Gas Chromatography-Mass Spectrometry (GC-MS)

Analysis of Essential Oil salvia officinalis in Sudan

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Abstract:
In this study the essential oils of Salvia officinalis growing in Sudan, were obtained by hydrodistillation and analyzed by Gas chromatography mass spectrometer, forty two compounds were identified. The essential oil composition of S.officinalis found that it had many important compounds. The detected main compounds were oxygenated monoterpenes followed monohydrocarbon, squiterpenes and other compounds. The main essential oil constituents were α-terpineol (33.07%), camphor (11.57%), α-pinene (8.96%) camphene (5.09%) β-cymen (5.40 %) caryophyllene (3.76%) β-myrccne (3.65%) β-menth1-en-b-ol (3.45%) bomeol (3.38%) β-pinene (2.74%) Epiglobulol (2.59%) 1,8 Cineol (2.24%) and trans-β- terpinyl butanone(2.00% ).

Keywords: Salvia officinalis, Essential oil, GC-MS, Sudan.

1 Introduction:
Medicinal plants are plants which contain substances that could be used for therapeutic purposes or which are precursors for the system of useful drugs [1]. The genus Salvia commonly called sage, is the largest member of lamiaceae or mint family containing over 900 species throughout the world [2]. Commonly known as garden or red sage, is a perennial hardy sub-shrub native to Mediterranean regions and is one of the most popular medicinal and culinary herb used in Arab world [3]. potential therapeutic activities of these a Salvia species are due to their essential oils [4]. Sage tea has been traditionally used for the treatment of digestive and circulation disturbances bronchitis, cough, asthma, angina, mouth and throat information, depression, excessive sweating skin diseases, and many other diseases. Salvia essential oils have been used in the treatment of a wide range of diseases like those of the nervous system, heart and blood circulation respiratory system digestive system, and metabolic and endocrine disease [5]. Essential oil of sage contains cineole, borneol and thujone. Sage leaf contains tannic acid, oleic acid, ursonic acid, ursonlic acid, niacin, nicotinamide, flavones, flavonoid glycosides, cornsole, cornsolic acid, fumaric acid, chlorogenic acid, Caffeic acid, and estrogenic substances [6].

This study aimed to investigate the gas gromatography mass-spectrometer analysis for essential Oil Salvia officinalis growing in Sudan.
2 Material and methods:

2.1 Plant material:
Sage (Salvia officinalis) aerial part was collected in February 2018, at Khartoum state, Sudan. Based on the available market samples brought from Syria. The identification of the plant material has been carried out at the Department of botany, faculty of science and technology, Omdurman Islamic University.

2.2 Isolation of the oils Salvia officinalis:
1kg of crushed sage was put in a Clevenger distiller apparatus. Then the sample was covered by distilled water. The temperature was adjusted at 66°C and the condenser was attached. The extraction was carried out for 3hrs. The mixture obtained was separated and the resulted oil was collected then it was treated with anhydrous sodium sulphate to eliminate all the water, and then stored in a refrigerator at approximately 4°C until used.

2.3 GC-MS analysis of the compound
The constituents of the n-hexane extract and fractions were characterized and identified by GC/MS. GC/MS analysis were performed an a Shimadzu GC/MS-QP2010A system in EI mode (70ev ) equipped with a split/splitters injector (250°C ), at split ratio of 5/50 using DB-5MSColumn (30m x 0.25mm id, film thickness: 0002E25 miss J and W scientific, fulsome, CA,WA ). Injection volume was 1misarlitre and electronic pressure programming was used to maintain a constant flame (0.67ml/mins) of the Helium carrier gas. The even temperature was programmed from 150°C (4mins) to 320°C at a rate of 2c/mins and held at than temperature 200°C and interface temperature 250°C. The relative approach percentage of each compound was determined by area. Components idiidentification was carried out using the NIST 147 and NIST 27 libraries.

3 Results and discussion:
The components of the essential oil are summarized in (table 1). Analysis of the extract by GC/MS resulted in the separation of 42 compounds (Table 1). α-terpineol (33.07%) was the major component identified followed by camphor (11.57%), α-pinene (8.96%) camphene (5.09%) β-cymen (5.40 %) caryophyllene (3.76%) beta-myrcene (3.65%) β-menth1-en-b-ol (3.45%) bomeol (3.38%) β-pinene (2.74%) Epiglobulol (2.59%) 1,8 Cineol (2.24%) and trans-β- terpinyl butanone(2.00%). According to the essential oils chemical composition of S.officinalis it was classified as α-terpineol chemotype (33.07%). According In 1990, Tucker et al. [7] categorized sage commercial oils in five chemotypes according to the amount of the major compounds: (i) camphor > α-thujone > 1,8-cineole > β-thujone; (ii) camphor > α-thujone > β-thujone > 1,8-cineole; (iii) β-thujone > camphor > 1,8-cineole > α-thujone; (iv) 1,8-cineole > camphor > α-thujone > β-thujone; and (v) α-thujone > camphor > β-thujone > 1,8-cineole. The chemical composition of the essential oil of sage of different regions in the Mediterranean basin such as the former Yugoslavia [8,9] Italy [10,11] Egypt [12] Morocco [13] and Tunisia [14]etc.
Table 1. Gas Chromatography – Mass Spectrometer of *S. Officinalis* essential oil:

| Peak NO | Compounds                              | R.T  | Area (%) | Formula     |
|---------|----------------------------------------|------|----------|-------------|
| 1       | α-pinene                               | 4.846| 8.96     | C_{10}H_{16}|
| 2       | camphene                               | 5.142| 5.09     | C_{10}H_{16}|
| 3       | β- pinene                              | 5.518| 2.74     | C_{10}H_{16}|
| 4       | β-myrcene                              | 5.587| 3.65     | C_{10}H_{16}|
| 5       | Sabinene                               | 5.664| 0.15     | C_{10}H_{16}|
| 6       | terpinene                              | 5.872| 0.22     | C_{10}H_{18}O|
| 7       | 1,8 Cineol                             | 6.594| 2.24     | C_{10}H_{18}O|
| 8       | β-phellandrene                         | 6.670| 0.18     | C_{10}H_{16}|
| 9       | α-terpineol                            | 6.742| 33.07    | C_{10}H_{18}O|
| 10      | D-limonene                             | 7.036| 0.37     | C_{10}H_{16}|
| 11      | Thujone                                | 7.509| 0.91     | C_{10}H_{16}O|
| 12      | Bicyclo(3.1)hexan-3-ol,3,-4-methyl     | 7.591| 0.81     | C_{10}H_{18}O|
| 13      | Borneol                                | 7.925| 3.38     | C_{10}H_{16}O|
| 14      | P-menth-1-en-8-ol                      | 8.142| 1.30     | C_{10}H_{18}O|
| 15      | Champhor                               | 9.194| 11.57    | C_{10}H_{16}|
| 16      | Bicyclo (3.1.1)heptan-3-one            | 9.654| 0.87     | C_{10}H_{18}O|
| 17      | P-cymen                                | 9.777| 5.40     | C_{10}H_{14}|
| 18      | Bicyclo(3.1.1)hept-2-ene-2-methano     | 9.876| 0.36     | C_{10}H_{24}|
| 19      | P-menth-1-en-β-ol                      | 10.026| 3.45    | C_{10}H_{18}O|
| 20      | Acetic acid                            | 10.090| 0.89    | C_{2}H_{4}O_{2}|
| 21      | Trans-beta terpinyl butanoate          | 10.156| 2.00    | C_{14}H_{24}O_{2}|
| 22      | Caryophyllene                          | 10.299| 3.76    | C_{15}H_{24}|
| 23      | linalool                               | 10.466| 0.79    | C_{10}H_{18}O|
| 24      | α-caryophyllene                        | 10.745| 0.70    | C_{15}H_{24}|
| 25      | Copaene                                | 11.429| 0.13    | C_{15}H_{24}O_{2}|
| 26      | menthol                                | 12.129| 0.31    | C_{10}H_{20}O|
| 27      | (+)-trans-caryophyllene                | 12.548| 0.08    | C_{10}H_{16}|
| 28      | Benzyl alcohol monoterpenene E         | 13.172| 0.05    | C_{10}H_{14}O_{2}|
| 29      | Isobutyl acetate                       | 13.248| 0.06    | C_{6}H_{12}O_{2}|
| 30      | Bicycle(3.2.0)-2-one5fomy              | 13.605| 0.07    | C_{10}H_{18}O|
| 31      | Cyclohexane,1,1,2-trimethyl             | 13.818| 0.09    | C_{10}H_{18}O|
| 32      | (+)-globulol                           | 13.974| 0.12    | C_{10}H_{20}O|
| 33      | Epiglobulol                            | 14.113| 2.59    | C_{15}H_{24}|
| 34      | Methyl(3z) 8,11,14 Eicosatrienoate      | 14.264| 0.84    | C_{21}H_{38}O_{2}|
| 35      | (+) Epi bicycles squiphellandrene       | 14.468| 0.22    | C_{15}H_{24}|
| 36      | Alpha-Caryophyllene                    | 14.871| 0.15    | C_{15}H_{24}|
| 37      | 3-Oxatricycloclo-\((4.1.1.0)(2.4)octane| 15.085| 0.30    | C_{10}H_{16}O|
| 38      | Humulane-1,2-dien-3-ol                  | 15.178| 0.09    | C_{15}H_{24}|
4 Conclusion:
The findings of this study shows that the *salvia officinalis* has many importance components, determined that the chemotype, α-terpineol (33.07%), and Champhor (11.57%) and *s.officinalis* would serve as good sources of pharmaceutical drugs.

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