

Hydro Distillation Method Extraction of Eucalyptus Oil & Lemongrass Oil

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Abstract

A large variety of plant materials contain Essential Oils with in-depth bioactivities. Acknowledging the importance of plants and its medicative worth, extraction of volatile oil had been done exploitation Hydro Distillation technique. During this project, Hydro Distillation was accustomed to extract oil from totally different plant materials like eucalyptus leaves, lemongrass, rose petals, etc. The distillation was conducted in Clevenger equipment within which boiling, compressing, and separation was done. Hydro distillation technique was found to be one in all the promising techniques for the extraction of volatile oil from plants as an honoured manufacturer can preserve the initial qualities of the plant. The recovery of the worth additional product i.e., oil from the raw biology beginning material is incredibly necessary since the standard of the oil is greatly influenced throughout this step. The Analysis of that area unit had been done by the exploitation of local area, Gas natural action and spectrometer equipment that evaluates volatile oil quantitatively and qualitatively. We have a tendency to currently find the calculable that the 'fragrant pharmacy' consists of compounds having an especially wide selection of organic chemistry effects. Essential oils area unit thus termed as they are believed to represent the terribly essence of odour and flavour.

The set-up

The experiment was conducted using a Clevenger's equipment. Equipment consists of 1 spherical bottom flask of 1000ml that holds material. And any it is connected with a glass tube condenser through the connector. The separating funnel is employed for the separation of oil and water.

List of Equipments

Auxiliary Equipments

- a) Insulated electrical Heater- Associate in nursing insulated space heater of holding capability of 1000cc flask is employed for heating the raw materials.
- b) Spherical bottom flask- A glass spherical bottom flask of borosil 4380 of 1000 ml capability unit} capacities are employed.
- c) Counter current flow glass condenser – A salt glass condenser 1450 Liebig of a 100 millilitre capability unit} capacities is employed.
- d) Pump- 50Watt submersible pump of Ash whole is employed. It is a forty watts motor which might carry water up to a pair of 29 meter (seven 5 linear unit approx) and includes a voltage of 165/240 volts /50Hz.
- e) Round shape Flask- A borosil round shape flask of capability of 250cc is employed.
- f) Separating Funnel- a transparent & Amber salt Glass Separating Funnel of Lab Smith of a 100 millilitre capability unit} capacity is employed for separating the extracted oil from water.
- g) Deliberation balance- A scales of Shimadzu Model AUX-220 of deliberation capability 200g and accuracy up to four decimal places is employed for deliberation raw grass.

Analysis instrumentation of Gas Chromatograph - This gas chromatograph consists of:

- a) An offer of a carrier gas from a high cylinder having a pressure regulator and flow meters.
- b) A sample injection system.
- c) The separation column made up of a style of materials as well as glass, copper, chrome steel, cupro-nickel, or organic compound (Teflon). Packed beds are used.
- d) The detector is located at the exits of the separation column that senses and measures the tiny quantity of the separated parts gift within the carrier-gas departure the column.
- e) Unremarkably used detectors are thermal conduction detectors, bridge circuit, and flame ionization detector.
- f) The recorder is fed by the output of the detector.
- g) Thermo expressed compartment for the column and detector.



Fig: 1 Gas Chromatograph

Experimental Procedure

Essential Oil Extraction Procedure

The method adopted for the extraction of volatile oil from Eucalyptus and Lemongrass was Hydro-distillation. During this technique, the raw feed material was soaked in solvent. Solvent used was water. Then heat the solvent and raw feed material until they fashioned vapours, then allowed the vapours to cool down and is collected at the end in a very receiving funnel. The principle behind exploitation the Hydro-distillation technique was that the boiling purpose of Lemongrass and Eucalyptus volatile oil having higher worth than that of the water however once Lemongrass and Eucalyptus soaked in water and heating up it forms vapour mixture of water and volatile oil. The azeotropic mixture cannot be separated within the vapour section. That the cooling through condenser was drained in order to induce the separation between oil and water because of the density variations. Most of the essential oils do not combine well with water.

Sample Preparation of Dry Lemongrass

Fresh lemongrass was collected. Recent and healthy lemongrass was chosen and washed with water to get rid of the mud and dirt over its surface. When exhausting flooding of free water on the surface of the lemongrass and its stem. It's been cooled for one night then second day it had been taken out from cold and was shade

dried underneath an acquaintance for concerning hour. The fan dried stem was cut in to different sizes like a pair of 5 cm, 2.0cm, 1.5cm, and 0.5cm with the assistance of cutting board and knife.

Sample Preparation of Wet Lemongrass

Fresh lemongrass was collected from the sphere, and recent and healthy lemongrass was chosen and washed with fresh water to get rid of the mud and dirt over its surface. When exhausting free water on the surface of the lemongrass stem, then weight 300 g of grass and cut in to a special items of varied sizes of concerning a pair of 5cm, 2.0cm, 1.5cm and 0.5cm length with a pointy edged knife.

Sample Preparation of Dry Eucalyptus leaves

Fresh leaves of eucalyptus were collected. Recent and healthy Eucalyptus leaves was chosen and washed with H₂O to get rid of the mud and dirt over its surface. We have exhaust the free water on the surface of both the leaves is been present. It's cold for first night of chopping, then on second day it has been taken out from cold water and was shade dried underneath an acquaintance for concerning hour. The fan dried leaves were cut in to totally different sizes like a pair of 5cm, 2.0cm, 1.5cm and 0.5cm with the assistance of cutting board and knife.

Sample Preparation of Wet Eucalyptus leaves

Fresh leaves of eucalyptus were collected from the sphere, and recent and healthy leaves were chosen and washed with H₂O or distilled water to get rid of the mud and dirt over its surface. When exhausting free water on the surface of the leaves, then weight **300 g** of grass and cut in to a special items of varied size of concerning a pair of 5 cm, 2.0 cm, 1.5 cm and 0.5 cm length on cutting board with a pointy edged knife.

Distillation procedure for laboratory experiment

- a. Firstly water was taken into a spherical bottom flask.
- b. For cut raw grass.
- c. Then ready leaves sample was placed in spherical bottom flask for distillation.
- d. After this, the spherical bottom attaching the connecting pipe to the condenser and a thermometer was inserted in hole of the flask thus on bit the highest of the leaves bed.
- e. Then heating mental was switched on and unbroken in a very pre-selected position to obtained desired rate of heating.
- f. Observations of accumulative extracted oil volume, temperature of extraction chamber, and energy meter reading were recorded at each half hour intervals.
- g. The load of hydrosol spent eucalyptus leaves and lemongrass and left over water within the extractor was additionally recorded at the top of every distillation.
- h. At the top of method extracted eucalyptus and lemongrass, oil was keep in icebox below 4°C for more analysis.

Operating parameters

There area of leaf unit principally following parameters which may influence the yield of volatile oil these area unit nature of the material, size of the material, temperature of the heating mixture, and time of extraction.

a) Nature of the material

The loose packing and the wet material in material in hydro-distillation still enhances the concentration of oil from the raw grass material. Additionally, it is going to be the fabric higher is going to be the concentration of volatile oil.

b) Size of the raw material/grass

Size of the material is additionally a very important parameter for the extraction of volatile oil. Though¹ smaller size will increase the extent of the material resulting in higher mass transfer and, thus, higher extraction.

c) Temperature of the heating mixture

The influence of the temperature plays a decisive important role to find out the most concentration of volatile oil from lemongrass and eucalyptus by hydro distillation. Principally, the temperature rise, which disrupts the glands of the grass plant and lower the causes retention of constituent within the feed, some part need the extreme temperature to extracted out from the tissue than alternative part of temperature is used. The temperature ought to be high enough to get vapours in order that it gets combined with vapours of solvent associate degreeed forms an azeotropic mixture. The temperature should not be thus high because it will destroy the properties of the oil. Optimum worth of the temperature should be chosen to induce associate degree considerable concentration of the extracted volatile oil.

d) Time of extraction

The time of extracting the lemongrass and eucalyptus volatile oil is additionally a very important parameter to yield a decent worth of the concentration of the volatile oil because the time will increase and throughout the extraction method the mass transfer rate additionally will increase that directly will increase the concentration of volatile oil. With increase in time of extraction, huge amount of vapours of the mixture forms. A lot of vapours would contain a lot of volatile oil which will later be condensed to separate the oil from solvent. The time ought to lean long enough to require place to complete extraction of the volatile oil from the grass. However not fare that it will burn the material, as longer the time would be a lot of the leaves would get hot.

RESULT & DISCUSSION**Experimental Observation of Lemongrass oil**

Table 1 Physical and Chemical Properties of Lemongrass oil

| | |
|---------------------------------------|--|
| Colour | Pale Yellow to Vivid Yellow |
| State | Liquid-oil |
| Odour | Very strong and stimulating characteristic lemon odour |
| Taste | Sour |
| Boiling Point of Cineole (Eucalyptol) | 224.00 °C. @ 760.00 mm Hg |
| Density of oil | 0.8894 gm/cm ³ |
| Solubility | 1. Insoluble in water; 2. Soluble in alcohol; 3. Miscible in oil; fats; paraffin; ether; chloroform and glacial acetic acid. |

Chemical Name: Lemonol, Geranyl alcohol, Trans-Geraniol, (E)-Geraniol

Molecular Formula of Geraniol: $C_{10}H_{18}O$ Molecular Weight: 154.253

Precaution of Storing: It should be stored in cool, dry place in tightly sealed containers, and it should be protected from heat and light.

Experimental Observation of Eucalyptol

Table 2 Physical and Chemical Properties of Eucalyptus Oil

| | |
|---------------------------------------|---|
| Colour | Pale yellow liquid |
| State | Liquid-oil |
| Odour | Camphoraceous odour |
| Taste | Pungent and cooling taste. |
| Boiling Point of Cineole (Eucalyptol) | $176^{\circ}C$ to $177^{\circ}C$; |
| Density of oil | 0.921 to 0.923 |
| Solubility | 1. Insoluble in water; 2. Miscible in alcohol having high concentration or in anhydrous alcohol; 3. Miscible in oil; fats; paraffin; ether; chloroform and glacial acetic acid. |

Major Components: 1, 8-Cineole

Chemical Name: 1, 3, 3- Trimethyl-2- Oxabicyclo [2. 2. 2] – octane or 1, 8- epoxy- *p*-methane.

Molecular Formula of Cineole: $C_{10}H_{18}O$ Molecular Weight: 154.25

Precaution of Storing: Products containing eucalyptus oil should be stored at a temperature not exceeding $25^{\circ}C$ in well filled containers. It should be protected from light. Liquid products containing eucalyptus oil are best stored in child resistant containers.

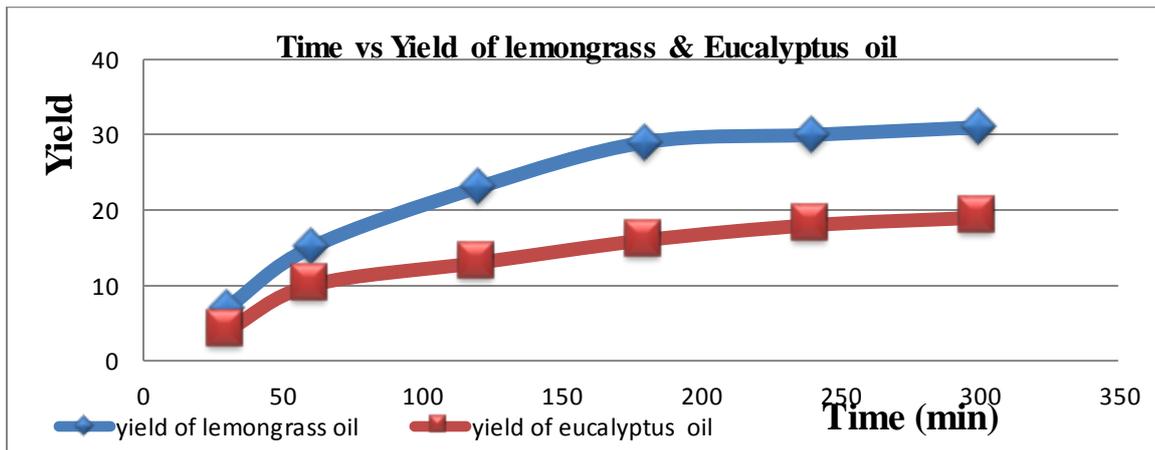
Table 3 Comparative analysis Lemongrass & Eucalyptus Essential Oil

| Sr. No. | Time (min) | Lemongrass Oil produced in ml/Yield | | Eucalyptus Oil produced in ml/Yield | |
|---------|------------|-------------------------------------|-----|-------------------------------------|-----|
| | | Dry | Wet | Dry | Wet |
| 1 | 30 | 5 | 7 | 2 | 4 |
| 2 | 60 | 11 | 15 | 7 | 10 |
| 3 | 120 | 18 | 23 | 10 | 13 |
| 4 | 180 | 23 | 29 | 12 | 16 |
| 5 | 240 | 24 | 30 | 13 | 18 |
| 6 | 300 | 25 | 31 | 13.5 | 19 |

From the experiment, it is found that the experimental data, the yield of wet sample is more than the yield of dry sample of both grasses. So, as we compared the data of wet samples only, it shows that the yield of lemongrass essential oil is greater than the yield of eucalyptus oil.

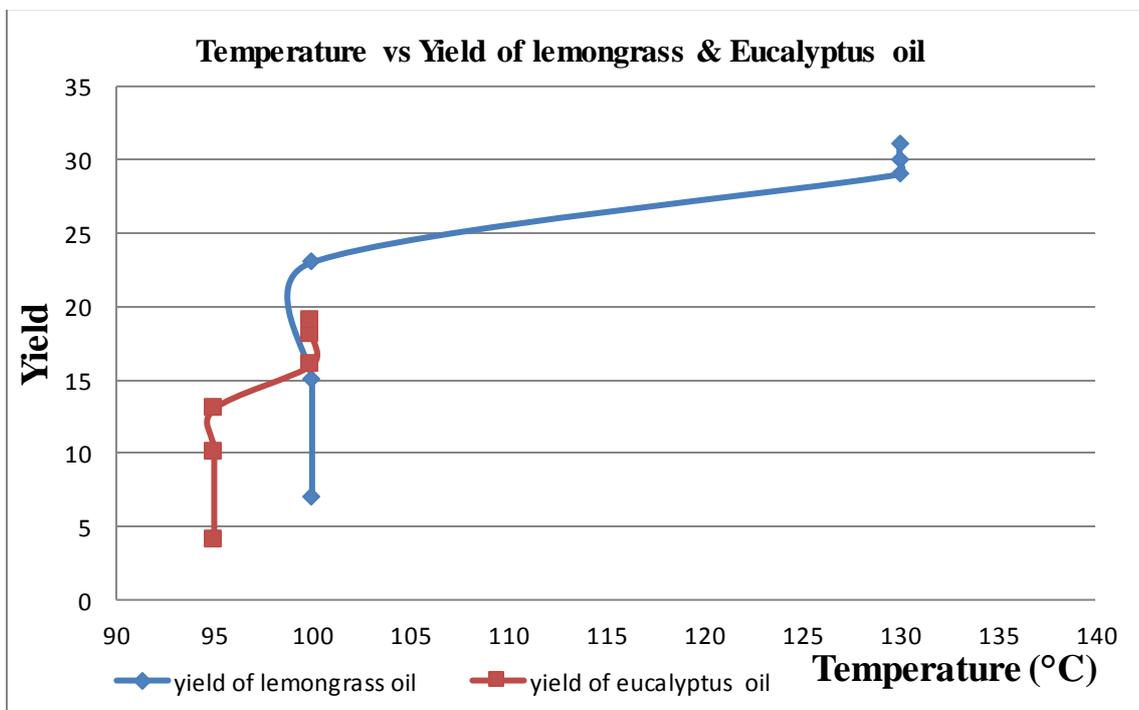
As we observed the reason behind that is we extracted the oil from lemongrass stem, and eucalyptus leaves so, the oil present in stem is much greater than oil present in leaves. The graphical results show the comparison between the yields of wet samples of both the grasses, which are as follows:

Time vs. Yield of lemongrass & Eucalyptus oil



The experimental analysis shows that the yield of both grass i.e. lemongrass and eucalyptus leaves depends upon the time of distillation process. We have seen that the oil yield of lemongrass is more than the eucalyptus leaves. At 3 hours, the yield of lemongrass was 29 ml, but the yield of eucalyptus leaves was 16 ml.

Temperature vs. Yield of lemongrass & Eucalyptus oil



After analysing the graphical data, it is been concluded that the temperature changed the yield percentage of the both grass. This graph also shows that the yield of lemongrass is more than the eucalyptus leaves. At the

optimum temperature (130°C) for lemongrass the yield was 31 but for optimum temperature (100°C) of eucalyptus leaves the value of yield was 19. .

Conclusion

According to the data obtained from the experiments the following are the conclusions drawn;

- The quantity of extracted oil from wet grass sample of lemongrass is more, the dry grass sample of lemongrass.
- The quantity of extracted oil from wet grass sample of eucalyptus leaves is more, the dry grass sample of eucalyptus leaves.
- A tendency to determine that distillation time is that the moving parameter of extraction of oil. The yield of extraction method has exaggerated with extraction time from half-hour to three hours, however, then it reached at saturation or equilibrium condition.
- The highest yield is been obtained at 180°C, once the distillation method was disbursed for one hundred eighty minutes (3 hours) for the grass size of 0.5cm roughly.
- The kinetic studies of distillation method showed that oil is not instantly extracted; it is time bounded.
- The yield % is raised from one Day to 12-tone system by exploitation water as solvent. As no chemicals are used there's no would like of purification for final product.
- As we have a tendency to compare the yield of each lemongrass and eucalyptus, we have a tendency to determined that the yield of wet lemongrass abundant is far away} much bigger that the yield of wet eucalyptus leaves. From that, we have a tendency to all over that the oil content in stem is bigger than the oil containing in leaves.
- The gas action analysis of lemongrass oil showed that the foremost compound gift in extracted oil is citral a (41.82%) and also the share of remaining compounds are as follows- α -pinene (0.13%), β -pinene, delta-3-catrene (0.16%), myrcene (12.75%), dipentene (0.23%), β -phellandrene (0.07%), β -cymene (0.2%), alkyl group heptanene (2.62%), citronellal (0.73%), β -elemene (1.33%), β -caryophyllene (0.18%), citronellyl acetate (0.96%), geranyl acetate (3.00%), citral b (0.18%), geraniol (1.85%), elemol (1.2%) and β -caryophyllene compound (0.61%).
- The gas action analysis of essential oil showed that the foremost compound gift in extracted oil is one, 8-eucalyptol (72.71 %) and also the share of remaining compounds are as follows- α -terpineol (2.54 %), terpinen-4-ol (0.34 %), volatile oil (0.24 %), α -pinene (9.22 %), and β -pinene (0.4 %), α -eudesmol (0.39 %), (-)-globulol (2.77 %), epiglobulol (0.44 %), α -terpineol acetate (3.1 %), geranyl acetate (0.71 %), L-pinocarveol (0.36 %), β -sabinene (0.25 %), and terpinolene (0.19 %).
- Hydro-distillation may be a special sort of separation method for temperature sensitive materials like oils, resins, hydrocarbons, etc. that are in soluble in water and should decompose at their boiling purpose. The temperature of the vapour should be high enough to vaporise the oil gift, nonetheless not therefore high that it destroys the feed of the volatile oil. Hydro-distillation was found to be economical and economical technique. the most finding was that the H₂O used as a solvent, helped the volatile oil to stay in its purest kind. The absence of the chemical during this specific experiment was one amongst the rationale why Hydro-distillation has established economical and optimum technique for the extraction of volatile oil.

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