

NOTES

Composition of the Essential Oil of *Pistachia khinjuk* Fruits Grown in Ilam Province of Iran

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The essential oil obtained from the fruits (whole seeds, kernel and the green hull of the seeds) of *Pistachia khinjuk* tree growing wild in Ilam province of Iran was analyzed by GC-MS. Thirty-four compounds consisting ca. 99% of the total components were identified in the oil which was obtained in 4.0% (v/w). Among them, *cis*-ocimene (24%), α -pinene (17.9%), myrcene (14%) and *trans*-ocimene (8%) were the major components.

Key Words: *Pistachia khinjuk*, Essential oil, *cis*-Ocimene, α -Pinene, Myrcene, *trans*-Ocimene.

The essence or aromas of plants are due to volatile or essential oils, many of which have been valued since antiquity for their characteristic odours. Essential oils are used mainly for their pleasant odours and flavours in perfumes, incense, scents and spices, and as flavouring agents in foods. Some are used medicinally and others as insect repellants. Essential oil components are often found in the glands or intercellular spaces of plant tissue. They may exist in all parts of the plant but are often concentrated in the seeds or flowers. Many components of essential oils are steam-volatile and can be isolated by steam distillation. Other methods of isolating essential oils include solvent extraction and pressing (expression), gas chromatography (GC) and high performance liquid chromatography (HPLC).

Wild *Pistachia khinjuk* seeds are the fruits of the *Pistachia* species. The *Pistachia* species is classified into the Anacardiaceae family. *Pistachia atlantica* and *Pistachia khinjuk* are the two major genera that grow in the Zagrossian region of Iran. *Pistachia khinjuk* grows at 700–1900 m above sea level. Large areas of Ilam province of Iran are covered by *Pistachia khinjuk* trees. Various genera of this tree grow in Iran and some of them have therapeutic efficacy and their fruits are pleasant and edible. The English name of this genus is *Pistachia acumulata*.

The fruits and the aerial parts of the wild-growing *Pistachia khinjuk* were collected from the surrounding mountains of Ilam province, Iran. The plant was identified as *Pistachia khinjuk* by the Herbarium Department and Faculty of Agriculture of Shahid Chamran University, Ahwaz, Iran.

The whole fruits of the plant were powdered and the volatile fraction was isolated by hydrodistillation; a liquid oil was obtained. The oil was dried over anhydrous sodium sulphate and kept in a refrigerator (4°C).

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The crude oil was analysed by gas chromatography (GC) and gas chromatography-mass spectrometry (GC-MS). GC analysis of the oil was conducted using a Thermoquest-Finnigan instrument equipped with a DB-1 fused silica column (30 m \times 0.32 mm i.d., film thickness 0.25 μ m). Nitrogen was used as the carrier gas at a constant flow of 1.1 mL/min. The oven temperature was held at 60°C for 1 min, then programmed to 250°C at a rate of 4°C/min, and then held for 10 min. The injector and detector (FID) temperature were kept at 250 and 280°C, respectively.

GC-MS analysis was carried out on a Thermoquest-Finnigan Trace GC-MS instrument equipped with a DB-1 fused silica column (60 m \times 0.25 mm i.d., film thickness 0.25 μ m). The oven temperature was raised from 60–250°C at a rate of 5°C/min, then held at 250°C for 10 min; transfer line temperature 250°C. Helium was used as the carrier gas at a flow rate of 1.1 mL/min; split ratio 1/50. The quadrupole mass spectrometer was scanned over 45–465 amu with an ionizing voltage of 70 eV and an ionization current of 150 μ A. The constituents of the volatile oil were identified by calculation of their retention indices under temperature-programmed conditions for *n*-alkanes (C₆–C₂₄) and the oil on a DB-1 column under the same conditions. Identification of individual compounds was made by comparison of their mass spectra with those of the internal reference mass spectra library or with authentic compounds and confirmed by comparison of their retention indices with authentic compounds or with those reported in the literature^{1,2} as well as by comparison of the fragmentation patterns of the mass spectra with those reported in the literature. Quantitative data was obtained from FID area percentages without the use of correction factors.

The essential oil obtained by hydrodistillation of the powdered fruits of *Pistachia khinjuk* was bright yellow colour which turned dark on standing with a strong acrid odour. On the basis of the results obtained, it was concluded that the essential oil of the whole fruits of *Pistachia khinjuk* consists of thirty-eight components: four major components, *i.e.*, *cis*-ocimene (24%), α -pinene (17.9%), myrcene (14%) and *trans*-ocimene (8%); eleven minor components (totally 18.32%) and twenty-three much less amount components (totally 8.2%) (Table-1).

TABLE-1
COMPOSITION OF THE ESSENTIAL OIL OF *PISTACHIA KHINJUK* OF
ILAM PROVINCE, IRAN

No.	Compounds	Retention	%
1.	α -Thujene	926	< 0.2
2.	α -Pinene	935	17.9
3.	Camphene	949	0.9
4.	Sabinene	969	1.3
5.	β -Pinene	976	2.0
6.	Myrcene	983	14.0
7.	α -Phellandrene	1001	0.7
8.	3-Carene	1009	1.5
9.	α -Terpinene	1013	0.4
10.	<i>Ortho</i> -cymene	1015	5.0

No.	Compounds	Retention	%
11.	<i>Cis</i> -ocimene	1027	24.0
12.	<i>Trans</i> -ocimene	1038	8.0
13.	γ -terpinene	1052	0.3
14.	Terpinolene	1083	0.4
15.	1-Terpineol	1119	1.4
16.	4-Terpineol	1168	0.5
17.	α -Terpineol	1178	< 0.2
18.	Isobornyl acetate	1274	0.2
19.	α -Gurjunene	1391	0.2
20.	β -Gurjunene	1441	0.2
21.	α -Guaiene oxide	1450	0.2
22.	γ -gurjunene	1452	0.2
23.	β -Chamigrene	1456	< 0.2
24.	α -Seline	1490	< 0.2
25.	<i>Trans</i> -nerolidol	1549	0.3
26.	Spathulenol	1573	0.2
27.	Guaiol	1577	0.2
28.	Unknown	1597	0.3
29.	Cubenol	1618	2.6
30.	α -Cadinol	1626	0.6
31.	β -Eudesmol	1647	0.5
32.	BR13	1661	1.3
33.	Patchouli alcohol	1668	0.3
34.	8 <i>S</i> - <i>cis</i> -5(1 <i>H</i>)-azulenone	1749	0.3
35.	<i>Trans</i> -farnesol	1772	0.7
36.	Unknown	1800	0.4
37.	Heneicosane	2096	2.0
38.	Unknown	2268	0.3

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