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GC-MS Analysis of Chemical Composition of the Essential Oil of *Salvia officinalis* from Iran

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The water-distilled essential oil produced from the aerial parts of *Salvia officinalis*, endemic in Iran, was analyzed by GC/MS. Thirty one compounds were identified representing 62.19 % of the total components detected with β-eudesmol (11.1 %), camphene (10.1 %) and *trans*-β-ocimene (9.4 %) as the major constituents.

Key Words: *Salvia officinalis*, *Lamiaceae*, β-Eudesmol, Camphene, *trans*-β-ocimene.

INTRODUCTION

The genus *Salvia* (*Lamiaceae*) is comprised of about 700 herbs and shrubs, growing in the temperate and warmer zones of the world. Fifty eight species are found in Iran, 17 of which are endemic[1].

Some species of the genus *Salvia* are used as medicinal, aromatic and ornamental plants. *Salvia officinalis* (sage) is one of the most widespread species and is known over the world from oldest times as a spice, condiment and for its medicinal values[2-4]. Previous chemical investigations on different species of *Salvia*, have shown the presence of flavonoids, diterpenoids and sesterterpenes[5-15].

EXPERIMENTAL

Aerial parts of the plant were collected from the Zagruse montaine in Lorestan state in south west of Iran in May 2007, at flowering. Dried aerial parts (100 g) were water distilled for 3 h using a Clevenger-type apparatus to obtain oil in 0.6 % w/w yield.

Gas chromatography-mass spectrometry: Gas chromatography analyses were carried out on a Shimadzu 17A gas chromatograph and a BP-5 (non-polar and 95 % dimethylpolysiloxane) capillary column (30 m × 0.25 mm; 0.25 μm film thickness). The oven temperature was held at 60 °C for 3 min then programmed at 5 °C/min to 300 °C. Other operating conditions were as follows: carrier gas helium, with a flow rate of 5 mL/min; injector temperature 230 °C; detector temperature 300 °C; split ratio, 1:8.

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GC/MS analyses were performed on a Shimadzu 17A GC coupled with Shimadzu QGD5050 mass system. The operating conditions were the same conditions as described above but the carrier gas was helium. Mass spectra were taken at 70 eV. Mass range was from m/z 50-450 amu. The constituents of the oil were identified by calculation of their retention indices under temperature-programmed conditions for identification of individual *n*-alkanes (C_6-C_{24}) and the oil on DB-5 compounds was made by comparison of their mass spectra with those of the internal reference mass spectra library (Wiley 5.0) or with authentic compounds or with those of reported in the literature[16,17]. Quantitative data was obtained from FID area percentages without the use of correction factors. The list of compounds identified in the oil of *Salvia officinalis* can be seen in Table-1.

TABLE-1
COMPOSITION OF THE ESSENTIAL OIL OF Salvia officinalis FROM IRAN RT: RETENTION TIME, RI: RETENTION INDICES, IN FLOWERING STAGE

No.	Compounds	RT	RI	Area % (at flowering)
1	α-Thujene	5.3	925	0.90
2	α-Pinene	5.5	932	1.10
3	Camphene	5.8	944	10.10
4	β-Pinene	6.5	973	1.90
5	1-Octen-3-ol	6.7	978	0.10
6	Myrcene	7.0	989	0.19
7	Limonene	8.0	1026	0.03
8	Ocimene Z-β	8.3	1036	1.45
9	E-β-Ocimene	8.5	1042	1.46
10	γ-Terpinene	9.0	1059	0.06
11	*trans*-Sabinene hydrate	9.2	1067	0.02
12	α-Terpinolene	9.8	1087	0.06
13	Linalool	10.2	1100	0.09
14	Camphor	11.4	1140	0.87
15	Borneol	12.1	1163	0.37
16	α-Terpineol	12.4	1173	0.04
17	Myrtenol + iso amyl Tiglate	13.1	1197	4.90
18	Butyrate	14.4	1240	1.59
19	Bornyl acetate	15.7	1282	0.68
20	Decadienal (2E,4E)	16.6	1314	0.06
21	*trans*-Pinocarvyl	16.8	1319	0.05
22	δ-Elemene	17.2	1335	0.34
23	Eugenol	17.8	1357	0.03
24	β-Elemene	18.8	1392	4.48
25	α-Gurjunene	19.5	1418	3.80
26	Aromadendrene	21.0	1475	1.39
27	Germacrene D	21.2	1483	2.30
28	Germacrene A	21.8	1506	1.95
29	α-Fernesene	21.9	1510	1.19
30	E-Nerolidol	23.1	1567	0.19
31	β-Eudesmol	25.4	1650	11.10

RESULTS AND DISCUSSION

The results of the GC/MS analysis of the oil of *S. officinals* are listed in Table-1. Among the 31compounds identified, β-eudesmol (11.1 %), camphene (10.1 %) and *trans*-β-ocimene (9.4 %) were the major constituents. Thus the oil consisted of 13 monoterpene hydrocarbons (27.89 %) 7 oxygenated monoterpenes (2.1 %), 6 sesquiterpenes hydrocarbons (14.26 %) and 2 oxygenated sesquiterpenes (11.29 %). Comparing these results with previous works on *Salvia* species revealed that in contrast to the oil of *S. nethiopis*[18], *Salvia hypoleuca*[19,20] and *Salvia hydrangea*[21], in *Salvia officinals* oil monoterpenes predominated over sesquiterpenes, the same as *Salvia multicaulis* and *Salvia sahendica* oil[22].

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