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Extraction process of *Haridra* & *Tulsi* essential oil with their medicinal uses

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ABSTRACT

Essential oils as defined by the European Pharmacopeia 7th edition as "Odorant products, which have the complex composition, and obtained from plant raw extract, either extracted by steam of water, dry distillation or a suitable mechanical method without heating. Generally, a physical method is used for the separation of essential oil from the aqueous phase which has no significant change in its chemical composition". The essential oils are extracted from different aromatic plants. In this article we chose *Haridra* (*Curcuma longa*) and *Tulsi* (*Ocimum sanctum*) plants. So, these plants essential oils were selected for the present study. The oil was obtained from the both plants. *Haridra* rhizome paste and *Tulsi* fresh leaves were taken for essential oil. The extraction process was carried out with the help of Clevenger apparatus.

Key words: *Essential oil, Extraction process, Tulasi, Haridra, Ayurveda, Clevenger apparatus.*

INTRODUCTION

Essential oils (EOs) are oily, aromatic and volatile liquids that can be harvested from plant material.[1] Multiple segments of the oils' plants such as peels, barks, leaves, flowers, buds, seeds, and others are used to produce these aromatic oily liquids, and various extraction techniques are applied for the extraction process.[2] Essential oils are multifunctional and exhibit a wide spectrum of activities, such as antiphlogistic, spasmolytic, antinociceptive, immunomodulatory, psychotropic, acarcidial expectorative and cancer-suppressing activities.[3,4] Essential oils are lipophilic, and soluble in organic solvents, due to their hydrophobic nature and lower density than water. The extraction yields are dependent on the type of species and plant segments used, but a very low yield like 1%, can make them highly valuable rare components.[5] Additionally, several essential oils genres are characterized in a small number of families: Lauraceae, Lamiaceae, Asteraceae, Myrtaceae, Rutaceae, Cuppressaceae, Poaceae, and Piperaceae.[6]

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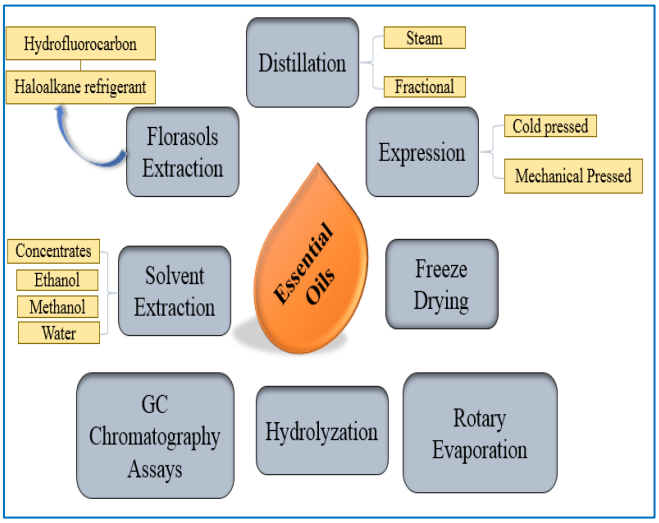
Essential oil extraction methods[7]

There are different methods of extractions as shown in figure: 1



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Distillation

a. Steam distillation

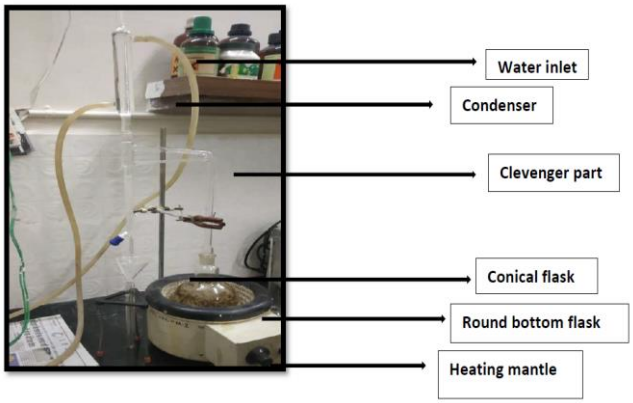
b. Fractional distillation

a) Steam distillation is the oldest and the traditional method of oil extraction.[8] In essential plant oil extraction, steam distillation method is the broadest technique applied. The percentage of essential oils being extracted by this technique is 93% and the remaining 7% can be further extracted by other methods.[9] In another study, Yildirim *et al.* reported a component 2, 2-diphenyl-1-picryl hydrazyl (DPPH) used to evaluate the antioxidant properties of essential oils by using steam distillation extraction process. It was reported to have a higher yield of antioxidant components than the oils extracted by hydro distillation (HD).[10] In essential plant oil extraction, steam distillation method is the broadest technique applied.[11]

b) Fractional distillation is an energy efficient and economically feasible upgrading process which has been continuously developed since the first refineries were built in the late 19th century until now.[12,13] Fractional distillation could be employed to improve the quality of bio crude by separating components based on their boiling point with each fraction having properties that may be distinct from the original bio crude as well as other fractions.[14]

In essential plant oil extraction, steam distillation method is the broadest technique applied.[15] So, from the above properties of steam distillation process we used Clevenger Apparatus for our study. Description of the apparatus is given below.

Parts of Clevenger Apparatus



1. Heating mantle
2. Round bottom flask
3. Condenser
4. Clevenger part
5. Water inlet and water outlet

Essential Oil Methodology

Clevenger apparatus is the equipment employed in hydro-distillation as shown in Figure. The name was titled after its inventor, Joseph Franklin Clevenger in 1928. The round-bottomed flask at the bottom contains the mixture of material and water. As the steam rises, the steam assembles in the condenser and the condensate falls into a burette. In the burette, oil floats on the water. After few hours of extraction, the oil can be collected for further use.[16]

The oil layer will be separated from the aqueous phase, and then filtrated and dried over anhydrous sodium sulphate (NaS_2O_4) to remove traces of moisture. Physical characteristics of the oil will be recorded and the percentage yield will be averaged over three experiments and calculated according to dry weight of the plant materials. The resulting essential oils will be subsequently stored in an amber-coloured bottle under refrigeration (4°C) until analysis for chemical compositions and larvicidal and adulticide activity.[17]

Samples Preparation

Rhizomes (Roots) parts of the *Haldi*, leaves of *Tulsi* were taken for the extraction of the essential oils. The plants materials were washed with distilled water to remove dust particles and shade dried. Essential oils of the plants were obtained by hydro-distillation method. In Clevenger apparatus, the raw material of the shade dried was subjected to water distillation in a Clevenger apparatus for 7h. The oil layer is separated from the aqueous phase using n-hexane with the help of separating funnel. The anhydrous sodium sulphate is added in hexane-oil solution to remove water content absorbed by hexane. The oil is obtained by removal of n-hexane at low temperature and the samples were kept in refrigerator at 4°C

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Extraction of essential oils from *Tulsi* leaves

Fig. 3

Fig. 4

50 gm. of *Tulsi* leaves were taken in 300 ml of water and were extracted for 7-8 hours in Clevenger apparatus as shown in Fig. 1 and 2. Then, the oil layer is separated from the aqueous phase using n-hexane with the help of separating funnel. The extraction procedure was repeated for several times. The samples were pooled, dried at low temperature and kept in refrigerator at 4°C.

Extraction of essential oils from rhizomes of *Haridra*

Fig. 5

Fig. 6

60 gm. of Rhizomes of *Haridra* was taken in 300 ml of water in one liter flask in Clevenger apparatus and extracted for 7-8 hours as shown in figure 3 and 4. The essential oil was collected in separating funnel and extracted with n-hexane. The essential oil was dried at room temperature. The process was repeated several times; samples were pooled and kept in refrigerator at 4°C.

Chemical constituent of *Tulsi*

Plant part	Extracts	Phyto Chemicals
Leaves	Essential oil[18-20]	Aromadendrene oxide, Benzaldehyde, Borneol, Bornyl acetate, Camphor, Caryophyllene oxide, cis-αTerpineol, Cubenol, Cardinene, D-Limonene, Eicosane, Eucalyptol, Eugenol, Farnesene, Farnesol, Furaldehyde, Germacrene, Heptanol, Humulene, Limonene, n-butylbenzoate, Ocimene, Oleic acid, Sabinene, Selinene, Phytol, Veridifloro, α-Camphene, αMyrcene, α-Pinene, β-Pinene, α-Thujene, β-Guaiene, βGurjunene, methyl chavicol and linalool.
Leaves / Areal Parts	Alcoholic Extract[21]	Aesculectin, Aesculin, Apgenin, Caffeic acid, Chlorgenic Acid, Circineol, Gallic Acid, Galuteolin, Isorientin, Isovitexin, Luteolin, Molludistin, Orientin, Procatechuic acid, Stigmsterol, Urosolic acid, Vallinin, Viceni, Vitexin, Vllinin acid.
Seed	Fixed oil[22]	Linoleic acid, Oleic acid, Palmitric acid, Stearic acid.

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Whole plant	Mineral Contents[23]	Vitamin C, Vitamin A, Calcium, Phosphorus, Chromium, Copper, Zink, Iron.

Chemical constituent of *Haridra*

Plant part	Extracts	Phyto Chemicals
Rhizome	Essential oil[24]	Curcumin (diferuloyl methane) and various volatile oils, including tumerone, atlantone and zingiberone, are active constituents of turmeric. Sugars, proteins and resins are other constituents.

In the 19th century, turmeric rhizome's main colour element was isolated and named as 'Curucmin. It was Roughley and Whiting (1973) who determined its chemical structure.[25]

Yield of essential oils of *Curcuma longa* (*Haldi*) rhizome paste and *Ocimum sanctum* (*Tulsi*) leaves

Essential oils of *Curcuma longa* (*Haldi*) rhizome paste and *Ocimum sanctum* (*Tulsi*) leaves was obtained by hydro-steam distillation by Clevenger extraction methods for 4-7 hour daily for several days. A total of 250 gm. of the plant materials of each plant was extracted in which *0.2gm of Curcuma longa and 0.1gm of Ocimum sanctum* was obtained, which yielded 1 gm essential oil of *Cu rcuma longa* and 0.5 gm. of essential oil of *Ocimum sanctum* after 5 times of extraction. % Yield of essential oils of *Curcuma longa* (*Haldi*) rhizome paste and *Ocimum sanctum* (*Tulsi*) leaves is given in table-1.

Table 1: Yield of essential oils of *Curcuma longa* (*Haldi*) rhizome paste and *Ocimum sanctum* (*Tulsi*) leaves.

Name of plants	Amount of plant materials extracted in per extraction (gm.)*	Total amount of plant materials extracted Gm.	Total Yield of essential oils	% Yield
Curcuma longa (*Haldi*) rhizome paste	50	250 gm.	1gm	0.4
Ocimum sanctum (*Tulsi*) leaves	50	250 gm.	0.5gm	0.2

*Plant material was extracted for 4 hour in Clevenger apparatus daily for several days.

Properties of *Haridra*

1. Anti- inflammatory Activity

Oral administration of curcuma longa decreased inflammatory swelling significantly. The oral administration of curcumin in cases of acute inflammation was found to be as effective as phenylbutazone or cortisone. C. Longa's anti-inflammatory properties may be due to its ability to suppress both biosynthesis of inflammatory prostaglandins from arachidonic acid and inflammatory neutrophil activity.[26]

2. Anti-Microbial Activity

Turmeric extract and *Curcuma longa* essential oil inhibit the growth of a wide range of bacteria, parasites and pathogenic fungi. The *Curcuma longa* treated group of rabbits showed a significantly higher mean value for wound contraction compared to controls.[27]

3. Repellent Activity

Curcuma aromatica was chosen to examine mosquito repellent behaviour under laboratory and field conditions. A 95% ethanol extract of CA [*Curcuma aromatica*] extract showed repellency against Ae. Togoi with 0.061 and 1.55 mg / cm2 respectively ED50 and ED95 values in a laboratory study. It also showed 3.5h biting protection when applied at a 25g percent concentration. The ethanol extracts also showed protective effect against *Armigeres subalbatus*, *Culex quinquefasciatus*, and Cx. *tritaeniorhynchus*. When applied to human skin the ethanol extract of curcuma did not cause any dermal irritation. Therefore, it concluded that curcuma extract can be used as an important personal protection against mosquito bites.[28] In a research on chemical composition of anti-mosquito potential of volatile oil and rhizome extract derived from *Curcuma aromatica* against *Aedes aegypti* (Diptera: Culicidae), crude rhizome extracts

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and volatile oils were evaluated for anti-mosquito ability, including larvicidal, adulticidal and repellent activity against the Aedes aegypti mosquito.[29]

Properties of *Tulsi*

1. Antibacterial activity

Extract taken from O. Sanctum was found to be equally effective against gram-positive and gram-negative pathogens.[30]

2. Antifungal activity

Essential oil of *Ocimum sanctum,* Methyl chavicol and linalol have shown strong antifungal efficacy against Candida, including azole-resistant strains.[31] Minimum inhibitory concentration (MIC) and minimum fungicidal concentration (MFC) of different extracts and fractions of *Occimum sanctum* leaves have also been evaluated against dermatophytic fungi used.[32]

3. Larvicidal Activity

Larvicidal activity of essential oils and various extracts of *Ocimum sanctum*, O. *Basil* and O. *gratissimum* were compared with *Culex quinquefasciatus* field collected and laboratory reared larvae. The O. *basilicum* and O. *sanctum* oil LD_{50} value were 39.31 and 40.02 on laboratory reared larvae and LD_{50} value 129.53 and 139.49 on field collected larvae. The larvae reared in Laboratory were more sensitive than the larvae collected in the field.[33]

4. Anti-Inflammatory Activity

Fixed oil and linoleic acid of *Ocimum sanctum* have been shown to possess significant anti-inflammatory activity against PGE2, leukotriene and arachidonic acid-induced paw edema.[34]

Discussion

Curcumin (diferuloyl methane) and various volatile oil s, including tumerone, atlantone and zingiberone, is Poly phenolic curcuminoids, Pharmacological actions of *Haridra* [*Curcuma longa*] are antimicrobial activity, antiviral activity, antifungal activity. The chemical composition of *Tulsi* [*Ocimum sanctum*] is volatile oil, phenolic compounds, flavonoids, Aesculectin, Aesculin, Stearic acid Aromadendrene oxide, Benzaldehyde, etc. The pharmacological actions of *Tulsi* [*Ocimum sanctum*] are antimicrobial activity, anti-inflammatory activity. We selected these plants due to their properties and due to various studies done in extract form for obtaining essential oil of these plants, we used Clevenger apparatus. For this reason, the plants were taken in fresh form for better extraction through Clevenger apparatus.

Conclusion

Essential oils, also called volatile odoriferous oil, are aromatic oily liquids extracted from different parts of plants, for example, leaves, peels, barks, flowers, bud, seeds, and so on. Essential oils are a good source of several bioactive compounds, which possess antimicrobial anti-inflammatory properties. In our study we use Clevenger apparatus for extraction of oil. Using this process, we obtained the essential oil of *Tulsi* [*Ocimum sanctum*] and *Haridra [Curcuma longa]* for our further study.

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