

A Review on Major Constituents of Various Essential Oils and its Application

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Abstract

The word aromatherapy has become a household term, yet most of the people have no clear knowledge about its application. We would have a query that why plant produce essential oil, the reason is they protect the plant from fungal infection, insect pests and it attracts pollinators. Hence essential oil extracted from plants would be major source for antifungal and insecticidal agents. Studies were reported for the effect of essential oil components on food borne fungi and mycelia growth. The complex chemical constituents of essential oil could be due to the attraction of wide range of pollinators. Even though these volatile chemical constituents are naturally available in plants, extraction process plays the major role for its utilization. When plant material is subjected to steam distillation, the herb material under pressure which softens the cells and allows the essential oil to escape as vapour which was condensed and collected as essential oil. Various extraction processes have been evolved recently for the better yield of essential oil. Micro wave steam distillation and conventional steam distillation was noticed most common in the literature. This review is to discuss about the extraction methods, major constituents of various essential oils, and its application.

Keywords Essential oil; Antifungal; Insecticidal activity; Human diseases; Hydro distillation

Introduction

Essential oils and their constituents was utilized to treat a large number of human diseases since ancient times. Today, essential oils act as an alternative source with its oral, topical and aromatherapy treatment. Increasing number of scientific investigators has started process of elucidating the specific mode of action of essential oils components. New antibiotic drugs have been evolved by targeting novel biochemical pathways which are not targeted by the existing antibiotics. Synergistic effect of existing antibiotic drug with essential oil components may provide an alternative approach to rectify the emerging drug resistance [1]. They are used in wide range of consumer goods such as soaps, detergents, toilet products, cosmetics, pharmaceuticals, confectionery, perfumes, soft drinks, distilled alcoholic beverages, food products and insecticides.

Screening of literature on essential oil provides knowledge on wide range of biologically active compounds. Broad range of variations were observed in the quantitative analysis of the major components of the essential oils from different parts of the plant (leaf, stem, flower, seed, fruit and rhizome) attributed to different growing conditions, geographic origins, seasonal variation and extraction process. Presence of variety of diverse constituents in essential oil could be responsible for wide spectrum of biological activities of the plant [2]. Essential oil could be used to develop new drugs from natural products, it can hopefully be considered in future for more clinical evaluations and possible applications, and as adjuvants to current medications [3].

Essential oil could be used in different modes, it could be applied on burns, skin and muscular problems, inhalation of respiratory tract

infection and physiological effect, and it can also be used for intestinal complaints. Taking bath with few drops of appropriate essential oil would be useful. Most of the essential oil will be concentrated in nature, it could be diluted with carrier oils for better results. Since essential oil has complex chemical composition, different combination of essential oils could be tried to utilize its synergistic effect [4].

Essential oil as antimicrobial agent

The major component present in *Coreopsis tinctoria* is limonene. The essential oil from its flower showed anti-cryptococcus activity better than the commonly used antifungal agents and has less possibility of inducing drug resistance due to its complex constituents [5]. *Achillea fragrantissima* essential oil could be used in the treatment of diseases caused by the drug resistant microorganisms, further research is required to prove clinical studies, drug interaction and safety of the oil as a medicine [6]. *Prangos asperulais* is one of Lebanese indigenous plants which have medicinal properties. Composition of the oils of stems, leaves, flowers and fruits appear as unique and substantially different from previously reported oils. It could be a new source of antimicrobial compounds to be applied in pharmaceutical industry [7].

Essential oil of *Eucalyptus maculate* grown in Nigeria contains medicinally active phytochemicals. Effective bactericidal activity was observed against multi-drug resistant gram-positive and gram-negative bacteria. Major compounds responsible for the activity are to be evaluated [8]. Essential oils obtained from *Anathallis graveolens* leaves and seeds may be a potential source of natural antimicrobial and antioxidants. *In vitro* assays indicated DSEO has a significant source of antioxidant which could be useful in preventing the progress or various oxidative stresses. Different parts of same plant utilized for extraction could have significant effect on the fraction of major

components in the essential oils. Bioactive compounds are to be investigated in future studies to explore the potential of *A. graveolens* L. seeds as chemo preventive and therapeutic agents [9].

Essential oil composition of *Artemisia herba-alba* in Algeria has been analysed and its antimicrobial activity was investigated. The essential oil could be used in the treating diseases caused by *Staphylococcus aureus* [10]. Plant essential oil has effect on various food borne fungi. Essential oil extracted from *Rosmarinus officinalis* L. and *Myrtus communis* L. inhibited the growth of mycelia of green mould when treated as fumigant. It was illustrated that rosemary could be used to control *Penicillium digitatum*, while as light activity was observed with myrtle. Concentration of fumigant is to be standardised further. These findings could be an important tool for the assessment of essential oil inhibitory potential on the fungal growth, when it is treated as fumigant [11].

Treatment on various human diseases

Medicinal value of *Osmium sanctum* grown organically was proved by many published reports. Essential oil constituents justify the uses of the Tulsi herb in various forms such as, aromatherapy, food industry, cosmetic additive and in cure of many diseases. Therefore, *O. sanctum* is emerging as an economic crop for traditional practitioners and farmers [12]. Synergistic activity is effective when compared with pure essential oil on biofilm formation and planktonic cells [13]. Due to the presence of various chemical constituents in *Zanthoxylum armatum*, it has antispasmodic, antimicrobial, cytotoxic and phytotoxic properties which support the ethno medicinal use of this valuable plant in the treatment of diarrhoea and various microbial infections [14].

Essential oil of *Scutia buxifolia* was subjected to preliminary evaluation of its antimicrobial and antioxidant activity. The study supports the possibility of linking the chemical contents with particular biological properties [15]. *Carum copticum* essential oil and crude extracts of the plant exhibited strong activity against certain microbes when compared to the standard antibiotics used. Further research is needed to explore the unexploited potential of this plant [16]. Molecular docking studies support that *Cymbopogon citratus* essential oil could be antidiabetic in nature. Further the study suggests application of *C. citratus* essential oil as an alternative for existing oral anti diabetic drugs and it minimizes the transformation of prediabetics into diabetics [17].

Essential oil extracted from *C. schoenanthus* could be used to control gastrointestinal nematodes when blended with other aroma chemicals. [18]. There is tremendous increase in population affected by lung cancer incidence every day, an alternative therapy is getting its glimpse in the market. Cost effective herbal drug treatment may be recommended to the rural and poor people [19]. Presence of sesquiterpene hydrocarbons such as Germacrene B and Germacrene D in the essential oil could be the reason for cytotoxic activity [20]. Chemical composition of *Guazuma ulmifolia* essential oil could be suggested as potential source of natural antioxidant and antimicrobial for food industry [21].

Seed essential oil of *Eucalyptus camaldulensis* possesses secondary metabolites which could be used for the development of new drug [22]. Phytochemicals and therapeutic potentials of the seed essential oil of *E. maculata* grown in Nigeria were demonstrated. It could be used as a natural source to isolate pinenes, cyclofenchene and terpenoids. Pharmacological activities could be due to the synergetic effect of the essential oil constituents. Esters and Terpenoids are

analgesic, antiseptic, anti-inflammatory, expectorant and stimulating compounds. Few are antiviral and some help to break down gallstones [23]. Eucalyptol, β -pinene, ocimene and p-menth-1-enol, have strong antimicrobial activities and eucalyptol was also used as therapeutic agent in cardiovascular effects [24]. Essential oil of *E. maculata* could be used for the possible exploitation of this species for various research and pharmaceutical purposes [25]. Large proportions of mono and sesquiterpenes which has medicinal property were identified in essential oil extracted from fruits of *Paraconotrochus capense* [26]. There was a clear understanding on the passage pattern of essential oil through the skin. The study explores the potential of using Gum-karaya patches of essential-oil for practical and commercial use [27].

Diversity of essential oil constituents

The major constituents of various essential oil was listed in Table 1, essential oil from *Annona Squamosa* showed sesquiterpenoids (85.2%) as a major constituent. There was considerable dissimilarity in chemical composition when compared with previously reported leaf essential oil compositions from other regions which was proved by hierarchical cluster analysis [28]. An ideal component identified from *Hypericum laricifolium* which was rarely detected in essential oils. Verticicol is a cembranoid diterpene present in the essential oil of many species belonging to Burseraceae, Cupressaceae, and Lauraceae families [29-31].

S.N	Plant species	Parts used	Major compound	Are a %
1	<i>Ocimum sanctum</i>	Leaves	Eugenol	62.7
2	<i>Cinnamomum cassia</i>	Leaves	Cinnamaldehyde	79.9
3	<i>Coreopsis tinctoria</i>	Flower	Limonene	52.5
4	<i>Achillea fragrantissima</i>	Leaves	Thujone	33.9
5	<i>Annona squamosa</i>	Leaves	(E)-Caryophyllene	15.9
6	<i>Prangos asperula</i>	Fruit	Sabinene	43.5
7	<i>Eucalyptus maculata</i>	Leaves	β -citronellol	18.5
8	<i>Zanthoxylum armatum</i>	Leaves	β - Linalool	53
9	<i>Scutia buxifolia</i>	Leaves	Spathulenol	27
10	<i>Carum copticum</i>	Whole plant	o-Cymene	37.4
11	<i>Hypericum laricifolium</i>	Leaves	α -pinene	20.2
12	<i>Eremostachys Macrophylla</i>	Aerial	Hexadecanoic acid	27.5
13	<i>Cydonia Oblonga</i>	Leaves	Benzaldehyde	12.8
14	<i>Wedelia chinensis</i>	Leaves	Carvocrol	46
15	<i>Anethum graveolens</i>	Leaves	Dillapiole	90.2
16	<i>Citrus auranticum</i>	Peel	Limonene	93.3
17	<i>Zingiber Officinale</i>	Rhizome	Zingiberene	27.4
18	<i>Artemisia absinthium</i>	Whole plant	β -thujone	22.7
19	<i>Artemisia herba- alba</i>	Aerial	Camphre	37.5
20	<i>Libanotis transcaucasica</i>	Aerial	Germacrene B	20.2

21	<i>Guazuma Ulmifolia</i>	Leaves	Thymol	20.9
22	<i>Cymbopogon Citratus</i>	Leaves	Geranial	42.4
23	<i>Cymbopogon schoenanthus</i>	Aerial	Cis-sabinene hydrate	30.1
24	<i>Eucalyptus camaldulensis</i>	Seeds	1,8-cineole	52
25	<i>Citrus sinensis</i>	Aerial	Limonene	94.3
26	<i>Prangos Latiloba</i>	Aerial	Geranial	26.8
27	<i>Aquilaria crassna</i>	Stem bark	β-Caryophyllene	8.1
28	<i>Thymus vulgaris</i>	Aerial	Thymol	73.6
29	<i>Eucalyptus maculata</i>	Seed	α-pinene	8
30	<i>Rosmarinus officinalis</i>	Aerial	α-pinene	30.8
31	<i>Piper capense</i>	Fruit	Cis-muurola-3,5-diene	15.5
32	<i>Lavandula angustifolia</i>	Areal	Linalool	36.1

Table 1: Comparison of major constituents of essential oil.

Investigation of essential oil from *Eremostachys macrophylla* revealed that the major compounds present are hexadecanoic acid (27.5%), ethyl linoleate (8.5%), and 6-methyl-α-ionone (8.0%). These constituents were different from those seen in previous studies on the same species [32-34]. Based on various parameters like time of collection, climate and the ground composition of the sampling area, in addition to the growth stages of the plant, chemical composition of the essential oil of the same species can change [35]. When compared to essential oil extracted from fruits of *Cissus oblonga*, α-Farnesene was observed as the major constituents [36-38]. The same constituent was found in lower concentration in leaves of *C. oblonga* of flowering and fruiting period [39].

Essential oil of aerial parts from *Prangos latiloba* Korov growing in Sabzevar showed considerable amounts of geranial (26.8%), methyl chavicol (22.8%) and neral (22.6%). These major constituents were different from previous study on the same species. These findings indicate that the chemical composition of the essential oil of the same species could be changed based on various conditions such as, altitude of plant collection, sampling area, ground composition, climate, time of collection and variable hydro distillation methods [40].

Various extraction processes

Microwave steam distillation (MSD) has substantial advantages when compared with conventional steam distillation (SD). Yield of essential oil extracted was more using MSD when compared with SD. This is because of quick rupture of the glandular walls resulting in higher extraction efficiency at a shorter time. There was no significant change in the chemical composition of essential oil extracted. Therefore MSD could be used as better alternative for conventional extraction method [41].

Stability of oil-in-water emulsions containing omega-3 fatty acids was evaluated with addition of essential oil and aqueous extract of ginger rhizome. Aqueous extract and essential oil of ginger rhizome was tested by 2, 2-Diphenyl-1- picrylhydrazyl, Ferric reducing antioxidant power, Folin-Ciocalteu's reagent and β-carotene bleaching.

The results revealed that essential oil has more anti oxidative activity potential than aqueous extract. Fish oils could be delivered in an emulsion form that allows incorporation of sensitive functional ingredients into food without affecting the taste, aroma, or texture [42].

Based on equilibrium data modelling and comparison on different water concentration, pressure and temperature various findings were observed. Increase in temperature of the bubble point to dew point temperature at constant pressure, thymol concentration in the liquid phase is increased. Since the plant compounds are sensitive to temperature, low pressure is recommended. At constant pressure and higher temperatures, the amount of thymol in the liquid phase increases [43]. Hydro distillation method produced greater amounts of *Aquilaria crassna* biologically active essential oils with significant antineoplastic and antiangiogenic effects. It could be promising candidates for novel chemo preventive or chemotherapeutic formulation with minimal side effects [44].

Effect on insect pests

Essential oil extracted from *Artemisia* and *Eucalyptus* had significant effect on various stored product insect pests [45]. There was an interesting outcome on complex matrices of natural origin; essential oil is an attempt to eradicate the bacterial speck of the tomato. It could be used as safe alternative source for conventional pesticides [46]. Essential oil extracted from *A. eryngioides* consist insecticidal compounds against *Tribolium castaneum* and *Sitophilus granarius*. If the cost-effective commercial problems can be solved, plant essential oils could be effectively used as part of integrated pest management strategies. Due to the volatile nature of essential oil, it is not suitable to be used to control the field crops. It could be utilized in effective manner to treat as fumigants against the stored product insect pest.

Conclusion

Essential oil research is an interesting outcome on complex matrices of natural origin. Even though lot of studies were made on exploring the composition of essential oils and its application on various diseases. Detailed study on its individual component and mode of action of particular compound on treatment of various diseases need to be investigated to use these novel chemicals as a commercial drug. Various methods have been followed for better extraction of essential oil from plants. This would help in better yield of essential oil from plants. Components of essential oils has various medicinal properties, it could be utilized for the novel development of new drugs. Even though essential oils are complex, volatile and water insoluble, it has significant biological activities at minimum concentration. Its volatile nature could be an added advantage to treat the food borne fungi and stored products insect pests.

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