

Chemical composition of *ocimum sanctum* essential oil by GC-MS analysis

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ABSTRACT

The essential oil from the dried leaves of *Ocimum Sanctum* was extracted by hydro distillation and after drying with sodium sulfate anhydrous it was analyzed by GC-MS. The oil was found to be a mixture of hydrocarbons (26.463%), alcohols (19.326%) and oxides (3.252%). Among the hydrocarbons caryophyllene (22.265%) was found to be a major component followed by α -caryophyllene (2.071%), α -pinene (0.125%), camphene (0.121%), α -cubebene (0.123%), copaene (1.637%) and α -bourboene (0.244%). Among the alcohols eugenol (15.906%) was found in large quantity followed by Borneol (0.468%) and Methyl iso-eugenol (2.952%). Caryophyllene oxide (3.252%) was also found in appreciable amount.

Keywords: *Ocimum sanctum*; Essential oil; GC-MS; Eugenol; Caryophyllene.

INTRODUCTION

Ocimum Sanctum is a small aromatic herb and locally known as "Tulsi". *O. Sanctum* belong to the family Lamiaceae, contains 200 species of herbs and shrubs [1,2] spread throughout India, Sri Lanka and Pakistan. *O. Sanctum* attracts a special interest because of its flavour and fragrance because of its medicinal properties it has made a great contribution to the field of science. Various parts of this plant are used in the preparation of medicines for a number of different diseases like bronchial asthma, chronic fever, cold cough, malaria, dysentery, convulsions, diabetes, diarrhea, arthritis, emetic syndrome skin disease, insect bite, hepatic cardiovascular and immunological disorder, antiallergic, antifungal, and antibacterial [3-16].

Essential oils are fragrant, highly concentrated essences of plants. Essential oils are approximately 75-100 times more concentrated than dried herbs [17]. Essential oil constituents are basically complex mixture of terpenic hydrocarbons and oxygenated derivatives such as aldehydes, alcohols and esters [18]. Essential oils are generally extracted by hydrodistillation, expression, solvent extraction, cold pressing, maceration or supercritical carbon dioxide extraction [19-21]. The composition of the essential oil

is effected by the ripens of fruits, vegetable stage of the plants, storage conditions and extraction methods [22]. Essential oils are natural flavours and used as flavouring agents [23]. Essential oils containing biological active constituents that possess insecticidal and nematicidal activities [24,25]. *Ocimum basilicum* from the family Lamiaceae has antibacterial activity. Black cumin (*Nigella sativa*) exhibit various antifungal, antibacterial and antioxidant character. Plants used in Japanese scent sachets due to their sedative activity are Galangal, patchouli, cinnamon, Clove etc. Ylang Ylang (*Cananga odorata*) produced oil which is importantly used in frangnace industry and also approved as safe by flavour and extract manufacturers association (FEMA) [26]. The lavender genus which includes *Lavendula angustifolia* and *Lavendula latifolia* are characterized by terpenes and terpenoids which are responsible for distinct flavours. This research work is continuation of our previous research work [27-31]. The utilization of essential oils in the beauty care products, detergent, soap and scent industry is of great concern from a financial point of view. The generation of essential oils for preparation of perfumes and scents has expanded enormously on a global level and simultaneously collection of these aromatic plants. *Salvia*, lavender and thyme species are highly consumed to produce these aromatic yields [32]. Essential

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oils are utilized as a part of pharmaceuticals for their potential as therapeutic agents [9,10]. This is particularly the instance of the essential oils from peppermint (*Mentha piperita*), sage (*Salvia officinalis*), anise (*P. anisum*), eucalyptus (*E. globulus*), clove (*S. aromaticum*), and tea tree (*M. alternifolia*). These oils are utilized as an expectorant for treating bronchitis and cough (eucalyptus essential oil), as antibacterial agents (sage, clove and tea tree oil), as a decongestant of the respiratory tract (peppermint oil), and as a carminative (anise oil). Moreover, clove oil is utilized as a part of dentistry for its antimicrobial and pain-relieving properties while tea tree oil is utilized in the field of dermatology (antiacne drug) as it possesses antimicrobial properties against Gram-positive microbes [33]

Essential oils are utilized as a part of a wide range of food products, for example, confectionery sodas, and alcoholic drinks. Apart from being consumed as a seasoning material, they are also utilized as a part of agriculture and food industry for their antimicrobial, antiviral, antifungal, insecticidal, nematocidal, and anticancer attributes. Due to these reasons, their use as preservatives in food and as an agent has been indicated. Numerous essential oils have antibacterial as well as anti-oxidative properties, yet their application as additives in food items requires a detailed learning of their properties, including the inhibition of the microorganisms on target, the particular method of activity, their antibacterial effectiveness, and the possible interaction impact on their antibacterial attributes with food components [34].

Keeping in view the importance of essential oil, current work was started. As the raw material in Pakistan is easily and abundantly available, so its chemical constituents were studied by GC-MS for further studies.

MATERIALS AND METHODS

Plant Material

The fresh leaves were collected from nursery and separated from stem. These were kept under shade and dried for eight days.

Extraction of *Ocimum Sanctum*

The essential oil from the dried leaves of *O. Sanctum* leaves was extracted through hydrodistillation using cleverger apparatus. The steam distillate was removed, dried over anhydrous sodium sulphate and stored at low temperature in the fridge for further analysis [33].

Gas Chromatographic Analysis

Jeol model IMX-AX500H mass spectrometer combined with Hewlett Packard 5890 gas chromatograph was used for GC-MS analysis. Oil sample was injected on a 25 m x 0.22 mm WCOT BP5 (5% phenyl, 95% dimethyl siloxane) fused silica column, using Helium as a carrier gas with split ratio 1/10, EI positive mode, electron energy 70+ev, ionization current 300^oA, ionization source temperature 250 °C, interface temperature 230°C, column temperature programmed at 60°C for 4 min., with a 6°C/min rise to 220° [30].

Data acquisition and processing were performed by JEOL JMA-DA 5000 system various components were identified by their retention time and peak enhancement with standard samples in gas chromatographic mode and NIST library search from the derived fragmentation pattern of the various components of the essential oils.

RESULTS AND DISCUSSION

Organoleptic Properties

The % age yield of essential oil obtained from *O.Sanctum* is 0.21%. The color and smell of oil is light yellow and intense scent respectively. The essential oil yield from the dried leaves has been reported from 0.07% to 0.7% by Valtcho et al., 2008 [35].

Chemical Composition of Essential Oils

Plant essential oils and extracts have been used for many thousands of years, in food preservation, pharmaceuticals, alternative medicine and natural therapies. It is necessary to investigate those plants scientifically which have been used in traditional medicine to improve the quality of healthcare [1]. The GC-MS analysis of essential oil of *O.Sanctum* revealed the presence of 22 components out of which 11 components are identified. The essential oil of *O.Sanctum* have a variety of group including monoterpenes hydrocarbons (e.g., α -pinene, camphene), sesquiterpene hydrocarbon (e.g., caryophyllene, Copaene, α -Caryophyllene, α -Bourboene, α -cubebene), oxygenated monoterpenes (e.g., Caryophyllene oxide and aromatic compounds (e.g., Eugenol, Borneol, Methyl iso-eugenol). Caryophyllene (22.265%) is present in large amount but absent as compared to previously reported [31] Eugenol (15.096%) is the second major and active constituent in the essential oil of *O.Sanctum* and also present in large quantity as compared to previously reported. It is largely responsible for the therapeutic potentials of Tulsi [28] and also used in local medicine as an antiseptic and anesthetic [29]. Methyl iso-eugenol (2.952%) is present in small quantity but it is an important component. Eugenol and Methyl iso-eugenol is extensively used in perfumes, food seasoning, flavoring, aromatherapy and medicinal application [36-38]. The nutritional and pharmacological properties of the whole herb in its natural form, as it has been traditionally used, may results from synergistic interactions of many different active phytochemicals [39]. Essential oil is one of the most important flavouring oil, used widely in all kind of beverages, soft drinks, tablets, baked goods, such as cakes, pastries, pie fillings, confectionary, soft and hard center candies, gelatin desserts, ice creams, etc. The oil is also employed in perfumes, toiletries, colognes, and in cosmetics to which it imparts a refreshing top note [40].

The essential oils have been used for centuries for different purposes and regarded with great intrigue, albeit many their uses have been lost with time, it is by and large acknowledged that people have been extracting them from fragrant plants since the very beginning of humankind [41-42]. Their application

for various purposes are gradually changed and not only used for culinary purposes to enhance the sensory appeal they also have been used for therapeutic purposes, yet in addition to their application in the fabrication of fragrances and beauty care products. Essential oils have been used by ancient Egyptians in medication, perfumery, and in the craft of planning bodies for

entombment through preservation. In Asian region, the Vedas classified the employments of these aromatic essences for remedial and worship purposes. Indeed, through the ages, humans have utilized essential oils for different purposes, including religious uses, production of scents or for curing purposes against deadly ailments [43] (Table 1).

| Components | % age | Mass fragmentation |
|-------------------------|--------|---|
| μ -pinene | 0.13% | M+ (100,93) (53,6) (67,8) (136,10) (105,4) (121,6) (77,30). |
| camphene | 0.12% | M+ (100,93) (53,10.656) (136,14.652) (67,23.976) (107,26.64) (79,35.964) (121,70.596) |
| Borneol | 0.47% | M+ (100,95) (121,5.64) (139,9.1) (67,10.92) (110,21.84) |
| α -cubebene | 0.12% | M+ (100,161) (115,9.24) (133,10.78) (77,15.4) (81,21.56) (204,24.64) (119,84.7) (105,14.86) |
| Copaene | 1.64% | M+ (100,161) (133,13.344) (77,16.68) (81,18.348) (204,21.684) (91,38.36) (105,78.396) (119,86.736) |
| α -Bourboene | 0.24% | M+ (100,81) (53,9.24) (119,10.78) (77,18.48) (105,20.02) (91,11.58) (161,46.2) (123,80.08) |
| Eugenol | 15.91% | M+ (100,164) (55,9) (137,15) (121,16) (91,20) (77,21) (131,24) (149,34) |
| α -Caryophyllene | 2.07% | M+ (100,93) (53,10.08) (67,15.12) (107,17.64) (147,25.2) (80,34.02) (121,36.54) |
| Methyl iso-eugenol | 2.95% | M+ (100,178) (77,9.1) (135,12.74) (103,23.68) (91,25.48) (147,32.76) (163,34.58) |
| Caryophyllene oxide | 3.25% | M+ (100,79) (177,16.68) (161,20.01) (149,21.68) (55,40.03) (121,41.7) (109,55.04)(93,83.4) |
| Caryophyllene | 22.27% | M+ (100,133) (175,15.34) (109,17.7) (55,20.06) (189,29.5) (147,37.76) (120,44.84)(69,46.02)(161,47.2) (105,54.28) (79,56.64) (93,79.06) |

Table 1: GC-MS analysis of volatile components of *O.Sanctum*.

CONCLUSION

The essential oil from the dried leaves of *Ocimum Sanctum* was extracted by hydro distillation and after drying with sodium sulfate anhydrous it was analyzed by GC-MS. The yield of the essential oil was 0.21%, pale yellow having characteristic smell. The essential oil was found to be a mixture of hydrocarbons (26.463%), alcohols (19.326%) and oxides (3.252%). Among the

hydrocarbons caryophyllene (22.265%) was found to be a major component followed by α -caryophyllene (2.071%), α -pinene (0.125%), camphene (0.121%), α -cubebene (0.123%), copaene (1.637%) and α -bourboene (0.244%). Among the alcohols eugenol (15.906%) was found in large quantity followed by Borneol (0.468%) and Methyl iso-eugenol (2.952%). Caryophyllene oxide (3.252%) was also found in appreciable amount. The flavoring and medicinal value of all these oxygenated substances present

in the essential oil are well known and therefore, this oil has a potential of becoming a commercial crop and due to low % age of oxygenated components it can be used in synthesis of perfumery chemicals.

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