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Chemical Constituents of the Essential Oils of *Cinnamomum sintok*, Blume

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ABSTRAK

Minyak pati dari daun, kulit dan kayu *Cinnamomum sintok* dihasilkan dengan jumlah 0.87, 1.63 dan 0.29% setiap satu menerusi sistem penyulingan hidro. Kandungan minyak dikenalpasti menerusi kaedah ko-kromatografi dengan sampel tulen di atas dua turus rerambut yang berlainan, indeks penahanan Kovats, analisis kromatografi gas-spektrometri jisim (KG-SJ). Seskuiterpina meliputi lebih 80% daripada minyak daun tetapi linalool sebanyak 17.4% merupakan komponen yang utama. Kandungan minyak pati dari kulit dan kayu adalah sama tetapi kepekatan tiap-tiap komponen adalah berlainan. Kandungan utama minyak minyak tersebut ialah eugenol dimana ia meliputi 87.5% daripada minyak kulit dan 72.6% daripada minyak kayu.

ABSTRACT

The leaf, bark and wood oils of *Cinnamomum sintok* were isolated in 0.87, 1.63 and 0.29% yields, respectively, by water distillation. The components of the oils were identified by co-chromatography with authentic samples on two different capillary columns, Kovats retention index and gas chromatographic-mass spectrometric (GC-MS) analysis. Sesquiterpenoids accounted for more than 80% of the oil. However, the most abundant component was linalool which constituted 17.4% of the oil. The constituents of the bark and wood oils were similar, but the concentrations differed. The major component of the bark and wood oils was eugenol which constituted 87.5 and 72.6% of the oils respectively.

Keywords: ***Cinnamomum sintok*, gas chromatography, Kovats index, linalool, eugenol**

INTRODUCTION

Cinnamomum sintok (family Lauraceae) is a tree of up to 39 m in height. It is a common tree of the hill forests of Peninsular Malaysia but is also found to a lesser extent in the lowland and mountain forests (Kochummen 1989). The tree is also found growing in Java, Sumatra and Borneo (Burkill 1966). All parts of the tree are aromatic, as are all *Cinnamomum* species. The bark, locally known as 'sintuk', is widely used in traditional medicine for various ailments, internally to treat diarrhoea and other intestinal complaints and as a vermifuge, and externally for wounds and numbness of the skin (Burkill 1966). The bark is also a common ingredient in tonics and cosmetics.

The bark is strongly aromatic with a clove-like odour and the essential oil distilled from it has been found to contain 13% eugenol (Gildemeister and Hoffman 1922). Other *Cinnamomum* species (*C. zeylanicum, C. loureirii* and *C. cassia*) are the source of cinnamon bark which has been an item of trade since ancient times. The major chemical component of the spice is cinnamaldehyde (Guenther 1975).

The essential oils of seven *Cinnamomum* species (*C. iners, C. mollissimum, C. impressicostatum, C. pubescens, C. porrectum, C. camphora* and *C. javanicum*) from Peninsular Malaysia have been studied by Ibrahim and Goh (1992). This paper reports on the chemical constituents of the leaf, bark and wood oils of *C. sintok* as part of a continuing survey on *Cinnamomum* oils as sources of chemical feedstock for pharmaceutical and technical preparations, and as a chemotaxonomy guide to species identification.

MATERIALS AND METHODS

The leaf, bark and wood of *C. sintok* were collected from Pasoh Forest Reserve, Negri Sembilan in January 1993. The plant materials were air dried under shade at room temperature for two days. The sample was identified at the herbarium of the Forest Research Institute of Malaysia.

The ground plant materials (200 g) (mesh size 40-60) were water-distilled for eight hours and the oily layers obtained were separated and dried under anhydrous sodium sulphate. The oil yields were averaged over two experiments and calculated based on dry weight of the plant materials.

The oils were analysed on a Shidmadzu GC 9A equipped with a FID detector using SE 30 and PEG 20M stationary phase capillary columns (25 m x 0.2 mm i.d.) with nitrogen as the carrier gas at a flow rate of 50 cm^3 min^{-1}. The temperature programming for the columns was as follows: SE 30; initial temperature 60°C for 10 min, then programmed 3° min^{-1} to 180°C. PEG 20; initial temperature at 45°, programmed 3°C min^{-1} to 230°C.

The oils were also analysed by GLC-MS with a Hewlett Packard GCMSD 5890 series 2 mass spectrometer (70 eV direct inlet) on a SE 30 capillary column (25 m x 0.2 mm i.d.) initially at 60°C for 10 min, then 3°C min^{-1} to 180°C with helium as the carrier gas. The constituents were identified by co-chromatography on the different columns with authentic samples and by comparison of their Kovat indices with literature values and their mass spectral data with those from the NBS mass spectral database.

Kovats indices were obtained from the gas chromatogram by logarithmic interpolation between bracketing alkanes. The homologous series of n-alkanes were used as standards (Kovats 1965).

RESULTS AND DISCUSSION

Yields of Essential Oils

Water distillation of the ground fresh materials yielded 0.87, 1.63 and 0.29% essential oils from the leaf, bark and wood of *C. sintok* respectively. Compared to other aromatic plants such as *Eucalyptus globulus* and *Pogostemon cablin*

distilled commercially, only the bark oil yield may be considered satisfactory for commercial exploitation. The leaf oil possessed a strong spicy odour, while the bark and wood oils had an odour that closely resembled clove oil.

Chemical Constituents of the Essential Oils

Leaf oil of Cinnamomum sintok

The gas chromatogram of the leaf oil in *Fig. 1* revealed the presence of at least 39 components, of which 32 were identified by co-chromatography with authentic samples on columns of different polarity and by comparing their Kovats indices with literature values and their mass spectral data with those from the NBS mass spectral database. The identified compounds, which accounted for 95.1% of the oil, were made up of monoterpenoid and sesquiterpenoid hydrocarbons. From the analysis of the mass fragmentation patterns, the unidentified compounds were assigned the formulae $C_{10}H_{14}O$, $C_{15}H_{24}$ and $C_{15}H_{26}O$ which indicated that they were oxygenated monoterpenes, sesquiterpenes and oxygenated sesquiterpenes respectively.

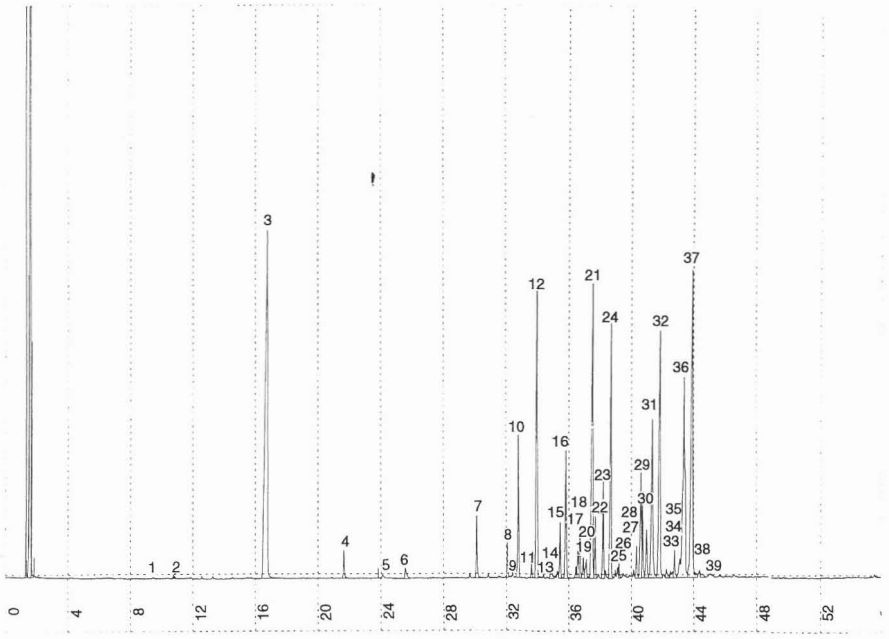

Fig. 1. Gas chromatogram obtained with capillary SE 30 column for the leaf oil of Cinnamomum sintok; *for identity of peaks, see Table 1*

There were only 6 monoterpenoids identified; they accounted for only 18.7% of the oil (Table 1). However, the most abundant component in the oil was linalool which constituted 17.4% of the oil. The other monoterpenoids, 3-carene, (E)-β-ocimene, α-terpineol, carvone and a monoterpenoid, were present at less than 1% concentration each.

Sesquiterpenoids were the major group of compounds, represented by 33 compounds (Table 1) They were present at more than 80% concentration

TABLE 1
Chemical constituents of the leaf oil of *Cinnamomum sintok*

Peak No.	Compound	Kovats (SE 30)	Kovats (PEG 20)	Yield (%)	Identification
1	3-carene	1000	1154	0.05	a,b,c
2	(E)-β-ocimene	1030	1258	0.10	a,b
3	linalool	1090	1554	17.37	a,b,c
4	α-terpineol	1172	1716	0.61	a,b,c
5	carvone	1213	1745	0.15	a,b
6	$C_{10}H_{14}O$	1241	-	0.41	a
7	α-cubebene	1335	1453	1.34	a,b,c
8	α-copaene	1366	1482	0.69	a,b,c
9	$C_{15}H_{24}$	1372	-	0.10	a
10	β-elemene	1380	1590	3.01	a,b
11	α-gurjunene	1396	-	0.31	a,b,c
12	β-caryophyllene	1405	1581	7.78	a,b,c
13	α-bergamotene	1424	-	0.41	a,b
14	α-patchoulene	1434	-	0.10	a,b
15	α-humulene	1438	1651	1.15	a,b,c
16	alloaromadendrene	1446	1630	3.00	a,b,c
17	$C_{15}H_{24}$	1462	-	0.83	a
18	$C_{15}H_{24}$	1464	-	1.04	a
19	α-cadinene	1469	1678	0.51	a,b
20	γ-muurolene[t]	1473	-	0.56	a,b
21	β-selinene	1482	1730	8.39	a,b
22	viridiflorene	1485	-	1.22	a,b
23	α-selinene	1496	1742	2.19	a,b
24	calamenene	1508	1840	6.09	a,b
25	γ-cadinene	1515	1744	0.05	a,b
26	δ-cadinene	1520	1770	0.31	a,b
27	elemol	1531	-	0.10	a,b
28	nerolidol[i]	1548	2038	0.72	a,b,c
29	palustrol[t]	1556	-	2.87	a,b
30	spathulenol	1564	2131	1.41	a,b
31	cedrol	1573	-	5.31	a,b
32	ledol	1584	-	7.96	a,b
33	guaiol	1588	-	0.10	a,b
34	$C_{15}H_{26}O$	1592	-	0.30	a
35	$C_{15}H_{26}O$	1605	-	0.63	a
36	τ-cadinol	1622	2157	9.66	a,b,c
37	α-cadinol	1638	2220	11.38	a,b,c
38	bulnesol	1646	-	0.28	a,b
39	$C_{15}H_{26}O$	1677	-	0.10	a

Yields were calculated based on the concentrations obtained on column SE 30. a = mass fragmentation; b = retention index; c =co-chromatography with authentic sample; t = tentative identification; i = correct isomer not determined.

and the major representatives were α-cadinol (11.4%), τ-cadinol (9.7%), β-selinene (8.4%), ledol (8%), β-caryophyllene (7.8%), calamenene (6.1%), cedrol (5.3%), β-elemene (3.0%) and alloaromadendrene (3.0%), arranged in decreasing order of concentration. Other sesquiterpenoids present in appreciable amount (more than 1% concentration) were α-cubebene, α-humulene, viridiflorene, α-selinene and spathulenol.

Bark and Wood Oils of C. sintok

The components of the bark oil of *C. sintok* were similar to that of the wood oil *(Fig. 2)* but the concentration of each component was different (Table 2). The major component of the oils was the non-terpene, eugenol, which made up 87.5% of the bark oil and 72.6% of the wood oil respectively. At 1.63% yield,

TABLE 2
Chemical constituents of the bark and wood oils of *Cinnamomum sintok*

Peak No.	Compound	Kovats (SE 30)	Yields (%) Bark	Wood	Identification
1	(E)-β-ocimene	1030	0.23	0.15	a,b
2	linalool	1090	3.06	4.41	a,b,c
3	terpinen-4-ol	1160	0.10	0.17	a,b,c
4	α-terpineol	1172	4.10	6.18	a,b,c
5	$C_{10}H_{18}O$	1205	trace	0.30	a
6	safrole	1266	trace	0.80	a,b,c
7	$C_{10}H_{16}O$	1276	trace	0.45	a
8	eugenol	1333	87.45	72.59	a,b,c
9	α-copaene	1366	trace	0.47	a,b,c
10	iso-eugenol[i]	1374	0.21	0.68	a,b,c
11	β-caryophyllene	1405	0.57	0.47	a,b,c
12	aromadendrene	1425	0.10	0.40	a,b,c
13	alloaromadendrene	1446	0.23	0.48	a,b,c
14	α-cadinene	1469	0.72	2.00	a,b
15	β-selinene	1482	0.75	0.30	a,b
16	viridiflorene	1485	0.20	0.42	a,b
17	α-selinene	1496	0.14	0.77	a,b
18	γ-cadinene	1506	0.53	0.63	a,b
19	nerolidol	1548	0.15	0.50	a,b,c
20	palustrol[t]	1556	trace	0.25	a
21	spathulenol	1564	0.10	0.61	a,b
22	cedrol	1573	0.15	0.53	a,b
23	guaiol	1588	0.23	0.59	a,b
24	$C_{15}H_{26}O$	1594	0.10	2.23	a
25	$C_{15}H_{26}O$	1614	0.16	0.75	a
26	τ-cadinol	1622	0.51	0.86	a,b,c
27	α-cadinol	1642	0.20	0.42	a,b,c

See Table 1 for legends.
Kovats indices of compounds on PEG 20 were also determined.

the bark oil could be a natural source of eugenol which is used in perfumery and as an analgesic in dentistry. The other non-terpenes were safrole and isoeugenol which were each present at less than 1% concentration in both oils.

Monoterpenoids and sesquiterpenoids were minor constituents and constituted 7.5% and 4.7% of the bark oil respectively, and 11.7% and 13.3% of the wood oil respectively. The main monoterpenoids were linalool and α-terpineol, which were present at more than 3% concentration each in both oils. Except for α-cadinene and a sesquiterpene which were present at 2.0% and 2.2% concentrations respectively in the wood oil, none of the sesquiterpenoids exceeded 1% in concentration.

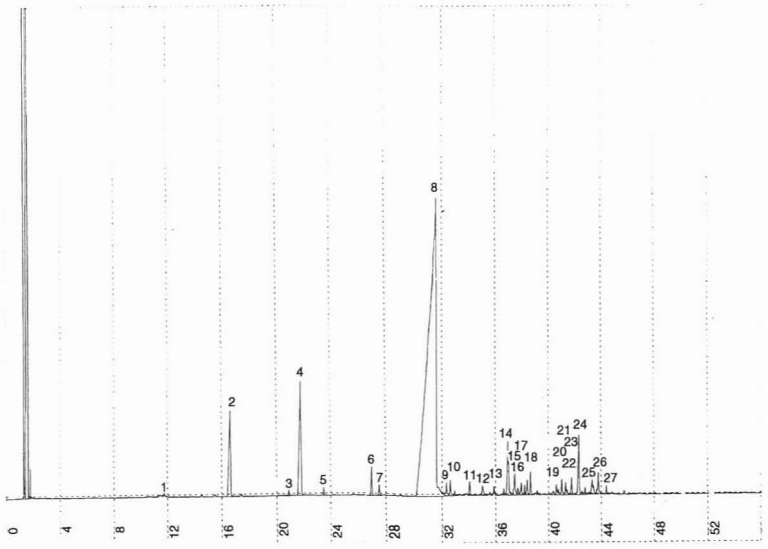

Fig. 2. Gas chromatogram obtained with capillary SE 30 column for the wood oil of Cinnamomum sintok*; for identity of peaks, see Table 2*

CONCLUSION

The quantitative and qualitative analyses of the components in the leaf, bark and wood oils of *Cinnamomum sintok* indicated that this species can be a natural source of eugenol which is a commercially important aromatic chemical. The distribution and accumulation of the components in different parts of the plant may contribute to the identification of this *Cinnamomum* species.However, chemical constituents of several specimens of *C. sintok* collected from different localities should be studied to determine the degree of intra-specific variation.

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REFERENCES

BURKILL, I.H. 1966 . *A Dictionary of Economic Products of the Malay Peninsula.* 2 vols. London: Crown Agents for the Colonies.

GILDEMEISTER, E. and F. HOFFMAN. 1922. *The Volatile Oils.* London: Longman, Green.

GUENTHER, E. 1975. *The Essential Oils.* Volume V. Huntington N. Y.: Robert E. Krieger.

IBRAHIM, J. and S.H. GOH. 1992. The essential oils of *Cinnamomum* species from Peninsular Malaysia. *J. Essential Oils Res.* **4**: 161-171.

KOCHUMMEN, K.M. 1989. Family Lauraceae. *Tree Flora* **4**: 124-132.

KOVATS, E. 1965. Kovats indices. *Adv. Chromatogr.* **1**: 229-231.