

CHAPTER 5



VOLATILE OIL

Odorous principle which are the mixture of hydrocarbons and oxygenated compounds derived from the hydrocarbons, evaporate when exposed to air at room temperature are called Volatile oil

VOLATILE OIL

Definition

Odorous principle which are the mixture of hydrocarbons and oxygenated compounds derived from the hydrocarbons, evaporate when exposed to air at room temperature are called Volatile oil.

Due to their essence or odoriferous principle in the plant they are also called as essential oil.

General properties

1. Colourless when fresh but become darker in colour after prolonged standing in air due to oxidation
2. They are kept in cool and dry place, in air tight container preferably in full amber colour glass.
3. Freely soluble in chloroform and ether, fairly soluble in alcohol & insoluble in water.
4. Volatile oil are lighter than water except clove oil.
5. Have high refractive index & optically active.

Occurrence

Depending upon the plant family volatile oil are present in different secretory glands or cells:

1. Labiate (granular hairs)
2. Piperaceae (parenchyma cells)
3. Umbelliferae (oil tubes or Vittae)
4. Pinaceae or Rutaceae (lysigenous or schizogenous cavities)

Volatile oil are present in various plant parts:

1. Rose (rose petals)
2. Cinnamon (bark)
3. Pepper mint (leaves)
4. Conifers (all tissues)
5. Orange (outer peel)

Significance

Volatile oil have great importance for both plants and human beings.

Exact role of volatile oil in plant is unknown as they are produced in the result of metabolism but they have some importance for the plants as:

1. Insect repellent
2. To prevent destruction of flowers
3. Attract the insect thus help in cross fertilization or pollination

General uses

1. Flavouring agent, e.g. Lemon oil
2. Used in perfumes, e.g. Rose oil
3. As condiments, e.g. Clove oil
4. Act as starting material for the synthesis of other compounds like Turpentine oil
5. May interfere with respiration and electron transport chain in various bacteria so, help in preservation of food and cosmetics, e.g. Eucalyptus oil

Therapeutic uses

1. Administered as inhalation, e.g. Eucalyptus oil
2. Administered as orally, e.g. Peppermint oil is used as gargles & mouth washes.
3. Carminative, e.g. Fennel, Coriander, Cardamom
4. Digestant increase appetite, e.g. Fennel
5. Reduce lung secretions, e.g. Menthol in ammonium chloride syrup
6. Local anaesthetic, e.g. Clove oil as dental anaesthetic
7. Antispasmodics, e.g. Fennel & Coriander
8. Cough preparations, e.g. Menthol
9. Antiseptic due to phenolic contents, e.g. Phenol & Thymol
10. Antibacterial & antifungal, e.g. Eucalyptus oil & Thymol
11. Anthelmintic, e.g. Chenopodium oil
12. Increase circulation (locally) & this property is applied in lotions & liniments, e.g. Camphor & Turpentine
13. Irritant & cause inflammation, e.g. Turpentine

Methods of obtaining Volatile oil

Volatile oil obtained from the plant parts depending upon the nature of plant material various methods are used

1. Distillation
 - i. Water Distillation
 - ii. Water & Steam Distillation
 - iii. Steam Distillation
 - iv. Destructive Distillation
2. Expression or Ecuelle Method
3. Enfleurage Method
4. Enzymatic Hydrolysis
5. Solvent Extraction Method

1. Distillation

i. Water Distillation

In this method those plant material is used where there is no chance of destruction upon boiling.

In this plant parts are placed in distilling tank, macerate in water and heat the tank. Volatile matters are evaporated and passed through the condenser and collected in receiver.

Special type of receiver are used having two outlets:

- a. Upper outlet
- b. Lower outlet

If volatile oil are lighter than collect it from the upper outlet otherwise lower.

Example

Turpentine oil

ii. Water & Steam Distillation

Those materials are used where there is a chance of destruction upon boiling.

In this method dried plant materials such as Clove & Cinnamon powder is placed in tank. Macerate it with water and steam is generated and passed through the macerate materials.

As steam passed through the macerate it carried the volatile oil and passed through the condenser and collected in receiver.

Example

Clove & Cinnamon

iii. Direct Steam Distillation

In this method fresh plant materials are used.

Plant materials are placed on truck bed which is taken in to the distillation tank. Here the plant material contain sufficient water (moisture) no need of maceration. Steam is passed over the fresh plant material that derived the volatile oil and passed through the condenser and collected in receiver.

During this process certain components of volatile oil may undergo hydrolysis or decompose. To prevent this or having minimum destruction, the diffusion rate of steam in the plant material should be high.

Example

Peppermint & Spearmint

iv. Destructive Distillation

This method is used to obtain the "Empyreumatic oils"

Empyreumatic oil is a oil obtained by distilling the volatile organic substances at high temperature.

Having burnt nature or smell due to high temperature.

In this method the wood part or some resin of family Pinaceae is placed in tank and heated without excess of air, decomposition takes place and number of volatile oils are driven off.

Number of volatile oil contain two layers:

a. Aqueous Layer

It contains wood naphtha (methyl alcohol) & pyroligenous acid (crude acetic acid)

b. Tarry Layer

It contains pine tar & juniper tar. In this the yield of tar is 10% obtained from the wood used.

Example

Wood & Resin of Family Pinaceae

2. Expression or Ecuelle Method

Citric acid are obtained by this method:

Volatile oil are present in oil gland just beneath the surface of outer rind of citrus fruits

Procedure

Roll the fruit over the truffle lined with sharp projection long enough to penetrate in the oil glands present in the outer rind of the citrus fruit.

Example

Lemon & orange

3. Enfleurage Method

In this method volatile oil obtained from those plant parts which are very small and volatile oil are decomposed on distillation process.

Procedure

In this method odourless and bland fixed oil is spread as a layer on the glass plate and the plant part like petals are placed on the layer of the fixed oil for few hours.

By repetitive removal of old petals and add new ones when the fats or fixed oil absorb as much as fragrance the petals are removed.

Volatile oil is removed by selected solvents particularly alcohol.

Not used now-a-days, because tiresome and time consuming.

Still used in perfume industry.

Example

Rose petals

4. Enzymatic Hydrolysis

Specific enzymes are used to get volatile oil

Glycosides volatile oil are obtained by enzymatic hydrolysis of glycosides.

Example

Singrin give Allyl isothiocyanate by the action of enzyme Myrosin.

5. Solvent Extraction

In this method specific organic solvents are used for the extraction of volatile oil.

In this method recovery of solvents are sometimes difficult.

Used in perfume industry

Costly method

Chemistry of volatile oil

Volatile oil are terpenes in origin also called terpenoids or mixture of terpenes or their derivatives

Terpenes are hydrocarbons

General formula of terpene is $C_{10}H_{16}$

Volatile oil are the mixture of hydrocarbons and oxygenated compounds derived from the hydrocarbons.

Taste and odour is due to oxygenated constituents which are to some extent soluble in water, e.g. rose water and freely soluble in alcohol, e.g. tincture of Lemon.

Volatile oil is composed of two portion:

1. *Eleoptenes* which is hydrocarbon portion and liquid in nature
2. *Stearoptenes* which is oxidized hydrocarbon portion and solid in nature

Terpene

Terpene is a molecule or group of molecule whose structure is based on various but definite number of Isoprene units

Isoprene

It is a branched chain five carbon unit containing two unsaturated bond with chemical formula C_5H_8 .

Terpenes are formed by the condensation of isoprene units which are linked with each other by head to tail fashion.

Number of isoprene units incorporated in a particular terpene serve as the basis of the

classification of these compounds

Classification

Name	Number of isoprene unit	Number of carbon atom
Monoterpenes	2	10
Sesquiterpenes	3	15
Ditrepenes	4	20
Sesterterpenes	5	25
Triterpenes	6	30
Tetraterpenes or carotenoids	8	40
Polyterpenes or Rubber	>100	>500

- Almost all types of organic compounds like ketones, aldehyde, oxides, ether etc are present in the volatile oil.

Some volatile oil has single compound with high percentage, e.g. In Mustard oil there is 93% of Allyl isothiocyanate.

Another major group of volatile oil is Phenylpropanoids (P.P.). these compounds contain 6 carbon phenyl ring attached 3 carbon side chain because they derived from aromatic aminoacids like phenylalanine and tyrosine respectively.

Immediate precursor of P.P. are cinnamic acid, cinnamaldehyde, anisealdehyde, p-hydroxycinnamic acid, eugenol & enethol etc.

Classification of volatile oil on the basis of terpenes

A. Monoterpenes

1. Acyclic Monoterpenes

- i. Citral
- ii. Geraniol
- iii. Coriandrol

2. Monocyclic Monoterpenes

- i. Menthol
- ii. Menthone
- iii. Limonene
- iv. α -terpineol

3. Dicyclic Monoterpenes

- i. α -pinene
- ii. β -pinene
- iii. Borneol

B. Sesquiterpenes

1. Acyclic Sesquiterpenes

- i. Farnesol

2. Monocyclic Sesquiterpenes

- i. Absciscic acid
- ii. Curcumene

3. Dicyclic Sesquiterpenes

- i. Cadinene

- ii. Laurene

C. Diterpenes

1. Acyclic Diterpenes

- i. phytol

2. Monocyclic Diterpenes

- i. Trisporic acid
- ii. α -camphorene

3. Dicyclic Diterpenes

- i. Agathic acid

4. Tricyclic Diterpenes

- i. Abietic acid
- ii. Pimaric acid

5. Tetracyclic Diterpenes

- i. Gibberellic acid

D. Triterpenes

1. Tetracyclic Triterpenes

- i. Lanosterol

2. Pentacyclic Triterpenes

- i. β -amyrin

E. Tetraterpenes

- 1. Carotenoids

F. Polyterpenes

- 1. Phenyl propanoids

CLASSIFICATION OF VOLATILE OIL ON THE BASIS OF DRUGS

1. Hydrocarbon Volatile Oil

- i. Cubeb
- ii. Turpentine oil

2. Alcoholic Volatile Oil

- i. Peppermint oil
- ii. Coriander
- iii. Cardamom

3. Aldehyde Volatile Oil

- i. Bitter orange peel
- ii. Sweet orange peel
- iii. Lemon oil
- iv. Cinnamon
- v. Bitter almond oil

4. Ketonic Volatile Oil

- i. Camphor
- ii. Spearmint
- iii. Caraway
- iv. Buchu

5. Phenolic Volatile Oil

- i. Clove
- ii. Thyme

6. Phenolic Ether Volatile Oil

- i. Fennel
- ii. Myristica (Nutmeg)
- iii. Anise

7. Oxide Volatile Oil

- i. Chenopodium
- ii. Eucalyptus

8. Ester Volatile Oil

- i. Rosemary

9. Miscellaneous Volatile Oil

- i. Allium
- ii. Anethum

HYDROCARBON VOLATILE OILS

CUBEB

Botanical Origin

Piper cubeba

Family

Piperaceae

Part used

Dried nearly fully grown unripe fruit.

Habit & Habitat

Plant is a woody climber

Indigenous to Borneo, Java, Sumatra and Indonesia.

Extraction

Obtained by steam distillation.

Constituents

Fruit contains:

Volatile Oils 18%

Resins 7.5 %

Gums 8%

Fixed oils 1%

Cubebin

Among the Volatile Oils the major V.O's are:

l-cadinene

l-sabinene.

Other constituents are:

Terpineol

Terpene alcohol

1,4-Cineol

Sesquiterpenes

Sesquiterpene alcohols.

Structures

Cadinene Sabinene Cineol Terpineol

Uses

Possess diuretic property
Mild antiseptic
Carminative
It is a stimulating expectorant.

TURPENTENE OIL**Botanical Origin**

Pinus palustris

Family

Pinaceae

Part used

Volatile Oil distilled from oleo-resins.

Habit & Habitat

Plant is a tree
Native: South Eastern United States.

Extraction

Obtained by the distillation process.

Characteristics

Colour: colourless liquid
Odour: characteristic
Taste: characteristic
It may become disagreeable upon exposure to air.

CONSTITUENTS:-

Two major principle constituents are:

α -pinene 65%
 β -pinene 30%

It also contains:

Terpineol
Methyl chavicol
Bornyl acetate
Pinocarveol

Structure

α -pinene β -pinene Terpeniol

Uses

It is used as counter-irritant and rubeficient.
Also possess anti-septic property.
Industrially it is used as a solvent for waxes
In the manufacturing of shoe polishes and furniture polishes.
Turpentine has been used experimentally in a bath for the treatment of disseminated sclerosis and sexual dysfunction.
Antibacterial activity and inhibition of osteoclast activity.
Turpentine is utilized in experimental models of inflammation to induce a systemic

inflammatory immune response in animals.

ALCOHOLIC VOLATILE OIL

PEPPERMINT

Botanical Origin

Mentha piperita

Family

Labiatae

Part Used

Dried leaves and flowering tops.

Habit and habitat

Plant is perennial herb

Indigenous: Europe

Naturalized: Northern US and Canada

Production

Peppermint oil is obtained by distillation with steam from fresh or ground part of flowering plants.

The influence of environmental factors in essential oil composition is important.

- Plant of the same specie or genotype may produce oil of different quality which grows in different areas.

The long days of Northern latitude favours the production of peppermint oil that contains large amount of "Menthol" and small amount of "Mentha-furan".

In short day's latitude the plant produce small amount of "Menthol" and large amount of "Mentha-furan".

The oil of good quality may obtain from the plants with high %age of mature tissues.

Characteristics

Colour: colourless to pale yellow liquid

Odour: strong penetration

Taste: pungent

Sensation of cold when air is drawn into the mouth.

Constituents

Peppermint contains:

Volatile Oils 1-1.2%

Some resins

Tannins

Peppermint Oil contains:

Menthol (50-78%) in another book (30-50%)

This menthol is in combined form with ester which is 5-20%

Mentha-furan

Menthyl acetate

Menthone

Neo-menthone

Iso-menthone

In small quantity
β-caryophyllene
Phellandrene
Valeric acid
Acetaldehyde
Limonene

Structures

Mentha-furan Limonene Menthyl acetate

Uses

1. Peppermint Oil is used as pharmaceutical aid as flavour.
2. Possess carminative property.
3. Act as stimulant.
4. Act as counter-irritant.
5. Industrially it is used in chewing gum, candies, jellies, extracts and as a flavour in confectionary

6. In mouth washes, tooth pastes and pharmaceuticals. **MENTHOL**

Menthol is prepared from the mint oil or obtained synthetically.

Menthol is usually obtained from Japanese peppermint oil by refrigeration at -22°C during which menthol crystallizes. The liquid portion is poured off and crystallized menthol is pressed b/w the filter papers and subsequently purified by recrystallization

Menthol can also be produced synthetically by the hydrogenation of thymol.

Menthol can also be obtained by pinene.

Properties:-

Menthol occurs as a colourless hexagonal crystal which are usually needle like, fused masses and crystal powders. It contain pleasant peppermint oil like odour.

Uses:-

1. Topical anti-pruritic (Mechanism: When applied to the skin in conc. b/w 0.1-1%, menthol dilates the blood vessels causing a sensation of coldness followed by the depression of sensory cutaneous receptors resulting in as anti-pruritic action.) So it is found in the preparations used to treat minor burn, sun burn, poison-ivy rash and athlete foot.
2. It is also used at high conc. 1-16% as counterirritant.
3. In smaller doses it also acts as antiseptic and stimulant and internally possess the depression effect on heart.
4. In combination with camphor, it has analgesic activity.

CORIANDAR

Botanical Origin:-

Corianderum sativum

Family:-

Umbelliferae

Part Used:-

Dried ripe fruit

Habit & Habitat:-

Plant is an annual herb

Indigenous: Italy

Naturalized: Central and Eastern Europe (temperate zone)

Cultivated: India, Bangladesh, Canada, Russia and China.

Eucarine major producer of coriander oil

Extraction:-

Volatile Oil is obtained by steam distillation from dried ripped fruits

Coriandar oil:-

Colour: colourless to pale yellow liquid

Odour: characteristic

Taste: characteristic

Constituents:-

Coriandar Oil contains:

Coriandrol 60-70%

Hydrocarbon 20%

Borneol

Geraniol

Limonene

Pinene

Cymene

Para-cymene

- α -terpinene

Structures:-

Coriandrol Borneol Geraniol

Uses:-

Flavouring agent

Also possess the carminative property

Also possess the aromatic property

CARDAMOM

Botanical Origin:-

Elletaria cardamomum

Family:-

Zingiberaceae

Part Used:-

Dried ripe seeds

Habit & Habitat:-

Plant is a perennial herb

Cultivated: Guatemala, Srilanka, India and Bangladesh

Extraction:-

Plant is obtained from wild sources.

Volatile Oil is obtained by the steam distillation from the dried ripe seeds.

Characteristics

Colour: pale yellow

Odour: balsamic

Taste: sweet

Constituents:-

Cardamom Oil contains 2.8-6.2% of V.O. which include:

- Terpinyl acetate 28-34%
- Terpinyl alcohol (mainly Terpeneol)
- Limonene
- Cineol
- Borneol
- Linalyl acetate

Structures:-

Limonene Terpeneol Borneol Cineol Terpinyl acetate

Uses:-

Cardamom seeds are used as:

- Flavouring agent
- Stimulant
- Carminative
- Condiment

Cardamom Oil is used as:

- Flavouring agent
- Also used as an ingredient in compound cardamom tincture

ALDEHYDE VOLATILE OILS

BITTER ORANGE PEEL

Variety:-

Amara

Botanical Origin:-

Citrus aurantium

Family:-

Rutaceae

Part Used:-

Outer peel of the unripe but fully grown fruit.

Habit & Habitat:-

- Plant is a tree
- Native: India
- Cultivated: Sub-tropical countries (China, Africa, Europe)

Collection:-

Volatile Oil is obtained by expression method or Ecuelle method.

V.O is obtained by the application of high pressure used for the removal of juice and oil

Oil is separated from juice by centrifugal separation at lowest temperature in short possible time.

Constituents:-

Bitter Orange Peel contains:

- V.O. 2.5%
- Vitamin C
- Some bitter principles

Resins

Gums

V.O. contains:

Limonene

Citral

Citronellal

Bitter amorphous glycoside Aurantiamarin

Resinous principle Aurantiamic acid

Flavonoid glycoside such as Hesperidin, Iso-hesperidin and Neo-hesperidin

Bitter principle Aurantin

Structure:-

Limonene

Uses:-

1. Used as flavouring agent.
2. Possess carminative property so also used in stomachic.
3. For loss of appetite and dyspeptic ailments. Bitter orange peel is thought to facilitate weight gain by stimulating the appetite
4. The leaf and flower of bitter orange are used, by infusion, for symptoms of neurotonic disorders in both children and adults in cases of minor sleeplessness

SWEET ORANGE PEEL

Variety:

Sinensis

Botanical Origin:-

Citrus sinensis

Family:-

Rutaceae

Part Used:-

Outer peel or outer rind of the non-artificially coloured ripened fruit.

Habit & Habitat:-

Plant is a tree

Native: India

Cultivated: Sub-tropical countries (China, Africa, Europe)

Brazil & USA are larger producer

Collection:-

Volatile Oil is obtained by expression method or Ecuelle method.

V.O is obtained by the application of high pressure used for the removal of juice and oil

Oil is separated from juice by centrifugal separation at lowest temperature in short possible time.

Constituents:-

Sweet orange peel contains V.O.

Terpene 90% (particularly d-Limonene)

- α & β Citral 5%
Citronellal
Methyl ester of anthranilic acid.

Structure:-

Limonene

Uses:-

1. Oil is used as flavouring agent
2. Possess the carminative property.

LEMON PEEL

Botanical Origin:-

Citrus limon

Family:-

Rutaceae

Part Used:-

Outer yellowish peel of fresh ripe fruit.

Habit & Habitat:-

Plant is a small evergreen tree

Indigenous to India, Pakistan

Cultivated in Sub-Tropical countries in all over the world such as Spain, Italy, California, Australia, Greece, Jamaica, Cyprus, Florida, Brazil.

Numerous varieties and hybrids are cultivated in these areas.

Collection:-

Fruits are collected in January or in August and November when green color of fruit changes to yellow.

Smaller fruits are usually used for the removal of V.O.

Lemon oil is a V.O which is obtained by expression method without heat from the fresh outer peel of the fruit

There are several methods for obtaining the V.O from the lemon fruit:

Method #1:-

Peel → Canvas bag → Pressed → Turbid oil → Stand → Sediment separated
→ Oil is decanted.

First of all, outer peel of the fruit is removed which is placed in the canvas bag and pressed.

Turbid oil is removed and then stand it for few minutes or few hours.

Sediment separated and then oil is decanted.

Method#2:- (Sponge method)

Outer peel is removed

Pressed flat so become flex and oil glands ruptured over a sponge.

Sponge will absorb the V.O.

When it will become saturated, V.O's are squeezed out.

Method #3:- (Ecuelle method)

Place a fruit in a saucer like container that contain small metal pins

- It will cause the rupturing of the V.O glands and from these glands oil is removed and collected in narrow depression slit of saucer.

Method#4:-

Similar to Ecuelle method but peel is used instead of whole fruit.

Method#5:- (Cold press method)

Used to obtain cold press oil.

Volatile Oil is obtained by the application of high pressure used for the removal of juice and oil

Oil is separated from juice by centrifugal separation at lowest temperature in short possible time.

Method# 6 :-

Volatile Oil can also be obtained by distillation method.

Such oil is not comparable with the expressed oil and does not meet the pharmaceutical standard

This method is used to obtain the terpene less oil.

Constituents:-

Lemon peel contains:

Volatile Oil 2-5%

Vitamin C

Other constituents

Volatile Oil contains 90% terpenes including:

Limonene 70-80%

Citral 4%

Other constituents include:

Citronilol

Pinene

Terpinene

Geranyl acetate

Terpeniol

Sesquiterpenes

Structures:-

Geranyl acetate Terpeniol Limonene

Uses:-

1. Flavouring agent
2. Stimulant
3. Possess the carminative property
4. Used in cosmetics

5. Act as liquid cleanser
6. Used for stomachic
7. Stomachic property

CINNAMON OIL

Botanical Origin:-

Cinnamomum zeylanicum.

Cinnamomum loureirii.

Cinnamomum cassia.

Family:-

Lauraceae

Part Used:-

Dried inner bark of coppiced shoots.

Habit & Habitat:-

Plant is a tree

Cultivated: Indonesia, Srilanka, Vietnam, China, West Indies & Madagascar.

Collection & Extraction:-

Bark is gathered from a tree which is about less than 6 years old / 2-3 years old

It is collected from coppiced shoot which is 18-36 months old.

The shoots grow from resting body of plant from where it is cut called COPPICED SHOOT.

5-6 shoots allowed to grow 2-3 meter long and 2-3 cm in diameter

It is trimmed outer cork of the bark is removed & rolled over the stick to make quill shape & outer cortex of the bark is removed

This bark is allowed to dry in air & inner portion is reserved.

Smaller pieces are grind and distilled for cinnamon oil.

Cinnamon oil is distilled with steam and rectified by redistillation.

Characteristics:-

Colour: yellowish / brown liquid

Odour: characteristic

Taste: characteristic

It becomes darker and thicker by exposure of air.

Constituents:-

Cinnamon contains:

Volatile oil 1.2%

Mucilages

Calcium oxalate

Phlobatannins

Volatile oil contains:

Cinnamaldehyde 80-90%

Cinnamyl acetate.

Limonene.

P-cymene.

Phellandrene.

β -caryophyllene
Smaller Eugenol

Structure:-

Cinnamaldehyde limonene

Uses:-

1. It is used as flavouring agent,
2. Used as carminative,
3. Used as powerful germicide.
4. Used as antiseptic ,
5. Used as astringent,
6. Used as aromatic and pungent

BITTER ALMOND OIL

Botanical Origin:-

Prunis amygdalus.

Family:-

Rosaceae.

Part Used:-

Dried seeds / kernels.

Habit & Habitat:-

It is a Tree

Indigenous: Mediterranean countries, Italy, France, Spain

Constituents:-

Seeds contain:

Fixed oil 45%

Proteins 25-30%

Volatile oil 1-3%

It also contains:

Bitter constituents *Amygdalin*

Enzyme *Emulsin*

Benz aldehyde not less than 80%

HCN not less than 2% & not more than 4%

Amygdalin Benzaldehyde + HCN

Structure:

Amygdalin

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Uses:-

1. Volatile oil is used in cough remedies.
2. It is not used in food preparations due to the presence of HCN.

KETONIC VOLATILE OILS

CAMPHOR

Botanical Origin

Cinnamomum camphora

Family

Lauraceae

Part Used

Ketonic crystalline substance in wood of tree

Habit & Habitat

Large evergreen Tree

Indigenous: Srilanka, Brazil, Florida, China, Taiwan.

Characteristics

Natural camphor is a colourless translucent mass with crystalline fracture:

- o Rhombohedral crystals from alcohol
- o Cubic crystals by melting and chilling.

Odour: characteristic

Taste: pungent and aromatic which is followed by cold sensation.

It volatilized at ordinary temperature.

Collection

Naturally

The best yield of camphor is obtained from old trees.

Occur as crystalline product in the collapse of wood of tree.

The wood is cut into chips and treated with steam in distillation tank.

1lb of camphor is obtained from 30-40lb of chips

Camphor is sublimed and liquid volatile is passed away into the receiver.

Excess of Camphor is obtained from the volatile oil.

Camphor is purified by treating it with lime and treating it with lime and charcoal and resublimation into large chambers to form "Flowers of Camphor" which can be made into the familiar blocks by hydraulic pressure.

Synthetically

Synthetic camphor is largely prepared from American Turpentine.

By the action of hydrogen chloride the pinene is converted into Bornyl chloride

It on treatment with sodium acetate ,yields isobornyl acetate.

Hydrolysis of this yields isoborneol and subsequent oxidation gives Camphor.

Chemical Constituents

Camphor oil contains:

Camphor

Cineol

Borneol

Pinene

Camphene

Phellandrene

Limonene

Vanillin
Sesquiterpene
Diterpenes

Structures

Uses

1. Externally as rubefacient, counterirritant
2. Internally as stimulant, carminative and antiseptic
3. Topical anti-pruritic and anti-infective
4. As camphor liniment
5. Used as 1-3% in skin medications and in cosmetic.
6. It is also used to manufacture some plastics, celluloid, in lacquers, varnishes, explosives, pyrotechnics, as in moth repellent and in embalming fluids.

SPEARMINT

Botanical Origin

Mentha spicata

Family

Labiatae

Part Used

Dried leaves and flowering tops which is more green to purple in colour

Habit & Habitat

Perennial herb

Indigenous: Europe

Cultivated: USA & Asian countries

Mentha is cultivated throughout the plains of India

Characteristics

Colour: yellow-yellowish green

Odour: characteristic strong penetrating

Taste: pungent without sensation of cold

Extraction

Obtained by steam distillation

Constituents

Spearmint contains:

Volatile oil 0.5%

Resin

Tannin

The principle components are:

Carvone 50-55%

Alcohols 6-20% (terpeneol)

Esters 4-20%

Other components are:

Limonene

Phellandrene

Dipentene

Dihydracarveol acetate

Cineol
α-pinene
Linalool

Structures

Uses

1. Flavouring agent
2. Carminative
3. Stimulant
4. Spasmolytic
5. Diuretic
6. Mouth washes
7. Tooth pastes
8. Chewing gums
9. It is given in fever, vomiting and bronchitis and employed as lotion.

CARAWAY

Botanical Origin:

Carum carvi

Family:

Umbelliferae (Apiaceae)

Part Used:

Dried ripe fruit

Habit & Habitat:

Plant is a biennial herb about 1 m in height.

It occurs both wild and cultivated in central and northern Europe (The Netherlands, Denmark, Germany, Russia, Finland, Poland, Hungary and Britain) and in Egypt, Morocco. Australia and China.

Collection:

Volatile oils are obtained by steam distillation of dried ripe fruit.

Caraway Fruit:

The fruits, usually used whole, have a pungent, anise-like flavour and aroma that comes from essential oils, mostly carvone and limonene.

Chemical Constituents:

Caraway contains:

Volatile oils 3-7%

Fixed oils 6-20%

- Proteins
- Calcium oxalate crystals
- Mucilage
- Resin
- Colouring matter

Volatile oils contain

Carvone 50-60%

Terpene Limonene 40-50%
Dihydrocarvone
Carveol
Dihydrocarveol

Structure:

Uses:

1. Flavouring agent
2. Carminative
3. Spasmolytic
4. Hepatoprotective
5. Condiments
6. As fragrance in soaps, lotions and perfumes

BUCHU

Botanical Origin:

Barosma betulina
Barosma crenulata

Family:

Rutaceae

Part used:

Dried Leaves

Habit & Habitat:

Plant is a low shrub
Indigenous: South Africa

Extraction:

Leaves contain volatile oils which are obtained by steam distillation.

Chemical Constituents:

Buchu contains

Volatile oils
Mucilage
Resins
Calcium oxalate crystals

Volatile oils contain

Diosphenol 30% (Buchu Camphor)

- Pulegone
- Menthone
- Isomenthone
- Limonene

Structure:

Uses:

As diuretic
As Urinary Antiseptic
For Menstrual Problems.

PHENOLIC VOLATILE OILS

CLOVE

Botanical Origin:

Eugenia caryophyllus

Eugenia caryophyllata

Syzygium aromaticum.

Family:

Myrtaceae.

Part used:

Dried ripe flowering buds.

Habit & Habitat:

Plant is a tree

Native: Mollucca Island

Cultivated: Zanzibar, Brazil, Pemba, Ambon, Madagascar, Mauritius and South Africa.

Best clove is of Tanzania

Collection:

Collected twice yearly when their base changes from green to crimson red in colour in dry weather from August to December.

Dried in open air and their stalk are separated.

On drying 70% water is lost.

In Indonesia 65% of clove production is ground & mix with tobacco in cigarette & smoke.

Extraction

Volatile oil obtained by steam distillation

Characteristics

Colour: colourless-pale yellow

Odour: characteristics

Taste: characteristic pungent

Heavier than water

Becomes darker and thicker by exposure to air.

Morphology:

Size: 1-1.7cm long

Parts:

- 1) Lower stalk called hypanthium.

2) Upper cap or crown.

Chemical constituents:

Clove contains:

Volatile oils 14-20%

Tannins 10-13%

Gums

Resins

Volatile oil contains:

Eugenol 70-95%

Acetyl eugenol 3%

α & β caryophyllene 5-8%

Vanillin

Methylfurfural

Methyl salicylates

β -pinene

Structure:

Eugenol

(4-allyl-2-methoxy phenol) Acetyleneugenol

(4-hydroxy-3-methoxy-benzaldehyde)

Uses:

1. As Antiseptic.
2. As Analgesic
3. Used for platelet aggregation inhibition.
4. As Carminative.
5. As Counter irritant.
6. As dental analgesic and anaesthetic
7. Aromatic
8. Flavouring agent

EUGENOL

It is 4-allyl-2-methoxy-phenol.

Preparation:

It is obtained from clove oil by treating oil with NaOH (10%)

It results in formation of water soluble salt known as sodium eugenolate.

Then washed with ether and decomposed with acids (H_2SO_4)

Finally eugenol is obtained by distillation.

It is a colourless or pale yellow liquid with strong aroma of clove and pungent taste.

Uses:

1. Antiseptic.
2. Local anaesthetic.
3. Applied topically to dental cavities
4. Mix with zinc oxide for temporary dental filling
5. Used in mouth washes.
6. To synthesize vanillin.

Conversion of eugenol into vanillin**THYME****Botanical Origin:**

Thymus vulgaris

Family:

Labiatae

Part used:

Dried leaves and flowering tops.

Habit & Habitat:

Small evergreen herbaceous shrub

Indigenous and cultivated in Spain , France , Italy , Germany (Europe), England , and U.S

Extraction:

Volatile oil is obtained by steam distillation of aerial parts of plant.

Chemical constituents:

Volatile oil contains:

Thymol 36-55%

p-cymene 15-28%

Carvacrol 1-4%

α -pinene

Myrcene

Linalool

Carvacrol Thymol

Uses

1. Anti-fungal
2. Anti-bacterial
3. Antitussive
4. Spasmolytic

THYMOL

Thymol is a phenol obtained from the Thymus oil, Horsemint oil, Ajowan oil (Carum copticum)

Obtained or prepared synthetically from p-cymene & m-cresol

Preparation:

V.O is subjected to freezing temperature until thymol come into crystal

Oil is treated with NaOH to form sodium thymolate which is water soluble hence it is separated from other non phenolic component and finally decomposed by acid to get thymol crystals.

Characteristics:

Colour: Crystals are colourless

Odour: thyme like

Taste: pungent

Solubility: slightly soluble in water

Uses:

1. Used as antiseptic
2. Spasmolytic
3. Used as topical antiseptic & analgesic preparation
4. Anti-bacterial
5. Used in mouth washes
6. As antitussive and expectorant.
7. Used to treat Tinea infection (anti-fungal)
8. Has antiseptic property due to presence of phenolic group

PHENOLIC ETHER VOLATILE OILS

FENNEL

Botanical Origin:

Foeniculum vulgare

Variety:

Vulgare variety: Bitter Fennel

Dulce variety: Sweet Fennel

Family:

Umbelliferae

Part Used:

Dried ripe fruit

Habitat:

Plant is a perennial herb

Indigenous: Asia & Europe

Cultivated: Central & Eastern Europe, Russia, India, China & Egypt

Production Area: Bulgaria, Spain, Japan & Italy

Extraction:

Volatile oil is obtained by steam distillation

Characteristics:

Colour: colourless-pale yellow liquid

Odour: characteristic

Taste: characteristic

Chemical constituents:

Fennel fruit contains:

Volatile oil 1-4%

Volatile oil contains:

Anethole 60-70%

Fenchone 10-30%

Methyl Chavicol

Anisaldehyde

Anisic acid

Limonene

α -pinene

Structure:**Uses:**

1. As Flavouring agent
2. As Carminative
3. Stomachic
4. Spasmolytic (infant colic)
5. Antioxidant
6. Has Aromatic property

MYRISTICA**Botanical Origin:**

Myristica fragrance

Family:

Myristicaceae

Part use:

Dried seeds of plant (dried kernels of the seeds)

Habit & Habitat:

Plant is a tree

Indigenous: Mollucca Island

Cultivated: Indonesia, Malaysia, West Indies and tropical regions of world.

Collection:

The tree bears fruits from its 8-9th year and continues to bear fruits for 30-40 years

2-3 crops collected yearly

Fruits are collected by hand or by hooked stick

When fruit ripe epicarp is split and outer epicarp is removed at the spot.

Seeds are allowed to dry in shell, which takes about 3-6 weeks

Then outer brittle testa is cracked out

Then (nutmeg) seeds are partially coated with lime to protect the attack of insects and then finally graded into slice.

Extraction:

Nutmeg oil is obtained by steam distillation from dried ripe kernels of plant.

Characteristics:

Colour: colourless to pale yellow liquid

Odour: characteristic

Taste: characteristic

Constituents:

Seed contains:

Volatile oil 5-15%.

Fixed oil.

Phytosterin.

Starch

Colouring matter

V.O contains:

α -pinene 10-30%

β -pinene 10-20%

Sabinene 15-30%

Camphene 60-80%

Myristicin 4% (odouring principle)

Safrol 2%

Eugenol 2%

Terpinene 3-6%

Iso, methyl & methoxy eugenol

Elemicin & isoelemicin

Cineol

Terpeneol

Myrcene

Structure:

Safrol Myristicin Elemicin

Uses:

1. Flavouring agent
2. Carminative
3. In large doses it is toxic to human and cause convulsions.
4. Astringent
5. Stomachic

ANISE OIL**Botanical Origin:**

Pimpinella anisum.

Family:

Umbelliferae.

Part Used:

Dried ripe fruit.

Habit & Habitat:

Plant is an annual herb

Indigenous: Asia minor, Egypt, Greece

Cultivated: Spain, Italy, America, Germany, Bulgaria, Southern Russia.

Collection:

Collect the fruit and get seed from them.

Extraction:

Volatile oil is obtained by steam distillation

Characteristics:

Colour: colourless or a pale yellow highly refractive liquid

Odour: strong aromatic

Taste: spicy

Constituents:

Seed contains:

Volatile oil 1-3%.

Fixed oil

Starch

V.O contains:

Anethol 80-90%

Methyl chavicol

Limonene

α -pinene

Linalool

Anisealdehyde

Structures:

Anethol

Uses:

1. Flavouring agent
2. Carminative
3. Condiments

OXIDE VOLATILE OIL

CHENOPODIUM

Variety:

Anthelmenticum

Botanical Origin:

Chenopodium ambrosioides

Family:

Chenopodiaceae

Habit & Habitat:

Plant is a perennial weed

Native: South & Central America

Indigenous: to Mexico

Naturalized: New England & Missouri

Collection:

Fruit is a small irregular and globular in shape, very light in weight & colour of the fruit is brown or greenish yellow.

On rubbing the membranous pericarp is removed & the small brownish-black seeds are exposed. Odour of the seed is strong, pungent & taste is bitter.

Odour of the seed is due to the presence of volatile oil which retain on drying.

Extraction:

Volatile oil is obtained by distillation of ripe seeds.

Oil is known as "*American worm seed oil*"

Characteristics:

Colour: colourless-yellowish

Odour: peculiar, penetrating & somewhat camphoraceous

Taste: bitter & pungent

Constituents:

Seeds contain:

Volatile oil 0.6-1%

Volatile oil contains:

Ascaridole 60-70% (anthelmintic)

Sylvestrene

p-cymene

Choline

Dihydroxy-p-cymene

Structure:

Ascaridole p-cymene

Uses:

1. Anthelmintic drug
2. Used for the expulsion of lumbricoids specially in children.
3. Used as fumigant against mosquitoes.
4. Used as fertilizers.

EUCALYPTUS**Synonyms:**

Gum tree
Fever tree
Tasmanian blue gum

Botanical Origin:

Eucalyptus globulus

Family:

Myrtaceae

Part Used:

Dried leaves

Morphology of leaves:

Leaves are 6-15cm in length

Leaves are covered with bluish grey waxy substance named as "*Blue Gum*".

Habit & Habitat:

Plant is an evergreen tree

Indigenous: Eastern Australia & Tasmania

Cultivated: Southern Europe & California

Commercial supply: France, Spain, Portugal & South Africa.

Extraction:

Dry the leaves & then volatile oil is collected from steam distillation of fresh leaves.

Characteristics:

Colour: colourless-pale yellow

Odour: characteristic aromatic & somewhat camphoraceous

Taste: pungent cooling

Constituents:

Volatile oil is identified in 1870 & prescribed the name Eucalyptol, which is commonly known as Cineole which is about 70%.

It also contains some

Monoterpenes (α -pinene, β -pinene, camphene),

Sesquiterpene (globulol, apiglobulol, ledol)

Monoxide

Aldehydes

Ketones

Structure:**Uses:**

1. It is used in common cold, as cough preparations & as flavourants.

2. Possess antiseptic property.
3. It also works as diaphoretic & expectorant property.
4. Used in nasopharyngeal infection, sinusitis & asthma.
5. It boost up the immune system & helpful in chicken pox, measles & common cold.
6. Used as decongestant.
7. Used as warming oil in muscular ache, rheumatoid arthritis & in pure circulation.

ESTER VOLATILE OIL

ROSEMARY OIL

Botanical Origin:

Rosemarinus officinalis.

Family:

Labiatae or Lamiaceae

Part Used:

Dried leaves and flowering tops

Habit & Habitat:

Plant is an evergreen shrub

Indigenous: Southern Europe.

Cultivated in Britain

Oil production: Spain and North Africa.

Extraction:

Volatile oil is obtained by steam distillation of flowering tops having leafy twigs.

Constituents:

Volatile oil 1-2% contains:

Camphor (20-50%)

Cineol

Borneol

Bornyl acetate

Rosemarinic acid

Monoterpenes hydrocarbons

Triterpenes (α & β -amyrene, flavanoids and phenols)

Structure:

Uses:

1. Used in perfumery, soap liniments.
2. In aroma therapy.
3. Used as flavouring agent.
4. Act as carminative, spasmolytic, diuretic, sedative, antimicrobial

MISCELLANEOUS VOLATILE OIL

ALLIUM

Botanical Origin:

Allium sativum (garlic)

Allium cepa (onion)

Family:

Liliaceae

Part Used:

Bulb of plant.

Habit & Habitat:

Plant is a perennial herb.

Native: Eurasia

Cultivation: Pakistan, Indonesia, China, Asia, India

Extraction:

Volatile oil is obtained by steam distillation.

Constituents:

Major constituent is allicin which is a di-allyl di-sulphide. Also contain allyl-propyl di-sulphide.

Structure:**Allicin****Uses:**

1. Used as ingredient in food and as a food
2. Used as Antithrombotic.
3. Used as Antiseptic, Antihypertensive, Hypoglycaemic.
4. Accelerates the wound healing
5. Possess antibiotic property
6. Hypolipidemic
7. Diaphoretic
8. Used as expectorant & in common cold

ANETHUM

Synonym:

Dill oil

Aneth odorant

Botanical Origin:

Anethum graveolens

Family:

Umbelliferae

Part Used:

Dried ripe fruit

Habit & Habitat:

Plant is an annual herb

Native: South western Asia & southern Europe

Cultivated: Eastern Europe & Egypt.

Extraction:

Volatile oil is obtained by the steam distillation of dried ripe fruit.

Constituents:

Fruit contains:

volatile oil 2-4%

Volatile oil contains:

Carvone 43-63%

Limonene 40%.

Phellandrene

Carveol

Terpinene

Dihydrocarvone

Structure:**Uses:**

1. used as a flavouring agent
2. Used as carminative
3. Ingredient in infant gripe water
4. Used in gastrointestinal ailments.