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# A Review on Techniques Available for the Extraction of Essential Oils from Various Plants

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***Abstract** - The different techniques available for the extraction of essential oils has been reviewed. Also the study of various parameters has been done which influence the yield and quality of the desired essential oils. Parameters like solvent to feed ratio, temperature of the boiling mixture, size of the raw material and the time of extraction have significant influences on the yield and quality of the extracted essential oils. The hydro-distillation method found to be most suitable method for the extraction of essential oils that are temperature sensitive.*

***Key Words**: Essential Oils, Extraction Methods, Parameters, Applications.*

## 1. INTRODUCTION

Essential oils derived from the plants and its different parts like stems, leaves, roots, flowers or fruit rinds have been widely used from the ancient times. And it has widely being use in the present time also for the medical and therapeutic purposes. It has also proved its valuable existence in the field of food and beverage industry. From the formation of the ionones to the characteristic pleasing aroma, essential oils derived from plants and its different parts has served pharmaceutical and fragrance industries equally well.

Many different types of methods like Hydro-distillation, Microwave-Assisted Hydro-distillation, Steam distillation, Cold pressing, Solvent extraction, $CO_2$ extraction and Maceration are available for the extraction of essential oils. These all varieties of method are used in order to produce a good quality or say to obtain an oil of appreciable yield. But from the previous researches and paper reviews, it shows that different types of methods have their different influences on the quality and the yield of essential oils. It can also be seen that the extraction time may vary and the production cost too. Hydro-distillation is one such traditional and widely used method for the extraction of essential oils. The hydro-distillation method has shown the optimum result particularly for the lemongrass essential oil. The essential oil of lemongrass mainly consists of neral and geranial (Alwani Hamad et al., 2017). These two aldehyde compounds were responsible for moderate to strong antimicrobial activity of essential oil of lemongrass against B.subtilis, S.aureus. Lemongrass is an important herbal and aromatic plant and its oil is one of the major essential oil used in the perfumery and cosmetic industry. The citral is isolated by hydro-distillation of lemongrass which is used to make lemongrass tea.

## 2. ESSENTIAL OIL

Natural essential oils are obtained from plants and its different parts are volatile, fragrant and pleasant tasting oils. They have wide applications in pharmaceutical, food and beverage, perfumery and cosmetic industries.

An essential oil has been used for many thousands of years. Oils have been in the embalming process, in medicine and in purification methods with the continual bombardment of the virus, bacteria, parasitic and fungal contamination in our world. Essential oils serve great benefit to help protect our bodies and homes from this onslaught of pathogens. The exotic citrus odour of the oil has contributed to its application as a flavoring agent in food, perfume and toiletries (Desai et al., 2011). An essential oil is usually separated from the aqueous phase by a physical method that does not lead to significant change in its chemical composition (Hesham H.A. Rassem et al.,2016). They could be biosynthesized in different plants organs as secondary metabolites (A. El Asbhanni et al., 2015).

## 3. ESSENTIAL OIL EXTRACTION METHODS

Early efforts at extraction used alcohol and a fermentation process. New methods of essential oils extraction are entering the mainstream of aromatherapy, offering new choices in oils never before available. The way in which oils are extracted from plants is important because some processes use solvents that can destroy the therapeutic properties. These oils are produced as 'absolutes' and while not technically considered essential oil they can still be of therapeutic value. The value of the newer processing methods depends greatly on the experience of the distiller, as well as the intended application of the final product. Each method is important and has its place in the making of potential grade essential oil. Some of the few methods available for extraction of essential oils are given below:

### 3.1Steam Distillation-

Most commonly, the essence of the plants is extracted by using a technique called distillation. One type of distillation places the plant or flowers on a screen. Then it is subjected to the steam without maceration in water. The injected steam passes through the plants from the base of the alembic to the top. It is a method where steam flows through the material (Rai A. et al., 2004). The principle of this technique is that the combined vapor pressure equals the ambient pressure at about 100 °C so that the volatile components with the boiling points ranging from 150 to 300 °C can be evaporated at a temperature close to that of water. Furthermore, this technique can also be carried out under pressure depending on the essential oils extraction difficulty (Hesham H.A. Rassem et al., 2016).

### 3.2 Cold Pressing

Cold pressing is used to extract the essential from citratus rinds such as orange, lemon and grapefruit. In this method the epidermis and oil glands were lacerated with a needle, creating areas of compression in the peel surrounded by which the oil flows to the exterior. The essential oil was collected, dried over anhydrous sodium sulphate and stored at 4 °C until used (Mohamed A. ferhat et al., 2007).

### 3.3 Solvent Extraction

A hydrocarbon solvent is added to the plant material to help dissolve the essential oil. When the solution is filtered and concentrated by distillation, a substance containing resin (resinoid), or a combination of wax and essential oil remain. This method is used in the processing of perfumes, vegetable oil, or biodiesel. It is used on delicate plants to produce higher amounts of essential oil at a lower cut (Chrissie et al., 1996). The amount used of the dry sample of the lemongrass was 150gm and placed in a 1 liter clean flat bottom flask. The solvent used was N-hexane. It is then poured into the flask. The flask and the feed were allowed to unaltered for 36 hours. This was done on order to extract all the oil content from the lemongrass (M. A. Suryawanshi et al., 2016).

### 3.4 $CO_2$ and Supercritical $CO_2$ Extraction

The most modern technologies, carbon dioxide and supercritical carbon dioxide extraction involve the use of $CO_2$ as the solvent which carries the essential oil away from the raw plant material. The oil extracted using supercritical $CO_2$ due to high selectivity of the solvent. The operational conditions studied varied from 313.15 K to applied pressure were 6.2, 10.0, 15.0 and 18.0 MPa (C. F. Silva et al., 2011). Better values of the efficiency of the extracted oil were obtained at higher pressure conditions. In practice, more than 90% of all analytical supercritical fluid extraction (SFE) is performed with $CO_2$ for several practice reasons. Apart from having relatively low critical pressure (74 bars) and temperature (32 °C), is relatively non-toxic , nonflammable, noncorrosive, safe, available in high purity at relatively low cost and is easily removed from the extract (Rozzi et al., 2002). The main drawback of $CO_2$is lack of polarity analyses (Pourmortazavi et al., 2007). The compounds present in large quantities in the lemongrass essential oil were neral, geranial and myrcene. The changes in pressure and temperature conditions had a significant effect on the composition of the extracts. But this technique of oil extraction still considered as the new technique on an industrial scale (Luiz Henrique Castelan Carlson et al., 2001).

### 3.5 Microwave Assisted Hyrdo-Distillation

Microwave Assisted Hyrdo-Distillation (MAHD) has recently gained attention for the extraction of essential oils. A concern with the use of MAHD is the possibility of sample deterioration during the external exposure to microwave irradiation (Mohammad-Taghi Golmakani et al., 2008). Use of microwaves (i.e, the irradiation) as an alternate extraction technique was first reported by Gazzler et al ., 1980. Since then numerous studies have sought the applicability of this new approach for the extraction of essential oils. The principle of heating using microwave assisted hydrodistillation is based on the fact that, the irradiation influences the polarity of solvents and the two phenomenons are responsible for it they are, ionic conduction and dipole rotation, which for the most cases occurs simultaneously (Letellier M.H. Budzinski et al., 1999).

In order to investigate the effects of applied microwave power and radiation time ( or extraction time), a central composite design was implemented to determined optimal conditions and to evaluate the robustness of the method by drawing surfaces. The capacity of the solvents to absorb microwave energy played a role in the efficiency of extraction. Methanol was found to be the best extraction solvent because of its good capacity to heat under microwaves andit's ability to solubalise cocaine (A. Brachet et al., 2002).

### 3.6 Soxhlet Extraction

A soxhlet extractor is generally a laboratory apparatus (Hardwood, Laurence M. and Moody, Christopher J, 1989) which was invented in 1879 by Franz Von Soxhlet (Soxhlet et al., 1879). Extraction of lipid from the solid material was the main motto behind the designed of the soxhlet extractor. Soxhlet extraction mainly used when the compounds under consideration has a limited solubility in a solvent and the impurity is insoluble in that solvent (Hesham H. A. Raseem et al., 2016).

Soxhlet extraction involves solid-liquid contact for the removal of one or more compounds from a solid by dissolving it into a refluxing liquid phase. In a conventional soxhlet device, the solid matrix is placed in a cavity that is gradually filled with the extracting liquid phase by condensation of vapours from a distillation flask. When the liquid reaches a preset level, a siphon pulls the contents of the cavity back into the distillation flask thus carrying the extracted analytes into the bulk of liquid (Schantz et al., 1998). Moreover, the temperature of the system is close to the boiling points of the solvent. This excess energy in the form of heat helps to increase the extraction kinetics of the system (Hesham H. A. Rassem et al., 2016). Besides these soxhlet extraction has its several disadvantages, this method takes many hours or days to perform; the dilution of the sample in large volumes of solvent etc.

### 3.7 Hydro-Distillation

Hydro-Distillation is a method of extraction, which is sometimes used instead of steam distillation. This process of extraction is one of the most used traditional methods of extraction. In this process rather having steam pass via charge in Hydro-Distillation, the charge is soaked into water. Then heat the water container till the steam comes out and then let it cool and then collect the oil sample from the top of the hydrosol.

Hydro-Distillation is potentially a very useful method to extract essential oil from various plants and from their different parts and was used to separate essential oil from cymbopogon fluxuous. The yield is dependent on various parameters like weight of raw material, volume of water, size of raw material and nature of raw material (Jigisha K. Parish et al., 2011).

In Hydro-Distillation essential oils are evaporated by heating the feed-solvent mixture followed by the liquefaction of the vapours with the help of a condenser. The set-up comprises also a condenser and a decanter to collect the condensate and to separate essential oils from water respectively. The principle of extraction is based on the isotropic distillation (Hesham H. A. Rassem et al., 2016). Hydrodistillation method used to isolate citral from lemongrass plant which is generally used to make lemongrass tea. The wet grass gives the maximum extract (Diwan et al., 2014).

## 4. CONCLUSION

There are variety of methods are available as discussed above for the extraction of essential oils from plant. Since the essential oils are temperature sensitive materials, which are insoluble in water and may decompose at their boiling point. Therefore the temperature of the vapour must not be so high that it destroys the plant or burns the essential oil, yet so high that can produce enough vapours for the desired separation of oil.

Parameters such as weight of raw material, volume of solvent, size of raw material, temperature and time of extraction influences the yield of essential oil. Some important applications of essential oils are in pharmaceutical, food and beverages industry and in aromatherapy.

## 5. REFERENCE

1. Andrew E. Aziza and Stanley Okiy, 2018, "Extraction and Characterization of Essential Oil Ginger from Ginger Rhizome" American Journal of Engineering Research (AJER), Volume-7, Issue-2, pp-266-270.
2. Alwani Hamad, Anggi Nuritasari, Dwi Hartani, 2017, "Chemical Composition and Antimicrobial Study of Essential Oil of Lemongrass (Cymbopogon Citratus)." Scholar Research Library, 9:109-106.
3. Hesham H. A. Rassem, Abdurahman H. Nour and Rousli M. Yunus, 2016."Techniques For Extraction of Essential Oils From Plants: A Review", Australian Journal of Basic And Applied Science, 10(16): 117-127.
4. M. A. Suryawanshi, V.B. Mane and G. B. Kumbhar, 2016."Methodology to extract essential oils from lemongrass leaves: Solvent extraction approach." International Research Journal of Engineering and Technology, 03: 1775-1780.
5. Miss Diwan Tapoja, Desai S.A., 2014. "Studies on Extraction of Ingredient Oil from Lemongrass." International Journal of Engineering Research and Technology, 3: 509-512.
6. Jigisha K. Parikh, Meghal A. Desai, 2011, "Hydrodistillation of Eseential Oil from Cymbopogon flexuosus." International Journal of Food Engineering, 7: 1-11.
7. C. F. Silva, F.C. Moura, M. F. Mendes and F. L. P. Pessoa, 2011, "Extraction of Citronella (Cymbopogon nardus) Essential Oil using Supercritical CO2: Experimental Data and Mathematical Modelling." Brazilian Journal of Chemical Engineering, 28: 343-350
8. D. Ganjewala, 2009. "Cymbopogon essential oils: Chemical composition and Bioactivities." International Journal of Essential Oil Therapeutics, 3: 56-65.
9. F. Bakkali, S. Averbeck, D. Averbeck and M. Idaomar, 2008. " Biological effects of essential oils- A Review." Food and Chemical toxicology, 46: 446-475
10. Mohammad-Taghi Golmakani and Karamatollah Rezaei, 2008." Microwave-assisted hydrodistillation of essential oil from zataria multiflora boiss."EUR. J. Lipid Sci. Technol, 110: 448-454.
11. Ferhat, M., B. Meklati, J. Smadja and F. Chemat, 2007." Comparison of different isolation methods from Citrus fruits: cold pressing, hydrodistillation and microwave 'dry' distillation. " Flavour and Fragrance Journal, 22: 494-504.
12. Pourmortazavi, S.M. and S.S. Hajimirsadeghi, 2007.Supercritical fluid extraction in plant essential and volatile oil analysis. Journal of Chromatography A, 1163: 2-24.
13. Rai, R. and B. Suresh, 2004. Indian Journal of Traditional Knowledge, 3(2): 187-191.
14. A. Brachet, P. Christen and J.L. Veuthey, 2002, "Focused Microwave-assisted Extraction of Cocaine and Benzoylecgonine from Coca Leaves." Wiley Interscience, 13: 162-169.

15. Rozzi, N.L., W. Phippen, J.E. Simon and R.K. Singh, 2002.Supercritical fluid extraction of essential oil components from lemon-scented botanicals. Lebensm.- Wiss. U. Technol., 35: 319-324.

16. Luiz Henrique Castelan Carlson, Ricardo Antonio Francisco Machado, Cinthia Bittencourt Spricigo, Lia Kru¨cken Pereira and Ariovaldo Bolzan, 2001."Extraction of lemongrass essential oil with dense carbon dioxide." Journal of Supercritical Fluids, 21: 33-39.

17. Letellier, M., H. Budzinski, L. Charrier, S. Capes and A.M. Dorthe, 1999. Optimization by factorial design of focused microwave-assisted extraction of polycyclic aromatic hydrocarbons from marine sediment. J. Anal. Chem., 364: 228-37.

18. Michele Schantz, M., and S.B. Hawthorne, 1998.Comparison of Supercritical Fluid Extraction and Soxhlet Extraction for the determination of polychlorinated biphenyls in Environmental Matrix Standard Reference Materials. Journal of Chromatography A, 816: 213-220.

19. Chrissie, W., 1996."The Encyclopedia of Aromatherapy." Vermont: Healing Arts Press, pp: 16-21.

20. Harwood, Laurence, M., Moody, J. Christopher, 1989. Experimental organic chemistry: Principles and Practice (Illustrated ed.). Wiley-Blackwell., pp: 122-125. ISBN 0-632-02017-2.

21. Soxhlet, F., 1879."Die gewichtsanalytische Bestimmung des Milchfettes". Dingler's Polytechnisches Journal (in German), 232: 461-465.