MONOGRAPH OF CLOVE

Syzygium aromaticum Linn

INTRODUCTION

Botanical Name : *Syzygium aromaticum* (*Eugenia caryophyllus*)

Family : Myrtaceaea

Synonym : Clove

Part used : Flower Buds

HISTORY

Cloves were used in China as early as 266 BC, and by the 4th century, they were known in Europe, although very expensive. Same as with nutmeg, the Dutch also destroyed all trees from surrounding native islands to secure a monopoly, and cultivated them only in a small group of islands. In 1770, the French managed to introduce clove trees to Mauritius, and started cultivating them there, as well as in Zanzibar, Penang and Sumatra

Fig : Fresh Clove Buds

GEOGRAPHICAL SOURCES

Molucca or Clove Islands, Zanzibar, Pemba, Madagascar, Indonesia & Brazil.

COLLECTION AND PREPARATION

- The flower buds are collected when the lower part turns green-crimson. The cloves are dried in the open air on mats & separated from their peduncles (forming clove stalks which are also sold commercially). If left on the tree for too long, the buds open & the petals fall, leaving "brown cloves". Later the fruits ("mother cloves") are produced.
- Dried clove buds are harvested at the time when the buds have reached their fullsize before the corolla open, and the hypanthium have turned reddish.
- Harvesting clove buds should be undertaken at the right stage. Early picking, fallen and over-ripe buds will produce buds of a lower quality
- The harvested buds are separated from the stems by hand or thresher machine. After separation, the buds are dried by the sun or an artificial dryer.
- The colour and oil content of sun and artificially dried clove buds are not significantly different

Fig : Drying of Clove buds

CLOVE OIL :

- The essential oil content and the ratio between eugenol and eugenol acetate influences the aroma. Higher content of essential oil is preferred. Higher content of eugenol will produce a harsher aroma, on the other hand, higher content of eugenol acetate produces a smoother aroma.
- Clove oil can be obtained from distillation of buds, leaf or stem, each resulting in an oil having different characteristics of oil . The yield and quality of the oil are influenced by origin, variety, post-harvest processing, pre-treatment before distillation, distillation method and post-distillation treatment.
- Clove buds and stem are comminuted before distillation to break the oil cells and widen the surface so that the oil can be released more easily from the cells. The highest yield derived from high-quality clove bud is 20 %. In the UK, the fi nest oil containing 85–89 % eugenol, is obtained by water distillation

DESCRIPTION

MORPHOLOGY :

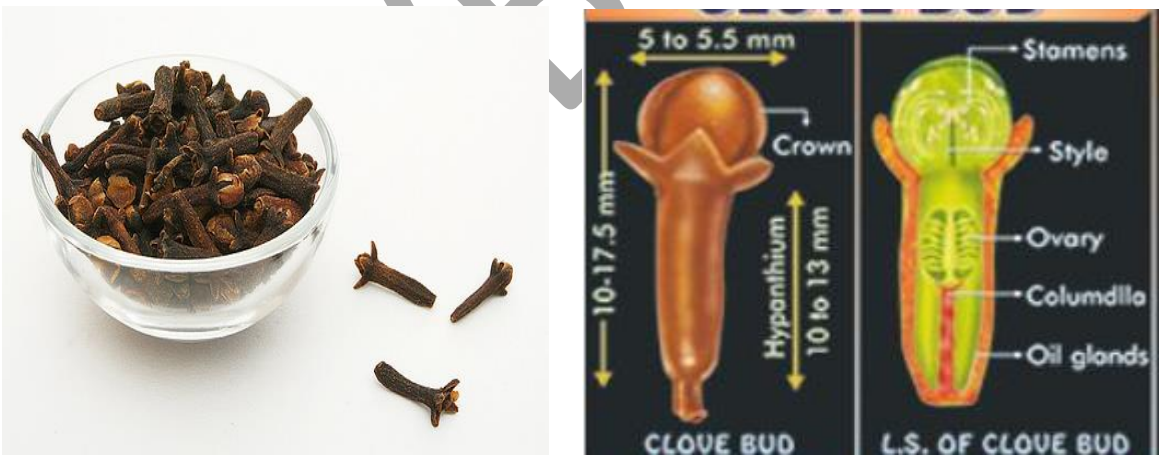


Fig : Dried Clove Buds

- Clove has a upper crown region and hypanthium.
- The crown region consists of calyx, corolla, style and stamens. Calyx has four thick sepals. Corolla is also known as head, crown or cap, it is dome shaped and has four pale yellow coloured petals which are imbricate, immature and membranous.
- The hypanthium is subcylindrical and tapering at the end. It is 10-13 mm long, 4mm thick and 2mm thick. It has schizolysigenous glands and bilocular ovary consisting of abundant ovules.

MICROSCOPY:

The transverse section through the hypanthium shows the following:

- Epidermis: Single layer , straight walled with anomocytic stomata and with thick cuticle.
- Cortex: The cortex has three distinct region. Peripheral region: Two or three schizolysigenous oil glands embedded in parenchymatous cells
  Middle layer: Consists of ring of bicollateral vascular bundles. Isolated lignified
  Inner region: Zone of parenchyma, composed of airspaces.
- Columella: Consists of parenchymatous cells rich in calcium oxalate clusters and a ring of vascular bundles towards the periphery
- The transverse section through ovary shows presence of ovary with numerous ovules in it.

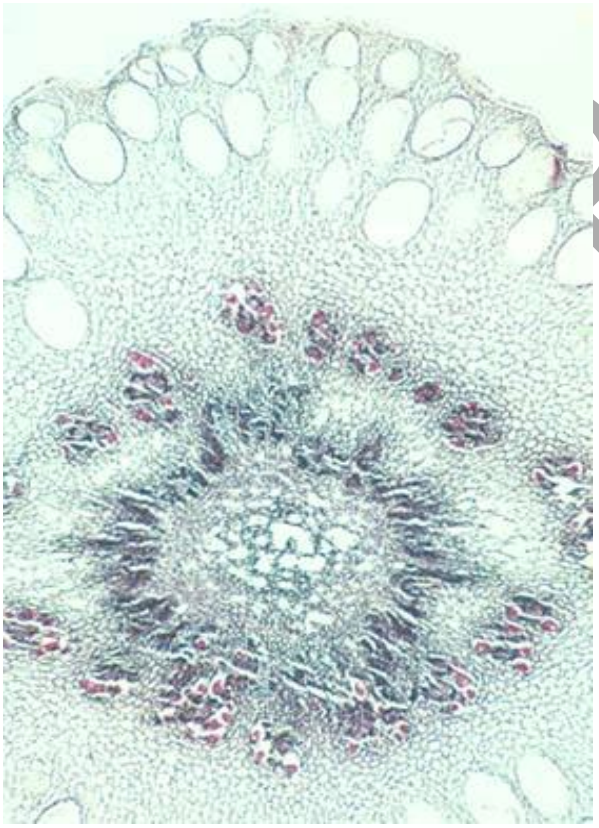
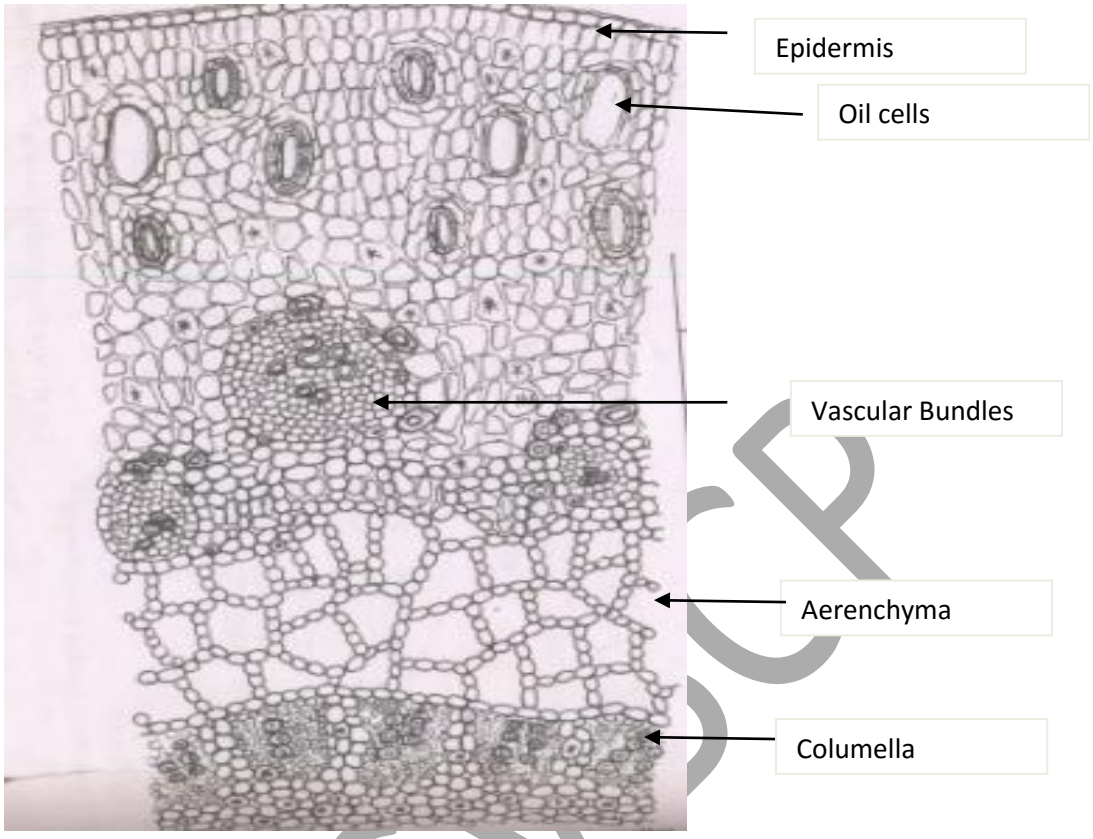
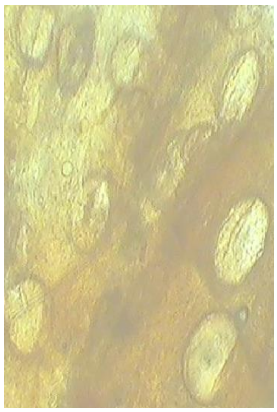


Fig : Transverse section of Clove buds



POWDER CHARACTERISTICS



Oil cells

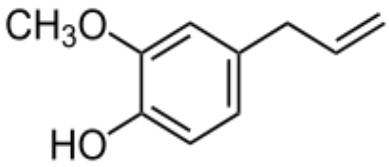
Pollen Grains (45X)

Fibres (45X)

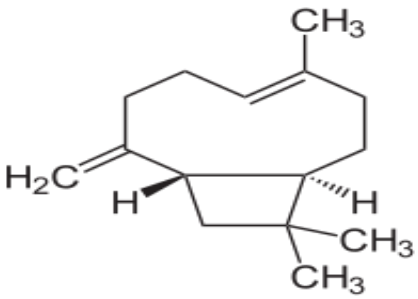
Anther

CHEMICAL COMPOSITION

- Eugenol composes 72–90% of the essential oil extracted from cloves and is the compound most responsible for clove aroma 100% extraction occurs at 80 minutes in pressurized water of 125 °C. Ultrasound-assisted and microwave-assisted extraction methods provide more rapid extraction rates with lower energy costs.
- Other constituents of clove oil include acetyl eugenol, beta-caryophyllene and vanillin, crategolic acid,
- Tannins- bicornin, gallotanniacid, methyl salicylate(painkiller),
- Flavonoids eugenin, kaempferol, rhamnetin.
- Triterpenoids -oleanolic acid, stigmasterol and campesterol
- Eugenol is toxic in relatively small quantities; for example, a dose of 5–10 ml has been reported as being a near fatal dose for a two-year-old child.
- Clove oleoresin is extracted from the stems or the buds. Clove oleoresin prepared by solvent extraction of clove bud yielded about 18–22 % oleoresin (90–92 % volatile components) using benzene and 22–31 % using alcohol.



Eugenol



Caryophyllene

CLOVE OIL

Fig : Clove oil

- Oil of cloves is yellow or colourless, is slightly heavier than water.
- Oil distilled in Europe and the US normally does not need purification, while oil distilled in other areas (e.g. Madagascar) does
- Contains mainly eugenol & acetyleugenol , Sesquiterpenes (α and β caryophyllenes)

THERAPEUTIC USES

- Dental analgesic - The effect is due to its ability to suppress prostaglandins and other inflammatory mediators
- Carminative, antiseptic, aromatic, stimulant.
- anaesthetic.
- It is used as a stimulating expectorant in bronchial problems.

ADULTARANTS

- **Clove stalks** are slender stems of the inflorescence axis that show opposite decussate branching. Externally, they are brownish, rough, and irregularly wrinkled longitudinally with short fracture and dry, woody texture.
- **Mother cloves (anthophylli)** are the ripe fruits of cloves that are ovoid, brown berries, unilocular and one-seeded. This can be detected by the presence of much starch in the seeds.
- **Blown cloves** are expanded flowers from which both corollae and stamens have been detached.
- **Exhausted cloves** have most or all the oil removed by distillation. They yield no oil and are darker in color

Clove stalks

Exhausted Clove

Blown Clove

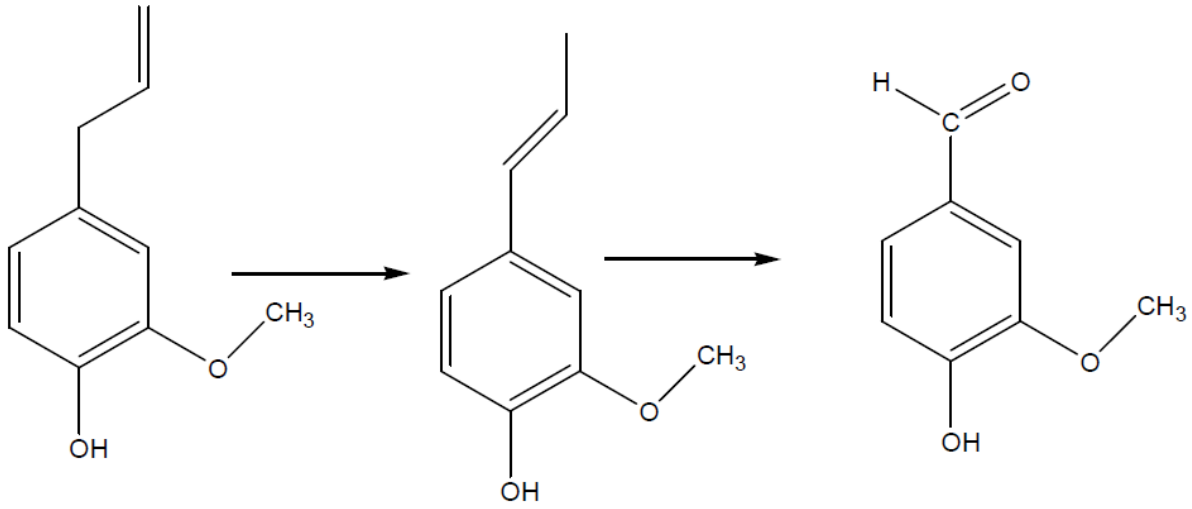
Mother Clove

COMMERCIAL APPLICATION

From eugenol to vanillin:

The large-scale industrial synthises of vanillin is a classic early method , it starts from eugenol, which occurs naturally in cloves, nutmeg and cinnamon. This isomerizes to isoeugenol in alkaline solution, and this in turn can be oxidized (by nitrobenzene) to vanillin .

Other oxidizing agents like acidified potassium dichromate can be used, but then the OH group has to be protected by acetylation prior to oxidation**.** The double bond was isomerizes, and then oxidized and cleaved to form vanillin



eugenol isoeugenol vanillin

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