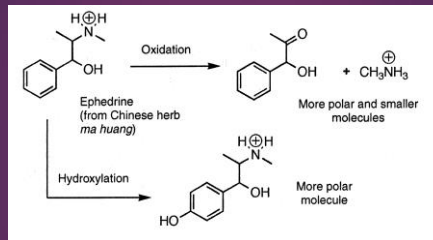
Daily Inhalation of Alpha-Pinene in Mice

- ▶ Mice were given inhalations of alpha-pinene 90 min. a day for 1 day, 3 days, or 5 days.
- ▶ Mice were given a plus maze stress test for 10 minutes after the inhalation.
- ▶ Analysis showed that there was a "significant anxiolytic" effect for the 5 days.
- ▶ Analysis also showed accumulation of alpha-pinene in the brain and liver.
- ▶ Accumulation peaked on the third day.
- ▶ Researchers felt this occurred due to the response to the introduced stress in the new environment, and helped keep the anxiolytic effect constant.

Phase I – P450 or CYP

- ▶ Different people metabolize via P450 and its related isozymes at different rates. This is genetic trait.
- ▶ That is why some people need more or less of a drug than other to achieve the therapy or toxicity.
- ▶ In the near future, there will be technology that will allow each of us to find out if we are a slow or fast metabolizer.
- ▶ EO constituents that are metabolized via the P450 path in the liver can affect pharmaceutical drug levels in the body.
- ▶ This can be beneficial or detrimental. However, the aromatherapist needs to be aware of client's medications for this reason.

Phase I Liver Metabolism



HERE EPHEDRINE IS METABOLIZED IN TWO DIFFERENT WAYS TO CREATE NEW MORE POLAR OR MORE POLAR AND SMALLER MOLECULES FOR EXCRETION.

c. Terracing Amanda Lattin 2009

Phase II Liver Metabolism

- ▶ Instead of breaking molecules down into smaller more polar molecules, Phase II adds specific polar groups to a molecule to make it more polar.
- ▶ Usually, the result of these reactions is creating molecules that resemble polar plant glycosides, which dissolve easily in cells.
- ▶ Many plant molecules, especially ones with phenolic hydroxyl groups, exist as glycosides, meaning in combination with sugar molecules, to be polar and H₂O soluble.
- ▶ When they encounter the stomach they usually lose their sugar group and become non-polar.
- ▶ Phase II gives them back a polar group.

c. Terracing Amanda Lattin 2009

Effects of Some Essential Oils on Mouse Liver Enzymes

- ▶ Essential oils of **cardamom, celery seed, cumin seed, coriander, ginger, nutmeg, and zanthoxylum** EOs were given by gavage, 10 microliters/day for 14 days.
- ▶ Nutmeg and zanthoxylum **induced** P450 significantly.
- ▶ Cardamom caused **reduction** in P450 activity.
- ▶ Aryl hydrocarbon hydroxylase activity **increased** with ginger. Nutmeg oil decreased it.
- ▶ "Glutathione S-transferase activity was **significantly elevated** in all experimental groups"



"Chillis and Coriander (4884045579)" by Vegan Feast Catering - Fixin's. Licensed under CC BY 2.0 via Wikimedia Commons -

Detoxification of Xenobiotics

A COMPLEX SYSTEM OF CYTOCHROME P-450 ENZYMES HAS EVOLVED TO REMOVE NON-NUTRIENT SECONDARY METABOLITES FROM THE ORGANISM.

PRACTICALLY ALL EO COMPONENTS STIMULATE THIS SYSTEM IN ONE WAY OR ANOTHER AND INDUCE THE REMOVAL (BIOTRANSFORMATION) OF TOXINS FROM THE BODY.

Essential Oil Administration

- ▶ Administration should reflect desired action.
- ▶ Applying essential oils to the affected area or system gives the best results.
- ▶ For psychological, emotional, or spiritual work, olfactory stimulation is a must, but can also be incorporated into other applications such as massage or other forms of dermal application.
- ▶ This gives the benefit of all aspects of EO actions.
- ▶ Inhalation for respiratory problems, infections, or for quick entrance to blood stream.

c. Terracina Amanda Lattin 2009

Safety Guidelines for Dermal Application

- ▶ Photosensitization
- ▶ Sensitization
- ▶ Sensitivity / allergic responses
- ▶ Dilution rates
- ▶ Ways to increase absorption
- ▶ Removal of irritating essential oil
- ▶ Skin patch testing
- ▶ Increased absorption of drugs
- ▶ Broken or damaged skin
- ▶ Cautions and contraindications



Image: <http://healthyhints.com.au/images/aromatherapy-that-works26418739121.JPG> retrieved 10/15/15

Phototoxicity and Photosensitization

- ▶ Certain essential oils cause photosensitization to the skin while they are present.
- ▶ Meaning sensitivity to ultraviolet light, including sun-light and artificial UV light as found in a tanning bed.
- ▶ This can range from a mild burn to a deep weeping burn. NAHA (2015)
- ▶ To read and see a first hand photosensitivity experience by a lay essential oil user visit: <http://thehomespunlife.com/photo-sensitive-essential-oils/>
- ▶ *Please note, I am not endorsing this website or any of the advice given there.

Photosensitizing or Phototoxic Essential Oils

- ▶ Bergamot, *Citrus aurantium* var. *bergamia*
- ▶ Lemon, *Citrus limon*
- ▶ Lime, *Citrus aurantifolia*
- ▶ Angelica root, *Angelica archangelica*
- ▶ Bitter orange, *Citrus aurantium*
- ▶ Rue, *Ruta graveolens*
- ▶ Grapefruit, *Citrus paradise*
- ▶ Cumin, *Cuminum cyminum*



Klaber RE. (2006) Phytophotodermatitis. Arch Dis Child. 91(5):385.

Safety Guidelines for Aromatherapy Baths

- ▶ The heat from the warm bath water increases circulation in the skin. This also increases the amount of essential oil that can be absorbed during the bath.
- ▶ Also, during a bath, the individual is receiving the essential oil via two pathways: via inhalation/olfaction and skin absorption.
- ▶ For these reasons, it is important to limit the amount of essential oil added to the bath.
- ▶ Also, certain oils are irritating to the skin and mucous membranes and should also be avoided in a bath.



"Roman bath at bath england". Licensed under Public Domain via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Roman_bath_at_bath_england.jpg#/media/File:Roman_bath_at_bath_england.jpg

Some Mucus Membrane Irritant and Dermal Irritant Essential Oils

- ▶ Oregano
- ▶ Thyme
- ▶ Cinnamon (bark and leaf)
- ▶ Cassia
- ▶ Garlic
- ▶ Onion
- ▶ Clove (bud, leaf, stem)
- ▶ Fir needle
- ▶ Oxidized essential oils
- ▶ High phenol, aldehyde, sesquiterpene lactone content



Sensitivity and Allergic Reactions

- ▶ Essential oil constituents **can be allergens**.
- ▶ There is information circulating that essential oil constituents can not be allergens because they contain no proteins.
- ▶ This however, is **incorrect** information.
- ▶ Essential oils do not contain the proteins and amino acids that usually trigger an allergic response in the body.
- ▶ They do however, contain **haptens** and **pre-haptens**.
- ▶ These small molecules can bind to proteins once in the body.
- ▶ This protein and hapten combination can elicit an allergic response.



Sensitization

- ▶ Sensitization is a reaction involving the immune system.
- ▶ "A state in which the body is sensitized to particular stimuli, e.g. (1) certain individuals exposed to some antigens by a particular route elicit an immune response which may be antibody-mediated, particularly IgE, or cell-mediated, which sensitizes them such that subsequent exposure to the same antigen elicits an allergic response; said especially of such exposure resulting in a hypersensitivity reaction."
- ▶ Saunders Comprehensive Veterinary Dictionary, 3 ed. © 2007 Elsevier, Inc. All rights reserved

Sensitization

- ▶ "1. A state or condition in which the response to a second or later stimulus (e.g. a drug) is greater than the response to the original stimulus (e.g. first administration of the drug). 2. The process in which exposure to an antigen results in the development of hypersensitivity."
- ▶ Millodot: Dictionary of Optometry and Visual Science, 7th edition. © 2009 Butterworth-Heinemann
- ▶ A sensitization reaction can occur after applying the same essential oil or essential oil blend every day or frequently over longer periods of time.
- ▶ The reaction produces a red, itchy, sometimes painful skin rash that is persistent until the allergen is removed. Often, once this happens, the person remains sensitized to this essential oil for many years or for life.

Some Sensitizing Essential Oils

Strong

- ▶ Cinnamon
- ▶ Garlic
- ▶ Cassia
- ▶ Oakmoss
- ▶ Fig leaf
- ▶ Backhousia *Backhousia citriodora*
- ▶ Turpentine oil *Pinus spp.*
- ▶ Verbena absolute *Lippia citriodora*
- ▶ Peru balsa *Myroxylon pereirae*
- ▶ Tea absolute, *Camellia sinensis*
- ▶ Inula, *Inula graveolens*
- ▶ Oxidized essential oils, especially needle tree or citrus oils.



Some Sensitizing Essential Oils

Weak or Potential Sensitizers

- ▶ Star Anise and anise
- ▶ Ylang ylang
- ▶ Lemongrass
- ▶ Pine (dwarf and Scotch)
- ▶ Melissa
- ▶ May chang (Litsea cubeba)
- ▶ Pay attention to essential oils with high aldehyde and phenol content.



Skin Patch Testing

- ▶ Skin patch testing is one of the most important safety precautions in aromatherapy.
- ▶ Skin Patch tests are easy to perform.
- ▶ Can check of both sensitivity and sensitization.
- ▶ A sensitivity test is checked over 24 hours.
- ▶ A sensitization check over 48 hours, with two applications.



Skin Patch Testing

- ▶ To perform a skin patch test, use the crook of the arm, with clean skin.
- ▶ For diluted oils, place enough of the blend to cover the inside of the elbow.
- ▶ Cover and leave on for 24 hours.
- ▶ For undiluted oils, place one drop on the inside of the elbow. Close arm for several minutes.
- ▶ Check for sign of sensitivity for 24 hours.
- ▶ If burning or irritation occurs, apply base oil or milk, then wash with soap and water.



Skin Patch Testing

- ▶ To perform a test for sensitization, begin the same as a test for sensitivity.
- ▶ After 24 hours, reapply the essential oil in the same dilution as the first application.
- ▶ Leave on for another 24 hours.
- ▶ Usually sensitization will begin to show within 48 hours.



Safety Guidelines for Aromatherapy Inhalations

- ▶ Inhalation is generally a safe method of essential oil administration.
- ▶ Remember inhalation occurs anytime around essential oils.
- ▶ Work in a well ventilated area. Take fresh air breaks.
- ▶ Avoid high level exposure for longer than an hour.
- ▶ Steam inhalations require only a few drops of essential oils, and few minutes of inhalation.
- ▶ Some oils irritate the eyes and mucus membranes.



Safety Guidelines for Internal Use

- ▶ Know the intention for the internal or oral use of the essential oil(s)
- ▶ Know the RDD for the essential oil(s) and follow it.
- ▶ Know the duration guideline for the essential oil(s).
- ▶ Use an appropriate delivery method.
- ▶ Seek advice from a trained aromatherapist, herbalist or other health care practitioner with training in using essential oils internally.



Safety Guidelines for Internal Use

- ▶ Many internal use protocols use around 1 to 3 drops of essential oil.
- ▶ Often gel capsules are used.
- ▶ Honey, sugar cubes, and charcoal have also be used as a delivery tool.
- ▶ Using essential oils in water often coats the mouth, esophagus, and stomach with the essential oil.
- ▶ Oral ingestion will deliver 100% of the essential oil to the system.



"Valle Honiggläeser 13a" by Waugsberg - Own work. Licensed under CC BY-SA 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Valle_Honiggläeser_13a.jpg#/media/File:Valle_Honiggläeser_13a.jpg

Signs of Toxicity

- ▶ Two types: Chronic toxicity and acute toxicity
- ▶ **Acute toxicity** would arise from one large dose of the essential oil.
- ▶ **Chronic toxicity** would arise from repeated use of the essential oil.
- ▶ Acute toxicity would be considered poisoning.
- ▶ A **poison** damages or inhibits the system, as opposed to a **lethal substance**, which kills the system.



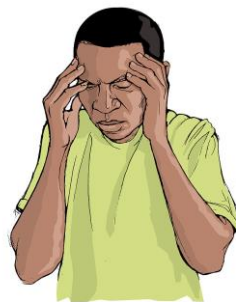
Signs of Toxicity

- ▶ Signs of acute toxicity with ingested essential oils: nausea, vomiting, diarrhea, confusion, ataxia, and coma.
- ▶ Most recorded cases of acute toxicity or poisoning from essential oils have come from ingestion of large amounts of essential oils.
- ▶ However, these large amounts of essential oils are readily available, 5ml, 15ml.



Signs of Toxicity

- ▶ Repeated, continued use of the same essential oil(s) without break can lead to signs of chronic toxicity (or sensitization).
- ▶ This can include: headache, fatigue, cough, kidney and liver irritation, upset stomach, diarrhea, urinary disturbance/changes.
- ▶ The best way to check for a correlation between essential oil use and these signs, is to remove the essential oil and note changes.



Oral Use: Delivery Method Makes a Difference



- ▶ Encapsulated vs. unencapsulated
- ▶ Microencapsulation vs. enteric
- ▶ Whole herb
- ▶ Half life and bioavailability changes

Case Study: Internal Use of Essential Oils

- ▶ W.T. is a female in her mid thirties complaining of abdominal discomfort, occasional constipation, indigestion, and bloating.
- ▶ She has been evaluated by two NDs and undergone several courses of herbal support plans, with some improvement.
- ▶ She has seen a gastroenterologist who diagnosed gallstones and some inflammation of the small intestine.
- ▶ W.T. underwent treatment with her ND for the gallstones and the intestinal inflammation.
- ▶ This process took place over 2 years. A.S. has seen improvement in her symptoms but not resolution.
- ▶ W.T. continues to struggle with discomfort and sees a colon hydrotherapist. Hydrotherapist advises there is evidence of yeast and/or parasites in the stool.

Case Study: Internal Use of Essential Oils

- ▶ W.T. researches on her own and finds a testimonial about a woman who had similar issues, and used a Vitamin A and oregano essential oil protocol with good results.
- ▶ I advise against this, as it may be irritating. But, W.T. feels strongly she wants to try it.
- ▶ Solution of 25% oregano *Origanum minutiflorum* essential oil and 75% olive oil. With Vitamin A palimate, 10.1mcg per drop of solution.
- ▶ W.T. takes 10 drops of sol. 3 x daily = 7 drops of oregano essential oil. For two weeks.
- ▶ Break for 5 weeks.
- ▶ Then 2 drops cinnamon essential oil in olive oil 3 x daily for one week.
- ▶ Then oregano oil regimen for three weeks.
- ▶ Then cinnamon for 10 days, then five days oregano.

Case Study Internal Use of Essential Oils



Case Study: Internal Use of Essential Oils

- ▶ W.T. developed rash on her chest and abdomen in the first few days of taking the essential oils. It persisted for 2.5 months before resolving.
- ▶ W.T. developed a head cold a few weeks into the essential oil regimen.
- ▶ W.T. developed flu like symptoms about 5 weeks into the regimen.
- ▶ W.T. experienced her first HSV-2 outbreak during the regimen. Estimated to be dormant for 8-9 years.
- ▶ W.T. developed a UTI infection toward the end of the regimen, and ended the regimen after an 11 day UTI.
- ▶ Her digestive symptoms persisted throughout.
- ▶ W.T. tested negative for SIBO after this protocol. W.T. tested low normal for liver metabolism and pancreatic enzymes. W.T. tested with overgrowth of two normal bacteria in her stool sample. Indicating inflammation.

Meaning of GRAS Status Federal Food, Drug, and Cosmetic Act

- ▶ Many essential oils have been given GRAS status by the FDA.
- ▶ This status is often used to denote the safety of taking these essential oils internally.
- ▶ But, what does GRAS status mean?
- ▶ Does GRAS status provide guidelines for how much of these essential oils is safe to consume?
- ▶ Does GRAS status include consuming undiluted, pure essential oils?



Meaning of GRAS Status Federal Food, Drug, and Cosmetic Act

- ▶ The Federal Food, Drug, and Cosmetic Act GRAS list is a list of substances that are **Generally Recognized As Safe** for their intended use – **IN FOOD**.
- ▶ The GRAS list is found in the Act Title 21, Volume 3, Chapter 1, the **Subchapter B** titled **Food for Human Consumption (Continued)**, Subpart A, section 182. CITE: 21CFR1812
- ▶ “It is impracticable to list all substances that are generally recognized as safe for their intended use. However, by way of illustration, the Commissioner regards such common food ingredients as salt, pepper, vinegar, baking powder, and monosodium glutamate as safe for their intended use.”
- ▶ “This part includes additional substances that, when used for the purposes indicated, in accordance with good manufacturing practice, are regarded by the Commissioner as generally recognized as safe for such uses.”

Meaning of GRAS Status Federal Food, Drug, and Cosmetic Act

- ▶ “For the purposes of this section, good manufacturing practice shall be defined to include the following restrictions:
- ▶ “(1)The quantity of a substance added to food does not exceed the amount reasonably required to accomplish its intended physical, nutritional, or other technical effect in food; and”
- ▶ “(2) The quantity of a substance that becomes a component of food as a result of its use in the manufacturing, processing, or packaging of food, and which is not intended to accomplish any physical or other technical effect in the food itself, shall be reduced to the extent reasonably possible.”
- ▶ Code of Federal Regulations Title 21, Volume 3, Chapter 1, the **Subchapter B** titled **Food for Human Consumption (Continued)**, Subpart A, section 182. CITE: 21CFR1812

Meaning of GRAS Status Federal Food, Drug, and Cosmetic Act

- ▶ What does "intended physical, nutritional, or other technical effect in food" mean in terms of essential oils?
- ▶ Essential oils are not used provide physical attributes to food, i.e., texture, viscosity, etc.
- ▶ Essential oils are not used provide any nutritional value to food. They do not contain any primary nutrients such as vitamins, minerals, proteins, etc.
- ▶ What is left? Technical effect.
- ▶ What does this mean in terms of essential oils?

Meaning of GRAS Status Federal Food, Drug, and Cosmetic Act

- ▶ Essential oils primary intended use in food falls under the technical effect:
- ▶ "(12) Flavoring agents and adjuvants : Substances added to impart or help impart a taste or aroma in food."
- ▶ Code of Federal Regulations. Title 21, Volume 3. Cite: 21CFR170.3
- ▶ Title 21, Chapter1, Subchapter B, Part 170, Subpart A, Sec. 170.3



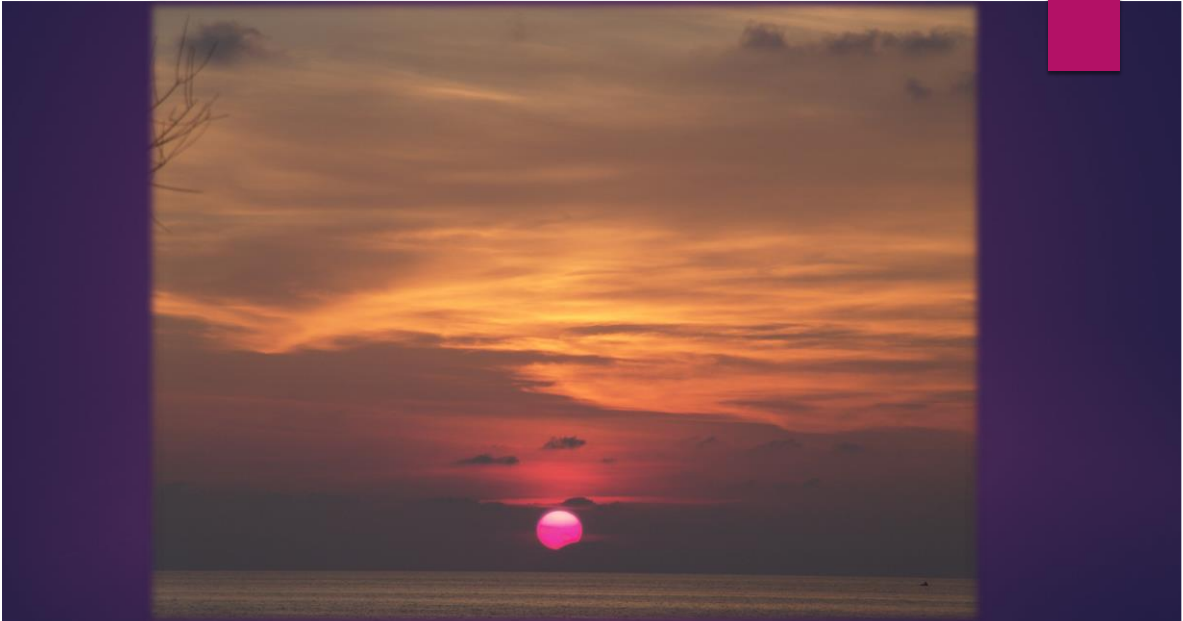
Meaning of GRAS Status Federal Food, Drug, and Cosmetic Act

- ▶ Essential oils are being researched for these intended uses (**FOR THE FOOD, NOT THE HUMAN CONSUMING THE FOOD**):
- ▶ “(3) Antioxidants : Substances used to preserve **food** by retarding deterioration, rancidity, or discoloration due to oxidation.”
- ▶ (2) Antimicrobial agents : Substances used to preserve **food** by preventing growth of microorganisms and subsequent spoilage, including fungistats, mold and rope inhibitors, and the effects listed by the National Academy of Sciences/National Research Council under "preservatives.”
- ▶ Code of Federal Regulations. Title 21, Volume 3. Cite: 21CFR170.3
- ▶ Title 21, Chapter1, Subchapter B, Part 170, Subpart A, Sec. 170.3

Meaning of GRAS Status Federal Food, Drug, and Cosmetic Act

Sec. 409. [21 USC §348] Unsafe Food Additives

- ▶ (B) shows that the proposed use of the additive would **promote deception** of the consumer in violation of this Act or would otherwise result in **adulteration** or in **misbranding of food** within the meaning of this Act.
- ▶ (4) If, in the judgment of the Secretary, based upon a fair evaluation of the data before him, a **tolerance limitation** is required in order to assure that the proposed use of an additive will be safe, the Secretary—
- ▶ (A) **shall not** fix such tolerance limitation at a **level higher** than he finds to be reasonably required to accomplish the physical or other technical effect for which such additive is intended; and
- ▶ (B) **shall not** establish a regulation for such proposed use if he finds upon a fair evaluation of the data before him that such data **do not establish** that such use would accomplish the intended physical or other technical effect



References

- ▶ [Code of Federal Regulations, Title 21, Volume 3, Revised as of April 1, 2015, CITE: 21CFR170.3](http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=170.3)
<http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=170.3>. Retrieved 10/1/15.
- ▶ FD&C Act Chapter IV: Food > Sec. 409. [21 USC §348] Unsafe Food Additives.
http://ucbiotech.org/biotech_info/PDFs/Food_Drug_Adm_Cent_Food_Saf_Appl_Nutr_1996_Safety_assurance_of_foods_derived_by_modern_biotechnology_in_the_United_States.pdf. Retrieved 10/1/15.
- ▶ Code of Federal Regulations, Title 21, Volume 3, [Revised as of April 1, 2015, [CITE: 21CFR182]
<http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?CFRPart=182> Retrieved 10/1/15.
- ▶ Rulis, A.M., Levitt, J.A., FDA'S food ingredient approval process, *Regul. Toxicol. Pharmacol.* (2008). doi:10.1016/j.yrtph.2008.10.003
- ▶ Sensitization. <http://medical-dictionary.thefreedictionary.com/sensitization> Retrieved 10/4/15.
- ▶ Safety Information. NAHA. (2015) <https://www.naha.org/explore-aromatherapy/safety/> Retrieved 10/4/2015.
- ▶ Patel S., Wiggins, J., (1980) Eucalyptus Poisoning. *Archives of Disease in Childhood.* 55(5):405-406.
- ▶ Bensouilah, J., Buck, P. (2006) *Aromadermatology: Aromatherapy in the treatment and care of common skin conditions.* Oxford: Radcliffe Publishing.

References

- ▶ Tisserand, R., Balacs, T. (1995) *Essential Oil Safety*. London: Churchill Livingstone.
- ▶ Satou T, Kasuya H, Maeda K, Koike K. (2014) Daily inhalation of α -pinene in mice: effects on behavior and organ accumulation. *Phytother Res*. 28(9):1284-7.
- ▶ NAHA. (2015). *Explore Aromatherapy, Safety Information*. <http://www.naha.org/explore-aromatherapy/safety/> Retrieved 10/15/15.
- ▶ Hagvall, L., Baron, J., Börje, A., Weidolf, L., Merk, H., & Karlberg, A. (2008). Cytochrome P450-mediated activation of the fragrance compound geraniol forms potent contact allergens. *Toxicology And Applied Pharmacology*, 233(2), 308-313. doi:10.1016/j.taap.2008.08.014
- ▶ Sköld, M., Hagvall, L., & Karlberg, A. (2007). Autoxidation of linalyl acetate, the main component of lavender oil, creates potent contact allergens. *Contact Dermatitis*, 58(1), 9-14. doi:10.1111/j.1600-0536.2007.01262.x
- ▶ Sanjeev Banerjeea, Roopa Sharmab, Raosaheb K. Kaleb & A. Ramesha Raaa. (1994) Influence of certain essential oils on carcinogen-metabolizing enzymes and acid-soluble sulfhydryls in mouse liver. *Nutrition and Cancer*. 21(3) 263-269. DOI:10.1080/01635589409514324.

References

- ▶ Chow HH, Salazar D, Hakim IA. (2002) Pharmacokinetics of perillid acid in humans after a single dose administration of a citrus preparation rich in d-limonene content. *Cancer Epidemiol Biomarkers Prev*. 11(11):1472-6.
- ▶ Zhang Y, Gong J, Yu H, Guo Q, Defelice C, Hernandez M, Yin Y, Wang Q. (2014) Alginate-whey protein dry powder optimized for target delivery of essential oils to the intestine of chickens. *Poult Sci*. 93(10):2514-25. doi: 10.3382/ps.2013-03843. Epub 2014 Aug 1.
- ▶ Haselmeier A, Zentek J, Chizzola R. (2014) Effects of thyme as a feed additive in broiler chickens on thymol in gut contents, blood plasma, liver and muscle. *J Sci Food Agric*. 95(3):504-8. doi: 10.1002/jsfa.6758. Epub 2014 Jun 26.
- ▶ Rassu, G., Nieddu, M., Bosi, P., Trevisi, P., Colombo, M., Priori, D., Manconi, P., Giunchedi, P., Gavini, E., & Boatto, G. (2014). Encapsulation and modified-release of thymol from oral microparticles as adjuvant or substitute to current medications. *Phytomedicine*, 21(12), 1627-1632.
- ▶ Satou, T., Takahashi, M., Kasuya, H., Murakami, S., Hayashi, S., Sadamoto, K. and Koike, K. (2013). Organ Accumulation in Mice After Inhalation of Single or Mixed Essential Oil Compounds. *Phytother. Res.*, 27: 306-311. doi: 10.1002/ptr.4723
- ▶ Lim JH, Kim MS, Hwang YH, Song IB, Kim TW, Yun HI. (2012) Effect of orange oil on the oral absorption of enrofloxacin in rats. *Exp Anim*. 61(1):71-5.

References

- ▶ Pouloupoulou I, Zoidis E, Massouras T, Hadjigeorgiou I. (2012) Terpenes transfer to milk and cheese after oral administration to sheep fed indoors. *J Anim Physiol Anim Nutr (Berl)*. 96(2):172-81. doi: 10.1111/j.1439-0396.2011.01128.x. Epub 2011 Feb 15.
- ▶ Lejonklev J, Løkke MM, Larsen MK, Mortensen G, Petersen MA, Weisbjerg MR. (2013) *J Dairy Sci*. 96(7):4235-41. doi: 10.3168/jds.2012-6502. Epub 2013 Apr 28.
- ▶ Satou T, Kasuya H, Maeda K, Koike K. (2014) Daily inhalation of α -pinene in mice: effects on behavior and organ accumulation. *Phytother Res*. 28(9):1284-7.
- ▶ Horváth, G., and Ács, K. (2015) Essential oils in the treatment of respiratory tract diseases highlighting their role in bacterial infections and their anti-inflammatory action: a review. *Flavour Fragr. J.*, 30: 331–341. doi: 10.1002/ffj.3252.
- ▶ Last Slide Image: "Sunset in Ricadi" by Manfred Morgner (ka-em-zwei-ein) - selbst. Licensed under CC BY-SA 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Sunset_in_Ricadi.jpg#/media/File:Sunset_in_Ricadi.jpg