Composition of Vietnamese Essential Oil from *Melaleuca Leucadendron L.*

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The Vietnamese plant kingdom, as part of the southeast Asian flora, contains a vast variety of plants, represented in many species and forms. Many of them are used in the traditional medicine of Vietnam and other countries, while others are sources for the production of essential oils, drugs and other useful materials.[1] The greater part of the chemical investigations of these plants dates back to before 1940, with rather modest results conditioned by the level of the methods employed.

In this paper, the chemical composition of the oil, established by a combination of gas-chromatography (GC) and gas-chromatography/mass-spectrometry (GC/MS), is described.

Melaleuca leucadendron L. (Myrtaceae). Many melaleuca species are widespread in southeast Asia, the Malay Peninsula and the East Indies. The leaves of some of them contain about 1% essential oil, rich in 1,8-cineole (40-65%), known as "cajeput oil." One of its most abundant sources is *M. leucadendron*. Other components of the oil are α-pinene, limonene, α-terpineol, and unidentified mono- and bicyclic sesquiterpenes.[2,3] Despite the large production of *M. leucadendron* oil, there are no detailed data on its chemical composition.

Besides being sources of cineole, the melaleuca (cajeput) oils are the main component of the traditional Asian "tiger drops" and various other ointments, widely used to cure migraine, colds, influenza, rheumatism and stomachache. An infusion prepared from 20g leaves in 2 litres of water is recommended for coughs, and a water emulsion with 0.2% oil is used to wash infected wounds.[4]

The investigated oil was an experimental sample with a specific soft cineole-camphorous aroma. The GC and GC/MS analysis was carried out with the total oil and with its hydrocarbon (A) and oxygenated (B) fractions which were isolated by consecutive elution from a silica column with pentane and with 10% methanol in ether. In this analysis, only components of over 0.1% of the total oil were taken into consideration. The two fractions, A and B, gave additional information on some components present in traces and also allowed the identification of some overlapping peaks found in the gas-chromatogram of the total oil. For example, the peaks of linalool-β-caryophyllene-β-elemene-terpinene-4-ol (or linalyl acetate), with very close Rt values, were successfully characterized. The results presented in Table I summarize the chemical composition of the oil as we determined it. Of the 34 peaks (99% of the oil), we were able to identify 26 of them.

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Table I. Chemical Composition of the Melaleuca leucadendron Essential Oil

Peak No.	Compound	Mol. Weight	%
1	α-pinene*	136	3.8
2	β-thujene	136	1.0
3	β-pinene*	136	2.6
4	limonene	136	4.8
5	1,8-cineole*	136	48.0
6	p-cymene*	134	13.2
7	α-terpinene	136	t
8	α-dimethylstyrene	132	0.2
9	δ-elemene	204	t
10	linalool*	154	3.4
11	β-caryophyllene	204	2.1
12	β-elemene	204	t
13	terpinen-4-ol*	154	1.6
14	aromadendrene	204	t
15	α-bisabolene	204	t
16	α-humulene (or α-selinene)	204	1.3
17	alloaromadendrene	204	1.5
18	δ-maaliene (?)	204	1.4
19	α-terpineol	154	9.8
20	$C_{15}H_{24}$	204	t
21	δ-cadinene (?)	204	0.4
22	geraniol	204	0.3
23	$C_{15}H_{24}$	204	0.3
24	$C_{10}H_{17}OH$	154	t
25	p-cymene-8-ol	150	0.4
26	$C_{15}H_{22}$	202	0.2
27	$C_{15}H_{25}OH$	222	t
28	$C_{15}H_{25}OH$	222	t
29	β-maaliol (?)	222	0.5
30	guaiol	222	0.2
31	$C_{15}H_{25}OH$	222	t
32	bulnesol	222	0.2
33	$C_{15}H_{25}OH$	222	0.9
34	cudesmol	222	0.9

*Also identified by external GC standards;
t = less than 0.1%.

As can be seen from the results, the main hydrocarbons in the oil are α- and β-pinene, limonene and p-cymene (69.4% of the oil) while the sesquiterpenes are less than 2% each, or in traces. Cineole (48% of the oil) is the main oxygen-containing component, followed by linalool, terpinen-4-ol, and α-terpineol. Smaller amounts of geraniol, nerol and sesquiterpene alcohols were also found. This blended composition makes the oil eligible not only as a source for the isolation of cineole, but also for use in compositions for hygienic products.

Experimental Section

The oil was an experimental sample, prepared in 1981 by water distillation of the fresh plant parts. It was of South Vietnamese origin.

M. leucadendron (leaves with young branches), collected in the Long An province: n_D^{20} 1.4739, α_D^{20} −1.3°, d^{20} 0.9061, acid number 0.96, ester number 26.5, ester number after acetylation 85.6.

GC analysis: Pye Unicam chromatograph series 304 with 50m glass capillary column with DEGS, carrier gas Ar, FID detector at 260°, Pye Unicam CDP1 integrator, temperature programme 60-190°/4° min, and 10 min at 190°, injector port at 200°.

GC/MS analysis: JEOL 20K gas-chromatograph, joined to a JEOL JMS D-300 double focusing mass-spectrometer with a JMA-2000 Data System; 50m glass capillary column with DEGS directly introduced in the ionization chamber (70eV), carrier gas He, temperatures as above.

The components were identified by their MS spectra, manually compared with the catalogue data,[6] and in part by the retention time of some terpene standards.

For preliminary separation, 0.5g of the oil in 2.0ml pentane was percolated over a column with 10g Merck silica-60. The hydrocarbons were eluted with 10ml pentane, and the oxygenated compounds, with 10% ethanol in ethyl ether.

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