



Benefits of essential oil

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ABSTRACT

Essential oil are very important and widely used since early times. The important role and mode of action of these naturally occurring products is discussed with regards to its bioactivity as antibacterial, antiviral, antioxidant and diabetic. Also its important role in chemoprevention and cancer suppression is discussed. The therapeutic properties of essential oils in aroma will be outlined. All these functions and its properties are due to the presence of certain constituents which are discussed in this review along with their chemical structures.

Key words: Volatile oil, Terpenoids, Biological Activities, Fragrance, Chemical Analysis

INTRODUCTION

Essential Oils are basically a natural oil, obtained from distillation and having a distinctive smell of the plant or other sources from which it is extracted. They are themselves in chloroplast of the leaf, vesigenous layer of cell wall or by the hydrolysis of certain glycosides. Many essential oils constituents of same plant can be extracted from the different parts of the plants with completely different properties [25]. They are produced using different methods steam distillation is a common method whereas other methods such as mechanical expression, solvent extraction or superficial fluid extraction are also used [13]. The main components of these oils are terpenoids which are synthesized from isoprene [47] which are followed by diterpenes and aromatic compounds. [10]

These oils are used for various purposes. Some of them are: Lavender, Marjore, *Melissa* etc. shows luminescent & fluorescent emissions [8]. *Ocimum basilicum* from the family Lamiaceae has antibacterial activity [50]. Black cumin (*Nigella sativa*) exhibit various antifungal, antibacterial and antioxidant character [26]. Plants used in Japanese scent sachets due to their sedative activity are Galangal, patchouli, cinnamon, Clove etc. [22]. Ylang Ylang (*Cananga odorata*) produced oil which is importantly used in fragrance industry and also approved as safe by flavour and extract manufacturers association (FEMA) [55]. The lavender genus which includes *Lavendula angustifolia* and *Lavendula latifolia* are characterized by terpenes and terpenoids which are responsible for distinct flavours [68].

The importance and uses of essential oil is not restricted to the aforesaid, they are quite diverse. Due to such important uses this topic is of great interest among the researchers therefore the paper include the importance of certain essential oils with their volatile constituents.

PHARMACOLOGICAL IMPORTANCE OF ESSENTIAL OIL

As plants are the important sources of medicine we can derive large number of drugs which are in use from them like morphine from *Papaver somniferum*, ashwagandha from *withania somnifera*, ephedrine from *Ephedra vulgaris* etc. [43]. The medicinal properties of plants from *Apiaceae* family are known from ancient times due to their essential oils [58]. According to survey (1993) of World Health Organisation (WHO), 80% of patients in India, 85% in Burma and 90% in Bangladesh are treated from these traditional medicines [43].

As antiviral agent

Essential oils possess antiviral activities without having any toxicity [7]. Incorporation of *Artemisia arborescens* essential oil in multi lamella liposomes improved its activity against intracellular herpes simplex virus type 1 (HSV-1) [51]. Replication of HSV-2 is also inhibited by *Melissa officinalis L.* essential oil due to the presence of citral and citronellal [3] and the ability of replication of HSV-1 can be suppressed through incubation with different essential oils *in vitro* [6]. Lemon grass essential oil possesses the most important HSV1 activity and inhibits replication [39]. Peppermint (*Mentha piperita*) essential oil show high level of virucidal activity against HSV-1, HSV-2, and acyclovir-resistant strain of HSV-1 in viral suspension tests [63]. Eucalyptus essential oil exhibit anti-viral activity against HSV-1, 2[64]. (*Santolina insularis*) showed an anti-viral activity against HSV-1 and HSV-2 *in vitro* and prevent cell-to-cell virus spread in effective cells [14]. The complex mixture of essential oils showed higher anti-viral activity than individual compounds due to synergism phenomena [15].

As antibacterial agent

Essential oils can act as anti-bacterial agents against many pathogenic bacterial strains like *Listeria monocytogenes*, *L. innocua*, *Salmonella typhimurium* [65]. Thyme and oregano essential oils show some pathogenic bacterial strains such as *E.coli*, *Salmonella choleraesuis* and *Salmonella typhimurium* [42] where inhibition is directly related to phenolic components of carvacrol and thymol. The presence of a phenolic hydroxyl group, in carvacrol is credited with its activity against pathogens like *Bacillus cereus*[57]. Alcohols possess bactericidal rather than bacteriostatic activity against vegetative cells [16]. Gram positive bacteria are more susceptible than gram negative pathogenic bacteria [66]. The essential oil of *Artemisia annua* inhibits the bacterial growth of *Enterococcus Hiral*. It contains β -selinene, β -caryophyllene, camphor, germacrene D, trans pinocarveol and artemisia ketone [31]. It is also suggested that use of tea tree oil in formulation does not lead to dermatological problems and also do not effect the original protective bacterial flora of the skin [12]. In veterinary therapy 10% tea tree oil containing cream formulation causes much faster relief against canine localized acute and chronic dermatitis than any commercial skin care cream [46]. And the active ingredient for antimicrobial property of tea tree oil is the high amount of terpenen-4-ol.

Bactericidal activities are also shown by essential oil against oral and dental pathogenic microorganism and therefore are used into rinses or mouth washes for pre-procedural mouth control [62]. Mouth washes containing essential oils could be used to control plaque since they can penetrate the plaque bio film where they kill pathogenic wall and inhibit their enzymatic activity [25]. Listerine contains thymol, menthol and eucalyptol components from essential oil which is very useful against dental problems [48]. Effectiveness of essential oil is also observed with gargles for the treatment of *oropharyngeal candidiasis* in AIDS [29].

They can also be used as anti-bacterial agents against certain respiratory tract pathogens. The oil of *Achillea clavennae* showed its maximum activity against *Klebsiella pneumoniae* and penicillin susceptible and penicillin resistant *Streptococcus pneumoniae*.

As antioxidant

Free radicals and many other reactive oxygen species cause the oxidation of biomolecules including proteins, amino acids, DNA etc. and ultimately produce molecular alterations related to aging, arteriosclerosis and cancer [24]. In human body an imbalance between free radical production and their removal by antioxidant system leads to 'oxidative stress' [1]. So the external supply of antioxidants is required to attain the balance between free radicals and antioxidants. The essential oils of basil, cinnamon, clove, nutmeg, oregano and thyme as natural sources of phenolic components have proven radical-scavenging and antioxidant properties in the DPPH (2,2-Diphenyl-1-picrylhydrazyl) radical assay at room temperature [56]. The antioxidant activity is due to high content of phenolic thymol and carvacrol in *Thymus serpyllus* and *Thymus spathulifolius* [52]. The antioxidant activity of oregano (*Origanum vulgare L.*) essential oil is comparable to α -tocopherol and BHT(butylated hydroxyl toluene) and is again due to thymol and carvacrol [35]. *Agnus castus* seeds essential oil is also found to be an excellent scavenger for DPPH radical [4].

The antioxidant activity cannot be only due to the presence of phenolic group whereas ketones, aldehydes, hydrocarbons and ether also show free radical scavenging activity of some essential oils like *Thymus caespitius*, *Thymus camphoratus* and *Thymus mastichina* show an antioxidant activity with high contents of linalool and 1,8-Cineole, while thymol and carvacrol are almost absent [37]. Tea tree oil act as natural anti-oxidant against BHT [32] mainly due to α -terpinene, γ -terpinene and α -terpinolene contents.

So to reduce oxidative stress essential oils should be formulated as a part of daily supplements or additives.

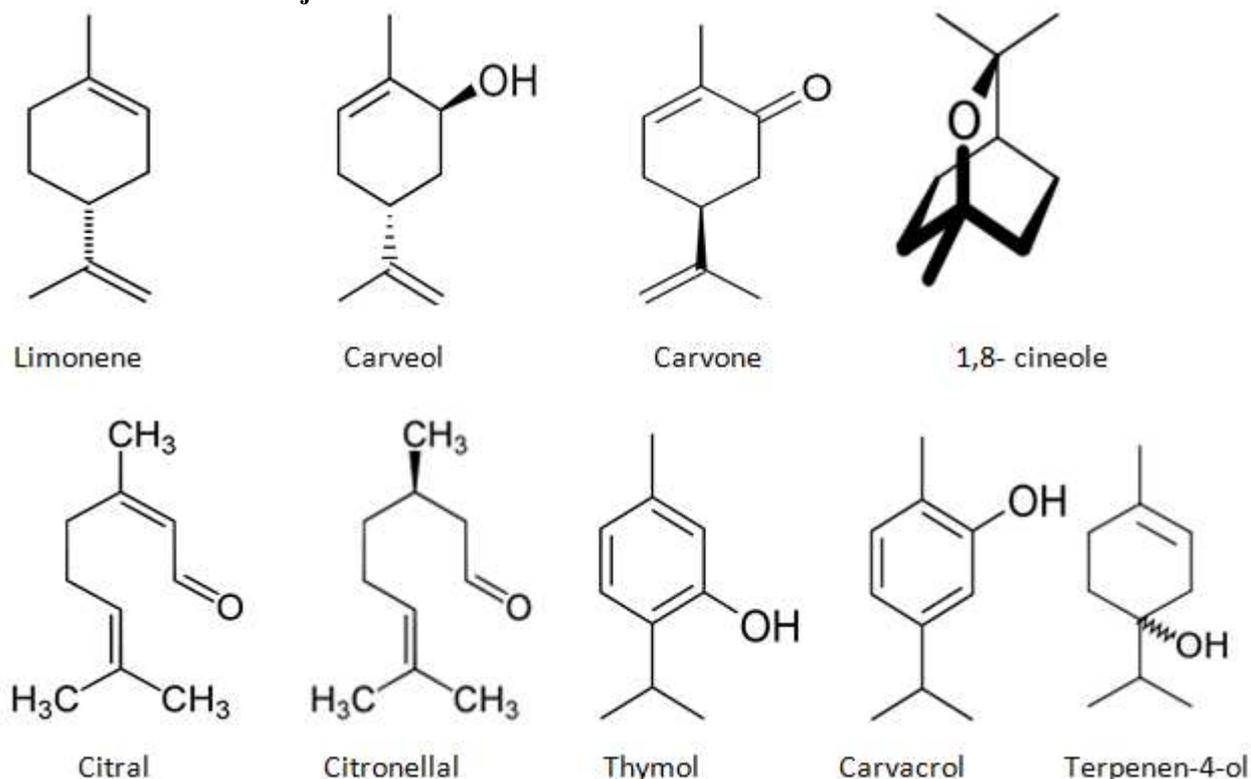
As anti-diabetic agent

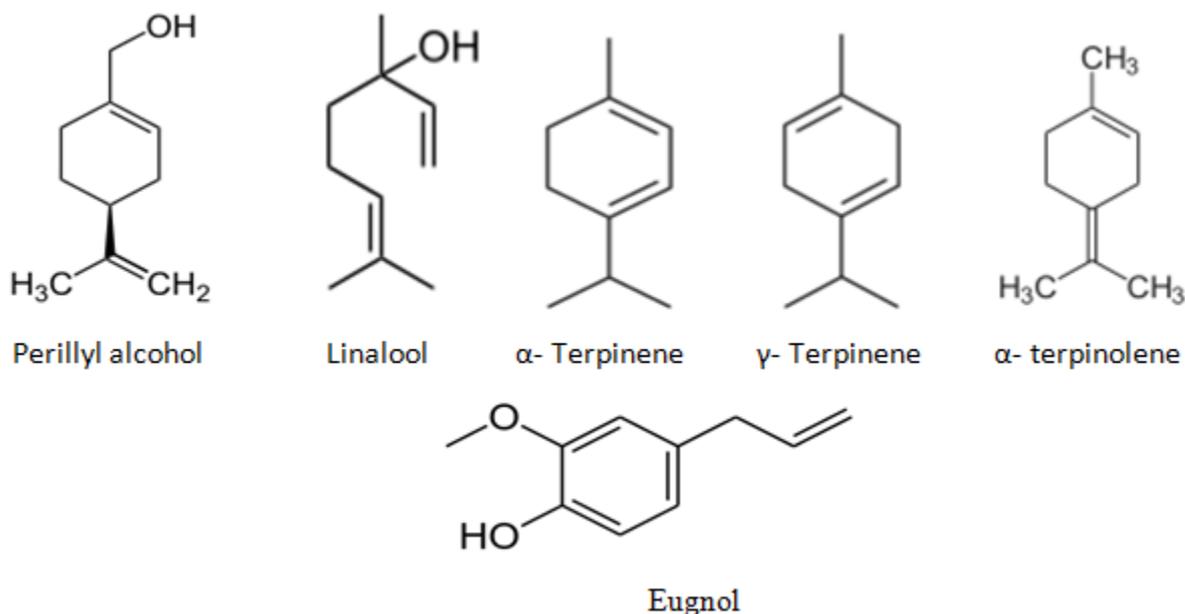
Diabetes is a hormonal disease in which either the production of insulin is inhibited or the body does not use it properly. Many researches were conducted to explore the anti-diabetic activity of essential oils, like rosemary essential oil showed hyperglycaemic and insulin release inhibitory effect in diabetic rabbits. Studies show that lipophilic fraction of aromatic plants are not only responsible for this activity but also indicated that oral administration of a combination of essential oils like cumin, cinnamon, oregano, fennel, myrtle etc. was able to enhance insulin sensitivity in type II diabetes [2]. Essential oil of *Satureja khuzestanica* cause large decrease in fasting blood glucose level in diabetic rats [25]. Eugenol and other important essential oils extracted from Tulsi (*Ocimum sanctum L.*) reduce raised blood sugar, triglyceride and cholesterol levels and activities of LDH, GPT and GOT and alkaline phosphatase in blood serum thereby acting as a good anti-diabetic [43].

In chemoprevention and cancer suppression

It is generally said that components that induce phase I or II drug metabolizing enzymes can protect against chemical damage during the initiation phase. A number of dietary monoterpenes exhibit not only anti-tumor activity but also prevent progression of cancer.

D-limonene in orange peel oil inhibits the development of chemically induced rodent mammary skin, liver, lung and fore stomach cancers [11]. Caraway seed oil with carvone helps in preventing chemically induced lung and fore stomach tumour development [59]. Also carveol and menthol have chemo preventive activity against DMBA induced cancer. Perillyl alcohol (POH) has initial stage chemo preventive activity against chemically induced liver cancer cells in rats [11]. POH was investigated by NCI (National Cancer Institute) in NCI sponsored Phase I, II and III chemoprevention trials for prostate, breast and colon cancers [67]. Citral is also an important constituent found in many essential oils like in lemon grass oil, is an inducer of glutathione-S-transferase class π (GSTP). Hence it is very essential chemo preventive agent towards inflammatory carcinoma such as skin cancer and colon cancer [17]. Garlic essential oil containing organosulphur components (OSCs) are the group of chemo preventive agents, as they modulate phase I and II drug detoxifying enzymes [38]. The essential oil of *Tetraclinis articulate* showed the hallmark of apoptosis when tested on a number of human cancer cell lines like melanoma, breast and ovarian cancer in addition to blood lymphocytes [25].

Chemical structures of major constituents



Aromatherapy

As essential oil have aroma, therefore they are used for psychological and physical well-being via inhalation. They have an effect on brainwaves and can alter the behaviour. The olfactory properties of essential oils cause objective and subjective effects on cognitive performance and mood respectively [40].

For the treatment of epilepsy, aroma inhalation of *storax pill* essential oil and pre inhalation of *Acorus gramineus rhizome* essential oil are used in Chinese folk medicine. By pre inhalation of AGR essential oil in the mouse brain the activity of γ - amino butyric acid (GABA) transaminase is inhibited due to which the GABA level was increased and glutamate content decreased thereby increasing the sleeping time of mice induced by pentobarbital[34]. Also the motility of mice decreased when it was artificially induced into over agitation by intra peritoneal application of caffeine and then subjected to inhalation of essential oils [9].

Lavender oil shows sedative and relaxant effect due to its effect on central nervous system by interfering the GABA neuro transmission. Anticipatory anxiety was reduced among dental patients on its inhalation [60]. Cinnamon and clove oil in vapour phase showed the inhibition of gram positive and gram negative pathogenic bacteria [36]. Lavender oil decrease the performance of working memory and impaired reaction times for both memory and attention based tasks whereas rosemary oil enhanced the overall quality of memory but impaired its speed [40].

The essential oil of lavender causes the spasmolytic activity in the contraction caused due to the calcium chloride. The main component responsible for its activity is 1, 8-cineole. Therefore, it mainly acts as sedative drug [23]. In one of the research it is found that balm oil is proven effective for the treatment against agitation in people suffering from dementia [5]. Neroli oil proved very effective for post cardiac surgery; according to the research foot massage was given which keeps long lasting psychological effect [54]. In a study aroma massage was given to the women with hypertension where its effect was proved very strong on the systolic blood pressure (SBP), diastolic blood pressure (DBP) and in sleep quality and hence concludes that aroma massage is very helpful to improve the quality of life on daily basis [30].

Against vaginal infection and rectal suppositories

Essential oil is used in vaginal douche for the vaginal infection like *candida albicans* [53]. For many vaginal infections, tea tree oil used on tampon is very effective. As essential oils are absorbed directly into the surrounding tissue, therefore, it is used for the treatment of gynaecological or urinary conditions through vaginal routes. Sandalwood oil was also given to treat urinary infections [27]. Against haemorrhoids in a double blind, an ointment containing tea tree oil can be used [28].

As Pesticides

Also essential oil with particular constituents shows neurotoxic effect on mites and insects. Because of lesser environmental hazards and harmful effect on human and other existing lives, natural alternatives have been considered better against the conventional synthetic sources.

The essential oil used as pesticides with their constituents are clove oil (eugenol), thyme oil (thymol and carvacrol), mint oil (menthol, pulegone), lemon grass oil (citronellal, citral), cinnamon oil (cinnamaldehyde), rosemary oil (1,8-cineole) and oregano oil (carvacrol) [45]. They work with many alternative mechanisms on insects for toxicity. In arthropod and many insects having octopamine as a neuro transmitter and neuro modulator, many essential oil constituents work by blocking these receptors [19] [20], certain essential oil may work with the disruption of cell membrane or they block the tracheal system in insects. But still the efficacies of these are low as compared to the current synthetic pesticides used. Still phenols are more active pesticide than other monoterpenes.

As insect repellents

Insect repellent used for the protection against mosquitoes is prepared by using lemon grass oil mixed with mint oil. The active ingredient of it is citronella [21]. Also these repellents are used to remove cockroaches and prevent their return in human habitations [41]. It is found in the study that terpinen-4-ol is most effective against adult lice which is further followed by the pulegone. While for *P. humanus* eggs, nerolidol and thymol are more active [44].

As miticides

Essential oil containing menthol and thymol has been used as mite fumigants in beehives [18]. Tea tree oil and eucalyptus oil containing 1, 8-cineole are effective against house dust mites [61].

Commercially used products

Various commercial products are available as pesticides containing essential oil. Some U.S based companies have made such products. EcoPCO brand for pest control professionals has been introduced as insecticides containing eugenol and 2-phen-ethyl propionate against crawling and flying insects by EcoSMART Technologies. As fungicide Sporan™ product is used. Also as insecticide/miticide with name EcoTrol™, is used on horticultural crops containing rosemary oil. Clove oil is used for weed control under the name of Matran™. Many more products are formed by several other companies of U.S based [45].

Table 1 showing crude drug with biological names, its active constituents and uses

Name of crude drug	Biological name	Active constituents	Uses
Lemon grass oil	<i>Cymbopogon flexuosus</i>	Citral, citronella, nerol	Anti-viral, flavour, anti-microbial, anti-inflammatory, pesticides
Peppermint oil	<i>Mentha piperita</i>	Menthol, menthone	Antiseptic, flavour, stimulant, anti-viral
Eucalyptus oil	<i>Eucalyptus globulus</i>	Cineole	Antiseptic, anti-viral, used in chronic bronchitis
Thyme	<i>Thymus vulgaris</i>	Thymol, linalool, carvacrol	Anti-microbial, pesticide, antispasmodic, flavour, anaesthetic, irritant
Oregano	<i>Origanum vulgare</i>	γ-terpinene, δ-terpineol	disorders of the gastrointestinal tract, respiratory tract, and nervous system
Tea tree oil	<i>Melaleuca alternifolia</i>	terpinen-4-ol	Anti-fungal, anti-viral, anti-bacterial
Basil	<i>Ocimum basilicum</i>	Eugenol	Anti-viral, anti-bacterial, anti-cancer, analgesic, anti-diabetic
Cinnamon	<i>Cinnamomum zeylanicum</i>	Eugenol, cuminaldehyde	Antiseptic, pesticides, anti-diabetic, flavour
Clove	<i>Syzygium aromaticum</i>	Eugenol	Anti-viral, anti-bacterial, anti-cancer, analgesic, anti-diabetic
Nutmeg	<i>Myristica fragrans</i>	Myristicine, safrole	Aromatic, flavour, anti-diabetic
Fennel	<i>Foeniculum vulgare</i>	Ketone, limonene	Stimulant aromatic, anti-diabetic
Cumin	<i>Cuminum cyminum</i>	α-pinene, β-pinene	Stimulant, carminative
Caraway seed oil	<i>Carum carvi</i>	Carvone, carvacrol	Stimulant, flavour, carminative
Garlic oil	<i>Allium sativum</i>	Allicin, propyl disulphide	Disinfectant, stimulant, carminative
Lavender oil	<i>Lavandula officinalis</i>	Linalool, pinene, cineol	Aromatic, carminative, flavour

CONCLUSION

This review has shed some light on the therapeutic proficiency of the essential oil in the prevention and cure of various diseases in one or other form which directly or indirectly relates to human life. The main aim of article is to grab the interest of researchers to use the traditional methods for making the new drugs in pharmaceutical diversity. These essential oils and their constituents can be useful in future with more positive impacts in medication or medicinal industry.

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