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Short Communication

Chemical Constituents of the Essential Oil of *Stachys lavandulifolia* Vahl from Iran

Katayoun Javidnia[*a], Faraz Mojab[b], Seyed Ali Mojahedi[c]

[a]*Department of Medicinal Chemistry, Faculty of Pharmacy, Shiraz University of Medical Sciences, Shiraz, Iran.* [b]*Pharmaceutical Sciences Research Center, Shaheed Beheshti University of Medical Sciences, Tehran, Iran.* [c]*Iranian Academic Centre for education, culture and research, Shaheed Beheshti University, Tehran, Iran*

Abstract

The essential oil of *Stachys lavandulifolia* Vahl (Lamiaceae) was isolated by hydrodistillation of the aerial parts of the plant, with a yield of 0.25%. The chemical composition of volatile oil was analyzed by capillary GC and GC/ MS. The main components were germacrene-D (13.2%), β-phellandrene (12.7%), β-pinene (10.2%), myrcene (9.4%), α-pinene (8.4%) and Z-β-ocimene (5.8%).

Keywords: *Stachys lavandulifolia*; Lamiaceae; essential oil; GC-MS.

Introduction

In the flora of Iranica genus, *Stachys* is represented by thirthy-one species. *Stachys lavandulifolia* is grown in many parts of Iran, Iraq and Anatolia (1). The plant is known as Chaye-kuhi in Iran and its' english name is Betony. It is used as the herbal tea in gastrointestinal disorders (2). Hydroalcoholic extract of the aerial parts of *S. inflata* shows potent anti-inflammatory activity in rat. The methanolic extract of the tuber of *S. sieboldii* has anti-anoxia action in mice (3, 4). Ramezani et al. reported spathulenol and caryophyllene oxide as the main constituents of *S. lavandulifolia* (5). In the present study a sample of *S. lavandulifolia* with different chemical composition has been reported.

Experimental

Plant Material and Isolation Procedure

The plant material was collected in May 2002 from the Fasham area near Tehran. A voucher specimen has been deposited in the Herbarium of the Faculty of Pharmacy, Shaheed Beheshti University of Medical Sciences (herbarium no. 0783). The aerial parts of the plant were air-dried. The oil was obtained by hydrodistillation using a Clevenger-type apparatus for 4 hours. The yield of oil was 0.25%.

Identification of the oil components

The analytical Gas Chromatography (GC) method was carried out using a Varian GC 3600 chromatograph with DB-5 (methyl phenyl siloxane 25 m X 0.25 mm, 0.25 μm film thickness), N_2 as the carrier gas with a split ratio of 1:20, and a flame ionization detector. Temperature programming was performed from 60°-240°C at 3°/min, with injector and detector temperatures, 240°C and 260°C respectively. GC/ MS was performed on a cross-linked 5% phenyl methyl siloxane (HP-5, 30 m X 0.25 mm, 0.25 μm film thickness) with He as the carrier gas ata split ratio of 1:20 and quadropole

* Corresponding author:
E-mail: javidniak@sums.ac.ir

mass spectrometer (Helwett- Packard 6890) operating at 70 eV ionization energy. EIMS spectra were obtained in the scan mode at m/e range of 35-400 amu. The chromatographic conditions were as above. Retention indices were determined by using retention times of n-alkanes, which has been injected after the oil, under the same chromatographic conditions. The retention indices for all the components were determined according to the Van Den Dool method using n-alkanes as standard (6). The constituents were identified by comparison of retention indices (RRI, HP-5) with those reported in the literature and by comparison of their mass spectra with those held in Wiley library of mass spectra or with the published mass spectra (7,8).

Results and Discussion

The yield of the oil obtained from *S. lavandulifoila* was 0.25%. The yield of the oils extracted from other species were, 0.18% from *S. setifera* ssp. *iranica* 0.18% from *S. chrysantha,* and 0.12% from *S.candida* (9, 10). The *S. lavandulifolia* oil was examined by GC and GC-MS. The list of compounds identified in the oil of *S. lavandulifolia* can be seen in Table 1. Seventy-nine compounds were identified, representing 98.2% of the essential oil, in which the major components were germacrene-D (13.2%), β-phellandrene (12.7%), β-pinene (10.2%) myrcene (9.4%), α-pinene (8.4%) and Z-β-ocimene (5.8%). In a previous study the main components of the oil were reported to be spathulenol (35.0%) and caryophyllene oxide (25.6%), this finding was completely different from our study, in which only 1.5% spathulenol was present in the oil. The major component of the *S. obliqua* oil was germacrene-D, which was also the main component of the *S. lavandulifolia* oil (11). The main components of the oils of *S. aegiptica* (α-pinene) and *S. glutinosa* (α-pinene and β-phellandrene) were presented as the major components of the *S. lavandulifolia oil* (12,13). β-Pinene, one of the main components of *S. recta* and *S. balansae* oils, was present at an amount of 8.4% in *S. lavandulifolia* oil (14).

Table 1. Composition of the essential oil of *Stachys lavandulifolia*.

Peak no.	Compound name	RI	% in oil
1	Hexanal	800	t
2	E-2-Hexenal	850	0.1
3	Heptanal	900	t
4	α-Thujene	928	0.5
5	**α-Pinene**	**937**	**8.4**
6	Camphene	949	0.3
7	Sabinene	974	0.3
8	**β-Pinene**	**982**	**10.2**
9	**Myrcene**	**995**	**9.4**
10	α-Phellandrene	1006	t
11	δ-3-Carene	1011	0.2
12	α-Terpinene	1017	0.5
13	**β-Phellandrene**	**1033**	**12.7**
14	Z-β-Ocimene	1043	5.8
15	E-β-Ocimene	1050	0.9
16	γ-Terpinene	1061	1.4
17	Z-Sabinene-hydrate	1068	0.2
18	Terpinolene	1088	0.3
19	Linalool	1101	0.5
20	Nonanal	1104	0.1
21	*p*-menth-2-en-1-ol	1120	0.1
22	α-Campholene aldehyde	1125	0.1
23	allo-ocimene	1128	0.2
24	E-Pinocarveol	1137	0.2
25	E-verbenol	1143	0.1
26	pinocarvone	1160	0.1
27	borneol	1165	t
28	terpinen-4-ol	1177	0.3
29	α-Terpineol	1190	0.3
30	methyl salicylate	1192	t
31	myrtenal	1195	0.2
32	+ myrtenol		
33	β-cyclocitral	1218	t
34	nerol	1226	t
35	cuminal	1237	0.1
36	geraniol	1254	0.1
37	bornyl acetate	1283	t
38	E-anethole	1285	0.6
39	*p*-cymen-7-ol	1290	t
40	δ-elemene	1337	0.1
41	α-cubebene	1348	0.1
42	eugenol	1357	0.1
43	cyclosativene	1365	0.2
44	α-copaene	1378	4.4
45	β -bourbonene	1382	0.5
46	β-elemene	1391	1.3
47	Z-jasmone	1394	t
48	α-gurjunene	1406	0.2
49	β-caryophyllene	1415	t
50	E-α-bergamotene	1433	0.7
51	Z-β-Farnesene	1441	0.8
52	α-humulene	1450	0.2
53	E-β-Farnesene	1458	3.4
54	**germacrene-D**	**1480**	**13.2**
55	bicyclogermacrene	1498	4.0
56	β-bisabolene	1508	0.8
57	γ-cadinene	1513	0.5
58	δ-cadinene	1526	3.1
59	cadina-1,4-diene	1531	0.1
60	α-cadinene	1536	0.1
61	β-calacorene	1560	0.1
62	Spathulenol	1577	1.8
63	globulol	1583	0.2
64	*T*-cadinol	1642	1.0
65	α-muurolol	1647	0.3
66	valeranone	1672	0.5
67	α-bisabolol	1685	0.9
68	heptadecane	1697	0.1
69	benzyl benzoate	1763	0.2
70	methyl hexadecanoate	1924	t
71	palmitic acid	1975	0.3
72	trans-phytol	2116	3.1
73	octadecanoic acid	2178	0.1
74	docosane	2197	0.1
75	tricosane	2298	0.2
76	tetracosane	2399	t
77	hexacosane	2595	0.1
78	heptacosane	2696	t
79	octacosane	2795	0.8
monoterpenes			**54.0%**
sesquiterpenes			**38.6%**

t=trace (<0.05%)

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