

# SCOPE OF EXTRACTION UNIT FOR MEDICAL AND AGRICULTURAL APPLICATION- A Literature Review

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**Abstract:-** Large quantities of herb resources contain Essential Oils with extensive bioactivities. Acknowledging the importance of plants and its Medicinal & Agricultural value, extraction of Essential Oil had been done using Steam Distillation method. In this project Steam Distillation was used to extract oil from different plant materials like eucalyptus leaves, curry leaves, hibiscus leaves, lemon leaves, marigold flowers, rose flowers, orange peels etc. Research has confirmed centuries of practical use of essential oils, and we now know that the 'fragrant pharmacy' surrounds compounds with an extremely broad range of biochemical effects. The distillation was conducted in Extraction unit in which boiling, condensing and decantation was done.

**Keywords:** - *Essential Oil, Distillation, Extraction, Agricultural*

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## I INTRODUCTION

Humankind has used plants for healing for many thousands of years, and it's from this tradition of that the use of aromatic plant compounds is medicine & Agriculture began[1] Oils were used in the embalming process, in medicine and in purification rituals and Growth of plant and protecting from diseases[9]. There are also over 200 references to aromatics, incense and ointments in the Old and New Testaments. It is estimated that there are 250,000 to 500,000 species of plants on Earth. A relatively small percentage (1 to 10%) of these is used as foods by both humans and other animal species. It is possible that even more are used for medicinal purposes (Moerman, D. E. 1996)[3]. He reported that while 625 species of plants have been used by various Native American groups as food, 2,564 have found use as drugs. Research has confirmed centuries of practical use of essential oils, and we now know that the 'fragrant pharmacy' contains compounds with an extremely broad range of biochemical effects[5]. There are about three hundred essential oils in general use today by professional practitioners[23]. With the continual bombardment of viral, bacterial, parasitic and fungal contamination in our world, essential oils are a great benefit to help protect our bodies and homes from this onslaught of pathogens. Immune system systems need support and

essential oils can give it[7]. Because of the enormous amount of raw product used to make wholly natural essential oils, lots of products on the market have been polluted with lower quality, commercial grade oils or contain other chemical substances to reduce the cost or increase the profit margin a fact not usually revealed on the label[5]. This is why it is important to study the chemical composition of the volatile fraction once the essential oil is extracted[7]. This fraction is characterized by the complexity in the separation of its components, which belong to various classes of compounds and which are present in a wide range of concentrations. Steam distillation is used in the extraction of Essential Oil from the plant material. It is a special type of distillation or a separation process for temperature sensitive materials like oils, resins, hydrocarbons, etc. which are insoluble in water and may decompose at their boiling point. The fundamental nature of steam distillation is that it enables a compound or mixture of compounds to be distilled at a temperature substantially below that of the boiling point(s) of the individual constituent(s)[5]. Essential Oil contains components with boiling points up to 200°C or higher temperatures. In the presence of steam or boiling water, however, these substances are volatilized at a temperature close to 100°C, at atmospheric pressure.

## II LITERATURE SURVEY

Essential oils are concentrated volatile aromatic compounds produced by plants - the easily evaporated essences that give plants their wonderful scents[5]. Each of these complex precious liquids is extracted from a particular species of plant life. Each plant species originates in certain regions of the world, with particular environmental conditions and neighboring fauna and flora.

Essential oils are frequently referred to as the “life force” of plants. Unlike fatty oils, these "essential" oils are volatile, highly concentrated, substances extracted from flowers, leaves, stems, roots, seeds, bark, resin or fruit rinds[1] The amount of essential oils found in these plants can be anywhere from 0.01 percent to 10 percent of the total. That's why tons of plant material are required for just a few hundred pounds of oil. These oils have potent antimicrobial factors, having wide range of therapeutic constituents. These oils are often used for their flavor and their therapeutic or odoriferous properties, in a wide selection of products such as foods, medicines, and cosmetics. Beware of imitations[9]. Essential oils cannot be substituted with synthetics. Only pure oils contain a full spectrum of compounds that cheap imitations simply cannot duplicate.

## III PHARMACOLOGICAL PROPERTIES OF ESSENTIAL OILS

### **Antiseptics:**

Essential oils have antiseptic properties and are active against a wide range of bacteria as well as on antibiotic-resistant strains. Moreover, they are also known to be active against fungi and yeasts (Candida)[12]. The most common sources of essential oils used as antiseptics are: Cinnamon, Thyme; Clover; Eucalyptus; Culin savory; Lavender. Citral, geraniol, linalool and thymol are much more potent than phenol.

### **Expectorants and diuretics:**

When used externally, essential oils like (L'essence de terebenthine) increase microcirculation and provide a slight local anaesthetic action[10]. Till now, essential oils are used in a number of ointments, cream and gels, whereby they are known to be very effective in relieving sprains and other articular pains. Oral administration of essential oils like eucalyptus or pin oils, stimulate ciliated epithelial cells to secrete mucus. On the renal system, these are known to

increase vasodilation and in consequence bring about a diuretic effect.

### **Spasmolytic and sedative:**

Essential oils from the Umbellifereae family, Mentha species and verbena are reputed to decrease or eliminate gastrointestinal spasms[7]. These essential oils increase secretion of gastric juices. In other cases, they are known to be effective against insomnia.

## IV CHEMICAL CONSTITUENTS OF ESSENTIAL OILS

Pure essential oils are mixtures of more than 200 components, normally mixtures of terpenes or phenylpropanic derivatives, in which the chemical and structural differences between compounds are minimal. They can be essentially classified into two groups:

**Volatile fraction:** Essential oil constituting of 90–95% of the oil in weight, containing the monoterpene and sesquiterpene hydrocarbons, as well as their oxygenated derivatives along with aliphatic aldehydes, alcohols, and esters.

**Nonvolatile residue:** that comprises 1–10% of the oil, containing hydrocarbons, fatty acids, sterols, carotenoids, waxes, and flavonoids.

## V METHODS OF EXTRACTING ESSENTIAL OILS

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[11]. With the new labels of CO<sub>2</sub> and Super Critical CO<sub>2</sub>, along with the traditional ‘steam’ and ‘hydro’ distillations, ‘absolutes’, and ‘cold pressing’, a little education for the aromatherapy enthusiast can go a long way in essential oil selection. Is one process better than another? Does one produce nicer smelling oil, or one with greater aroma therapeutic value? It turns out that essential oil production, like winemaking, is an art form as well as a science[7]. The way in which oils are extracted from plants is important because some processes use solvents that can destroy the therapeutic properties. Some plants, and particularly flowers, do not lend themselves to steam distilling.[3]. They are too delicate, or their fragrance and therapeutic essences cannot be completely released by water alone. These oils will be produced as ‘absolutes’ – and while not technically considered essential oils they can still be of

therapeutic value. Jasmine oil and Rose oil in particular are delicate flowers whose oils are often found in 'absolute' form[15].

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[8]. Each method is important, and has its place in the making of aromatherapy-grade essential oils. Some of the few methods are available for extractions of essential oils are given below:

**Maceration:** Maceration actually creates more of an "infused oil" rather than an "essential oil".[21]. The plant matter is soaked in vegetable oil, heated and strained at which point it can be used for massage.[23]

**Cold Pressing:** Cold pressing is used to extract the essential oils from citrus rinds such as orange, lemon, grapefruit and bergamot. This method involves the simple pressing of the rind at about 120°F to extract the oil. The rinds are separated from the fruit, are ground or chopped and are then pressed[13]. The result is a watery mixture of essential oil and liquid which will separate given time. Little, if any, alteration from the oil's original state occurs – these citrus oils retain their bright, fresh, uplifting aromas like that of smelling a wonderfully ripe fruit. oils extracted using this method have a relatively short shelf life, so make or purchase only what you will be using within the next six months.[23].

**CO<sub>2</sub> & Super Critical CO<sub>2</sub> Extraction:** The most modern technologies, Carbon Dioxide and Supercritical Carbon Dioxide extraction involve the use of carbon dioxide as the 'solvent' which carries the essential oil away from the raw plant material. [22].The lower pressure CO<sub>2</sub> extraction involves chilling carbon dioxide to between 35 and 55 degrees F, and pumping it through the plant material at about 1000 psi. The carbon dioxide in this condition is condensed to a liquid. Supercritical CO<sub>2</sub> extraction (SCO<sub>2</sub>) involves carbon dioxide heated to 87 degrees F and pumped through the plant material at around 8,000 psi – under these conditions; the carbon dioxide is likened to a 'dense fog' or vapor. With release of the pressure in either process, the carbon dioxide escapes in its gaseous form, leaving the essential oil behind[12]. The usual method of extraction is through steam distillation. After extraction, the properties of a good quality essential oil should be as close as possible to the "essence" of the original plant. The key to a 'good' essential oil is through low pressure and low

temperature processing. High temperatures, rapid processing and the use of solvents alter the molecular structure, will destroy the therapeutic value and alter the fragrance.[19].

**Steam Distillation:** Most commonly, the essence is extracted from the plant using a technique called distillation. One type of distillation places the plants or flowers on a screen. Steam is passed through the area and becomes "charged" with the essence. The steam then passes through an area where it cools and condenses[11]. This mixture of water and essential oil is separated and bottled. Since plants contain such a small amount of this precious oil, several hundred pounds may need to produce a single ounce[20].

## VI CONCLUSION

Steam distillation is a special type of distillation or a separation process for temperature sensitive materials like oils, resins, hydrocarbons, etc. which are insoluble in water and may decompose at their boiling point. The temperature of the steam must be high enough to vaporize the oil present, yet not so high that it destroys the plants or burns the essential oils.

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## REFERENCES

- 1."The Encyclopedia of Chromatography", edited by Dr. Jack Cazes of Florida Atlantic University.
2. R. Oprean; M. Tamas; R. Sandulescu; L. Roman "Essential oil analysis. I. Evaluation of essential oil composition using both GC and MS " fingerprints. J. Pharm. Biomed.
3. A. Tezel; A. Hortacsu; O. Hortacsu, "Multi-component models for seed and essential oil extraction" Supercritical Fluids.
4. R. P. W Scott "Chromatographic Detectors ", Marcel Dekker, Inc., New York.
5. "Chromatography Theory " Jack Cazes (Florida Atlantic University) and Raymond P.W. Scott (University of London).

- 6.R. P. W Scott “*Chromatographic Detectors* “, Marcel Dekker, Inc., New York.
- 7.“*Extraction of Essential oil*” from webpage of [AWorldofAromatherapy.com/essential\\_oils](http://AWorldofAromatherapy.com/essential_oils).
- 8.“*Essential\_Oils\_Introduction* “ from the webpage of <http://www.theherbsplace.com/index.html>.
- 9.“*Making Essential Oils - Methods of Essential Oil Extraction*” from the Webpage of <http://www.anandaapothecary.com/essential-oils.html>
- 10.“*Methods of Extraction Essential Oil*” from the webpage of <http://www.aromathyme.com/essentialoils.html>
- 11.“*Chemical Constituents of Essential oils*” from the webpage of <http://healingdeva.com/selena2.htm>  
<http://healingdeva.com/selena3.htm>
- 12.“*What are Essential Oils, How are Essential Oils Made, How to Make Essential Oils* “from the webpage of <http://www.deancoleman.com/index.htm>
- 13.D. pandey and P.S.Rao Virendra, Extraction of essential oil from Eucalyptus leaves (Btech project), NIT Rourkela.
14. Essential oil/ <http://www.wikipedia.org>
- 15.H. J. Williams, Ahmed, Mahmoud, A. I. Scott, J. H. Reibenspies, and T. J. 15.Mabry. 1993. New sesquiterpene a-methylene lactones from the Egyptian plant *Jasonia Candice*’s. *J. Nat. Prod.* 56:1276–1280.
16. [http://en.wikipedia.org/wiki/Steam\\_distillation](http://en.wikipedia.org/wiki/Steam_distillation)
- 17.[http://www.quinessence.com/oil\\_testing.htm](http://www.quinessence.com/oil_testing.htm)
- 18.<http://www.cherylinskintherapy.co.uk/chemical-constituents-essential-oils-may.pdf>
- 19.[http://en.wikipedia.org/wiki/Gas\\_chromatography-mass\\_spectrometry](http://en.wikipedia.org/wiki/Gas_chromatography-mass_spectrometry)
20. <http://lmkinteriorsltd.wordpress.com/2010/04/18/what-is-that-wonderful-scent/>
- 21.<http://www.bellevuemassagetherapy.com/methods-of-extracting-essential-oils.html>
10. H. Singh, M.Hasan and L. J. Kang, Supercritical carbon dioxide extraction of Sarawak black pepper oil, Department of Chemical Engineering, University of Malaya.
- 22.<http://www.healingdeva.com/selena2.html>
23. H. Mukhtar, M. Khalid Shabbiri, R. Nadeemi, A. Farooq, and W. Mumtazi 1Department of Chemistry, physico chemical analysis and determination of various chemical constituents of essential oil in *Rosa cent folia*, University of Agriculture.