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Chemical composition of the wood essential oil of *Tectona grandis*

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Abstract
The wood essential oil of *Tectona grandis* was obtained from cultivated trees growing in Guanacaste, Costa Rica. The essential oil was analyzed by gas chromatography – mass spectrometry and was dominated by oxygenated sesquiterpenoids: α-Cadinol (25.5%), τ-muurolol (11.8%), cedrol (10.1%), α-muurolol (8.8%), and τ-cadinol (8.7%). Unfortunately, the essential oil yield was very low, only 0.04%.

Keywords: Teak, teca, cadinol, muurolol, cedrol

1. Introduction

Tectona grandis L. f. (Lamiaceae), teak, *teca*, is an important timber tree, producing one of the strongest and most durable timbers. The wood is highly rot and termite resistant and is prized for use in boat building, manufacture of furniture, and indoor counter tops and flooring [1]. The tree is native to south and Southeast Asia, including India, Thailand, Laos, and Myanmar [2, 3], but has been cultivated in tropical regions including Indonesia, tropical Africa, and the Neotropics [4-6].

The wood is known to contain oils that make it termite and pest resistant [7–9]. The heartwood extracts have been the source of several biologically active naphthoquinones and anthraquinones [10, 12]. Several norlignans [13], terpenoids [14], as well as naphthoquinones and anthraquinones [15, 18] have been isolated and characterized from the leaves of *T. grandis*. The leaf essential oil from Ibadan, Nigeria, was composed largely of linalool (8.7%), β-eudesmol (8.5%), (*E*)-β-ionone (7.8%), mesitylene (6.0%), and (*E*)-geranyl acetone (5.1%) [19]. The wood waste from *T. grandis* has been investigated in terms of added value; *T. grandis* sawdust has been used to prepare activated carbon [20]. Because it is a member of the Lamiaceae, it was hoped that the wood might produce a fragrant essential oil that would serve as a value-added commodity to teak production.

2. Materials and Methods

2.1 Essential Oil

A 500-g sample of *Tectona grandis* wood shavings, obtained from the workshop of Leonardo Vargas Garcia, La Cruz, Abangares, Guanacaste, Costa Rica, was hydrodistilled using a Mountain Home Biological SL-SS 20-L stainless steel essential oil distiller to give the essential oil in 0.04% (v/w) yield.

2.2 Gas Chromatography – Mass Spectrometry

The wood essential oil of *T. grandis* was analyzed by gas chromatography-mass spectrometry (GC-MS) as previously described [21]: Shimadzu GCMS-QP2010 Ultra operated in the electron impact (EI) mode (electron energy = 70 eV), scan range = 40–400 atomic mass units, scan rate = 3.0 scans/s, and GC-MS solution software v. 4.20. The GC column was a ZB-5 fused silica capillary column (30 m length × 0.25 mm internal diameter) with a (5% phenyl)-polymethylsiloxane stationary phase and a film thickness of 0.25 µm. The carrier gas was helium with a column head pressure of 552 kPa and flow rate of 1.37 mL/min. The injector temperature was 260 °C and the ion source temperature was 260 °C. The GC oven temperature program was programmed for 50 °C initial temperature, temperature increased at a rate of 2 °C/min to 260 °C. A 5% *w/v* solution of the sample in CH_2Cl_2 was prepared and 0.1 µL was injected with a splitting mode (30:1). Identification of the essential oil components was based on their retention indices (RI) and their mass spectral fragmentation patterns with those in the literature [22] and stored in our own in-house library [23].

3. Results and Discussion

The wood essential oil of *T. grandis* was obtained by hydrodistillation of wood shavings to give a yellow essential oil with a leather/woody fragrance, but in very low (0.04%) yield. The essential oil was dominated by sesquiterpenoids with α-cadinol (25.5%), τ-muurolol (11.8%), and cedrol (10.1%) as the major components (Table 1).

Table 1: Chemical composition of the wood essential oil of *Tectona grandis*

RI	Compound	%
1374	α-Ylangene	1.9
1428	β-Gurjunene	5.5
1479	*ar*-Curcumene	2.9
1585	Globulol	4.8
1593	Viridiflorol	3.5
1603	Ledol	5.0
1608	Cedrol	10.1
1626	1-*epi*-Cubenol	5.8
1641	τ-Cadinol	8.7
1643	τ-Muurolol	11.8
1645	α-Muurolol (= δ-Cadinol)	8.8
1654	α-Cadinol	25.5
1658	Selin-11-en-4α-ol	5.7

4. Conclusions

Although the fragrance and sesquiterpenoid profile of *Tectona grandis* wood essential oil are interesting, the very low yield precludes it potential benefit as a commercially viable product.

5. Acknowledgments

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