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ESSENTIAL OIL COMPOSITION OF *Achillea teretifolia* FROM TURKEY

S. Aslan,[1] H. Evren,[2] B. Konuklugil,[1*] I. Turkoglu,[2] and M. Kartal[1]

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The genus *Achillea* (Asteraceae) is represented by 42 species in the flora of Turkey, and 23 of them are endemics [1, 2]. Some *Achillea* species have ethnopharmacologic importance and are known to be used in folk remedies for various purposes [3].

Dried aerial parts of *Achillea teretifolia* were found to contain 0.4% (calculated per weight of dried plant material) of essential oil. The chemical composition of the essential oils of *Achillea teretifolia* is reported in Table 1.

Thirty-seven compounds, representing 83.53% of the essential oil of *Achillea teretifolia*, was identified by GC-MS.

The major components of the oil were found to be piperitone (21.37%), linalool (18.99%), 1,8-cineole (6.79%), α-terpineol (5.88%), and borneol (4.29%). The essential oil was found to be significantly rich with oxygenated monoterpenes, with a percentage of 71.39%.

Although there are a lot of studies reporting the composition of the essential oils of *Achillea* species, there is only one report referring to *Achillea teretifolia* [4]. Compared with this work, the two essential oils show different compositions.

TABLE 1. Composition of the Essential Oil of *Achillea teretifolia*, %

Compound	RI	Area, %	Compound	RI	Area, %
α-Pinene	1004	0.14	Borneol	1695	4.29
β-Pinene	1086	0.22	Piperitone	1715	21.37
Limonene	1175	0.09	*ar*-Curcumene	1750	0.11
1,8-Cineole	1187	6.79	*trans*-Carveol	1858	1.11
γ-Terpinene	1220	0.25	*cis*-Jasmone	1930	0.13
p-Cymene	1245	0.27	Caryophyllene oxide	1974	3.33
trans-Linalool oxide	1414	0.20	Methyl eugenol	1992	0.23
cis-Linalool oxide	1439	0.05	Nerolidol	2018	2.32
α-Campholene aldehyde	1460	0.28	Spathulenol	2110	1.46
Camphor	1485	3.92	Valencene	2128	0.08
Linalool	1517	18.99	Eugenol	2148	0.70
cis-Sabinene hydrate	1536	0.20	Thymol	2160	0.54
Pinocarvone	1541	0.49	β-Eudesmol	2217	1.23
Bornyl acetate	1552	0.86	Myristicine	2244	0.20
Caryophyllene	1571	0.62	Methyl jasmonate	2325	0.24
4-Terpineol	1578	1.75	Monoterpene hydrocarbons		0.97
trans-Pinocarveol	1606	0.65	Oxygen-containing monoterpenes		71.39
Myrtenal	1641	0.21	Sesquiterpene hydrocarbons		1.05
β-Terpineol	1652	0.38	Oxygen-containing sesquiterpenes		8.34
β-Patchoulene	1655	0.35	Aromatic hydrocarbons		1.78
trans-Chrysanthenol	1673	3.60	Total identified		83.53
α-Terpineol	1679	5.88			

RI: retention index relative to *n*-alkanes on the INNOWAX column.

1) Faculty of Pharmacy, Department of Pharmacognosy, Ankara University, 06100 Tandogan-Ankara,Turkey, e-mail: belmakonuk@yahoo.com; 2) Faculty of Science and Education, F1rat University, 23119 Elazig, Turkey. Published in Khimiya Prirodnykh Soedinenii, No. 2, pp. 230–231, March–April, 2009. Original article submitted August 15, 2007.

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Sixteen compounds were common with different percentages. The major compounds were not also the same. In our study, piperitone was the major compound of the oil, with an amount of 21.37%; in contrast, it was not found in the essential oil studied by Unlu et al. In this previous work, the major components of the oil were found to be eucalyptol (1,8-cineole – 19.9%), camphor (11.1%), and borneol (11.9%). These differences may be due to different localization of the plants collected.

GC-MS analysis was carried out using an Agilent 6890N Network GC system combined with an Agilent 5973 Network Mass Selective Detector. The GC conditions were: column, HP Innowax Capillary; 60.0 m × 0.25 mm × 0.25 μm; oven temperature program, the column held initially at 60°C for 10 min after injection, then increased to 220°C with 4°C/min heating ramp for 10 min and increased to 240°C with 1°C/min heating ramp for 5 min. Then the final temperature was increased to 240°C with 10°C/min heating ramp without hold; injector temperature, 250°C; carrier gas, helium; inlet pressure, 20.85 psi; linear gas velocity, 28 cm/s; column flow, 1.2 mL/min^{-1}; split ratio, 30:1; injected volume, 1.0 μL. MS conditions: ionization energy, 70 eV; ion source temperature, 280°C; interface temperature, 250°C; mass range, 34–450 atomic mass units.

Identification of the components was done by comparison of their retention indices relative to *n*-alkanes with the literature [4–7], and by comparison of the mass spectral datas using the Wiley, Nist, and Adams electronic libraries. The percentages of the components were calculated from the GC peak areas, using the normalization method.

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