

Chapter 2

Properties and chemical composition of essential oils.

Presented by

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Topics

- review <https://www.youtube.com/watch?v=aLpBF0Uxp3I>
- Related definitions and definitions
- Properties of essential oils
- Chemical composition of essential oils
- Type of essential oil
- The difference between natural and synthetic essential oils
- Conclusion

Related definitions and definitions

- ISO defines “An essential oil is a product made by distillation with either water or steam or by mechanical processing of citrus rinds or by dry distillation of natural material. Following the distillation, the essential oil is physically separate from the water phase”
- “**Essential oil or Volatile oil**” Essence means smell , Volatile means that it can evaporate without decomposition.

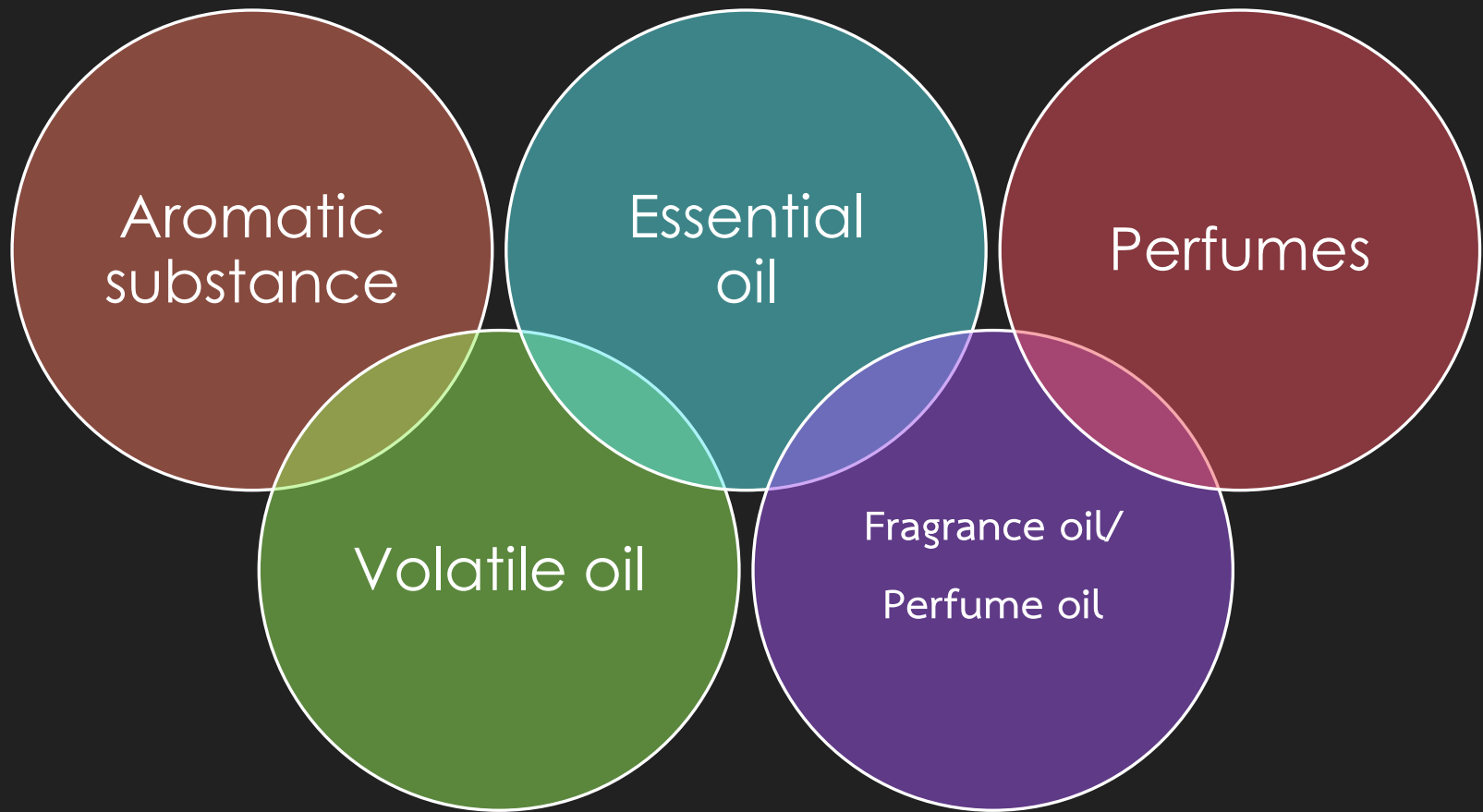
Related definitions and definitions

- Essential oils (Essential oils or Volatile oils) are oils produced by plants in a secondary metabolized extracted from plants, animals and from liquid synthesis. and evaporates at room temperature. Most are clear or light in color. There are many chemical compounds that give fragrances or flowers, which are referred to as aromatic substances.
- Aromatic substances are chemicals that have a unique smell. not in liquid state Including in the form of oil It alone did not produce a very pleasant smell. But if several types are combined in the right proportions, it will smell better. which can be found in both plants animal and synthetic

Related definitions and definitions

- Fragrance oil or perfume oil is a synthetic essential oil produced by science to imitate the fragrance of nature. Most of the chemicals produced are consumer products. It is an imitation of natural scents such as the smell of baby powder, shampoo, lotion, etc.
- Perfume is water that contains a mixture of perfume and alcohol, etc., which have various scents. according to the type and proportion of perfume For the purpose of concocting body scents according to user preferences Perfume concentrates are more popular to make perfume than essential oils because they are cheaper, smell stronger and last longer.

Related keywords



Related definitions and definitions

Certified Organic Essential Oil

It is pure essential oil extracted from plants that grow naturally, or has been cultivated by organic farming methods without chemicals throughout the cultivation process. Including having standard control throughout every step of harvesting and bringing raw materials to be refined. So that essential oils are 100% clean and pure.

Pure Essential Oil

It is an oil that has the same properties and information as organic essential oils. It's just that producers grow plants and distill essential oils. Has not registered or applied for organic certification from a certifying organization. Perhaps due to the fact that it is a small farm, only a few essential oils are cultivated and produced, and the quality and reputation of the essential oils are already being trusted. Therefore, it is not necessary to request a certificate from any organization.

Summary of related definitions

Fragrance oils are liquids that can be extracted both natural and synthetic. Naturally extracted essential oils are called essential oils while synthetic volatile oils are called fragrance oils. Even though they smell the same, their properties or actions are different. In addition, the quality of essential oils varies depending on the cultivation methods, extractions, and different production standards. As a result, there are different names for oils such as organic essential oils. Pure essential oils, etc.

Properties and characteristics of essential oils

General properties of essential oils

- It is a concentrated organic substance. originated from plants It is a liquid with a unique smell and taste.
- Most of them are colorless. If oxidation occurs, it will darken and the smell will change. Each type has its own unique smell.
- readily volatile without decomposition volatile at room temperature low boiling point
- Low density, less than 1 g/ml, except for cinnamon and clove oils.
- Very soluble in organic solvents such as ether, chloroform and alcohol, somewhat soluble in water.
- Make the paper translucent until the substance evaporates

Characteristics of the extracted essential oils.



Concretes



Pomades



Resinoids



Absolute

Concretes

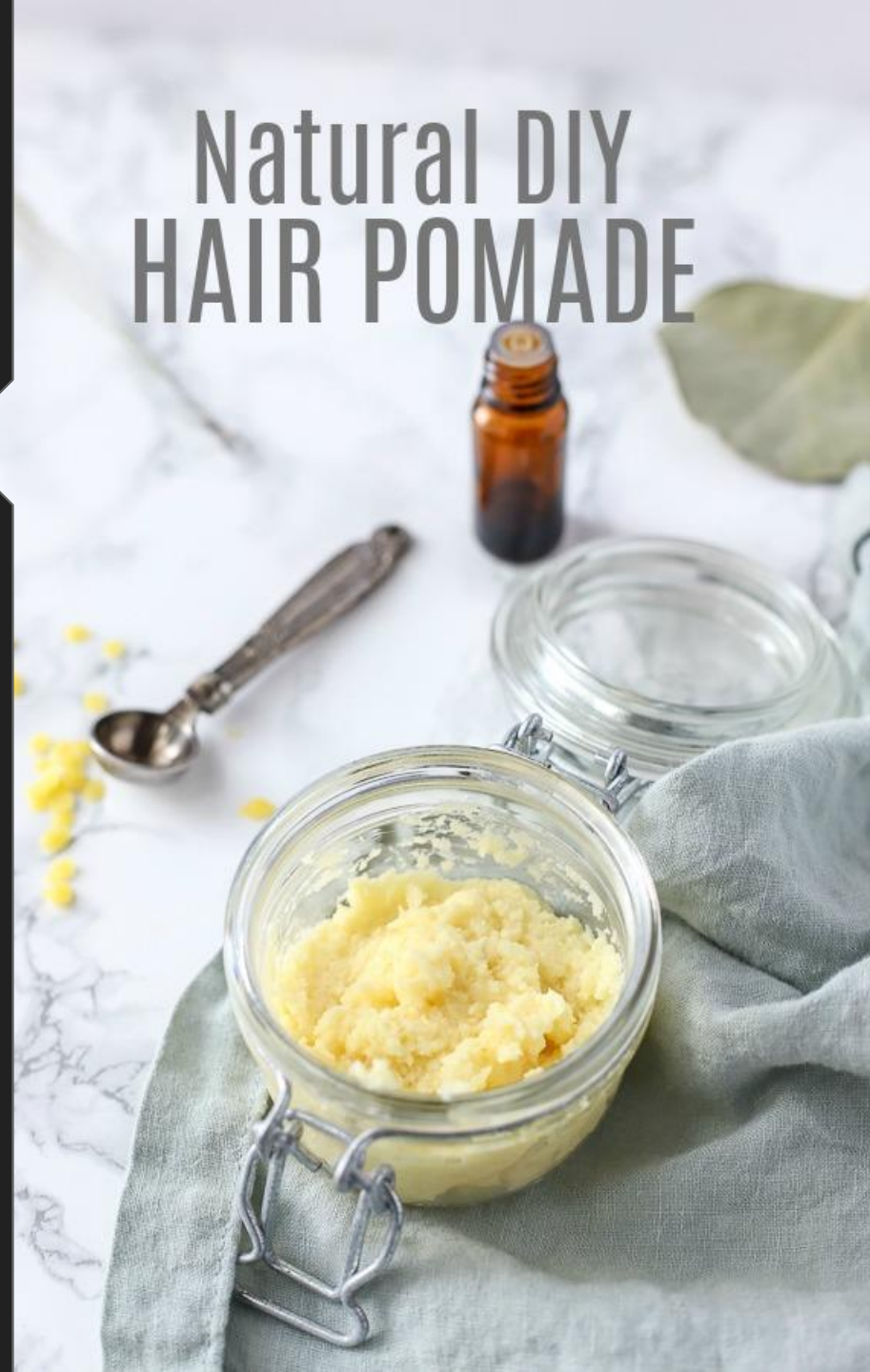
- Raw materials such as leaves, flowers, roots, bark are extracted with organic solvents such as hexane and then evaporated.
- Contains essential oils, fatty acids and waxes.
- Such as Jasmine concrete (50% waxes และ 50% essential oil) Ylang Ylang concrete (20% waxes และ essential oil 80%)
- Higher stability and concentration pure essential oil



Pomades

- from essential oil extraction by enfleurage method
- Used with flowers that retain their scent long after harvest.
- The fat used is saturated with flower essential oils.
- Pomegranates are aromatic saturated fats. Essential oils are highly concentrated in fats.
- It can be extracted using alcohol.

Natural DIY HAIR POMADE



Resinoids

- Prepared from resinous sap. using a non-aqueous solvent such as petroleum ether or hexane
- For example, resinous turpentine, turpentine, frankincense.
- It is a viscous liquid, semi-solid or solid. Homogeneous non-crystalline appearance
- Used in the perfumery industry as a long-lasting fixative.



Absolute

- Obtained from the extraction of concrete, pomades or resinoids. using alcohol The extraction process was repeated until the substance was concentrated.
- The ethanol solution is cooled to filter out the wax. Get rid of the ethanol.
- by distillation method Most are highly concentrated and viscous substances.









Chemical composition of essential oils

- Terpenes Terpenes are the most abundant secondary substances in plants. The precursors for the synthesis are acetyl CoA or intermediates. from the glycolysis process The smallest unit has 5C or isoprene (C_5H_8)
- Terpenoids Terpenoids are derivatives of terpenes. Most of them are volatile terpenes, with small molecules monoterpenes and squalenes. May contain oxygen derivatives such as alcohols, aldehydes, ketones, phenol oxides, and esters. For example, limonene in the citrus family is an unsaturated hydrocarbon monocyclic terpenes and menthol in peppermint is a monocyclic terpenes with Hydroxyl group and Alcohol group
- Phenylpropenes have the main structure as an aromatic ring connected to three carbon atoms, e.g. Eugenol/Cinnamic aldehyde found in Essential oils of clove, Chinese cinnamon, and Cinnamon have antibacterial and local anesthetic properties. Anethole/Estragole It can be found in essential oils from nutmeg, basil, etc., which have properties to relieve spasticity (Thapanee Hongratanaworakij, 2007).


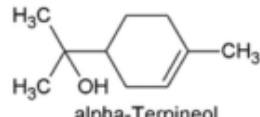
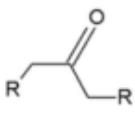
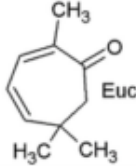
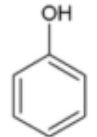
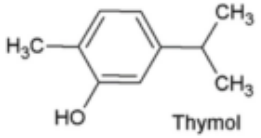
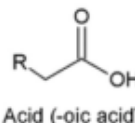
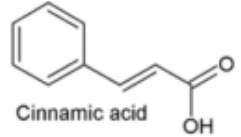
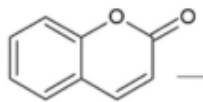
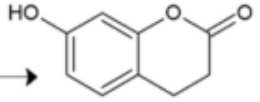
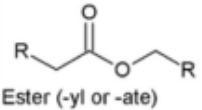
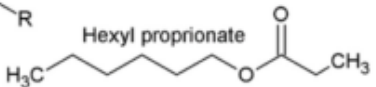
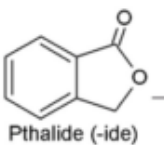
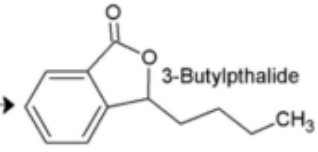
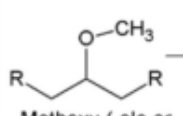
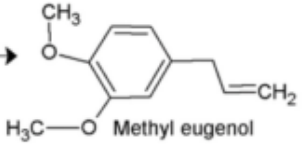
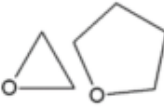
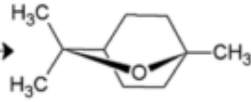

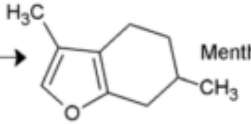
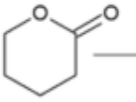
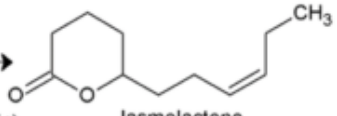
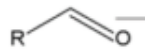
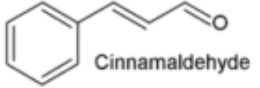
Main chemical constituents found in essential oils

Terpenes

TERPENE	BENEFIT	AROMA
 <p>Pinene Also found in pine needles</p>	<p>Anti-inflammatory Anti-bacterial Bronchodilator Aids memory</p>	<p>Pine Earth</p>
 <p>Myrcene Also found in hops</p>	<p>Sedative Sleep aid Muscle relaxant</p>	<p>Flowers Pungent Earth</p>
 <p>Limonene Also found in citrus</p>	<p>Treats acid reflux Anti-anxiety Antidepressant</p>	<p>Citrus Fresh spice</p>
 <p>Terpinolene Also found in coriander</p>	<p>Analgesic Pain reduction Digestive aid Stomachic</p>	<p>Pine Herbal Anise Lime</p>
 <p>Linalool Also found in lavender</p>	<p>Anesthetic Anti-convulsive Analgesic Anti-anxiety</p>	<p>Flowers Lavender Citrus Fresh spice</p>
 <p>Terpineol Also found in mugwort</p>	<p>Calming aid Antibacterial Antiviral Immune system</p>	<p>Pleasant lilac Citrus Wood</p>
 <p>Caryophyllene Also found in black pepper</p>	<p>Anti-inflammatory Analgesic Protects cells lining Digestive tract</p>	<p>Citrus Spice</p>
 <p>Humulene Also found in basil</p>	<p>Anti-inflammatory</p>	<p>Robust Herbaceous Earth</p>
 <p>Ocimene Also found in thyme and alfalfa</p>	<p>Decongestant Antiseptic Antiviral Bactericidal</p>	<p>Citrusy green Wood Tropical fruit</p>

Chemical classification of essential oils

Group of functions

Functional Group (-name ending)	Example	Functional Group (-name ending)	Example
 Alcohol (-ol)	 alpha-Terpineol	 Ketone (-one)	 Eucaryone
 Phenol (-ol)	 Thymol	 Acid (-oic acid)	 Cinnamic acid
 Coumarin (-in; -en or -one)	 Umbelliferone	 Ester (-yl or -ate)	 Hexyl propionate
 Phthalide (-ide)	 3-Butylphthalide	 Methoxy (-ole or -ol) = methyl ether	 Methyl eugenol
 Oxide (-ole) = cyclic ether	 1,8-Cineole	 Furan (-furan-)	 Menthofuran
 Lactone (-one or -in)	 Jasmolactone	 Aldehyde (-al)	 Cinnamaldehyde

R = H or R = Remainder of molecule

Classification of chemical elements according to functional groups

1. Hydrocarbon essential oil Hydrocarbons are essential oils that contain hydrocarbons as the main constituents, possibly monocyclic terpenes, for example, eucalyptus oil, cardamom oil, orange oil, cinnamon oil.
2. Alcohol essential oils (Alcohols) are essential oils that contain alcohol as the main component. in essential oils at the position of OH binding in the same position But the amount of alcohol, size is different. Scents are different, for example, turpentine, rose oil, orange blossom oil, mint oil.
3. Aldehyde essential oils (Aldehydes) are essential oils that contain aldehydes as the main constituents. In essential oils containing 1-4 carbon aldehydes, the odor is pungent, not very good, but with 5 carbon or more carbon, it smells fruity, floral, herbal, etc. For example, citrus oil, lemon oil, lemongrass oil. Chinese Cinnamon Bark Oil

Classification of chemical elements according to functional groups

4. Esters essential oils and ester derivatives give different scents. Is an essential oil with esters as the main component as follows
5. Aliphatic esters There are many types of aliphatic esters found in this group. Giving aroma, whether it is methyl esters (Methyl esters) or ethyl esters (Ethyl esters) in the large methyl ester group The more and more fragrant
6. Terpenyl esters (Geraniol esters), Nerol esters, Linalol esters
Linalool esters Citronellol esters Menthol esters

Classification of chemical elements according to functional groups

7. Aromatic esters such as benzyl alcohol ester, phenyl ethanol ester, cinnamyl alcohol Ester (Cinnamyl alcohol ester), benzoic acid ester (Benzoic acid ester), salicylic acid ester (Salicylic acid ester), etc. Each type has a different smell. Smells flowers, resin, reserves whales.
8. Ketone essential oils (Ketones) are essential oils that contain ketones as the main constituents. Carbonyl ketones at the second position of propanone, butanone and pentanone have a bad odor. but when larger than this It was found to smell spices, flowers, fruits and herbs. If there is carbonyl at positions 3 and 4, there will be different odors. An example is found in Undecanone, which gives citrus, rose, and iris scents, for example, mint oil, camphor oil.
9. Oxides are essential oils that contain oxides as the main constituents, such as cineol (eucalyptol). For example, eucalyptus oil.

ALDEHYDES

!

Anti-inflammatory
 Antiviral (Citral)
 Calming
 Skin irritant
 Sedative

- Citronella
- Eucalyptus Citridora
- Lemongrass **F**
- Lemon Verbena **F**
- Litsea Cubeba (May Chang)
- Melissa **T**

KETONES

!

Abortive
 Cell regenerative
 Lipophilic
 Mucolytic
 Potentially neurotoxic
 Strong skin irritant
 *Avoid in pregnancy & asth

- Mugwort
- Sage
- Thuja

SESQUITERPENES

N

Antihistamine
 Antiviral
 Cell Regenerative
 Calming
 Cooling
 Strong anti-inflammatory

- Cedar, Atlas
- Moroccan Blue Chamomile (Azulene)
- German Chamomile (Chamazulene)
- Frankincense **T**
- Myrrh **T**
- Patchouli
- Spikenard
- Vetiver

ESTERS

N

Anti-inflammatory
 Antispasmodic
 Anxiolytic
 CNS nerve
 Fungicidal (Candida alb.)
 Releasing tension
 Relaxing
 Safe for Children
 Sense of well-being

- Cardamom **F T**
- Roman Chamomile **F T**
- Clary Sage
- Helichrysum italicum
- Cocoa **F**
- Jasmine **F**
- Lavender **F T**
- Ylang Ylang **F**

TERPENES

!

Antiseptic
 Antiviral
 Mild diuretic
 Possibly photosensitizing
 Potential skin irritant
 Stimulant

CITRUS

- Bergamot **F T**
- Grapefruit **F T**
- Lemon **F T**
- Lime **F T**
- Orange **F T**

TREES

- Cypress **T**
- Fir, Doug
- Pine, Wild Scotch **T**

PHENOLS

!

!

Antibacterial
 Antifungal
 Antiviral
 Immunostimulant
 Potential skin irritant
 Strongest antimicrobial

- Thyme thymol **F T**
- Oregano **F T**
- Cinnamon Leaf

PHENYL-PROPANES

Antibacterial
 Antiviral
 Antifungal
 Strong skin irritant
 Warming
 Invigorating
 Immunostimulant

- Cinnamon Bark **F T**
- Clove **T**

ALCOHOLS

N

Antibacterial
 Antifungal
 Antiviral
 Diuretic
 Energizing
 Immune stimulant

- Basil, Linalol **F T**
- Eucalyptus Radiata **T**
- Eucalyptus Globulus
- Rose Geranium **F T**
- Marjoram, Sweet **T**
- Neroli **F T**
- Palmarosa **T**
- Peppermint **F T**
- Ravintsara **T**
- Rose otto & white **F T**
- Rosemary Cineol **F T**
- Sandalwood **T**
- Tea Tree **T**
- Thyme Linalol **F T**
- Vanilla **F**

PHENYL-PROPANE ETHERS

N

Antispasmodic
 (Cramps/Asthma)
 Mentally stimulating

- Anise **F T**
- Fennel **F T**

N = Neat (UNDILUTED) Application

! = Use with Caution. Use Diluted 1-10% in a Carrier.

F = Used for Flavoring Food in Moderation.

T = Can be Used Therapeutically in Medicinal Honeys or Tinctures.

MAIN ACTIONS OF ESSENTIAL OILS BY CHEMICAL FAMILIES

RELAXING &
CALMING

Anti-stress, Calm, Sedate

BALANCING &
RESTORING

Warm, Ground, Release

STIMULATING &
INVIGORATING

Heal, Repair, Uplift, Fight

ESTERS	Lavender	SESQUITERPENES	Patchouli	ACIDS	Coriander
	Petitgrain		Chamomile (G)		Cypress
	Bergamot		Cedarwood		Marjoram
	Rose		Ginger		Sage
	Chamomile (R.)		Ylang Ylang		Mandarin
	Clary Sage		Geranium		Nutmeg
	Jasmin		Black Pepper		Orange
ALDEHYDES	Benzoin	Yarrow	MONOTERPENES	Grapefruit	
	Lavandin	Myrrh		Lemon	
	Melissa	Marjoram		Myrtle	
	Lemongrass				
KETONES	Lime		OXIDES	Rosemary	
	Vetiver			Eucalyptus	
	Sage			Lavender spike	
	Spearmint		PHENOLS	Clove	
	Hyssop			Cinnamon	
	Rosemary			Thyme	
	Marjoram			Fennel	
			ALCOHOLS	Oregano	
				Tea Tree	
				Basil	
				Rose	
				Neroli	
				Palmarosa	

Table 1 : Main compounds and amounts found in essential oils of plants.

Order	Plant name	Scientific name	Part used	Main compound	ปริมาณที่พบ (%)
1	กะเพรา	Ocimum sanctum	leaf	Eugenol	62.7
2	อบเชยจีน	Cinnamomum cassia	leaf	Cinnamaldehyde	79.9
3	แก้วตาเสือ	Coreopsis tinctoria	Flower	Limonene	52.5
4	น้อยหน่า	Annona squamosa	leaf	(E)-Caryophyllene	15.9
5	หมักก้าก	Zanthoxylum armatum	leaf	β - Linalool	53.0
6	เทียนเขยาวพาดิณี	Carum coptium	whole tree	o-Cymene	37.4
7	กระเม็งตัวผู้	Wedelia chinensis	leaf	Carvocrol	46
8	ผักชีลาว	Anethum graveolens	leaf	Dillapiole	90.2
9	ส้มซ่า	Citrus auranticum	Shell	Limonene	93.3
10	ขิง	Zingiber officinale	Head	Zingiberene	27.4
11	ตะไคร้	Cymbopogon citratus	leaf	Geranial	42.4
12	ยูคาลิปตัส	Eucalyptus camaldulensis	Seed	1,8-cineole	52.0
13	ส้มเกลี้ยง	Citrus sinensis	Shell	Limonene	94.3
14	กฤษณา	Aquilaria crassna	Bark	β -Caryophyllene	8.1
15	ไทม์	Thymus vulgaris	leaf	Thymol	73.6
16	โรสแมรี่	Rosmarinus officinalis	Trunk	α -pinene	30.8
17	พริกไทย	Piper capense	ผล	Cis-muurola-3,5- diene	15.5
18	ลาเวนเดอร์	Lavandula angustifolia	ต้น	Linalool	36.1

Table 2 : Examples of aromatic compounds in some essential oils.

Fragrant substances	Essential oil
Cineol (Eucalyptol)	Eucalyptus ,Marjoram
Citronellol	Geranium, Citronella, Rose
Camphor	Camphor tree
Benzyl acetate	Jasmine, Ylang ylang
Limonene	Citrus
Linalool	Lavender, Bergamot, Guava
Nerol	Rose , Orange flower
Thymol	Thyme
Methyl chavicol	Sweet basil
Menthol	Peppermint
Santatool	Sandalwood

Types of essential oils

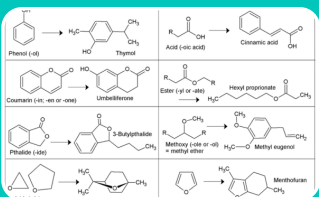
The source of aromatic compounds or essential oils.



Plant-derived essential oils



Animal-derived essential oils



Synthetic essential oils

Plant-derived essential oils





Ambergris

- regurgitation of whales Obtained from Sperm whale found in coastal areas of New Zealand or the Indies.
- Specific gravity between 0.78-0.92, annealing at 60 °C.
- Very soluble in ether, alcohol and oil
- Fragrance agents are amberin, benzoic acid and others such as cholesterol and fatty oils.
- Good golden amber looks light gray, volatile, flammable, and has a specific aroma that makes the odor last (fixative).
- Gold amber extraction: 30 g of gold amber/alcohol 1 L, then shaken at about 25-30 °C.

Ambergris



Castoreum

- Excretions from the oval-shaped bulb between the anus and reproductive organs.
- When the new bulb is cut out, the castoreum has a creamy white appearance. When it is dried and ang fire turns brown.
- At first there will be a bad smell, but over time The chemical process will change it to give a long lasting fragrance.
- The main compounds are castorin crystals with resin bezoic acid and volatile oils: benzyl alcohol, acetophenone, pethylphenol 1-bormeol and lactone.
- It is often sold in the form of a tincture of castoreum.
- Used as a fixative in perfume, especially perfume with a heavy smell.

Castoreum



Civer

- It is excreta from the pair of glands near the reproductive organs of males and females that are wiped along the trees. to attract the opposite sex
- Can be scraped with a knife which is popular in the morning
- Males smell stronger and stronger than females.
- The key compound is in the ketone group called zibetone, used as a fixative in perfumery.
- To purify musk, mix it with arrowroot powder or pure sand, soak it in alcohol for 1 month, then strain it.

Civer



Musk

- Excreta from the gonads of mountain deer
- Musk appears as a dark powder in a leathery pouch. have a unique smell Had to kill deer to get it. make it expensive
- It is a ketone group called muskone or muscone (3-methylcyclopentadecanone).
- Used as a fixative in fragrances.

Musk



Examples of aromatic compounds or synthetic essential oils

Characteristics of smell	Substrate
Almond scent*	Nitro benzene(Nitric acid + Benzene)
Jasmine scent	Coal black oil
Roses	Coal black oil + alcohol + Citronella oil
Carnation scent	Clove wood oil

*It was the first scent that could be synthesized.

Currently, there are over 4,000 kinds of scents that can be synthesized.

Scented substances or synthetic essential oils

- Perfume oil is a chemical product that is mainly produced as a consumer product. It is an imitation of natural scents such as the smell of baby powder, shampoo, lotion, etc.
- General perfume (Perfume) is a water that contains a mixture of perfume and alcohol, etc., which have various scents. according to the type and proportion of perfume For the purpose of concocting body scents according to user preferences
- Perfume concentrates are more popular to make perfume than essential oils because they are cheaper, smell stronger and last longer.

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The table shows the proportions of fragrance oils.

Catagoties	% Perfume	% Alcohol	% Water
Perfume	15-30	90-95	5-10
Eau de Perfume	8-15	80-90	10-20
Eau de Toilette	4-8	80-90	10-20
Eau de Cologne	4-8	70	30

Fragrance Wheel

In 1983, fragrance industry consultant Michael Edwards classified fragrances. And created a fragrance wheel diagram (Fragrance Wheel perfume classification chart ver. 1983)



Scent classification of perfume

1. **Floral Notes:** Fresh, soft, delicate, floral notes are the most popular fragrances. The concept of creating perfumes in this family is often based on the concept of blending several floral scents. virtual kind in bouquet Commonly used flowers are jasmine, rose, putjat, carnation, ylang-ylang, etc.
2. **Oriental Notes** is a scent that is obtained from a combination of spices, herbs, animal extracts such as musk, etc. Due to the wide variety of spices and herbs, this family of fragrances has a variety of **characteristics**. The smell of spicy spices or spice notes is the main to create. The deep warmth of the musk blends with fiery spices like basil as the base, blended with slightly sweet, herbal notes like vanilla to add a different dimension.

Scent classification of perfume

3. Forest Wood (Fougère Notes) Fougere is the French word for fern. Fougere notes represent the scents of plants and forests in nature. The smell will be a mixture of herbal and wood scents The main ingredients of this family of perfumes are mainly lavender and mixed with amber, oakmoss, etc. This family of perfumes is popular in the men's perfume market.
4. Woody Notes are the scents of oils from fragrant woods such as sandalwood. It is often used to make perfumes that show the personality of men.
5. Fresh Notes The fruity scent family is mainly derived from citrus, lemon, and bergamot families. All berries, peaches, apples come in as well. This family of perfumes has a mild, mild scent that gives a fresh, natural knowledge.

The difference between natural and synthetic essential oils

- Both are very similar. But synthetic essential oils do not have therapeutic properties. It has only the properties of smell.
- Real essential oils cost more than synthetic ones.
- Real essential oils are more volatile than synthetic essential oils. as fixatives may also be added.
- Real essential oils have more chemicals than synthetic essential oils.
- The number of synthetic fragrance oils is greater than that of natural essential oils because they can be synthesized in a lab.

Table 6 Comparison of differences between natural and synthetic essential oils.

Topics	น้ำมันหอมระเหยแท้ (Pure Essential Oil)	น้ำมันหอมระเหยผสม (Reconstituted Essential oil)	น้ำมันหอมสังเคราะห์ (Synthetic Essential Oil)
Price	cheap to very expensive	cheap to moderately expensive	Cheap
Origins	directly from that plant	Mix cheap essential oils together.	Synthetic smell from various chemicals
Fragrant	natural Scent	It smells close to the real thing.	It has a synthetic fragrance.
safety*	Safe	Safe	potentially dangerous
Psychotherapy effect	results in accordance with the information of that plant	does not match the data of that plant	None and potentially dangerous
Beauty effect	results in accordance with the information of that plant	does not match the data of that plant	None and potentially dangerous
Medical effect	results in accordance with the information of that plant	does not match the data of that plant	None and potentially dangerous

Conclusion

- Essential oils contain many chemicals. Some types contain hundreds of odor-causing chemicals in that oil. There are also other organic substances. found in very small quantities But it affects the action of essential oils in terms of properties. or effects on various body systems
- Essential oils can be classified into 2 groups: natural essential oils, mostly from plants, called Essential oil or Volatile oil, and synthetic essential oils, called Fragrance oil, which are commonly used to flavor various appliances. as well as perfume (Perfume) used to sprinkle the body in general

Conclusion

- The things that make these oils smell good are aromatic substances with the main elements being carbon, hydrogen and oxygen. Some sulfur and nitrogen may be found. which is synthesized through various biosynthetic pathways Among the essential oils found in nature, there are different functional groups such as alcohols, aldehydes, ketones, esters, oxides.
- Essential oils can be classified according to their source. and the nature of the smell or feeling after smelling
- Natural essential oils differ from synthetic ones in many ways. Especially the healing properties. The same thing is that similar scents affect emotions and feelings that are similar.