

ESSENTIAL OILS

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INTRODUCTION

- **Essential oils** are complex mixtures of volatile chemicals found in natural matrices of living organisms.
- They are responsible for the odour and sometimes taste properties of aromatic materials which maybe **of plant, animal or microbial origin** occurring in terrestrial and marine realms.
- Such materials which are generally odorous are named also as “volatile oils”, “essences”, “aetheroleum” or “ethereal oils” due to their oil-like nature.



INTRODUCTION

- Aromatic plants are the major source of essential oils which may be found in almost all parts of a plant such as leaves, flowers, bark, seeds, fruits, wood, rhizome, root, root bark, etc.

leaves (eucalyptus, cedar, laurel)
leafy branches (pine)
herbaceous parts (oregano, mint, sage)
flowers (rose, jasmin)
dried buds (cloves)
bark (cinnamon, cassia)
wood (sandalwood, cedarwood, rosewood)
bulb (onion, garlic)
roots (angelica, vetiver, orris)
rhizomes (ginger, acorus)

fruits (aniseed, fennel, coriander, cumin)
fruit peel (orange, lemon)
pseudofruit (juniper)
seed (carrot seed, mustard seed, cardamom)
root bark (sassafras, xylopi)
balsam (storax, peru balsam)
oleogumresin (frankincense, myrrh, mastic)
oleoresin (turpentine, opopanax)
lichen (oakmoss, treemoss)
liverwort

INTRODUCTION

- Among many others, main essential oil plant bearing families include **Apiaceae, Lamiaceae, Asteraceae, Cupressaceae, Lauraceae, Pinaceae, Rutaceae, Myrtaceae, Santalaceae, Zingiberaceae, Zygophyllaceae** etc.
- Essential oils, their fractions or aromachemicals isolated from them are ingredients of flavors and fragrances.

INTRODUCTION

- ❑ Essential oils are “low volume – high value” products.
- ❑ 3.5 to 4 tons of fresh rose flowers are needed to produce 1 kg of rose oil. One kilogram of rose oil sells for *ca.* € 9.000 in world markets.
- ❑ In oregano oil for which Turkey is a major producer, yield varies between 2-8 per cent according to the species used and it sells between \$ 60 to 120 according to its quality.
- ❑ On the other hand, 1 kg of agarwood oil (Oud oil) (*Aquilaria* sp.) sells for \$ 30.000.

INTRODUCTION

- ❑ They are either used as such, or pure aroma chemical or an oil fraction can be added to flavor or fragrance compositions.
- ❑ However, flavor and fragrance industries prefer to use their synthetic derivatives in compounding due to their lower cost.
- ❑ Essential oils are also used in food industries especially in flavoring sauces and package food

INTRODUCTION

- A few of them are found in animal sources such as musk, castoreum, civet or sperm whale (ambergris), or produced by microorganisms.
- Production of essential oils from animals has been banned in order to protect biodiversity.



Castor canadensis



Musk deer, *Moschus moschiferus*



Civet cat, [*Civettictis civetta*](#)



Sperm whale, Cachalot, *Physeter macrocephalus*

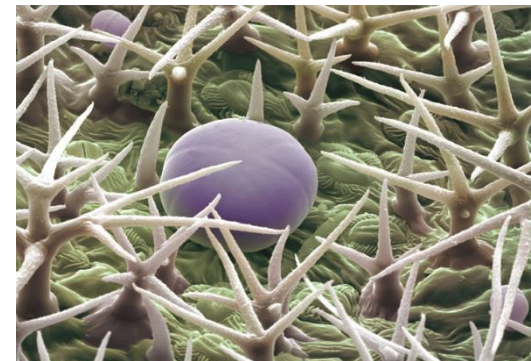
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- Essential oils are frequently associated with gums and/or resins.
- They are freed from such products by distillation.
- The Council of Europe describes essential oil as a product obtained from vegetable raw material.



INTRODUCTION

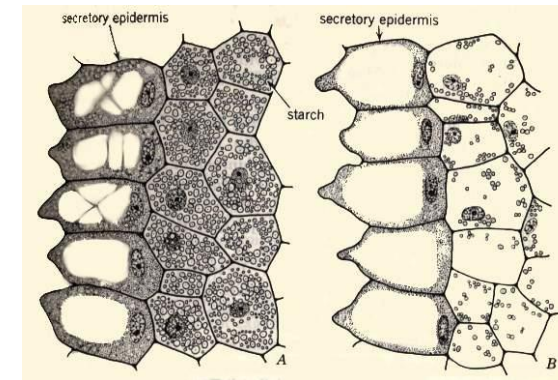
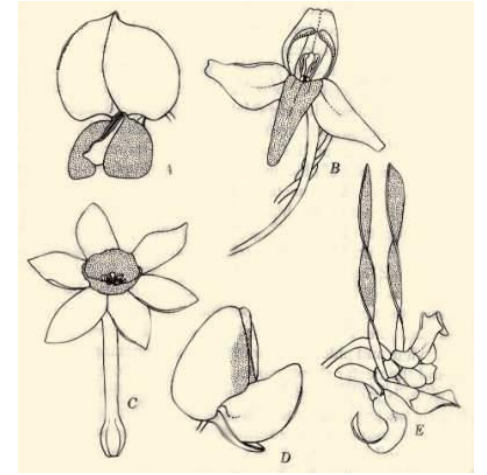
- Volatile constituents are biosynthesized and stored in plants by superficial or subcutaneous structures.
- Superficial structures include glandular hairs. Subcutaneous structures are specific tissues with a function to produce and store them.
- Glandular hairs are generally found on the surface tissues of Labiatae (**Lamiaceae**) plants and by gently squeezing the surface due to bursting of the hair releasing the oil, volatiles are emitted to the air.



Jasminum glandular hair

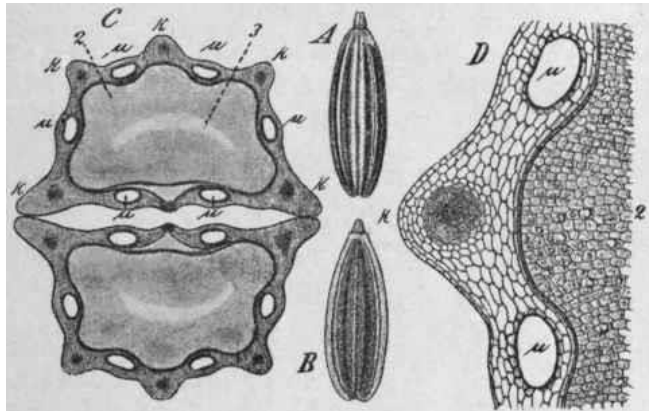
INTRODUCTION

- Subcutaneous oils, on the other hand, are contained in internal structures such as oil cells, ducts or secretory cavities. The fragrance of flowers is commonly produced by essential oils distributed throughout the epidermis of perianth parts. In some plants, however, the fragrance originates in special glands named osmophors.
- Osmophors are found in Asclepiadaceae, Aristolochiaceae, Araceae, Orchidaceae and Burmanniaceae. The osmophors have a secretory epidermis tissue usually several layers in depth.
- The tissue may be compact and vacuolated, in other words, it may be permeated by intercellular spaces. Oil is contained in modified parenchyma cells in Piperaceae, resin canals in Coniferae and gum canals in Cistaceae and Burseraceae.

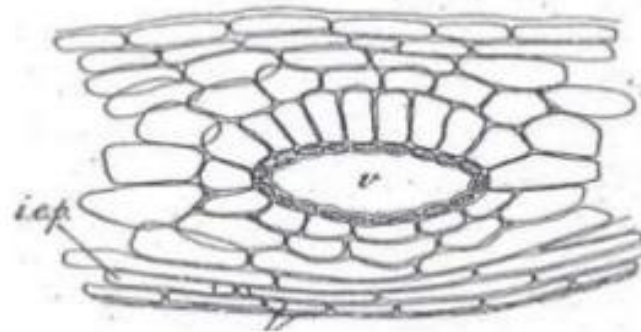


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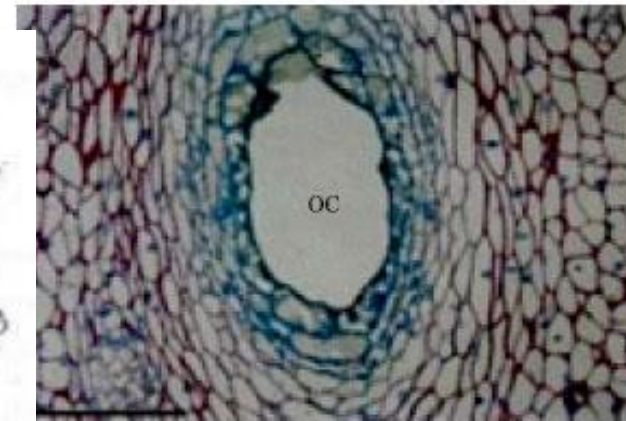
- Depending on the plant family, subcutaneous oils are found in modified parenchyma cells (Piperaceae, Rosaceae) or lysigenous, schizogenous, schizolysigenous cavities and passages (Apiaceae, Pinaceae, Rutaceae)



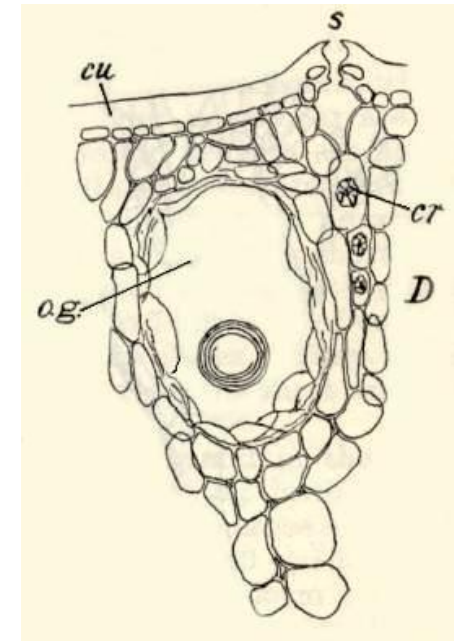
Fennel fruit showing vittae



Schizogenous duct (vittae)
in fennel fruit



Lysigenous oil gland of Orange
rind

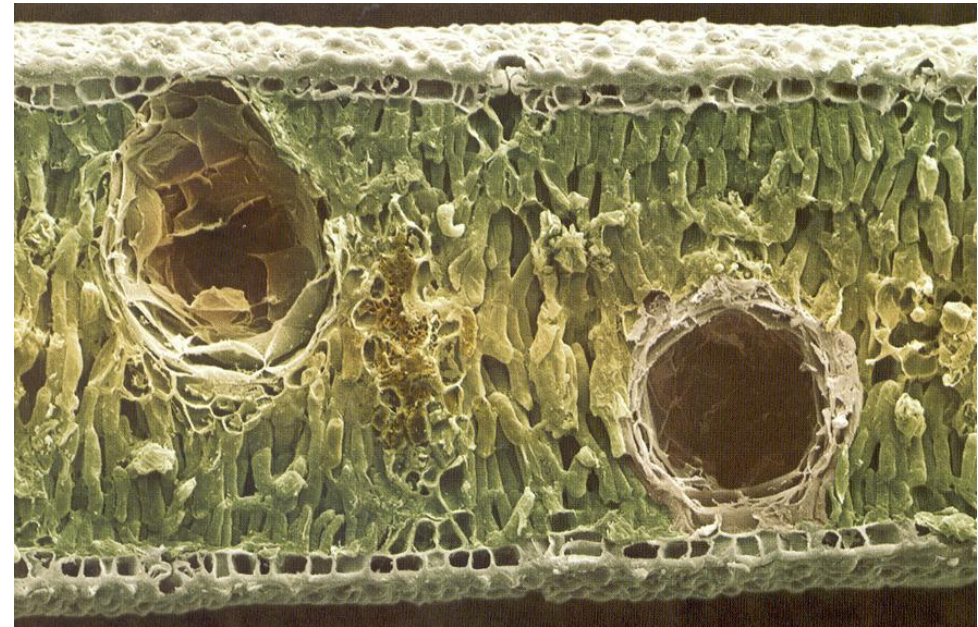
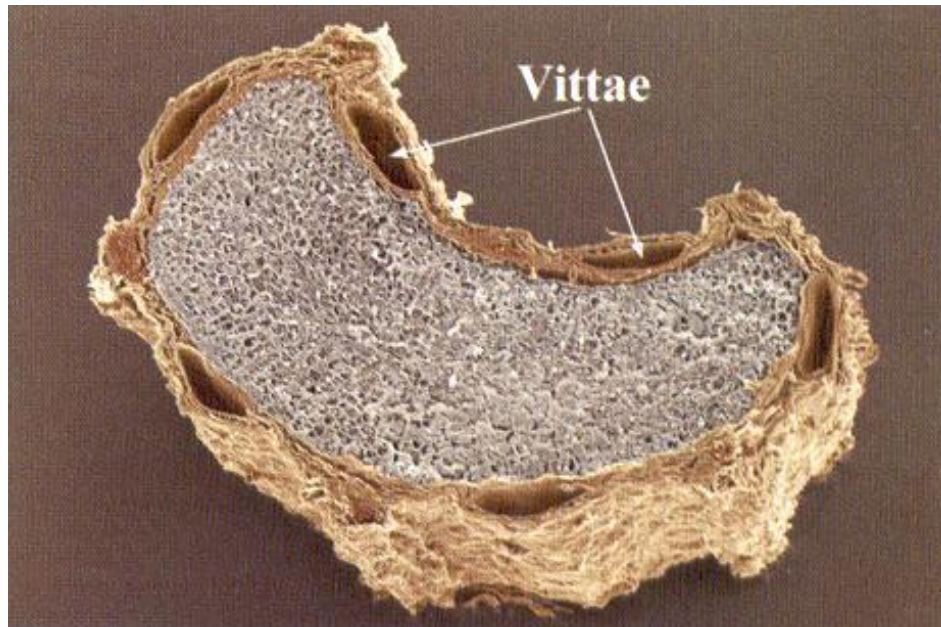
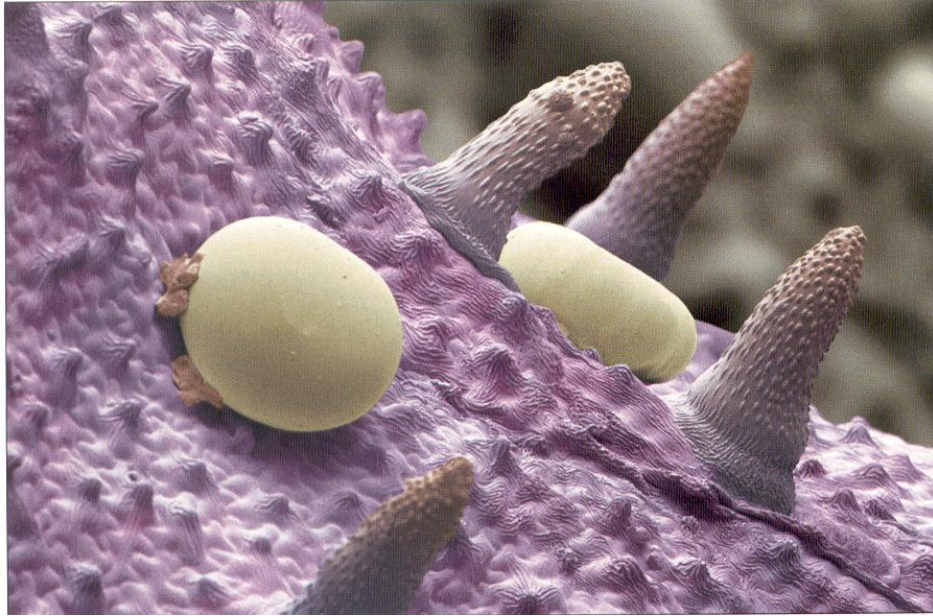


Schizolysigenous cavity
in clove buds

INTRODUCTION

- For subcutaneous oils, it is necessary to crush the plant organ such as leaf, bark, wood, root, fruit or seed, in order to break those tissues to free the oil.
- Therefore, you need to gently touch the leaf of a mint to smell the oil, but crush the laurel leaf to get the same effect.
- Plant exudates such as balsams, oleoresins and gumoleoresins also contain essential oils in their matrix.

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- In some plant species, volatiles are in glycosidical form bound with sugars and some type of hydrolysis is needed to free them to become fragrant.
- Therefore, rose petals, for instance, are subjected to a short wilting period to allow enzymes to free the volatiles prior to distillation in order to increase the yield of essential oil.

INTRODUCTION

- Due to their liquid nature at room temperature, essential oils are called as oil.
- However, they should not be confused with fixed or fatty oils, which comprise naturally occurring mixtures of lipids which may not necessarily be volatile.
- Therefore, essential oils differ entirely from fixed oils both in chemical and in physical properties.

INTRODUCTION

- A simple test can verify the occurrence of an essential oil.
- When dropped on a filter paper, essential oil evaporates completely; however, fixed oil leaves a permanent stain which does not evaporate even when heated.

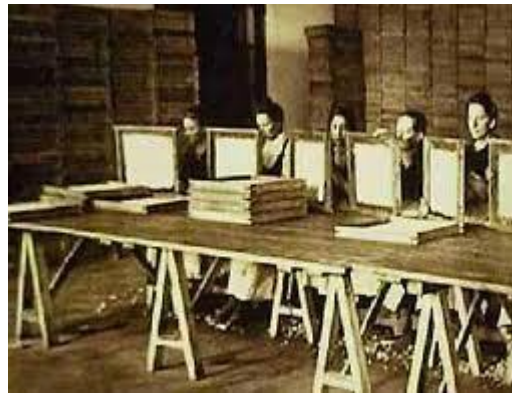


INTRODUCTION

- Essential oils can be freed from their matrices by a thermal process or expression and are obtained by water, steam, water and steam distillation, dry distillation, or expression only in the case of citrus fruits.
- Aromatic chemicals can be captured from the headspace of plant parts emitting volatiles by headspace trapping techniques.

INTRODUCTION

- Aromatic materials can also be recovered by **extracting with organic solvents or fluidized gasses** but the resulting material is not technically considered an essential oil.
- Concretes, absolutes, spice oleoresins, etc. are considered **aromatic extracts** which contain non-volatile components as well.



INTRODUCTION

- Apart from distillation to obtain essential oils the following extracts are obtained from aromatic plants.
- When fresh material is extracted a non-polar solvent (e.g., n-hexane), the final product is called a “**concrete**” which is a dark coloured fragrant semi-solid mass.
- A concrete can be extracted with ethanol, followed by cooling to freezing temperature (-15°C) and filtering to eliminate waxes to obtain an “**absolute**” which is a thick, dark highly fragrant liquid resembling an essential oil.
- If dried plant material is used in extraction, the final solid or semi-solid product is called a “**resinoid**”, or “**oleoresin**” in trade.
- If ethanol is used in the extraction process, the final product which is used in liquid form is a “**tincture**”.

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- “**Enfleurage**” is an extraction technique whereby fresh flowers are placed on a bed of thick prepared fat spread on a glass support and spent flowers are replaced with fresh ones until the fat is saturated with oil. This oil rich fat is called a “**pommade**” which can be used as such or extracted with ethanol to produce an “**extrait**”.
- “**Balsam**” is a pathologically induced fragrant exudate of a shrub or tree. It is characterized by high content of benzoic and cinnamic acids and their esters.
- “**Oleoresin**” is also a pathologically induced natural exudate of a tree or a shrub which comprises resin and high content of essential oil.
- “**Oleogumresin**” is like oleoresin but it also contains gum.

INTRODUCTION

- The function of essential oil in plants is not fully understood.
- Microscopic examination of plant parts that contain the oil sacs readily shows their presence.
- The odours of flowers are said to act as attractants for insects involved in pollination and thus may aid in preservation and natural selection.
- Essential oils are almost always bacteriostats, often bacteriocides and antimicrobials having a wide range activity spectrum.

INTRODUCTION

- Many chemicals of essential oils are **active** and thus could participate readily **in metabolic reactions**.
- They are **sources of plant metabolic energy**, although some chemists have referred to them as waste products of plant metabolism.
- **Exudates**, which contain essential oils, e.g, balsams and resins, act as protective seals against disease or parasites, prevent loss of sap, and are formed readily when the tree trunks are damaged.



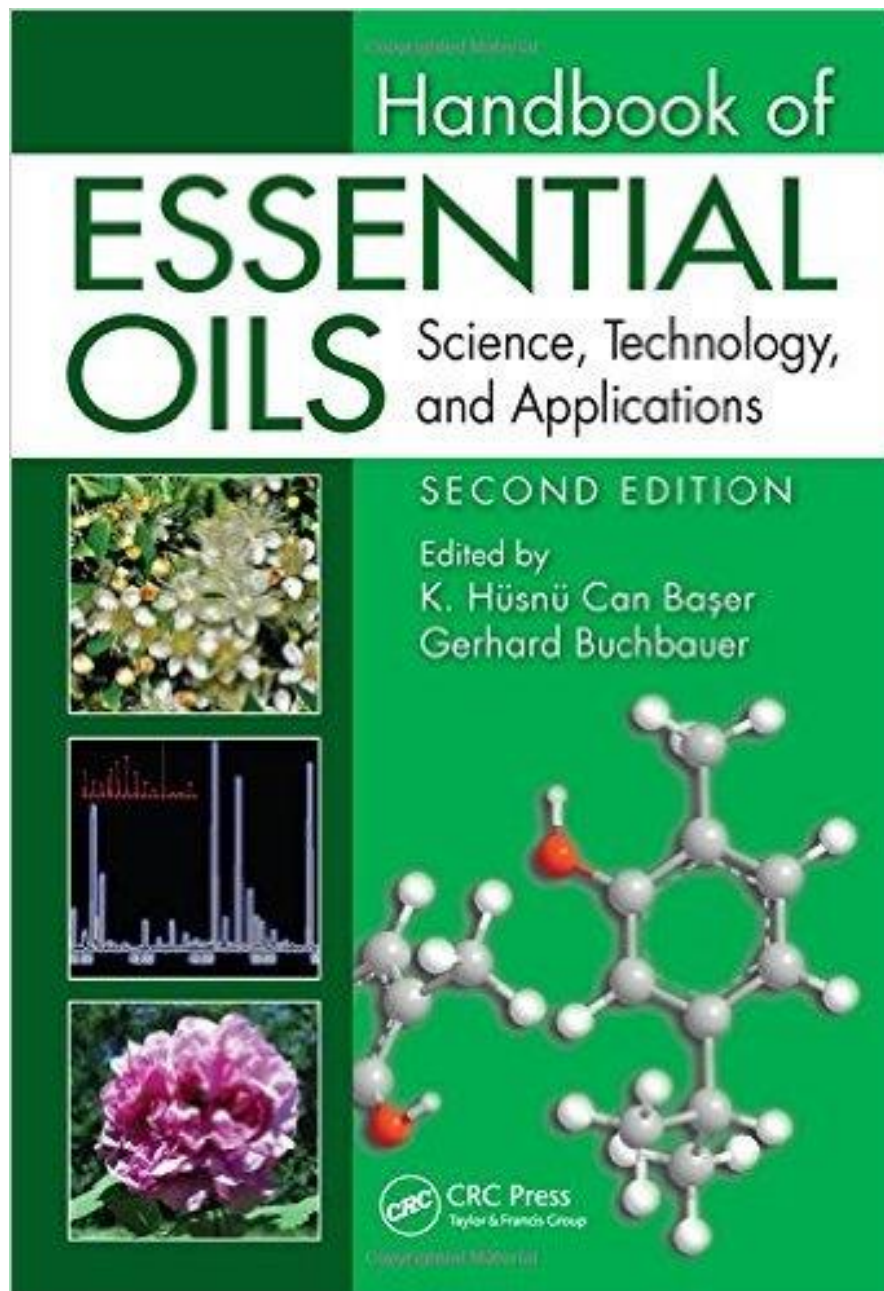
INTRODUCTION

- Essential oils are used:
- For **flavouring**, for instance in confectionery, beverages and processed goods
- As **fragrances** in, for instance, oral & body care products, perfumes and hair care
- In **therapeutic applications**, as pharmaceuticals, pharmaceutical excipients, in health care and aromatherapy
- As **antimicrobials** in health care products, food preservation, veterinary medicine
- As **insect repellents**
- In **household products**.
- As **sources of aromachemicals**
- and are utilized as such or in diluted forms in therapy or by the aromatherapy sector.
- The main industries using essential oils for cosmetics are aromatherapy, perfumes/fragrances and skin & hair care industry.

INTRODUCTION

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