

Extraction and Formation of Natural Perfume from Lemon Grass

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Abstract: Three methods are used for oil extraction namely solvent extraction, hydro distillation and enfleurage. Distillation based recovery processes such as steam and vacuum distillation are preferred for the extraction of essential oils from plant materials. Essential oils are very complex in their chemical nature. Fragrance extraction refers to the extraction of aromatic compounds from raw materials and using methods such as distillation, solvent extraction, expression or enfleurage. All of these techniques tend to distort the odor of the aromatic compounds obtain from raw materials. Heat, chemical solvents or exposure to oxygen in the extraction process denature the aromatic compounds either changing their odor character or rendering them odorless. Before perfumes can be composed the odorants used in various perfume compositions must first be obtained. Synthetic odorants are produced through organic synthesis and purified. Odorants from natural sources require the use of various methods to extract the aromatics from the raw materials. Solvent extraction most used and economically important technique for extracting aromatics in modern perfume industry. Raw materials are submerged in a solvent that can dissolve the desired aromatic compounds. % Yield for using Ethyl Acetate at various feed to solvent ratio like 1:2 can be calculated by experimental analysis. As per literatures and observations Ethyl Acetate is the best suitable for extraction of Lemongrass Oil from the lemongrass. Ethyl Acetate can easily separate after extraction and has higher yield than other with low cost. Maximum yield and recovery of perfume oil from lemongrass is 2 % and 80 % for feed to solvent ration 1:2.

Keywords: Lemongrass Oil, Ethyl Acetate, Solvent Extraction Process, Perfume Oil

I. INTRODUCTION

Perfume extraction process is distortion of the odor of the aromatic compounds obtained from the raw materials. Heat, harsh solvents and the exposure to oxygen which will denature aromatic compounds and odor, character or render odorless. Formulation of perfume involves knowing proportion in which essential oil and other materials to mixed to avoid skin irritation and increase intensity and longevity of perfume. Most imported perfumes are synthetic odorant which are not pure chemical substance but are mixture of organic compounds that are harmful when applied. There are limited perfume plants, from which perfume can be made lead to importation of perfume thereby causing the decline of foreign reserves and unemployment. Essential oils found in many different plants. EO different from fatty oils because they evaporate or volatilize on contact with the air and they possess a pleasant taste and strong aromatic odor. Removed of EO from plant tissues without any change in composition. Essential oils complex their chemical nature. The two main groups are the hydrocarbon terpenes and the oxygenated and sulphured oils.

Perfume-Classification

1. Perfume extract, or simply perfume (Extract): 15- 40% aromatic compounds.
2. Esprit de Parfum (ESdP): 15-30% aromatic compounds
3. Eau de Parfum (EdP), Parfum de Toilette (PdT): 10-20% aromatic compounds.
4. Eau de toilette (EdT): 5-15% (typical 10%) aromatic compounds.
5. Eau de Cologne (EdC): Chypre citrus type perfumes with 3-8% aromatic compounds.
6. Perfume Mist: 3-8% aromatic compounds (typical non-alcohol solvent).
7. Splash (EdS) and Aftershave: 1-3% aromatic compounds

II. LITERATURE REVIEW

Perfume extraction is the extraction of aromatic compounds from raw materials using methods such as distillation, solvent extraction etc. Essential oils, absolutes, butters, depending on the amount of waxes in the extracted product. Here, in this work solvent extraction, Enfleurage method, hydro distillation and steam distillation methods used to extract essential oil from lemongrass leaves. Distillation based recovery processes such as steam and vacuum distillation are preferred for extraction of essential oils from plant materials. [1]

Four methods are used for oil extraction namely solvent extraction, hydro distillation and enfleurage. Solvent extraction 2.07 % yield of essential oil obtain. In enfleurage method 1.957% oil yield. 0.946% yield of oil by hydro distillation process. Steam distillation process give 0.70% yield of oil. Solvent extraction give highest yield because of less exposure air and heat. EO formulated in perfume using a fixative and carrier solvent. [1]

Formulation is mixture of ingredients prepared in a certain way and used for a specific purpose.

10 ml of lemongrass essential oil extract were measured and placed in a 120 ml beaker containing 5 ml of Methanol. 5 ml of the Fixatives added to the mixture to improve longevity of perfume. Solution shaken and poured into a 50 ml bottle. Extraction of essential oil from lemongrass. To determine yields using different extraction methods and formulation of perfume with essential oil produced. [1] The aroma of oil of bergamot fruit was given by blending the oil in an oil diffuser. Perfumery oil by this method 0.912 gm of perfumery oil per 75 gm of dry lemon grass. Oil produced light ochre yellow in color with a tinge of pungent odor. Perfumery oil extracted using eco-friendly method and method economical. Perfumery oil when blended with oil of bergamot or oil of geranium used an air-freshener and deodorizer. Lemongrass oil helps to relax and tone muscles, relieve cramps, toothache, migraines & headaches & characteristic citrus lemony odor. Organic oil primarily used for perfumery application and insect repellent. [2] 300 g of lemongrass powder weighted and placed in a clean round bottomed flask and 700 ml of N- hexane solvent poured in to flask. Allowed to stand for 48 hours with continuous shaking with electrical shaker. Extract containing solvent decanted in beaker. This has highly volatile aroma molecules as well as non-aroma waxes. Solvent removed from extract using rotary evaporator at 40 OC. Waxy mass remains known as concrete. [3] EO of lemongrass inhibited bacterial growth by mechanism of attacking multiple targets in bacterial cell included inhibiting biofilm formation, promoting intracellular material leakage. Effects depending concentration and amount of components. [5] Extraction of aromatic compounds from raw materials using methods such as distillation, solvent extraction, expression or enfleurage. Extracts essential oils, absolutes, concretes or butters, depending on amount of waxes in extracted product. Heat, chemical solvents or exposure to oxygen in extraction process denature aromatic compounds, either changing their odor, character or rendering them odorless. [6] Powdered dry lemongrass leaves (300 gms) added to 600ml of solvent (n- hexane) in a 1000 ml flask and stopped. For complete extraction all oil in lemongrass content allowed to stand for 38 hrs. after which the extract decanted into a 500 ml beaker. Ethanol (200 ml) added to dissolve extract. The mixture transferred to 1000 ml separating funnel and allowed to come to equilibrium which separated into two layers. The lower ethanol extract and the upper hexane layer carefully separated, collected into two separate 250 ml beakers and placed in a water bath at 60 OC. Remove excess ethanol leaving only natural essential oil. [9]

Uses of Perfumes

1. Sense of smell consider right brain activity which rules emotions, memory & creativity.
2. Perfumes are used to mask body odor.
3. Used to make people feel good
4. To heal and physical and emotional problems
5. Perfumes being revived to help balance hormonal and body energy.
6. Immune system inhaled or applied topically.
7. Smelling sweet smells and can be used as a form of psychotherapy.

Chemicals and Raw Materials

1. Powder Lemongrass
2. Ethyl Acetate
3. Ethanol
4. Methanol
5. Benzyl Salicylate

Apparatus Requires

1. Round Bottom Flask
2. Simple Distillation
3. Digital Thermometers
4. Heating Element/Mental
5. Measuring Cylinders
6. Beaker and Filter Papers
7. Magnetic Stirrer

Experimental Process Solvent Extraction

Extraction with Ethyl Acetate for 1:2 Feed to Solvent Ratio

1. Dry lemongrass in oven at 40-50 OC for 7-8 hrs. and make powder lemongrass sample.
2. 250 gm sample put in 1liter beaker and add 500 ml of ethyl acetate solvent.
3. After addition beaker place on magnetic stirrer for 15-20 min for complete mixing.
4. The beaker/flask and content are allowed to stand for 24-36 hrs. to extract perfume oil.
5. Then extract filter and transfer in 1 liter beaker.
6. Add 500 ml of ethanol to extract since essential oil is soluble in ethanol.
7. The mixture is then transferred to 1000 ml separating funnel.
8. The content of the separating funnel are allowed to come to equilibrium which separates into two layers for 3-4 hrs.
9. Lower layer contains ethanol with essential oil while upper layer contains ethyl acetate.
10. Further separate these two layers can easily.
11. Simple distillation is done in water bath at 78 OC to separate Ethanol & essential oil.
12. Ethanol is to be vaporize and condensed and the perfume oil remains in flask.

Perfume Formulation

Lemongrass essential oil measured in a beaker containing of methanol. To improve the longevity of the perfume, benzyl salicylate was added to the mixture. The solution was shaken and poured into a 50 ml bottle.

Parameter To be Analyzed

1. Effect of Use of Different Solvents

Yields of palm seed oil using various extraction solvents. The highest oil yield found for hexane and Ethyl Acetate. Lemongrass oil yield is better with non-polar solvents (Diethyl ether, n-hexane & Ethyl Acetate) as compared to polar solvents.

2. The Effect of Particle Size

The effect of particle size on the yield of perfume oil that the decrease in particle size leads to increase of oil yield. This manner is expected because of the increased surface area of grounded lemongrass. The contacted area between lemongrass and solvent increased and the mass transfer of oil from the solid phase to the liquid phase increased accordingly. The time needed for the solvent to diffuse inside the small particle is lower than large particle. The effect of the particle size on extraction processes recovery of oil by increasing the surface area in contact with the liquid fraction.

3. The Effect of Extraction Time

The impact of extraction time on perfume oil yield for different particle size. The oil extraction rate quick at the starting of the extraction process before reaching the steady state. This is because the driving force for transfer of oil from the solid phase to the liquid phase is higher in start of the process.

The difference of oil concentration between the solid phase and solvent phase is greater in the initial extraction process. The oil diffuses rapidly from date seed to the solvent and the maximum amount of extractable oil was transferred. The oil yield unchanged even after prolongation the time of extraction process.

4. Effect of Temperature on Oil Yield

Oil extraction carried out at room temperature where temperature dose not major impact on the rate of extraction in lemongrass perfume oil extraction. As extraction carried out at higher temperature it impact on smell and quality of perfume.

5. Feed to Solvent Ratio

The ration of feed to solvent also important factor to be consider for extraction process which effect on the yield of oil. Ratio from 1:3-1:6 should be selected for extraction. As ratio of feed to solvent increase yield also increase but cost of operation increase so it is necessary to select optimum ratio for feed to solvent in extraction process.

% Yield and Recovery of Lemongrass Oil

As per literature maximum perfume oil content in the lemongrass will be 2-2.5% on dry basis. Here, we select the ethyl acetate as a solvent for extraction of oil from lemon grass and ethanol also use as solvent for increase the purity of oil in which only the oil will be dissolved/extracted in ethanol from substrate that extracted by the ethyl acetate from lemongrass. B. P. of perfume oil 215 - 225 OC at atm pressure. Due to large B.P. difference it can easily separate using simple distillation.

1. Extraction and Filtration Balance

Ethyl Acetate + Lemongrass = (Substrate + Ethyl Acetate) + Residue 500 ml Ethyl Acetate + 250 gm Lemongrass Powder
= 430 ml + 265 gm Lemongrass Residue + 55 ml Ethyl Acetate Vaporized

2. Extraction and Separation Balance

(Substrate + Ethyl Acetate) + Ethanol = Ethyl Acetate + (Ethanol + Perfume Oil) 430 ml + 500 ml Ethanol
= 400 ml + 490 ml + 30 ml of Ethyl Acetate vaporized + 15 ml of Ethanol Loss During Addition and Separation

3. Distillation Balance

Ethanol+ Perfume Oil = Distillate (Ethanol) + Residue (Perfume Oil)

490 ml (Ethanol + Perfume Oil) = 475 ml Ethanol

+ 5 ml product Oil + 10 ml ethanol vaporized during Distillation

Experimental Energy Balance For Distillation

$Q = m * C_p * (T_2 - T_1)$

Where, Q = Heat Required for Solvent to vaporized or boil

T_1 = Initial temperature of Solvent = 30 OC + 273 = 303 K

T_2 = Final Temperature = 78.37 OC

$T_2 = 273.15 + 78.37 = 351.52$ K (B. P. Ethanol)

C_p = Specific Heat = 2.57 KJ/Kg. K for Ethanol m = Mass for Solvent = 490 ml = $490 * 10^{-6}$ m³

(Density = 789.5 Kg/m³) m = Density * Volume $m = 789.5 * 490 * 10^{-6}$

$m = 0.3868$ kg

$Q = 0.3868 \text{ kg} * 2.57 \text{ KJ/Kg. K} * (351.52 - 303) =$

14.44 KJ or KN. m

Distillation time is 1.5 hrs. = $3600 * 1.5 = 5400$ Sec.

Q (in Watt) = $14.44 * 1000 \text{ N. m} / 5400 \text{ Sec} =$

2.30 N. m/sec or 2.30 W or J/s

Q Required per hr. = $2.30 * (1/3600) = 8280$ W Distillation Time = 1.5 hrs.

$Q = 8280 \text{ W} * 1.5 = 12420 \text{ W} = 1.2420 \text{ KW}$

1 Unit Energy Consumption 1 KW for 1 hr.

Hence, Total Energy Consumption = 1.25 Units

% Yield and % Recovery of Lemongrass Oil

% Yield of Oil = $[\text{Mass of Oil Extracted} / \text{Mass of Lemongrass Feed}] * 100$

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III. OBSERVATIONS

Sr. No.	Feed to Solvent Ratio	% Yield of Oil	% Recovery of Oil
01	1:2	2	80

Table % Yield of Lemongrass Oil for Various Feed to Solvents

Observation table shows the % yield of Lemongrass Oil using solvent extraction with various feed to solvents ratio. % Yield for using Ethyl Acetate at

% Yield of Oil = $[5/250] * 100$

% Yield of Oil = 2

% Recovery of Oil = $[\text{Mass of Oil Extracted} / \text{Mass of Oil Content in Lemongrass}] * 100$

As per literature, maximum oil contains in lemongrass 2.5 ml / 100 gm of lemongrass.

Hence maximum oil in 250 gm lemongrass = $250 * 2.5 = 6.25$ ml

% Recovery of Oil = $[5/6.25] * 100$

% Recovery of Oil = 80 %

various feed to solvent ratio like 1:2 can be calculated by experimental analysis. As per literatures and observations Ethyl Acetate is the best suitable for extraction of Lemongrass Oil from the lemongrass. Ethyl Acetate can easily separate after extraction and has higher yield than other with low cost. Maximum yield and recovery of perfume oil from lemongrass is 2 % and 80 % for feed to solvent ration 1:2.

IV. FUTURE SCOPE

Extracted oil from the lemon grass has very good natural flavor so it most widely used for making natural perfume. There is a very high content of citral in the leaves (70-80%). It is used in soaps and medicine. Citral is extensively used in perfumes, bath salts, cosmetics and toilet soaps and as a food flavoring. It also source of aromatic substances known as ionone's which have many uses. EOs and their single constituents have been used to treat several phytopathogens, human pathogens and insects as well as their effective uses in food and pharmaceutical industries. Lemongrass is one type of essential oil source grows in most tropical countries. It belongs to the genus Cymbopogon of aromatic grasses (Aldehyde family) and contains essential oil with fine lemon flavor. Essential oils is used in the perfume, soap, cosmetics industries and to treat fevers and infections. Essential oils have been utilized in different domestic aspects such as in perfumery, cosmetics, food, beverages and drugs. lemongrass essential oils are widely used as a traditional folkloric remedy in different parts of world. The plant especially as an additive in some beverages like coffee and as a source for pleasant aroma by putting it with their cloths and by boiling with butter to have a pleasant odor for the purpose of hair food. Due to all these various application there is large scope for essential oil extracted from the lemongrass.

V. CONCLUSION

Three methods are used for oil extraction namely solvent extraction, hydro distillation and enfleurage. Distillation based recovery processes such as steam and vacuum distillation are preferred for the extraction of essential oils from plant materials. Fragrance extraction refers to the extraction of aromatic compounds from raw materials using methods such as distillation, solvent extraction, expression or enfleurage. All of these techniques tend to distort the odor of the aromatic compounds obtain from raw materials. Heat, chemical solvents or exposure to oxygen in the extraction process denature the aromatic compounds either changing their odor character or rendering them odorless. Before perfumes can be composed the odorants used in various perfume compositions must first be obtained. Synthetic odorants are produced through organic synthesis and purified. Odorants from natural sources require the use of various methods to extract the aromatics from the raw materials. Solvent extraction most used and economically important technique for extracting aromatics in the modern perfume industry. Raw materials are submerged in a solvent that can dissolve the desired aromatic compounds.

% yield of Lemongrass Oil using solvent extraction with different solvents. As per observation Ethyl Acetate is the best suitable for extraction of Lemongrass Oil from the date seed. Ethyl Acetate can easily separate after extraction and has higher yield than other with low cost. % Yield for using Ethyl Acetate at various feed to solvent ratio like 1:2 can be calculated by experimental analysis. As per literatures and observations Ethyl Acetate is the best suitable for extraction of

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