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EXTRACTION OF ESSENTIAL OIL: CAMPHOR OIL

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ABSTRACT

Pure essential oils are concentrated oils from various naturally occurring plants, including flowers, roots, seeds, resins, and the outermost layer of plants, trees, shrubs, and fruit rinds. Humans know these oils' benefits for the body, skin, and spirit. Due to their abundant therapeutic or odoriferous qualities, these oils are frequently used in commercial settings.

Objectives: - To learn about the perks and pitfalls of various extraction techniques, the selection and effectiveness of a single method, and the processes available for extracting oils from plants and trees.

Results: The method used to extract essential oils from plants is crucial since some techniques employ solvents, which might harm the medicinal qualities of trees and plants. The quality and yield of the oil never stay the same despite the different extraction techniques. The hydrodistillation technique has been used in this investigation because of its low operating costs and gentle extraction conditions. Water vapour is used as a critical component in extracting oils.

Conclusion: The process of extracting essential oils through a variety of innovative techniques and procedures improves the quality and yield of the essential oils while reducing the risk of losing the essential components of

plants and trees. It also reduces the risk of chemical exposure and extraction time, making it environmentally friendly.

Keywords: Camphor oil, Hydro Distillation using Clevenger apparatus

INTRODUCTION

Since ancient times, people have used plants and trees for therapeutic purposes. We now deploy the same process with essential oils. Many therapeutic plant systems contain sweet-smelling hydrocarbons called essential oils.[1]Essential oils are highly concentrated volatile plant-derived aromatic chemicals that evaporate readily and give plants their inherent fragrances. They are soluble in organic solvents, lipid-soluble, volatile, and infrequently coloured. Due to the "Fragrant pharmacy" benefits of its constituents, research indicates that essential oils have been used for biochemical effects for ages. Essential oils are the principal source of perfumes for the ancient human beings of Egypt, India, Greece, Rome, etc. Essential oils are derived from various aromatic plants primarily found in warm, temperate regions such as the Mediterranean and tropical areas, where they are widely used in traditional pharmacopoeias.

Essential oils are called the "Life Force" of plants. These "essential" oils are volatile, highly concentrated compounds that are taken from flowers, leaves, stems, roots, seeds, bark, resin, or fruit rinds, in comparison to fatty oils. [2 Since] ancient times, essential oils have been employed in homoeopathic and siddha treatment for body massage.[3]There are four primary means in which fragrance oils interact with the human body: pharmacological, physiological, psychological, and spiritual.[4-5]Essential oils possess antimicrobial, antiviral, antifungal, and insecticidal properties that help protect plants in the natural world.[6-7]Based on the aforementioned concepts this review has been structured into three parts. In the first part, the chemical constituents & composition of essential oils have been listed. In the second part, the most critical technologies (i.e extraction & distillation) have been presented. Finally, the last part explains the extraction of essential oil present in camphor through hydro-distillation.

Table no:1.1 Major Raw Material Used in Extraction of Essential Oil

Wood	Seed	Peel	Flowers	Leaves
Camphor	Almond	Bergamot	Chamomile	Basil
Cedar	Celery	Grapefruit	Clove	Cinnamon
Rosewood	Cumin	Lemon	Jasmine	Lemon Grass
Sandalwood	Nutmeg Oil	Orange	Rose	Camphor

1.1 Chemical Constituents of Essential Oil

The blends of about 200 natural and pure essential oils components are typically terpene/phenyl propanoic derivative mixtures with minimal structural and chemical variation between the constituents.[8] They are generally classified as: -

1. Volatile Fraction: Essential oil, which makes up 90–95% of the total weight of the oil, comprises a combination of aliphatic aldehydes, alcohol, esters, and hydrocarbons such as monoterpene and sesquiterpene. It also incorporates their oxygenated derivative.
2. Non-Volatile: Essential oils contain hydrocarbons, fatty acids, steroids, carotenoids, waxes, and flavonoids, making up 1–10% of the oil.

1.1.1 Hydrocarbon: Hydrogen and carbon are the basic components of the chemical compounds found in essential oils. The main hydrocarbons are present in trees and plants isoprene.

1.1.2 Alcohols: Hydroxyl molecules constitute alcohol. They are found naturally either as an inde-

pendent compound or in combination with an ester or terpene. Alcohol is the end product of terpene attachments to hydrogen and oxygen atoms. Alcohol consumption is regarded as safe since it has a very low level of absence of toxicological reactions on the body and skin.

Properties: Anti-viral, anti-septic, bactericidal and germicidal.

Example:

1.linalool found in Ylang-Ylang and lavender.

2. Geraniol in geranium and rose.

1.1.3 Aldehydes: Aldehydes-containing medicinal essential oils are helpful in the treatment of candida and other fungi infections.

Properties: Antifungal, anti-inflammatory, antiseptic, antiviral, bactericidal, disinfectant, and sedative.

Example:

1. lemongrass and lemon balm.

2. Citral in lemon.

1.1.4 Terpenes: These names generally finish in "ene," such as piperene, camphene, limonene, etc. As subcategories of terpenes, monoterpenes, sesquiterpenes, and diterpenes are distinguished. When two isoprene units link head to tail, a monoterpene is produced; three joins, a sesquiterpene; and four linked isoprene units, a diterpene. Remember that isoprene units are under the hydrocarbon category.

Properties: Anti-inflammatory, Antiseptic, Antiviral, and Bactericidal.

1.1.5 Ester: The reactions of alcohols with acids produce esters. Essential oils with esters are employed because of their calming and balancing qualities. Because alcohol is present, esters work well as antibacterial agents. In medicine, esters are sedatives with a mild antifungal effect on the nervous system.

Example:

1.linlyl acetate in bergamot and lavender.

2.Geranyl formate in geranium

1.1.6 Acid: Most essential oils contain relatively modest free organic acids. The acids plants produce is part of the buffer system that regulates the acidity. **Properties:** Anti-inflammatory.

Example:

1.Cinnamic and benzoic acid in benzoin.

2.Citric and lactic.

1.1.7 Lactones: By their expectorant properties and ability to reduce prostaglandin synthesis, lactones have been shown to have anti-inflammatory properties. Ketones don't have the same expectorant activity as lactones.

Properties: Anti-inflammatory, Antiphlogistic, Expectorant, Febrifuge.

1.1.8 Ketones: Plants commonly employed for upper respiratory symptoms frequently contain ketones. Ketones facilitate the passage of mucus and relieve congestion. Ketone-containing essential oils aid in the development of scar tissue and the healing of wounds. As a whole, ketones are highly poisonous. In addition, hazardous ketones found in essential oils include pulegone in pennyroyal and pinocamphone in hyssops. The highly toxic ketone is thujone, which is present in mugwort, sage, tansy, thuja, and wormwood oils. Jasmone in jasmine oil, fenchone in fennel oil, carvone in spearmint and dill oil, and menthone in peppermint oil are a few examples of non-toxic ketones.

Properties: anti-catarrhal, cell proliferate, expectorant, vulnerary.

Example:

1.Fenchone in the funnel, Carvone in spearmint and dill.

2.Menthone in peppermint.

1.2 Properties of Essential Oil: Pharmacological properties

- **Spasmolytic and sedative:** It is said that the essential oils of the verbena, Mentha, and umbelliferous families lessen gastrointestinal spasms.
- **Expectorants and diuretics** can treat sprains and other articular symptoms and function as mild local anaesthetics.
- **Antiseptic:** Essential oils' antiseptic qualities make them powerful against bacteria and antibiotic strains of the disease.
- Others: Cholagogue, anti-inflammatory, cicatrising

II. METHODS OF EXTRACTING ESSENTIAL OIL

Alcohol and fermentation were employed in the extraction procedure in the past. Modern techniques for extracting essential oils make aromatherapy more widely available and offer previously unattainable oil options. A little education for the aromatherapy enthusiast can go a long way in crucial oil choosing, in addition to the new labels of CO_2 and Supercritical CO_2, along with the conventional “steam” and “hydro” distillation, “absolutes,” and “cold pressing”.

Removing essential oil from plants or other raw materials requires using solvents, which can harm the oil's therapeutic qualities. Consequently, the technique chosen is crucial.[9] Very few plants and flowers are not suitable for steam distillation because they are too delicate or because the process cannot fully liberate their aroma and medicinal essences. Particularly delicate flowers with oils frequently obtained in "absolute" form include jasmine and rose oils.

The intended use of the finished product and the distiller's experience are key factors determining the worth of newer techniques. Every technique plays a role in producing essential oils suitable for aromatherapy. They are all significant. A few methods available for extracting essential oils are given below:

METHOD	EXPLANATION
1. Maceration	Merely producing as much "essential oil" yields more "infused oil." This process involves soaking the plant matter in vegetable oil, heating it, and then straining it to be ready for massaging.
2. Solvent Extraction:	The plant material is mixed with a hydrocarbon solvent to dissolve the essential oil. Concrete, a wax and essential oil mixture is left over after the solution is filtered and condensed through distillation. The concentrate is poured into pure alcohol to extract the oil which is left behind when the alcohol evaporates. However, because the solvent may leave a little residue behind that can trigger allergies and weaken the immune system, this extraction technique isn't considered the best.
3. Cold pressing	This technique extracts oils from the rinds of citrus fruits, including bergamot, orange, lemon, and grapefruit. The fruit's rinds are removed, and the diced fruit is then pressed at 120 degrees Fahrenheit to extract the oil. The end product is an aqueous essential combination that will be separated later.
4. Enfleurage:	An extensive and traditional method of flower oil extraction. The process of enfleurage entails covering the flower petals with a layer of fat. Alcohol is used to extract the essential oil from the fat after the fat has absorbed the essential oil from the flower. After some time, the oil evaporates, yielding essential oil.
5. Hydro distillation	Several extraction procedures become outdated, such as hydro distillation, which is still utilised in developing nations. The still could dry up or become too hot, scorching the aromatics and leaving an unpleasant burnt scent in the essential oil. Hydro distillation appears to be the most effective technique for particularly difficult materials like roots, wood, nuts, and powders (such as spice powders, pulverised wood, etc.).
6.CO_2 & Super critical CO_2 Extraction	The most advanced method of extracting essential oils is this one. Extracting carbon dioxide and supercritical carbon dioxide involves using CO2 as a solvent to remove the essential oil from the raw plant material. Lower-pressure CO2 extraction entails chilling CO2 to a temperature between 35 and 55 degrees Fahrenheit and forcing it through the plant material at roughly 1000 psi. In this state, the CO2 condenses into a liquid. In supercritical extraction, CO2 is heated to 87 °F and pushed through the plant material at a pressure of about 8,000 psi. Both scenarios compare Carbon dioxide to a "dense fog" or vapour. Carbon dioxide leaves in gas form when pressure is released during any process step, leaving the essential oil behind. A high-quality essential oil should have characteristics that closely resemble the original plant's essence after extraction. Processing crucial oils at low pressure and low temperature is the secret to excellent quality. The molecule structure is altered, the medicinal value is destroyed, and the scent is altered due to high temperatures, quick processing, and solvent use.
7. Turbo Distillation	It is possible to extract essential oil from hard-to-extract plant materials more quickly using turbo

Extraction	distillation, which works well for coarse or hard-to-extract plant material like bark, roots, and seeds. In the turbo extraction process, the plants are soaked in water and steam is circulated through this plant and water mixture. The same water is continuously circulated through the plant material throughout the entire process.
8. Steam Distillation:	In this procedure, a method known as distillation is used to remove the plant's essence. Steam is circulated throughout the space after the flowers or plants are arranged on a screen, "charging" the material with the essence. After that, the steam is directed via the condenser, which cools the steam. After being separated, this mixture of water and essential oil is bottled. Since flowers and plants only contain trace amounts of this valuable essential oil, several hundred pounds of raw materials are needed to make one ounce.

III. EXTRACTION OF ESSENTIAL OIL USING HYDRO DISTILLATION PROCESS.

Various techniques, some of which are not widely utilised now, can be employed to extract essential oils. Even while distillers are now crucial to bringing back plants' beneficial properties, extraction is often necessary to yield the desired therapeutic benefits. Looking at the current situation, the extraction of camphor essential oil through hydro distillation is widespread. In this article, we take an example of the extraction of camphor essential oil. The massive, evergreen Cinnamomum camphora tree can reach 20 to 30 metres. When crushed, the leaves release a camphor scent and have a glossy, waxy look. According to recent research, the primary chemical components of C. Camphora were lignin, organic acids, volatile oil, alkaloids, and flavonoids.[10-12] In traditional medicine, C. camphora has traditionally been used to treat conditions such as eczema dermatitis, migraines, and stomach discomfort.[13-14]

Properties of Camphor

Empirical Formula	$C_{10}H_{16}O$
Molecular formula:	1,7,7-trimethyl bicyclo [2.2.1] heptanes-2-one is a ketone related to bicyclic terpenoids.
Physical State	colourless crystals
Melting Point:	175-177 °C.
Boiling Point	209 °C.
Vapor density	5.24 g/dl
Specific gravity	0.992 g/cm^3
Molecular weight	152.23
Solubility	Soluble in ethanol and some other organic solvents and only slightly soluble in water.
Isomers:	Stereoisomeric alcohols- borneol and isoborneol. Camphor has two asymmetric carbon atoms and occurs as two stereoisomers (-) -camphor and (+)-camphor due to its chirality.

Hydrodistillation

Water distillation involves immersing the botanical material entirely in water and heating the still to a boil to produce essential oils. This technique's primary feature is the contact between the plant material and boiling water.[15] Better conditions for oil osmosis are provided by distillation because the increased temperature and water movement brought on by changes in the still's pressure and temperature speed up the forces of diffusion to the point where all of the volatile oil contained in the plant tissue can be collected. A unique instance of water distillation uses the technique of re-boiling the distillate water by adding it to the still after the oil has been extracted. Reducing the number of oxygenated components lost is the underlying idea. The stills are affordable, simple to build, and appropriate for field use, which are practi-

cal benefits of water distillation. In several nations, these are still often used in conjunction with portable equipment. As the surrounding water acts as a barrier to keep it from scorching, this approach partially protects the extracted oils.

Material & Method

In this study, the extraction of camphor was done using a hydro-distillation process through the Clevenger apparatus.

Objective: Extraction of Camphor from dry leaves of *Karpura* Tree

EQUIPMENT

S. No.	Instruments	Requirements
1.	Round Bombing flask	Capacity – 500ml
2.	Heating mantle	Capacity – 500ml
3.	Clevenger apparatus	Capacity – 500 ml
4.	Condensor	1
5.	Weighing machine	1
6.	Funnel	1
7.	Grinder	1
8.	Inlet & Outlet pipes	2

INGREDIENTS

Karpura dry Leaves = 60 g

Water (Distilled) = 400 mL

Procedure:

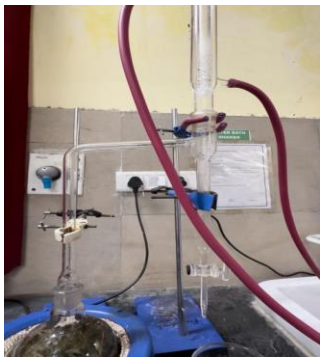
1. *Karpura* dry leaves were collected and transferred into the grinder to make a fine powder.
2. 60 gms of *Karpura* dry leaf powder was measured in a weighing balance and kept in a beaker.
3. Then, it was transferred into a round bottom flask through a funnel.
4. 400 ml of distilled water was added to the flask, which was placed on the heating mantle. The Clevenger apparatus was attached to the flask.
5. Inlet and outlet pipes were attached to the condenser of the Clevenger apparatus.
6. The inlet pipe was attached to the water source, and the condenser opening was closed with a cotton plug.
7. The heating mantle was turned on to its total capacity till the boiling of water.
8. After 30 min. Water started boiling, and we decreased the temperature of the heating mantle.
9. After 1 hrs, camphor crystals started to be deposited in the Clevenger tube.
10. This process continued for 7 hours, and more and more Camphor crystals were deposited in the tube.
11. After 1 hr, Camphor was collected and weighed when the apparatus cooled down.
12. Triplicate the whole process to get the average yield.

Collection of leaves

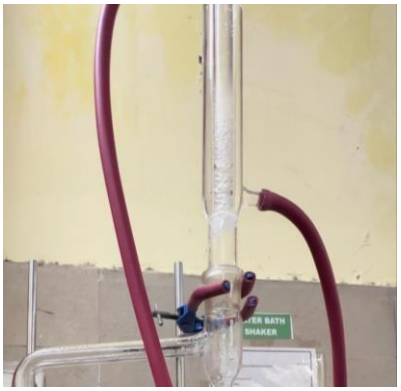
Shade dried & crush leaves

Transfer the crushed leaves into RBF

Adding Distilled water



Process of boiling starts & after 1 hr crystals appears



Crystal appears at Condenser of Cleveger

Observations and Result:

i. Weight of extract: 1.136 g
ii. Weight of sample: 60 ± .02 gms
iii. Yield: 1.89%

Precautions:

1. The plant material should be entirely immersed in water.
2. Care should be taken to prevent water spilling in the heating mantle.
3. The opening in the Clevenger apparatus should be closed with a cotton plug soaked with distilled water.

Advantages of Hydrodistillation:-

The benefit of hydro distillation is that it is a relatively inexpensive process with lower initial capital requirements, and the oil produced by this method has well-known and acceptable qualities.

APPLICATION OF ESSENTIAL OIL

1. Camphor has been utilised as a cold cure to alleviate chest congestion and treat inflammation-related ailments, including rheumatism, sprains, bronchitis, asthma, and muscle soreness.[16]

2. According to a cancer study, when immunotherapy treatment is administered in conjunction with using camphor odour as a conditioning agent for the cancer cells of YC8 lymphoma in mice, the growth of the YC8 tumour may be suppressed.[17]

3. Furthermore, it has been demonstrated that cinnamon inhibits solid melanoma growth in naked mice's skin.[18]

CONCLUSION

Based on the findings of this investigation, the subsequent deductions are made:

1. The best conditions to yield camphor oil are hydrodistillation distillation at 100 °C and, after boiling, decrystallisation at 50 °C to 60 °C.
2. Under best conditions, the maximum yield of camphor oil produced by hydrodistillation was with its shade of dry leaves.

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