

Synthesis of liquid and Vaporized Air Freshener Using Local Material

Rajkumar Gaikwad*¹, Rushikesh Gorde*², Prashant Shidore*³, Gaurav Murkute*⁴ and

Prof. N. B. Chavan*⁵ Our Project Guide

*1, *2, *3, *4 UG Students of Department of Chemical Engineering

*5 Assistant Professor Department of Chemical Engineering of
Pravara Rural Engineering College, Loni, Dist.: Ahmednagar- 413736.

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. The % yield for extraction of perfume oil from lemongrass using steam distillation. For 1:2, 1:3, 1:4 and 1:5 feed to solvent shows the yield 1.6, 1.8 2 and 2.2 % resp. For 1:2,

1:3, 1:4 and 1:5 feed to solvent shows the yield 1.6,

1.8 2 and 2.2 % resp. % yield for extraction of lemongrass oil from lemongrass using Soxhlet extraction. 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. Properties for lemon grass oil are color - pale yellow to orange yellow, density – 0.872- 8.897 at 20 oC, Refractive Index – 1.48-1.50 at 20 °C, viscosity – 4.45 cSt. 6.4.5 and pH – 4-5 Gel formulation in the study was made from a mixture of herbal essential oil sodium benzoate, absolute alcohol and lemongrass essential oil in distilled water with a variety of different concentrations of herbal essential oil at 5 ml, 10 ml, 15 ml and 20 ml then performed an evaluation form test gel evaporation of a liquid test during 4 weeks of storage is 60 %, 54 %, 44 % and 28 %.

Keywords – Air Freshener, Natural (Local) materials, Gelatin, Lemongrass oil, Steam Distillation.

Introduction

Essential oils as natural fragrances are frequently used in green and healthy marketed housecleaning products and air fresheners. A specific insight is provided on terpenes present in fragranced housecleaning products, air fresheners and pure essential oils. Standard protocols and real scale approaches are expected to explore the indoor physics and chemistry of terpenes from emission to reactivity. Household as scented and chemically formulated products used in a non-permanent way in indoor environments for housekeeping and air freshening purposes are included (i) cleaning products (ii) air fresheners (iii) air purifiers. Air

fresheners can produce higher and steady-state concentration levels of terpenes when compared to other indoor terpene sources. The use of air fresheners is responsible of the release of a great variety of fragrance molecules and suggest an elevation of the health risk of building occupants. It appears that their purifying or odor neutralizer claims are highly ambiguous since they mostly correspond to massive emissions of VOCs to provide pleasant odors. These purifying properties of essential oils can come from their ability to limit or eliminate the proliferation of microorganisms. Fragrance compounds have been used since antiquity to freshen the air or to mask the odors. Different types of air fresheners are known such as electric air fresheners with 30% market share, sprays, including aerosol air fresheners with 27%, car air fresheners with 16%, gel air fresheners with 9%, candle air fresheners and wax melts with 7 %, liquid air fresheners with 6% and others.

Essential Oil Based Products

1. Formulation of Cleaning Products, Air Fresheners and Purifiers

Cleaning agents are assembled in different product categories according to their technical functions and purposes of use. They are typically composed by one or more active components. The chemical formulations of household products and classifying products according to their categories and diffusion modes.

2. Fragrances Contained in Household Products

Fragrance mixtures and essential oils are used in cleaning product formulations either to provide them a pleasant odor to hide odors from other chemicals used or to enhance their antibacterial performance. There is a clear difference between essential oils and fragrance mixtures. Essential oils are natural oils, extracted from plants while fragrance mixtures represent the combinations of different compounds. Household products can be formulated with (i) synthesized fragrances (ii) pure essential oil or a mixture of them (iii) mixtures of synthesized fragrances and essential oils.

Experimental Analysis Raw Materials

1. Distilled Water
2. Dried Lemon Grass

Apparatus

1. Steam Distillation Apparatus
2. Weighing Balance
3. Measuring Cylinder
4. Soxhlet Apparatus
5. Separating Funnel

Experimental Procedure for Steam Distillation

1. Take 100-250 gm of Jasmine flower or lemongrass.
2. Steam from boiling water is passed through the raw material for 1-3 hrs. which drives out most of their volatile fragrant compounds.
3. Condensate from distillation which contains both water and Essential oil settle in separator.
4. For easy separation of essential oils from water as oil will float to the top of distillate where it is removed leaving behind watery distillate.
5. The water collected from condensate which retains some of oils from raw material is called hydrosol and is sometimes sold for consumer and commercial use.
6. This is most commonly used for fresh plant materials such as flowers, leaves and stems. For Spices essential oil to be used.
7. Measures the various properties of essential oil.
8. Make perfume by addition of various agents.

Experimental Setup

x` Experimental Setup for Steam Distillation



Fig. Experimental Setup for Steam Distillation

Fig. shows the experimental setup for steam distillation column consisting two neck flask, single neck flask, heating mental, retort stand, beaker, pressure head, condenser and tubing for condenser.

Experimental Setup for Soxhlet Apparatus**Fig. Experimental Setup for Soxhlet Apparatus****Fig. Simple Distillation Apparatus Experimental Process for Soxhlet Apparatus**

1. Take 100 gm dried lemon grass.
2. Put lemongrass in Soxhlet apparatus
3. Take solvent in bottom flask of Soxhlet apparatus.
4. Take filter paper and keep citrus peels powder in cloth or filter paper.
5. Start heating supply and cooling supply to the condenser
6. After extraction removal of round bottom flask from Soxhlet apparatus.
7. Lemongrass oil (B.P. 92-93^oC) to be separated from solvent using simple distillation.
8. Separation by simple distillation carried out at temperature 75-80 ^oC.
9. In distillation ethanol recover as top product and lemongrass oil as a bottom product.

Procedure for Air Freshener Gel Formulation

1. In 50 ml of distilled water at room temperature dissolved 15 g of gelatin.
2. 150 ml of distilled water boiled.

3. Gelatin solution added to boiling water and mixed until yellow homogeneous solution obtained.
4. 15 drops of lemongrass essential oil added without any color added and 1% of the salt also added.
5. After well stirring the homogeneous mixture pouring into a mould with different shapes and then left in the freezer for 2 hours to cool.
6. After cooling in the freezer, the samples taken out at the room temperature.
7. The 3D structures of gel air fresheners of desired shapes and odors obtained.
8. Repeat the similar process for synthesis of air freshener from various essential oil. [2]

Liquid Air Freshener Formulation Raw Material

1. Essential or Fragrance Oil
2. Distilled Water
3. Vodka or Rubbing Alcohol or 70 % Ethanol
4. Benzyl Salicylate (Fixative)

Liquid Air Freshener Formulation

1. For making 100 ml of natural liquid vaporized perfume we need 10 ml of essential oil, 10 ml of benzyl salicylate to improve the longevity of the air freshener, 20 ml 70% ethanol and 60 ml of distilled water.
2. Take 100 ml of air freshener spray bottle.
3. Pour 60 ml of distilled water in it.
4. Add 20 ml 70% ethanol.
5. Then add 10 ml of benzyl salicylate as a fixative to increase the rotativity of air freshener.
6. Finally add 10 ml of perfume oil.
7. Shake the bottle for 2 minutes for complete mixing of components.

Results and Discussions

Material Balance for Steam Distillation For 1:2 Feed to Solvent

Lemongrass + Distilled Water = Essential Oil + Water

200 gm + 400 ml = **3.2 ml** + 280 gm Sludge + 300 ml + 16.8 ml loss

For 1:3 Feed to Solvent

Lemongrass + Distilled Water = Essential Oil + Water

200 gm + 600 ml = **3.6 ml** + 275 gm Sludge + 500 ml + 21.4 ml loss

% Yield = [Weight of oil Extracted/Feed] * 100

For 1:4 Feed to Solvent

Lemongrass + Distilled Water = Essential Oil + Water

200 gm + 800 ml = **4 ml** + 275 gm Sludge + 700 ml + 21 ml loss

% Yield = [Weight of oil Extracted/Feed] * 100

For 1:5 Feed to Solvent

Lemongrass + Distilled Water = Essential Oil + Water

200 gm + 1000 ml = **4.4 ml** + 280 gm Sludge + 895 ml + 20.6 ml loss

% Yield = [Weight of oil Extracted/Feed] * 100

% Yield for various feed to solvent ration

1. For 1:2 Feed to Solvent

% Yield = $[3.2/200] * 100 = 1.6$

2. For 1:3 Feed to Solvent

% Yield = $[3.6/200] * 100 = 1.8$

3. For 1:4 Feed to Solvent

% Yield = $[4/200] * 100 = 2$

4. For 1:5 Feed to Solvent

% Yield = $[4.4/200] * 100 = 2.2$

% Yield Using Steam Distillation of Lemongrass Oil

Sr. No.	Feed to Solvent Ratio	% Yield Using Steam Distillation	% Yield Using Soxhlet Extraction
01	1:2	1.6	1.8
02	1:3	1.8	2.0
03	1:4	2	2.1
04	1:5	2.2	2.4

Table % Yield of Lemongrass Using Steam Distillation

Table shows the % yield for extraction of lemongrass oil from lemongrass using steam distillation. For 1:2, 1:3, 1:4 and 1:5 feed to solvent

shows the yield 1.6, 1.8 2 and 2.2 % resp. % yield for extraction of lemongrass oil from lemongrass using steam distillation. For 1:2, 1:3, 1:4 and 1:5

feed to solvent shows the yield 1.6, 1.8 2 and 2.2 % resp. % yield for extraction of lemongrass oil from lemongrass using Soxhlet extraction.

Properties of Lemongrass Oil

1. Color - Pale yellow to orange yellow
2. Density – 0.872-8.897 at 20 oC.
3. Refractive Index – 1.48-1.50 at 20 oC.
4. Viscosity – 4.45 cSt.

Graphical Representation of % Yield of Lemongrass Oil

Fig shows the % yield for extraction of lemongrass oil from lemongrass using steam distillation. For 1:2, 1:3, 1:4 and 1:5 feed to solvent shows the yield

1.6, 1.8 2 and 2.2 % resp. % yield for extraction of lemongrass oil from lemongrass using steam distillation. For 1:2, 1:3, 1:4 and 1:5 feed to solvent

shows the yield 1.6, 1.8 2 and 2.2 % resp. % yield for extraction of lemongrass oil from lemongrass using Soxhlet extraction.

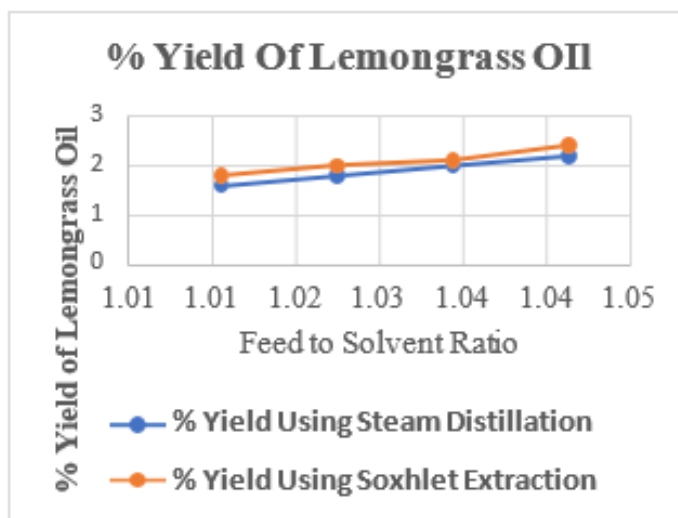


Fig. % Yield of Lemongrass Using Steam Distillation

Factors Affected on the Yield of Lemongrass Oil Size of Lemongrass

Size of Lemongrass Oil has influence on the recovery of oil and recovery of oil small size date seed is more than large size. Crushed lemongrass in powdered form gives large surface area for solid- liquid contact. Due to small size particles increase rate as well as yield of extraction of oil from lemongrass.

Moisture Content of Lemongrass

By the Experimental analysis the moisture content of the lemongrass at the time of oil extraction has a great influence on the extraction recovery of the oil. Moisture should be lower for increase rate and yield of extraction.

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. The optimum value for feed to solvent is 1:4 on which maximum yield for Lemongrass Oil extraction. As the feed to solvent ration increase more than 1:4 there is appreciable change in the yield but the cost of solvent increase. The 1:4 feed to solvent ration is to be optimum value for Lemongrass Oil extraction.

Time of Extraction

As the time range of extraction increased the Lemongrass Oil yield increases but up to a limit. The time of extraction increased yield of oil also increase and up to maximum level. The extraction of Lemongrass Oil carried out 3-4 hrs. using steam distillation.

Evaporation Study for Air Freshener Gel Using Lemongrass Oil

Sr. No.	ML of Lemongrass Oil Use for Gel Air Freshener	% Evaporation of Air Freshener Gel
01	5	60
02	10	54
03	15	44
04	20	28

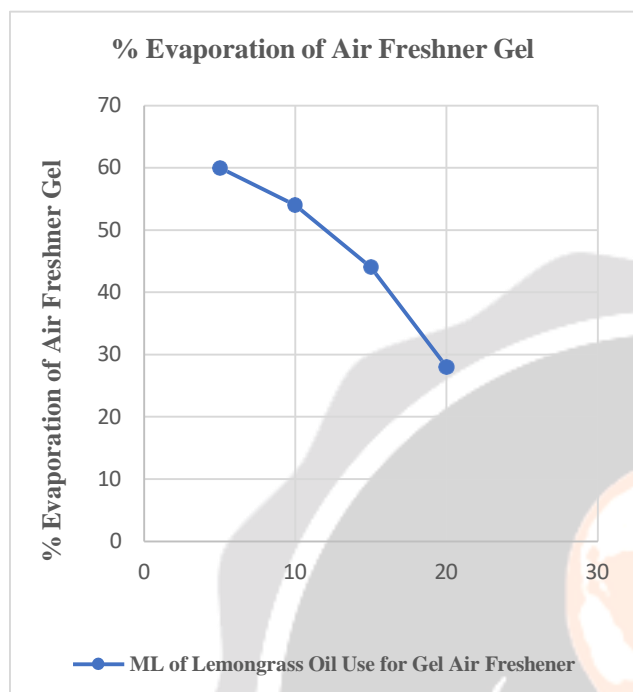
Table Evaporation Study for Air Freshener Gel Using Lemongrass Oil

Gel formulation in the study was made from a mixture of herbal essential oil sodium benzoate, absolute alcohol and

lemongrass essential oil in distilled water with a variety of different concentrations of herbal essential oil at 5 ml, 10 ml, 15 ml and 20 ml then performed an evaluation form test gel evaporation of a liquid test during 4 weeks of storage is 60 %, 54 %, 44 % and 28 %.

Graphical Representation of Evaporation for Air Freshener Gel

Fig. shows the variety of different concentrations of herbal essential oil at 5 ml, 10 ml, 15 ml and 20 ml then performed an evaluation form test gel evaporation of a liquid test during 4 weeks of storage is 60 %, 54 %, 44 % and 28 %.



such as in perfumery, cosmetics, food, beverages and drugs. Lemongrass and jasmine flower 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 applications, there is large scope for essential oil extracted from the lemongrass and jasmine flower.

Fig. Evaporation for Air Freshener Gel Future Scope and Benefits

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 are used in the perfume, soap, cosmetics industries and to treat fevers and infections. Essential oils have been utilized in different domestic aspects

By the Experimental analysis the moisture content of the lemongrass at the time of oil extraction has a great influence on the extraction recovery of the oil. Moisture should be lower for increase rate and yield of extraction.

Economics

1. Flavoring

Adds flavor to food such as in used as flavoring for drinks such as tea and used as a spice in sherbet.

2. Soil Erosion Control - A good crop for checking soil erosion and used as mulching material for various plants and trees.

3. Oil

Commercial lemongrass oil or Indian verbena oil which has a reddish yellow color with the intense odor and taste of lemons. Used for isolation of Citral for manufacturing Vitamin C. Citral is the starting material for the manufacture of ionone and in preparing food flavoring. Small amount of oil is used in making soap, detergent and other preparations.

4. Fuel

The plants waste after oil extraction is used as fuel for distillation process.

5. Medicinal

Crushed leaves are applied to the forehead and face as a cure for headache. Root decoction serves as a diuretic. Excellent stomachic (stimulating the function of the stomach) for children. With black pepper it is useful in checking menstrual disorders. A carminative and tonic to the intestinal mucus membrane useful in cases of vomiting and diarrhea. Lemon grass oil mixed with equal quantity of pure coconut oil makes liniments for lumbago, chronic rheumatism, neuralgia, sprains and other painful afflictions. It is also helpful in treating ringworm. When taken internally oil acts as stimulant and diaphoretic.

Conclusion

Essential oil constituting of 90–95% of oil in weight containing monoterpene and sesquiterpene hydrocarbons as well as their oxygenated derivatives with aliphatic aldehydes, alcohols and esters. Essential oils, pure grain oil and water are three key ingredients in perfume making. Essential oils or volatile oils are found in many different plants. Oil extraction by distillation for modification and optimization. Essential oil constituting of 90–95% of oil in weight containing monoterpene and sesquiterpene hydrocarbons as well as their oxygenated derivatives with aliphatic aldehydes, alcohols and esters. Essential oils, pure grain oil and water are three key ingredients in perfume making. Essential oils or volatile oils are found in many different plants. Oil extraction by

distillation for modification and optimization. Size of Lemongrass Oil has influence on the recovery of oil and recovery of oil small size date seed is more than large size. Crushed lemongrass in powdered form gives large surface area for solid-liquid contact. Due to small size particles increase rate as well as yield of extraction of oil from lemongrass. As the time range of extraction increased the Lemongrass Oil yield increases but up to a limit. The time of extraction increased yield of oil also increase and up to maximum level. The extraction of Lemongrass Oil carried out 3-4 hrs. using steam distillation.

The ration of feed to solvent also important factor to be consider for extraction process which effect on the yield of oil. The optimum value for feed to solvent is 1:4 on which maximum yield for Lemongrass Oil extraction. As the feed to solvent ration increase more than 1:4 there is appreciable change in the yield but the cost of solvent increase. The 1:4 feed to solvent ration is to be optimum value for Lemongrass Oil extraction.

References

1. Angulo Shadia, Emissions and reactivity of terpenes from the use of essential-oil-based household products under realistic conditions Impact on indoor air quality, Ecole national supérieure Mines-Telecom Lille Douai, 2019.
2. Amra Bratovčić, Synthesis of Gel Air Freshener and Its Stability Original Scientific Paper, Technological Acta, vol. 12, No. 2, pp. 15-21, 2019.
3. ALshaer Fatima Ibrahim, Dalal Fuad ALBaharna, Hafiz Omer Ahmed, Qualitative Analysis of Air Freshener Spray, Journal of Environmental and Public Health, Nov 2019.
4. Ayush Kumar Garg, Amit Singh, Harish Vishnoi and Gulab Chand Meena, Swine Flu- The Changing Scenario and Preparedness with Formulation Of "Win Flu Air Freshener Gel, International Journal of Ayurveda and Pharma Research, ISSN: 2322 – 0902, Vol 5, Issue 11, November 2017.
5. Fineman Stanley, Air Fresheners, American College of Allergy, Asthma & Immunology, Connecticut Department of Public Health Environmental & Occupational Health Program, (860) 509-7740 July 2017.
6. Hutagaol Rosemary, Formulation of air Freshener Gel with Carrageenan as Gelling Agent, Lemon Oil as Fragrance and Patchouli Oil as Binder, International Journal of Chem Tech Research, ISSN: 0974-4290, Vol.10, No.4, pp 207-212, 2017.
7. Jumbo Oyinbrakemi Golda, Perfume Extraction and Formulation from Lemongrass Leaves, Iconic Research and Engineering Journals, IRE Journals, Volume 5, Issue 11, ISSN: 2456-8880, May 2022.
8. Joshi Amol, Vamsee Sonti, Samiksha Rahate and Prof. Vivek Nagnath, Extraction of Perfumery Oil from Lemon Grass, International Research Journal of Engineering and Technology (IRJET), Vol: 03 Issue: 08, Aug-2016.
9. Purnima Mulmia and Hem Raj Pant, Fabrication of Air Freshening Spongy Three-Dimensional Electrospun Membrane, Journal of the Institute of Engineering, 14(1): 14-21, 2018.

10. Sulong Mohd Faisal, Extraction of Essential Oils from Jasmine Flower Using Solvent Extraction Method, Faculty of Chemical & Natural Resources Engineering University College of Engineering & Technology Malaysia, November, 2006.
11. Saeed Muhammad, Malik Abid Mahmood and Naveed Ahmad, Quantitative and Qualitative Analysis of Essential Oil of Arabian Jasmine (*Jasminum Sambac*) Flowers Harvested from Pothohar Region of Pakistan, *Journal of Ornamental Plants*, Volume 7, Number 1: 17-24, March, 2017.
12. Sellam P., Jayoti Majumder and Puja Rai, Floral Essential Oils Importance and Uses for Man Kind, *Directorate of Floricultural Research, IARI, Pusa, New Delhi Hort Flora Research Spectrum*, 3(1): 7- 13, ISSN: 2250-2823, March 2014.
13. S. J. Kulkarni, Oil Extraction and Perfume Formulation from Plants: A Review, *International Journal of Research & Review*, Vol.3; Issue: 11; November 2016.
14. Tri Duc Lam, Vo Hoang Yen and Nguyen Thi Ngoc Lan, Extraction of Jasmine Essential Oil by Hydro distillation method and Applications on Formulation of Natural Facial Cleansers, *Materials Science and Engineering* 542, 012057, 2019.
15. Thana Raj S. Azhari H. Nour, Ranitha M., Abdurahman H. Nour and Ziad A. Sulaiman, A Comparative Study of Lemongrass Essential Oil Extracted by Microwave-Assisted Hydro distillation and Conventional Hydro distillation, *International Journal of Chemical Engineering and Applications*, Vol. 5, No. 2, April 2014.

