Essential Oil Composition of *Eucalyptus camaldulensis* and *E. tereticornis* grown in Bangladesh

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Abstract

Essential oil constituents of *Eucalyptus camaldulensis* and *E. tereticornis* were studied for their comparison. Essential oil of *E. tereticornis*, contains 46 compounds of which 1,8-cineole (39.7%) is the major constituents followed by terpinyl citronellol (7.9%), cyclohexanol (7.8%) and thujene (6.1%). The essential oil of *E. camaldulensis* contains 27 compounds containing p-cymene (34.0%) and a-phellandrene (23.0%) as major constituents followed by 1,8-cineole (7.3%) and a-pinene (6.5%).

সারসংক্ষেপ

Eucalyptus camaldulensis ও *E. tereticornis* এর উদ্বায়ী তৈলের রাসায়নিক উপাদান সনাক্ত করা হয়েছে। *E. tereticornis* এর উদ্বায়ী তৈলে মোট ৪৬টি উপাদান আছে, তার মধ্যে প্রধানগুলো হল 1,8-cineole (৩৯.৭%), citronellol (৭.৯%), cyclohexanol (৭.৮%) ও thujene (৬.১%)। *E. camaldulensis* এর তৈলে ২৭টি উপাদানের মধ্যে প্রধানগুলো হল p-cymene (৩৪.০%), α-phellandrene (২৩.০%), 1, 8-cineole (৭.৩%) ও a-pinene (৬.৫%)।

Key words : *Eucalyptus camaldulensis, E. tereticornis,* essential oil constituents, 1, 8-cineole, p-cymene, a-phellandrene.

Introduction

Eucalyptus camaldulensis and *E. tereticornis* introduced in Bangladesh originating from Australia were among the recognized (Davidson and Das 1985) fast growing species. These are widely grown species in Bangladesh. Their fast growth characteristics have bought manifold uses, as paper pulp and firewood. Their leaf oil can also be used in different way (Atal and Kapur 1982). In this paper chemical constituents of essential oil of closely related *E. camaldulensis* and *E. tereticornis* have been presented.

E. camaldulensis oil reported to contain p-cymene and phellandrene as major constituents and *E. tereticornis* contains cineole as major constituents (Penfold and Morrison 1950). Pouline *et al.* (1997) reported that *E. camaldulensis* from Kenya. Conteing more than 70% cineole. Samate *et al.* (1998) reported the presence of a-phellandrene (24.8%), 1,8-cineole (19.3%), a-pinene (12.8%) and g-terpinene (11.8%). Singh *et al.* (1983) reported from India that *E. camaldulensis* give high yield of cineole (60.38%) as compared to the plant grown in Tarai region of India, which showed a much lower cineole content (20.65%). Both the plants

have got closely similar morphological characters (Penfold and Morrison 1950). This work was undertaken as a screening program on essential oil bearing plants grown in Bangladesh for their flavour constituents.

Materials and Methods

The leaves of *E. tereticornis* were collected from the campus of BCSIR Laboratories, Chittagong and that of *E. camaldulensis* from the campus of Bangladesh Forest Research Institute, Chittagong during August, 2004.

Isolation of the oil :

The oils were isolated from the fresh leaves by hydrodistillation in a Clevenger apparatus for a period of 4 hrs. The oil contents in *E. camaldulensis* and E. *tereticornis* were found 0.42 and 0.91% respectively on volume by fresh weight basis. The dehydrated oils were analyzed by GC and GC/MS.

GC Analysis :

We used a Fisions chromatograph 5160 Mega Series equipped with a Shimadzu data processor C-R 3A. The following GC parameters were used.

Column : SE-52 fused silica column (25 m x 0.32 mm, film thickness 0.40-0.45 mm, Mega, Legnano, Italy).

Column temperature : 40°C (6 min) to 240°C at 3.0°C/min.

Injector temperature : 250°C.

Detector temperature : 280°C

Injection mode : Split; split ratio, 1:50.

Volume injected : 1ml of a solution 1/20 in pentane of the oil.

Carrier gas : He, 100 kPa.

GC-MS Analysis :

We used a CE Instrument MD 800 equipped with Adams library (Adams 1995), FFC bank (Mondello *et al.* 1995) and NIST library. The following parameters were used.

Column : DB-5 fused silica column (30 m x 0.25 mm, film thickness 0.25 mm, J and W, Folston, California, USA);

Column temperature: 60-240°C at 3°C/min to 250°C; injection mode, split; split ratio, 1:50.

Volume injected : 1ml of a solution 1/20 in pentane of the oil.

Carrier gas : He, 83 kPa.

Linear velocity : 40 cm/sec at 60°C, EI+ acquisition with mass range of 41-300 amu.

Results and Discussion

Table-1 shows chemical constituents of the essential oils of *E. camaldulensis* and *E. tereticornis* grown in Bangladesh. It is observed that *E. camaldulensis* contains 27 compounds of which p-cymene (34.0%) and a -phellandrene (23.0%) are the major components, followed by 1,8-cineole (7.3%), a-pinene (6.5%) and limonene (5.8%). Other notable components are g-terpinene (4.4%), terpinen-4-ol (2.2%), piperitone (2.1%) and terpinolene (1.2%). The oil of *E. tereticornis* reported to contain 1,8-cineole (39.7%) as major constituents followed by citronellol (7.9%), cyclohexanol (7.8%) and thujene (6.1%) out of 46 compounds.

On the basis of their morphological characters and chemical constituents compared with the literature (Penfold and Morrison 1950, Penfold and Willis 1961) we have confirmed their identification. From the result it can be concluded that *E. camaldulensis* and *E. tereticornis* oil can be used as sources of p-cymene and 1,8-cineole respectively useful as perfumery raw materials and disinfectants.

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Table 1. Constituents of *Eucalyptus camaldulensis* and *E. tereticornis* leaf oils.

No	Name of the Compounds	% Content	
		E. camaldulensis	*E. tereticornis*
1.	Alloocimene	-	0.09
2.	1(10)-Aristolene	-	0.26
3.	Aristolone	-	0.08
4.	Aromadendrene	-	1.12
5.	Butanoic acid, 3-methyl,3-methyl-3-butenyl ester	-	2.5
6.	Butanoic acid, 3-methyl,3-methylbutyl ester	-	0.26
7.	4-Carene	-	5.41
8.	Carvacrol	0.47	0.12
9.	Carvotanacetone	-	0.28
10.	Caryophyllene	-	0.18
11.	1,8-Cineole	7.28	39.69
12.	Citronellal	-	7.87
13.	Citronellol	-	0.14
14.	Cuminyl alcohol	-	0.21
15.	Cyclohexanol,1,3,3-trimethyl-2-(3-methyl-2-methylene -3-butenylidene)	-	7.85
16.	Cyclopentane,1-methyl-3-(1-methylethyl)	-	0.37
17.	m-Cymene	-	0.43
18.	p-Cymene	34.01	-
19.	Dihydroeudesmol	-	0.0
20.	2,5-Dimethyl-styrene	0.12	-
21.	Geranial (citral-b)	-	0.27
22.	a-Eudesmol	0.32	-
23.	b-Eudesmol	0.33	0.06
24.	g-Eudesmol	0.27	-
25.	Geraniol	-	0.06

Table 1. Contd.

No	Name of the Compounds	% Content	
		E. camaldulensis	*E. tereticornis*
26.	Globulol	0.41	-
27.	Guaiol	-	0.13
28.	b-Guajene	-	0.18
29.	a-Gurjunene	-	0.50
30.	g-Gurjunene	-	0.94
31.	3-Hexen-1-ol	-	0.14
32.	3-Hexen-2-one,3,4-dimethyl(E)	-	0.30
33.	Isoamyl alcohol	-	0.23
34.	Isopentyl isovalerate	0.42	-
35.	Isopulegol	-	0.27
36.	Ledene	-	0.9
37.	Limonene	5.81	-
38.	Linalool	0.15	-
39.	Longifolene	0.17	-
40.	cis-p-Menth-2-en-1-ol	0.19	-
41.	trans-p-Menth-2-en-1-ol	0.27	-
42.	3-Methyl-3-butenyl ester	-	2.5
43.	Myrcene	0.80	0.54
44.	Neral (Citral-a)	-	1.43
45.	Palustrol	-	0.08
46.	Pentanoic acid	-	0.89
47.	a-Phellandrene	23.08	-
48.	Phenylethyl-3-methyl-butanoate	0.16	-
49.	a-Pinene	6.48	-
50.	b-Pinene	0.09	0.14

Table 1. Contd.

No	Name of the Compounds	% Content	
		E. camaldulensis	*E. tereticornis*
51.	trans-Pinocarveol	-	0.09
52.	trans-Piperitol	0.14	-
53.	Piperitone	2.11	0.28
54.	Safrole	-	0.15
55.	a-Terpene	-	0.43
56.	Terpinen-4-ol	2.16	-
57.	a-Terpinene	1.42	-
58.	g-Terpinene	4.45	
59.	4-Terpinenyl acetate	-	2.54
60.	a-Terpineol	0.51	1.45
61.	Terpinolene	1.22	-
62.	a-Thujene	0.22	6.65
63.	Thujenol	-	0.12
64.	Thujenyl acetate	-	0.13
65.	Thymol	-	0.12