



The effect of physical factors on chemical composition of the essential oil of *Cinnamomum tamala* leaves

Shahnaz Sultana, M.Ali*, S.H.Ansari, Priyanka Bagri
Department of Pharmacognosy and Phytochemistry, Faculty of Pharmacy,
Jamia Hamdard (Hamdard University), New Delhi-110062, (INDIA)
Tel: +91-9968281082; Fax: +91-26059663
E-mail: mali_chem@yahoo.co.in

Received: 31st January, 2008; Accepted: 5th February, 2008

ABSTRACT

The essential oil of the fresh leaves of *Cinnamomum tamala* Nees et Eberm (Lauraceae) of Delhi region was composed predominantly of eugenol (74.4%), isoeugenol (21.1%), acetyl eugenol, β -elemene and ethyl cinnamate. Heating of the oil at 110°C for 24 hours showed percentage variation slightly. When the oil was exposed to the sunlight for 48 hours isoeugenol (59.4%) was the main constituent while the concentration of eugenol is decreased to 36.7%. Silica gel treated oil showed percentage variation slightly. Treatment of the oil with UV light for 24 hours and alumina neutral increased the concentration of eugenol to 95.4 and 96.4%, respectively.

© 2008 Trade Science Inc. - INDIA

KEYWORDS

Cinnamomum tamala;
Lauraceae;
Physical factors;
Chemical composition
variations.

INTRODUCTION

Cinnamomum tamala Nees et Eberm (Lauraceae), a medium sized evergreen tree up to 1.4 m girth and 7.5 m height, is distributed in tropical and sub-tropical Himalayas, Khasi and Jaintia hills in Meghalaya, Sikkim, Assam and Mizoram and cultivated in Tripura^[1]. The oil possesses strong carminative, stimulant, diuretic, diaphoretic, deobstruent and lactagogue properties^[2]. Due to high content of eugenol and cinammic aldehyde, it is an important flavoring agent. The oil has wider applications in perfumery, cosmetics, chemicals and other industries. It can be used as an economic substitute for oil of pure cinnamon bark^[3]. The oil can be utilized in anorexia, bladder disorder, dryness of the mouth, coryza, diarrhoea, nausea and spermatorrhea^[4]. The major components of the leaf oil are eugenol, pinene, limonene, caryophyllene, camphene, trans-sabinene

hydrate, β -ocimene and germacrene A^[5-6]. The essential oil of the leaves possessed strong antimicrobial^[7-8], antiseptic and disinfectant properties^[9]. The present paper describes the effect of different physical factors on the content and chemical composition of the oil.

EXPERIMENTAL

Plant material

The dried leaves of *Cinnamomum tamala* were purchased from the local market of Ghonda Maujpur, Delhi. The plant material was identified by Dr. M.P.Sharma, Taxonomist, Department of Botany, Jamia Hamdard. A voucher specimen is preserved in the herbarium of the Department of Pharmacognosy and Phytochemistry, Faculty of Pharmacy, Jamia Hamdard.

Isolation of the volatile oil

Full Paper

The leaves (2 kg) of *C. tamala* were hydrodistilled in all glass Clevenger apparatus according to the method recommended in the British Pharmacopoeia, 1988. The colorless volatile oil was dried over anhydrous sulphate and stored at 4°C in the dark. The yield was 2.31% based on the weight of the plant material.

Thermal effect on the volatile oil

The volatile oil (3 ml) of *C. tamala* was heated in a sealed vial at 110°C in an electric hot oven for 24 hours. After cooling the oil was stored in the dark at 4°C.

Sunlight effect on the volatile oil

The volatile oil (3 ml) of *C. tamala* was exposed to sunlight for 48 hours at 15°C in a glass vial. After exposure, it was stored in the dark at 4°C.

Ultraviolet light effect on volatile oil

The volatile oil (3 ml) of *C. tamala* was exposed in ultraviolet light for 24 hours at 12°C in a glass. After exposure, the oil it was stored in the dark at 4°C.

Treatment of the volatile oil with silica gel-G

The volatile oil (3 ml) of *C. tamala* was treated with silica gel-G in a sealed vial for 24 hours at 12°C. It was dissolved in solvent ether, filtered and the solvent evaporated under reduced pressure on a hot steam bath. The treated volatile oil was stored in the dark at 4°C.

Treatment of the volatile oil with alumina neutral

The volatile oil (3 ml) of *C. tamala* was treated with alumina neutral in a sealed glass vial for 24 hours at 12°C. It was dissolved in solvent ether, filtered and the solvent evaporated under reduced pressure on a hot steam bath. The treated volatile oil was stored in the dark at 4°C.

GC analysis

Analytical GC was carried on a Varian 3300 gas chromatography fitted with a silicon DB-1 capillary column (30 m×0.25 mm), film thickness 0.25 µm; carrier gas nitrogen, flow rate 1.5 ml/min, split mode, temperature programmed 80°C-225°C at 4°C/min. Injector temperature 250°C, detector used FID, detector temperature 300°C. Injection volume for all samples was 0.1 µl.

GC-MS analysis

GC-MS analysis were carried out on a QP-2000 instrument fitted with a fused silica column Ulbon HR-1 (25 m×0.22 mm), film thickness 0.22 µm and FID, carrier gas He, flow rate 1.5ml/min. The initial temperature was 100°C for six minutes and then heated at a rate of 10°C per minute to 250°C. The chromatograph was coupled to a HP 5971 A mass selective detector (70eV).

Identification of constituents

The most constituents were identified by GC by comparing their retention indices with those of authentic standards available in the laboratory which were in close agreement with reference. Further identification was achieved by GC/MS. The fragmentation patterns of mass spectra were compared with those stored in the spectrometer data base using the NBS 54 KL and Wiley L-built libraries and with those reported in the literature^[10-16].

RESULTS AND DISCUSSION

The oil was characterized by high amount of aromatic components (97.4%). The predominant constituents were eugenol (74.4%) and isoeugenol (21.1%). The other aromatic components present in the volatile oil were acetyl eugenol (1.2%) and ethyl cinnamate (0.7%). There were two monoterpene hydrocarbons, α -thujene and α -pinene, present in trace amounts. Among five sesquiterpenes (2.1%), β -elemene (1.1%) and β -caryophyllene (0.2%) were the hydrocarbons. There were two sesquiterpene alcohols and one sesquiterpene oxide, all occurring in trace amounts. All the components were positively identified. The oil was devoid of aliphatic constituents.

A comparative variation of the volatile oil components of the dried leaves of *C. tamala* after different treatments is summarized in TABLE 1. α -Pinene, eugenol, β -elemene, ethyl cinnamate and caryophyllene oxide were detected in all the oil samples. α -Thujene was only detected in normal cinnamomum oil in trace amount. The percentage composition of α -pinene varies from 0.1 to 0.3%. Except UV light exposed and alumina treated samples, linalool was detected in all other samples from 0.3% yield in the normal oil to 0.8% yield in the heated oil sample. Cinnamic aldehyde was char-

TABLE 1: Comparative variation of the volatile oil of the leaves of *C tamala* after different treatments

S.no.	Components	Retention Indices	A %	B%	C %	D %	E %	F %
1	α - Thujene	922	0.1	-	-	-	-	-
2	α - Pinene	925	0.2	0.3	0.2	0.1	0.3	0.1
3	Linalool	1086	0.3	0.8	0.5	-	0.5	-
4	Cinnamic aldehyde	1210	-	-	-	-	-	1.2
5	Isoeugenol	1317	21.1	15.9	59.4	-	32.7	-
6	Eugenol	1324	74.4	80.1	36.7	95.4	63.0	96.4
7	β -Elemene	1380	1.1	1.0	0.9	0.8	1.4	1.4
8	Ethyl cinnamate	1390	0.7	0.7	0.8	0.6	0.8	0.4
9	β -Caryophyllene	1403	0.2	-	0.2	0.1	0.3	0.3
10	Acetyl eugenol	1430	1.2	0.6	0.8	2.1	-	-
11	Caryophyllene oxide	1520	0.2	0.6	0.5	0.1	0.7	0.2
12	Spathulenol	1544	0.4	-	-	0.8	0.5	-
13	Ledol	1580	0.2	-	-	-	-	-

A =Volatile oil without treatment (Normal); B= Volatile oil heated at 110 °C for 24 hours; C= Volatile oil exposed to sun light for 48 hours; D= Volatile oil exposed to UV light for 24 hours; E= Volatile oil treated with silica gel for 24 hours; F= Volatile oil treated with alumina neutral for 24 hours

acterized in the oil sample treated with alumina neutral in 1.2% yield. Isoeugenol was detected in all the oil samples, except UV light exposed and alumina treated samples, from 15.9 to 59.4% yield. The percentage concentration of eugenol was detected minimum in the sunlight exposed sample (36.7%) and maximum in the alumina treated sample (96.4%). The level of β -elemene differed slightly from 0.8% in the UV light exposed sample to 1.4% in the alumina and silica gel treated samples. The concentration of ethyl cinnamate also varied slightly from 0.4% in the alumina treated sample to 0.8% in the sunlight exposed sample. Except the heated oil sample, β -caryophyllene was identified in all the volatile oil samples from 0.1 to 0.3 yields. Acetyl eugenol was present in all oil samples except silica gel and alumina treated sample from 0.6% yield in the heated oil to 2.1% in the UV light exposed sample. The percentage composition of caryophyllene oxide differed from 0.1% in the UV light exposed sample to 0.7% in the silica gel treated sample. Spathulenol was only detected in the normal (0.4%), UV-light exposed (0.8%) and silica gel treated (0.5%) samples. Ledol was identified in the normal oil in 0.2% and it disappeared in all other oil samples. From this study it was concluded that α -pinene, eugenol, β -elemene, ethyl cinnamate and caryophyllene oxide were not affected by different types of treatments carried out. α -Thujene and ledol were transformed to other components, most probably into cinnamic aldehydes and eugenol.

ACKNOWLEDGMENTS

The authors are thankful to the Director, Regional Research Laboratory (CSIR), Jammu Tawi for recording GLC and GC/MS data of the volatile oil.

REFERENCES

- [1] Anonymous; 'The Wealth of India', New Delhi, Raw Materials, Publication and Information Directorate, CSIR, **2**, 580-581 (1992).
- [2] S.R.Sharma, S.K.Dwivedi, D.Swarup; Ind.J.Exp. Bio., **34(4)**, 372 (1996).
- [3] B.C.Gulati, S.G.Aggarwal, R.K.Thappa, K.L.Dhar; Ind.Perfumer, **21(1)**, 15-20 (1997).
- [4] K.R.Kirtikar, B.D.Basu; 'Indian Medicinal Plants', LMB Prakashan, Allahabad, India, 2147 (2000).
- [5] B.C.Gulati; 'Essential oils of Cinnamomum species', In Cultivation and Utilization of Aromatic Plants, Atal CK, Kapoor BM (eds); RRL, CSIR Jammu, 616 (1982).
- [6] S.R.Mir, M.Ali, K.Reni; Flavour Frags.J., **19**, 112-114 (2004).
- [7] J.B.Girgune, B.D.Garg; Ind.Drugs., **10**, 24 (1978).
- [8] P.Yadav, N.K.Dubey; Ind.J.Pharm.Sci., **56(6)**, 227 (1994).
- [9] M.De, A.Krishna, A.B.Banerjee; Phytother. Res., **13(7)**, 616-618 (1999).
- [10] R.P.Adams; 'Identification of essential oil components by gas chromatography/mass spectrometry'. Allured Publication Corp., Carol Stream, Illinois, (1995).

Full Paper

- [11] M.Ali; 'Techniques in terpenoids identification'. Birla Publications (Regd.), Delhi, (2001).
- [12] N.H.Andersen, C.H.Falcone; (1969); J. Chromatogr., 44, 52 (1969).
- [13] W.Jennings, T.Shibamoto; 'Qualitative Analysis of Flavour and Fragrance Volatiles by Capillary Gas Chromatography', Academic Press, New York, (1980).
- [14] L.M.Libey; J.Essent.Oil.Res., 3, 193-194 (1991).
- [15] G.Vermin, N.Petitjean; In: 'The chemistry of heterocyclic flavoring and aroma compounds', Ellis Horwood, Chichester., 305 (1982).
- [16] A.A.Swiger, R.M.Silverstein; Monoterpenes, Aldrich Chemicals Co., Milwaukee, WI, (1981).