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Original Article

Volatile Constituents of *Matricaria chamomilla* L. from Isfahan, Iran

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Abstract

The volatile oil obtained by hydrodistillation of the aerial parts of *Matricaria chamomilla* L. (Asteraceae) growing in Botanical Garden, Isfahan University of Medical Sciences, Iran, was investigated by gas chromatography (GC) and GC/ mass spectrometery (MS). Sixty-three components were characterized, representing 86.21% of the total oil components detected. α-Bisabolol oxide A (25.01%) and a-bisabolol oxide B (9.43%) were the major constituents of the oil.

Keywords: Asteraceae; a-Bisabolol oxide A; α-Bisabolol oxide B; Essential oil; *Matricaria chamomilla.*
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1. Introduction

Chamomile, *Matricaria chamomilla* L. Asteraceae family, is a well-known and important medicinal plant in Iran that traditionally have been used for the treatment of various diseases, and it is cultivated all over the world [1, 2]. The medicinal and pharmacological effects of chamomile are mainly connected with its essential oil for its antispasmodic, antimicrobial and disinfective properties [2-4]. Chamomile essential oil is widely used in food, cosmetics and pharmaceutical industries. The largest group of medically important compounds forming the essential oil are α-bisabolol, bisabolol oxides, chamazulene and en-yn-dicycloethers. Flavonoids, coumarins, hydroxycinnamic acids, mucilages and some other primary metabolites also have pharmacological effects [2-5].

Different essential oil isolation techniques and analysis methods have been applied for studying the volatile constituents of chamomile by several groups [2, 3, 5, 6]. The purpose of this work was to determine the composition of volatile essential oil from a chamomile sample cultivated in Botanical Garden of School of Pharmacy, Isfahan University of Medical Sciences, Isfahan, Iran, to identify and compare the composition of this oil with those of foreign origins.

2. Materials and methods

2.1. Plant material

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Table 1: Composition of essential oil of *Matricaria chamomilla* L. flowers.

Compounds	*Percentage*	*Retention Index*
Propyl butyrate	0.10	927
α-Pinene	0.03	952
Camphene	0.02	958
Butyl butyrate	0.10	993
Yomogi alcohol	0.20	1001
para-Cymene	0.18	1020
Artemisia ketone	0.40	1047
n-Octanol	0.08	1053
Artemisia alcohol	0.16	1062
Linalool	0.04	1072
n-Nonanal	0.08	1075
Camphor	0.04	1099
cis-Chrysanthenol	0.06	1114
Borneol	0.28	1117
n-Nonanol	0.07	1112
4-Terpineol	0.05	1113
para-Cymene-8-ol	0.11	1133
3-Decanol	0.16	1138
Ethyl octanoate	0.21	1143
n-Decanal	0.06	1148
n-Hexyl 2-methyl butyrate	0.02	1167
Hexyl 3-methyl butanoate	0.32	1170
Nonanoic acid	0.22	1201
trans-Anethol	0.38	1207
Azulene	0.12	1218
trans, *trans*-2,4-Decadienal	0.11	1227
Methyl decanoate	0.11	1233
δ-Elemene	0.07	1240
Daucene	0.09	1251
3-Dodecanone	0.03	1259
β-Elemene	0.13	1268
trans-β-Damascone	0.22	1275
β-Caryophyllene	0.26	1279
γ-Elemene	0.61	1282
cis-β-farnesene	0.31	1321
trans-β-farnesene	4.68	1331
α-Terpinyl isobutyrate	0.24	1337
Germacrene-D	0.48	1344
β-Selinene	0.37	1347
α-Muurolene	0.50	1355
cis-α-Bisabolene	0.18	1360
β-Bisabolene	0.15	1364
γ-Cadinene	0.29	1366
δ-Cadinene	0.15	1372
trans-γ-Bisabolene	0.16	1376
α-Cadinene	0.14	1386
Spathulenol	8.49	1419
Caryophyllene oxide	0.40	1429
n-Hexadecane	0.52	1435
γ-Eudesmol	1.98	1462
α-Bisabolol oxide B	9.43	1476
β-Bisabolol	0.62	1482
α-Bisabolene oxide A	7.17	1493
α-Bisabolol	6.01	1499
Chamazulene	3.28	1524
α -Bisabolol oxide A	25.01	1557
β-Bisabolenal	0.28	1578
α -Bisabolol acetate	0.48	1602
n-Octadecane	0.38	1611
cis-en-yn-Dicycloether	7.42	1659
trans-en-yn-Dicycloether	1.82	1674
Ethyl hexadecanoate	0.12	1757
7-hydroxy-4-methyl Coumarin	0.03	1782
Identification (%)		86.21
Grouped components		
Monoterpene hydrocarbons		0.35
Oxygen-containing monoterpenes		1.72
Sesquiterpene hydrocarbons		11.85
Oxygen-containing sesquiterpenes		60.33
Others		11.96

Flowers of cultivated *M. chamomilla* were collected from Botanical Garden of faculty of Pharmacy, Isfahan University of Medical Sciences, Isfahan, Iran in June 2000. The plant identity as *Matricaria chamomilla* L. was confirmed by the Herbarium Department of School of Pharmacy, Shiraz University of Medical Sciences, Shiraz, Iran. A voucher specimen of the plant was deposited in the herbarium. The air-dried flowers of the plant were powdered and the volatile fraction was isolated by hydrodistillation for 3 h according to the method recommended in British Pharmacopoeia [7]. The oil was dried over anhydrous sodium sulfate and stored in a refrigeratore (4 °C).

2.2. Analysis

The oil was analyzed by gas chromatography (GC) and GC/ mass spectrometery (MS). GC analysis was carried out on a Perkin-Elmer gas chromatograph Model 8500, equipped with a FID detector and a BP-1 capillary column (30 m×0.25 mm, film thickness 0.25 mm). The operating conditions were as follows: carrier gas, helium with a flow rate of 2 ml/min.; column temperature, 60-275 ºC at 4 ºC/min.; injector and detector temperatures, 275 and 280 ºC, respectively; volume injected, 0.1 ml of the oil; split ratio, 1:25.

GC/MS analysis was performed on 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 mm) and operating under the same conditions as described above. The MS operating parameters were as follows: ionization potential, 70 eV; ionization current, 1 A; ion source temperature, 200ºC; resolution, 1000.

Identification of components in the oil was based on GC 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 [8-10]. The relative percentage of the oil constituents was calculated from the GC peaks.

3. Results and discussion

Flowers of *M. chamomilla* yielded a blue essential oil with a fresh pleasant odour. Sixty-three components were characterized, representing 86.21% of the total oil components detected. These are listed in Table 1 with their percentage composition. The oil was rich in sesquiterpenoids. Many of the unidentified compounds were present in trace amounts. The major constituents of the oil were α-bisabolol oxide A (25.01%), α-bisabolol oxide B (9.43%), spathulenol (8.49%), *cis*-en-yn-dicycloether (7.42%) and α-bisabolene oxide A (7.17%). Other components were present in amounts less than 7%. *M. chamomilla* produces a volatile oil which is different from those known chamomile oils [2-6, 11]. This oil is a valuable source of α-bisabolol oxides A and B.

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