



Essential Oil Constituents of Two African Olibanums Available in Isfahan Commercial Market

Suleiman Afsharypuor*, Marzieh Rahmany

Faculty of Pharmacy and Pharmaceutical Sciences,
Isfahan University of Medical Sciences, Isfahan, Iran

Abstract

The composition of the essential oils of two African (“white” and “yellow”) olibanums available in the commercial market of Isfahan (Iran) was analyzed by gas chromatography (GC) and GC-mass spectroscopy methods. The main constituents of the “White” olibanum oil were *alpha*-pinene (34.8%), limonene (15.9%), *alpha*-thujene (9.0%), *para*-cymene (7.0%), myrcene (6.2%) and sabinene (6.0%). Major components of the “yellow” olibanum oil were *alpha*-pinene (48.0%), limonene (21.7%), myrcene (4.9%), *beta*-caryophyllene (4.9%) and *para*-cymene (3.5%).

Keywords: African olibanums; *alpha*-Pinene; Limonene; Volatile oil; “White” and “yellow” olibanums.

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1. Introduction

Olibanum, or frankincense, is an oleo-gum-resin that has been collected since ancient times from barks of *Boswellia carterii*, *B. frereana* and other species of *Boswellia* (Burseraceae), small trees indigenous to north-eastern Africa and Arabia [1, 2]. This drug occurs in more or less ovoid tears, 5-25 mm long, which are sometimes stuck together. The surface is dusty and of a yellowish, bluish-white or greenish-white tint. Olibanum is used in incense and fumigating preparations [2, 3]. Its powdered form is used in toothache [3].

“White” and “yellow” olibanums are two varieties of African olibanums which are available in Isfahan commercial markets. In order to define the volatile terpenoid

composition of the above mentioned olibanums and get more pertinent criteria of identification, we decided to isolate their essential oils and analyze them by gas chromatography and GC-mass spectroscopy (MS) methods.

2. Materials and methods

2.1. Examined materials

“White” and “yellow” olibanums were obtained from a commercial market in Isfahan (Iran) in 2003. The samples were identified macroscopically and authenticated to be two African olibanums obtained from *Boswellia* species according to Hairfield et al method [1].

2.2. Oil preparation

Freshly powdered samples of the “white” and “yellow” olibanums were steam distilled

*Corresponding author: Suleiman Afsharypuor, Faculty of Pharmacy and Pharmaceutical Sciences, Isfahan University of Medical Sciences, Isfahan, Iran.

Table 1. Percentage composition of oil constituents of the “white” and “yellow” olibanums available in commercial markets of Isfahan.

Components	Retention indices	“White”olibanum oil (%)	“Yellow” olibanum%
<i>alpha</i> -thujene	933	9.0	1.5
<i>alpha</i> -pinene	940	34.8	48.0
camphene	953	0.7	0.6
verbenene	966	0.3	t*
sabinene	978	6.0	2.6
<i>beta</i> -pinene	981	1.3	0.8
myrcene	992	6.2	4.9
<i>alpha</i> -phellandrene	1007	1.4	2.6
<i>alpha</i> -terpinene	1019	0.2	t
<i>para</i> -cymene	1028	7.0	3.5
limonene	1033	15.9	21.7
1,8-cineole	1033	0.3	t
(<i>Z</i>)- <i>beta</i> -ocimene	1042	0.2	t
(<i>E</i>)- <i>beta</i> -ocimene	1051	0.1	t
<i>gamma</i> -terpinene	1063	0.3	0.2
<i>beta</i> -thujone	1115	0.3	t
<i>alpha</i> -campholenal	1126	0.3	t
<i>cis</i> -sabinol	1137	0.7	0.2
pinocarvone	1164	0.2	t
<i>alpha</i> -phelladren-8-ol	1167	0.5	0.3
terpinen-4-ol	1177	0.6	0.4
<i>para</i> -cymen-8-ol	1183	0.2	t
<i>alpha</i> -terpineol	1190	0.2	t
myrtenal	1194	0.3	t
verbenone	1205	0.4	t
<i>trans</i> -carveol	1219	0.2	t
carvone	1243	0.1	t
<i>alpha</i> -copaene	1378	0.8	0.7
<i>beta</i> -bourbonene	1384	0.2	t
<i>beta</i> -elemene	1392	0.5	1.2
<i>beta</i> -caryophyllene	1418	2.5	4.9
<i>alpha</i> -humulene	1456	0.6	0.6
alloaromadendrene	1462	0.2	t
germacrene-D	1482	0.4	0.6
<i>beta</i> -selinene	1485	0.4	0.6
valencene	1493	0.5	0.8
<i>alpha</i> -muurolene	1499	0.2	t
<i>gamma</i> -cadinene	1514	0.4	0.5
<i>delta</i> -cadinene	1524	0.7	1.4
caryophyllene oxide	1583	0.4	0.3
Grouped constituents:			
Monoterpene hydrocarbons		83.4	86.4
Oxygen-containing monoterpenes		4.3	0.9
Sesquiterpene hydrocarbons		7.4	11.3
Oxygen-containing sesquiterpenes		0.4	0.3
Total		95.5	98.9

*t: trace (less than 0.1%)

for 4 h. Pale yellow oils (4.0 % and 4.06 % v/w) were obtained which exhibited the following physical properties, respectively: d^{25} : 0.915; η^{25} : 1.4720 and d^{25} : 0.871; η^{25} : 1.4770.

2.3. GC analysis

Initially to check the separation of the components, samples were examined by capillary GC using a Perkin Elmer 8500 instrument. The column used was a BP1 capillary column (30 m x 0.25 mm; film thickness: 0.25 μ m). The carrier gas was nitrogen with a flow rate of 2 ml/min. The oven temperature was programmed from 60 to 275 $^{\circ}$ C at 4 $^{\circ}$ C/min. The injector and detector temperatures were 275 $^{\circ}$ C and 280 $^{\circ}$ C, respectively.

2.4. GC/MS analysis

Analysis of the volatile constituents was performed on a Hewlett Packard 6890 GC/MS instrument under the following conditions: injection of 0.1 μ l samples, HP-5 MS capillary column (30 m x 0.25 mm; film thickness 0.25 μ m); carrier gas He, flow rate 2 ml/min, the injector temperature 250 $^{\circ}$ C, temperature program: 60 to 275 $^{\circ}$ C at 4 $^{\circ}$ C/min; mass spectra: electronic impact, ionization potential 70 eV, ion source temperature 250 $^{\circ}$ C, ionization current 1000 μ A, resolution 1000, and mass range 30-300.

Identification of the constituents was based on computer matching against the library spectra (Library Database Wiley 275), their retention indices with reference to an *n*-alkane series in a temperature programmed run, interpreting their fragmentation pattern and comparison of the mass spectra with the literature data [4].

3. Results and discussion

Forty constituents in the oils of the "white" and "yellow" olibanums were identified which accounted for 95.5% and

98.9% of the total oils, respectively (Table 1). The volatile oils of both olibanums are predominantly monoterpenoid in nature (87.7% and 87.3%), with *alpha*-pinene (34.8% and 48.0%) being the major constituent. However, Verghese et al. [5] reported that the Indian olibanum oil contains higher proportions of *alpha*-thujene. Other major monoterpenoids identified in the examined "white" olibanum oil include limonene (15.9%), *alpha*-thujene (9.0%), *para*-cymene (7.0%), myrcene (6.2%) and sabinene (6.0%); while other major monoterpenoids identified in the oil of "yellow" olibanum were limonene (21.7%), myrcene (4.9%) and *para*-cymene (3.5%).

The predominance of monoterpenoids in the examined samples was in agreement with what was reported by Verghese et al. [5], Maupetit [6], and Kasali et al. [7].

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