

**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 distillating 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 ssmaterial 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**

Rolled the fruit over the truff 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-day, 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 isothiocynate 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 C10 H16

 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 C5H8.

 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 isothiocynate.

 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. Abscisic 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. Myrstica (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 rubificient.

 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:-**

Coriandorl 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 Terpineol )

 Limonene

 Cineol

 Borneol

 Linalyl acetate

**Structures:-**

Limonene Terpineol 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 Aurantiamaric 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 SHOOTS.

 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:-**

*Pruris 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*

Syzgium 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-2methoxy phenol) Acetyleugenol

(4-hydroxy-3methoxy-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 result in formation of water soluble salt known as sodium eugenolate.

 Then washed with ether and decomposed with acids (H2SO4)

 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

 Anisealdehyde

 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 continue 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 dried 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 piene10-20%

 Sabinene 15-30%

 Camphene 60-80%

 Myristicin 4% (odouring principle)

 Safrol 2%

 Eugenol 2%

 Terpinene 3-6%

 Iso, methyl & methoxy eugenol

 Elemicin & isoelemisin

 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.