

1-1 Essential oil:

An essential oil is a concentrated hydrophobic liquid containing volatile aroma compounds from plants. Essential oils are also known as volatile oils, ethereal oils, aetherolea, or simply as the "oil of" the plant from which they were extracted, such as oil of clove. An oil is "essential" in the sense that it contains the characteristic fragrance of the plant that it is taken from. Essential oils do not form a distinctive category for any medical, pharmacological, or culinary purpose. They are not essential for health.

Essential oils are generally extracted by distillation, often by using steam. Other processes include expression or solvent extraction. They are used in perfumes, cosmetics, soaps and other products, for flavoring food and drink, and for adding scents to incense and household cleaning products.

Essential oils have been used medicinally in history. Medical applications proposed by those who sell medicinal oils range from skin treatments to remedies for cancer and often are based solely on historical accounts of use of essential oils for these purposes. Claims for the efficacy of medical treatments, and treatment of cancers in particular, are now subject to regulation in most countries.

As the use of essential oils has declined in evidence-based medicine, one must consult older textbooks for much information on their use. Modern works are less inclined to generalize; rather than refer to "essential oils" as a class at all, they prefer to discuss specific compounds, such as methyl salicylate, rather than "oil of wintergreen".

1-2 Clove essential oil:

It is antimicrobial, antifungal, antiseptic, antiviral, aphrodisiac and stimulating in nature.

Clove essential oil has long been used in treatment related to dental care, like toothaches and cavities, as well as for infections skin care, stress, headaches, respiratory problems, weakness, premature ejaculation, cholera and sties.

1-3 Description:

Cloves are the unopened pink flower buds of the evergreen clove tree. The buds are picked by hand when they are pink and dried until they turn brown in color. Cloves are about 1/2-inch long and 1/4-inch in diameter and with their tapered stem, they resemble tiny nails. In fact, their English name is actually derived from the Latin word *clavus*, which means nail.

Although cloves have a very hard exterior, their flesh features an oily compound that is essential to their nutritional and flavor profile. Cloves have a warm, sweet and aromatic taste that evokes the sultry tropical climates where they are grown.

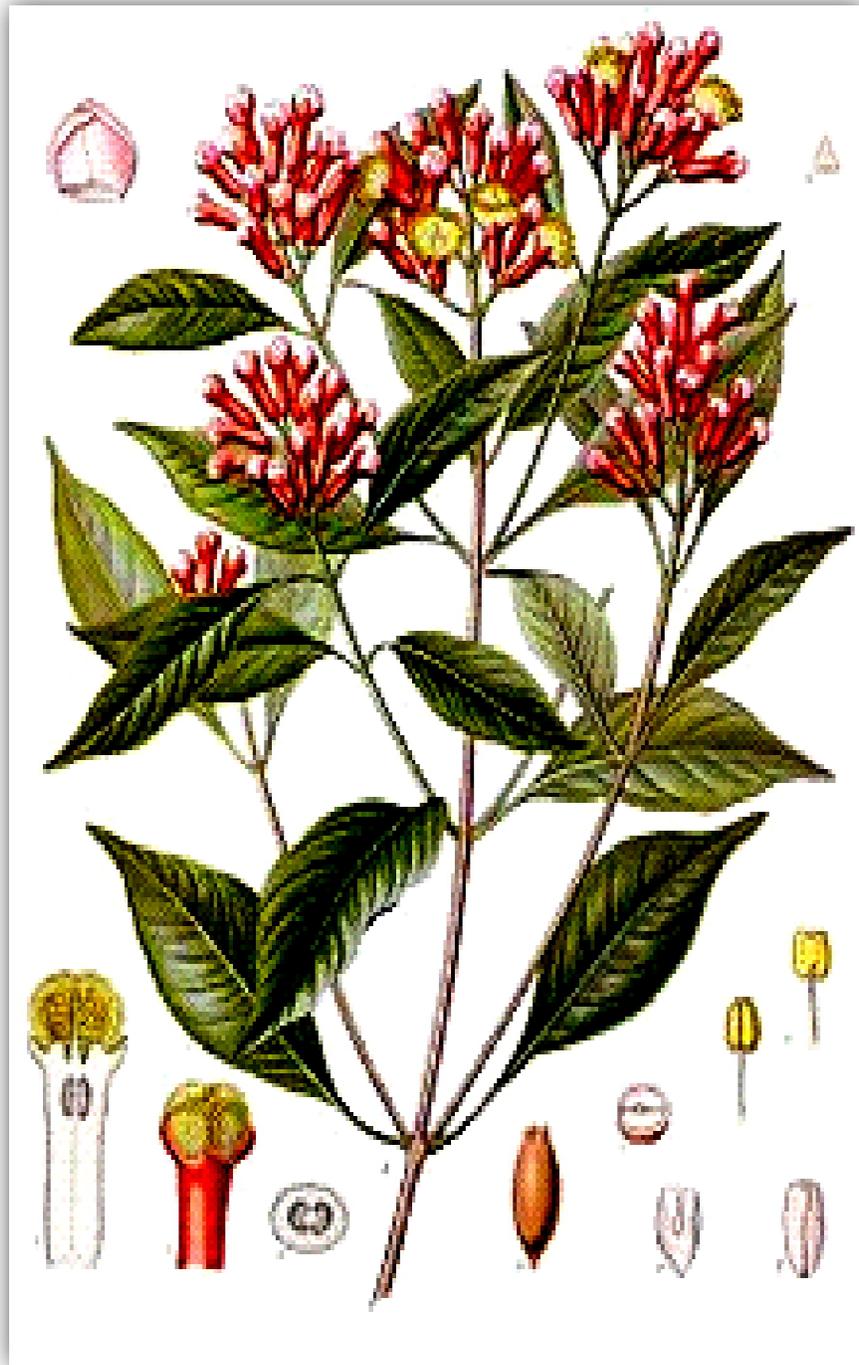


Figure (1-1): Cloves tree

1-4 Scientific classification:

Kingdom	Plantae
Phylum	Angiosperms
unranked	Eudicots
unranked	Rosids
Order	Myrtales
Family	Myrtaceae
Genus	Syzygium
Species	aromaticum

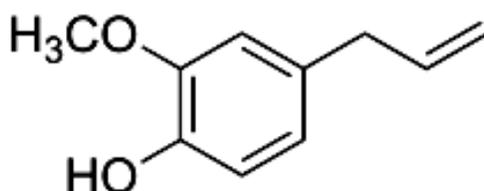
Cloves are the aromatic flower buds of a tree in the family Myrtaceae, *Syzygium aromaticum*. They are native to the Maluku Islands in Indonesia, and are commonly used as a spice. Cloves are commercially harvested primarily in Indonesia, India, Madagascar, Zanzibar, Pakistan, Sri Lanka—and the largest producer, Pemba Island, just off the coast of Tanzania.

The clove tree is an evergreen that grows up to 8–12 m tall, with large leaves and sanguine flowers grouped in terminal clusters. The flower buds initially have a pale hue, gradually turn green, then transition to a bright red when ready for harvest. Cloves are harvested at 1.5–2.0 cm long, and consist of a long calyx that terminates in four spreading sepals, and four unopened petals that form a small central ball.

1-5 Active compounds:

Eugenol comprises 72-90% of the essential oil extracted from cloves, and is the compound most responsible for the cloves' aroma. Other important essential oil constituents of clove oil include acetyl eugenol, beta-caryophyllene and vanillin, crategolic acid, tannins such as bicornin, gallotannic acid, methyl salicylate (painkiller), the flavonoids eugenin, kaempferol, rhamnetin, and eugenitin, triterpenoids such as oleanolic acid, stigmasterol, and campesterol, and several sesquiterpenes. [

Eugenol can be toxic in relatively small quantities; with a dose of 5 - 10 ml severely affecting a 2 year old child.



The compound eugenol is responsible for most of the characteristic aroma of cloves.

1-6 Toxicity:

Eugenol is hepatotoxic meaning it may cause damage to the liver . overdose is possible , causing a wide range of symptoms from blood in the patient's urine , to convulsions, diarrhea nausea ,unconsciousness, dizziness or rapid heartbeat .

According to a published 1993 report a 2- year old boy nearly died after taking between 5 and 10 ml.

1-7 History:

Cloves are native to the Moluccas, formerly known as the Spice Islands of Indonesia. They have been consumed in Asia for more than 2,000 years. Owing to their sweet and fragrant taste, Chinese courtiers dating back to 200 BC would keep them in their mouths in order to freshen their breath when addressing the emperor so as to not offend him. Arab traders brought cloves to Europe around the 4th century, although they did not come into widespread use until the Middle Ages when they became prized for their pungent flavor that served to mask the taste of poorly preserved foods. While for a long time, they were cultivated almost exclusively in Indonesia, today the leading clove-producing region is Zanzibar in Eastern Africa. In addition to these two regions, cloves are also grown commercially in the West Indies, Sri Lanka, Madagascar, India, Pemba and Brazil.

1-8 How to Select and Store:

Whenever possible, buy whole cloves instead of clove powder since the latter loses its flavor more quickly. When squeezed with a fingernail, good quality cloves will release some of their oil. Alternatively, you can place a clove in a cup of water. Those of good quality will float vertically while those that are stale will either sink or float horizontally.

Even though dried herbs and spices are widely available in supermarkets, explore the local spice stores or ethnic markets in your area. Oftentimes, these stores feature an expansive selection of dried herbs and spices that are of superior quality and freshness compared to those offered in regular markets. Just like with other dried spices, try to select organically grown cloves since this will give you more assurance that the herb has not been irradiated.

Cloves should be kept in a tightly sealed glass container in a cool, dark and dry place. Ground cloves will keep for about six months, while whole cloves will stay fresh for about one year stored this way. Alternatively, you can extend their shelf life by storing them in the refrigerator.

1-9 Nutritional Profile:

Source of vitamin K and dietary fiber. They are also a good source of iron, magnesium, and calcium.

1-10 In-Depth Nutritional Profile:

In addition to the nutrients highlighted in our ratings chart, an in-depth nutritional profile for Cloves is also available. This profile includes information on a full array of nutrients, including carbohydrates, sugar, soluble and insoluble fiber, sodium, vitamins, minerals, fatty acids, amino acids and more.

1-11 Oil of cloves:

Oil of cloves, also known as clove oil, is an essential oil extracted from the clove plant, *Syzygium aromaticum*. It has the CAS number 8000-34-8

Clove oil is a natural analgaesic and antiseptic, used primarily in dentistry for its main ingredient eugenol. It can also be purchased in pharmacies over the counter as a home remedy for dental pain relief, mainly toothache. It is also often found in the aromatherapy section of health food stores, and is used in the flavoring of some medicines. Madagascar and Indonesia are the main producers of clove oil.

Clove oil is used widely in microscopical preparation, as it is miscible with Canada balsam, and has a similar refractive index to glass (1.53).

Oil of cloves is also used as an ingredient in cat deterrent sprays, coupled with garlic oil, sodium lauryl sulfate, and other ingredients.

1-12 Types of cloves oil:

There are three types of clove oil :

Bud oil is derived from the flower-buds of *S. aromaticum*. It consists of 60–90% eugenol, eugenyl acetate, caryophyllene and other minor constituents.

Leaf oil is derived from the leaves of *S. aromaticum*. It consists of 82–88% eugenol with little or no eugenyl acetate, and minor constituents.

Stem oil is derived from the twigs of *S. aromaticum*. It consists of 90–95% eugenol, with other minor constituents.

1-13 Uses:

Clove oil can be used for acne, bruises, burns and cuts, keeping infection at bay and as a pain reliever. It helps with toothache, mouth sores, rheumatism and arthritis.

It is beneficial to the digestive system, effective against vomiting, diarrhea, flatulence, spasms and parasites, as well as bad breath.

Clove oil is valuable for relieving respiratory problems, like bronchitis, asthma and tuberculosis. The disinfecting property is useful in cases of infectious diseases.

Placing a few drops of clove oil on a cotton ball and then placing the cotton ball in a linen cupboard will not only fragrance the cupboard, but will help to keep fish moths at bay.

The researchers found three Iraqi women to extract and produce material

Alaijunol used in dentistry from the plant cloves, and managed to researchers from the production of material very act anesthetic and sterilized and used the researchers volatile oil distilled in a steam flowers, plant cloves of the platoon exponential in the extraction and production of material Alaijunol widely used in dental clinics , in a way include the recovery and purification for the degree of purity of 79 - 99% and the rate of extraction amounted to 81.1 - 88.2% out of Alaijunol located in the oil, showed the results of the analysis and study of toxic conducted on new innovation matching full as Alaijunol drug substance pharmaceutical usable it is noteworthy that the material aleugnol rich doing drug and sterile, especially in dentistry , it is used under the same name as asterile and analgesic for dental pain and as an incendiary nerve open in charges root and as and additive in temporary fillings in the manufacture of molds of teeth in the lotions , ownmouth , which underlines the importance of the new discovery draw in this article.

1-14 Cloves benefits:

Stringthens the stomach and the heart and the liver , helps digestion , strimgthens the gums and the praim ,the pleasure of flavor ,goes plurred vestion ,cuts incontinence , removes flickeming if used with homey and vinegar sblaced on the teeth almtsush piece wet by the destruction of sensitive nerve and is antiseptic and for pain and sores and generaes menstruation and against changes in the stomach and weakness and impaired vision and hearing and landing strong , soothing and sedatipe used if costume honey.

1-15 Method of oil extraction:

Soxhlet extractor

It is a piece of laboratory apparatus invented in 1879 by Franz von Soxhlet. It was originally designed for the extraction of a lipid from a solid material. However, a Soxhlet extractor is not limited to the extraction of lipids. Typically, a Soxhlet extraction is only required where the desired compound has a limited solubility in a solvent, and the impurity is insoluble in that solvent. If the desired compound has a significant solubility in a solvent then a simple filtration can be used to separate the compound from the insoluble substance.

- 1- Stirrer bar/anti-bumping granules.
- 2-Still pot (extraction pot) - still pot should not be overfilled and the volume of solvent in the still pot should be 3 to 4 times the volume of the soxhlet chamber.
- 3- Distillation path.
- 4- Soxhlet Thimble.
- 5- Extraction solid (residue solid).
- 6- Syphon arm inlet.
- 7- Syphon arm outlet.
- 8- Expansion adapter.
- 9- Condenser.
- 10- Cooling water in.
- 11- Cooling water out.

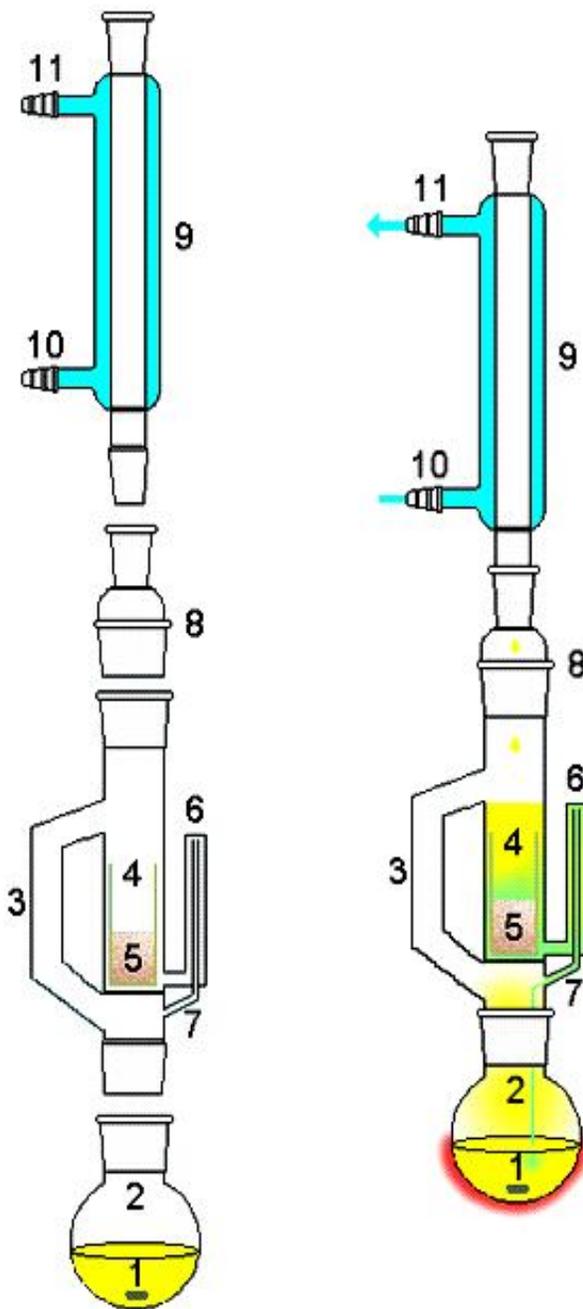


Figure (1-2): Soxhlet extractor

Normally a solid material containing some of the desired compound is placed inside a thimble made from thick filter paper, which is loaded into the main chamber of the Soxhlet extractor. The extraction solvent to be used is taken into a distillation flask and the Soxhlet extractor is now placed onto this flask. The Soxhlet is then equipped with a condenser.

The solvent is heated to reflux. The solvent vapour travels up a distillation arm, and floods into the chamber housing the thimble of solid. The condenser ensures that any solvent vapour cools, and drips back down into the chamber housing the solid material.

The chamber containing the solid material is slowly filled with warm solvent. Some of the desired compound will then dissolve in the warm solvent. When the Soxhlet chamber is almost full, the chamber is automatically emptied by a siphon side arm, with the solvent running back down to the distillation flask. The thimble ensures that the rapid motion of the solvent does not transport any solid material to the still pot. This cycle may be allowed to repeat many times, over hours or days.

During each cycle, a portion of the non-volatile compound dissolves in the solvent. After many cycles the desired compound is concentrated in the distillation flask. The advantage of this system is that instead of many portions of warm solvent being passed through the sample, just one batch of solvent is recycled.

After extraction the solvent is removed, typically by means of a rotary evaporator, yielding the extracted compound. The non-soluble portion of the extracted solid remains in the thimble, and is usually discarded.

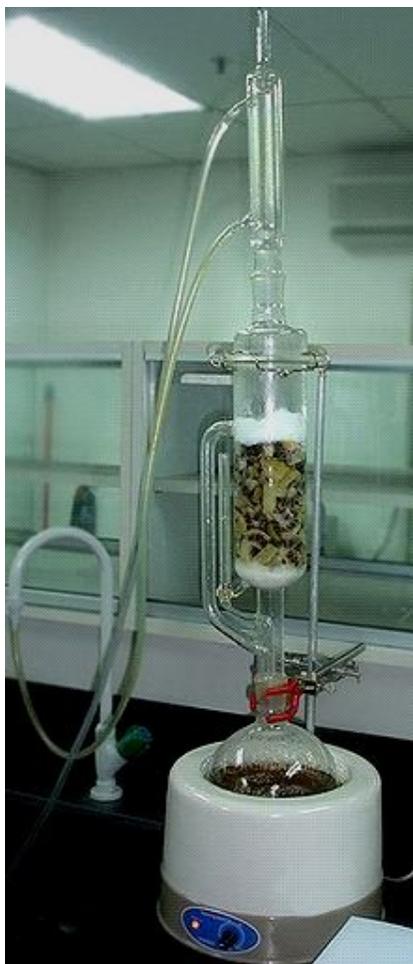


Figure (1-3): Soxhlet extractor

Experimental

2.1 Sample's orgine, description and sample preparaton:

The clove was bought from local market at omdurman . It was in a form of dried and un opened brown flower buds.

cloves are about 1/2 inch long and 1/4 inch in diameter cloves was kibbled into small pices using a mortar and pestle. after that the cloves was weighed and kept in containers till further wed.

2.2 Extraction of the oil using soxhlet extractor:

150ml of petroleum ether was placed into a round botton and was inserted in the center of the extractor , and the appasatus was assembld . The soxhlet extrution was heated at 40c ,when the solvent boiled ,the vapour rises throubh the vertical tube into the condenser at the top. the liquid condensate drips into the filter paper thimble in the center , which contais the solid clove to be extracted. the extract seeps through the pores of the thimble and fills the siphon tube , where it flows back down into the round botton flask the extraction was allowed to continue for 7hours at the end the solvent was evaporated on rotarory evaporator and the percentave of oil extracted was determind .

2.3 Determination of the saponification value (Sv):

2g of clove oil was weighed in a conical flask 25ml of alcoholic potassium hydroxid (0.5M) was added from burette . the content of the flask was refluxed on water bath 45 minuts ,cooled and titrated against dilute hydrochloric acid until the end point using ph. ph indicator (V1) . The saponification value Sv was caleulated according to the equation.

$$Sv = \frac{(v_2 - v_1) \times 28.05}{w}$$

When v_1 is the volume of acid used in titration of the sample . v_2 is the volume of acid used in titration of the blank.

V_1 is the volume of acid used in titration of the sample.

V_2 the volume of acid used in titration of the blank.

W = weight of sample

2.4 Determination of the acid value (Av):

1g of cloves oil was weighed in a conical flask 2 ml of ethanol were added by measuring cylinder . the content of the flask was shaken well and titrated against standard potassium hydroxide solution (v_1) .the titration was repeated without the sample (blank titration v_2).

The acid value Av was estimated as follows:

$$Av = \frac{(v_2 - v_1) \times 5.61}{w}$$

when

V_1 is the volume of potassium Hydroxide used in titration of the sample.

V_2 the volume of potassium Hydroxide used in titration of the blank.

W = weight of sample

2.5 Determination of the iodine value:

0.2g of cloves oil was weighed in conical flask ,10 ml of chloroform and 25 ml of wiggins solution were added to conical flask . the conical flask was left in the dark for 30 minutes . 10 ml of potassium 10% iodide solution was added followed by 100 ml of distilled water and the liberated iodine was titrated 0.1N sodium thiosulphate solution using starch as indicator

(v1) the titration was repeated without the sample (blank titration v2) .

The iodine value Iv was determined using the following relation:

$$Iv = \frac{(v_2 - v_1) \times M \times 12.69}{w}$$

where

V1 is the volume of thiosulphate solution used in titration of the sample.

V2 the volume of thiosulphate solution used in titration of the blank.

W = weight of sample

M = molarity of thiosulphate

Results and discussion

3.1 Result:

The percentage of cloves oil extracted was 14.37% by weight obtained result for properties carried out on the cloves oil.

Property	value
Saponification value	189.33
Acid value	6.95
Iodine value	119.9

3.2 Discussion:

The results obtained for the percentage of cloves oil is 14.37 based on the type of clove which is used and the method of extraction.

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The saponification value of cloves oil was found to be comparable to that of sesame oil, sun flower oil olive oil and corn oil were found to be 189.33, 190.5, 192.5, 190 and 190 respectively.

The higher iodine value the more $C=C$ bonds are present in the oil.

The result obtained for the iodine value of clove oil 119.9 shows increase in the average degree of unsaturation of the oil as such the amount of iodine sesame oil 111.5 , olive oil 84.5 and corn oil 115.5 .

Acid value was used to quantify the amount of acid present.

The acid value of clove oil was found to be 6.95mg where as that of sesame oil was 2mg.

3.3 Conclusion:

The acid values of cloves oil was three time higher comparable to sesame oil.

Where as its iodine value and saponification value were compare very with sesame oil, sun flower oil and corn oil.

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