

## Quantity and Composition of the SDE Prepared Essential Oil of *Nepeta macrosiphon* Boiss

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### Abstract

The essential oil from flowering aerial parts of *Nepeta macrosiphon* Boiss. growing wild in Kermanshah Province, Iran, was analyzed by GC/MS. This essential oil was prepared by a modified Likens-Nickerson's simultaneous distillation-extraction (SDE) method. Forty-five compounds consisting 95.1% of the total components were identified from the oil obtained with a yield of 0.1%w/w. Among them, spathulenol (14.1%), germacrene D (9.2%) and caryophyllene oxide (8.1%) were the major components of the oil.

**Keywords:** *Nepeta macrosiphon*; Lamiaceae; Essential oil composition; GC/MS; Spathulenol; Germacrene D; Caryophyllene oxide.

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### Introduction

The genus *Nepeta*, also called *Glecho ma* and *Cataria*, is named after the ancient Italian city of Nepi (1). This genus which belongs to Stachyoideae-Nepeteae tribe, Lamiaceae family, consists of about 250 species distributed in the central and southern parts of Europe, Asia and Middle East (2, 3). Many reports on phytochemical analysis of this genus, including essential oil analysis, are found in the literature (4-27). Most oils of *Nepeta* species contain nepetalactones as the main components, but some differences in the essential oil composition were detected in several *Nepeta* oils (15-27). Antibacterial, fungicidal, antiviral and opioid analgesic activities have been attributed to nepetalactones (19, 21). *Nepeta* species are still used in the traditional medicine of many countries as diuretic, diaphoretic, vulnerary, antitussive, antispasmodic, anti-asthmatic, tonic, febrifuge, emmenagogue and sedative agents (22, 27, 28). Some of Iranian

*Nepeta* species has been of great interest to Iranian folk and traditional medicines and used in the treatment of various disorders, such as some nervous, respiratory and gastrointestinal diseases (27, 29).

The Iranian flora comprises 67 species of *Nepeta* and one of them is *Nepeta macrosiphon* Boiss (2, 30). This herb distributed in different rocky western areas of Iran (2). The Persian names of the plant are "punesaye sisakhti" and "punesaye lulehboland" (30). Our literature surveys revealed that the essential oil of the aerial parts of *N. macrosiphon* has not been chemically studied to date, therefore this article deals with the detailed quantity and composition of the SDE oil prepared by GC/MS.

### Experimental

#### Plant Material

The aerial parts of wild-growing *N. macrosiphon* were collected during the flowering period from northern slopes of Dalakhani mountain, Songhur (Kermanshah Province, Iran) at an altitude of ca. 2300 m in

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June 2001. The plant identity as *N. macrosiphon* was confirmed by the Herbarium Department of the Faculty of Pharmacy, Shiraz University of Medical Sciences, Shiraz, Iran. A voucher specimen of the plant was deposited in the Herbarium of the Department of Pharmacognosy, School of Pharmacy and Pharmaceutical Sciences, Isfahan University of Medical Sciences, Isfahan, Iran.

The air-dried aerial parts of the plant were powdered and the volatile fraction was prepared by a modified Likens-Nickerson's simultaneous distillation and extraction (SDE) method (31, 32). A microscale simultaneous distillation extraction apparatus (Ashke Shishe, Tehran, Iran) was used. Dried powdered plant was homogenized with distilled water and the

homogenate subjected to SDE apparatus for 3 h using pentane (chromatography grade reagent, Merck) as solvent and then extract was concentrated with nitrogen.

#### GC/MS Analysis

The oil was analyzed by GC/MS using a Hewlett Packard 6890 mass selective detector coupled with a Hewlett Packard 6890 gas chromatograph, equipped with a cross-linked 5% PH ME siloxane HP-5MS capillary column (30 m × 0.25 mm, film thickness 0.25 μm). Operating conditions were as follows: carrier gas, helium with a flow rate of 2 ml/min; column temperature, 60-275°C at 4°C/min; injector and detector temperatures, 280°C; volume injected, 0.1 μl of the oil; split ratio, 1:50.

The MS operating parameters were as follows: ionization potential, 70 eV; ionization current, 2 A; ion source temperature, 200°C; resolution, 1000.

Identification of components in the oil was based on retention indices relative to *n*-alkanes and computer matching with the WILEY 275.L library, as well as by comparison of the fragmentation patterns of the mass spectra with those reported in the literature (33-36).

## Results and Discussion

Aerial parts of *N. macrosiphon* yielded 0.1% (w/w vs dried material) of a pale yellowish oil with a strong pleasant aroma. Forty-five components were characterized, representing 95.1% of the total oil compounds detected. These are listed in Table 1 with their percentage composition. The major constituents of the sesquiterpene-rich oil of *N. macrosiphon* were spathulenol (14.1%), germacrene D (9.2%), caryophyllene oxide (8.1%), alpha-murolene (6.0%) and bicyclogermacrene (5.7%). Other components were present in amounts less than 5%. Many of the unidentified compounds were present in trace amounts.

Although the presence of nepetalactones in several *Nepeta* species in relatively high concentrations has been reported (15-27), no nepetalactones were found in this oil. The predominance of spathulenol and caryophyllene oxide has been found in essential oils of two Turkish *Nepeta* species (9, 12). These compounds and germacrene D are typical in most *Nepeta* species (4-27).

**Table 1.** Components present within the oil obtained from the aerial parts of *Nepeta macrosiphon*.

No.	Compound	%	RI
1	trans-2-hexenal	trace	850
2	alpha-pinene	0.3	936
3	camphene	0.1	951
4	beta-pinene	0.1	978
5	1,8-cineole	0.2	1030
6	trans-beta-ocimene	0.3	1048
7	gamma-terpinene	1.0	1058
8	cis-sabinene hydrate	0.1	1065
9	linalool oxide B	0.1	1071
10	linalool oxide A	0.4	1086
11	alpha-pinene oxide	0.3	1094
12	linalool	4.1	1097
13	trans-pinocarveol	0.4	1137
14	trans-verbenol	1.0	1142
15	borneol	0.2	1165
16	terpinene-4-ol	0.5	1176
17	myrtenol	2.0	1194
18	verbenone	4.4	1204
19	geraniol	0.5	1253
20	bornyl acetate	1.1	1283
21	citronellyl acetate	3.8	1350
22	alpha-copaene	0.4	1375
23	beta-bourbonene	1.3	1384
24	longifolene	1.0	1401
25	aromadendrene	4.8	1438
26	germacrene D	9.2	1481
27	bicyclogermacrene	5.7	1495
28	alpha-murolene	6.0	1497
29	germacrene A	2.4	1501
30	gamma-cadinene	1.0	1512
31	delta-cadinene	2.3	1523
32	alpha-cadinene	3.0	1538
33	spathulenol	14.1	1580
34	caryophyllene oxide	8.1	1581
35	gamma-eudesmol	3.9	1633
36	torreyol	2.0	1642
37	alpha-cadinol	4.9	1657
38	cadalene	0.4	1679
39	caryophyllene acetate	0.4	1705
40	khusimol	0.2	1740
41	gamma-eudesmol acetate	1.0	1782
42	n-octadecane	0.5	1804
43	pentadecanoic acid	0.3	1869
44	n-nonadecane	0.2	1907
45	methyl octadecanoate	1.1	2139

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