

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 tow 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 monohydrocarbone, 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 %) caryphyllene (3.76%) β -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%).

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

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, ursolic 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.

Material and Methods

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

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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 monoterpene 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 ₂₆ O
33	Epiglobulol	14.113	2.59	C ₁₅ H ₂₄
34	Methy(z) 8,11,14 Eicosatrienoate	14.264	0.84	C ₂₁ H ₃₆ 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-Oxatricyclo-(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
39	Limonene-1,2-epoxide(fr-1)	15.520	0.34	C ₁₀ H ₁₆
40	1-Oxaspiro(2,5)octane,5,5 dimethyl	15.693	1.15	C ₈ H ₁₂ O ₃
41	1-Naphthalene propanol	16.035	0.58	C ₁₅ H ₂₄
42	5-Hydroxy methyl furfural	17.344	0.07	C ₆ H ₆ O ₃

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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 66C 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 4c until used.

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 ET 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 1mislitre and electronic pressure programming was used to maintain a constant flame (0.67ml/min) 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 identification was carried out using the NIST 147 and NIST 27 libraries.

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 %) caryphyllene (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.

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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