

Date : May 04, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code** : 21D20-ORA07


**Customer identification** : Tea Tree - Australia - 3 years - 049695A

**Type** : Essential oil

**Source** : *Melaleuca alternifolia* ct. Terpinen-4-ol

**Customer** : Organic Aromas Inc.

ANALYSIS

**Method**: PC-MAT-014  - Analysis of the composition of an essential oil or other volatile liquid by FAST GC-FID (in French); identifications validated by GC-MS.

**Analyst** : Benoit Roger, Ph. D.

**Analysis date** : May 03, 2021

Checked and approved by :

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Alexis St-Gelais, M. Sc., chimiste 2013-174

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Clear liquid

**Refractive index:**  $1.4791 \pm 0.0003$  (20 °C; method PC-MAT-016)

*CONCLUSION*

No adulterant, contaminant or diluent has been detected using this method.

## ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

New readers of similar reports are encouraged to read table footnotes at least once.

Identification	%	Class
2-Methylbutyral	0.01	Aliphatic aldehyde
(3Z)-Hexenol	0.04	Aliphatic alcohol
$\alpha$ -Thujene	0.78	Monoterpene
$\alpha$ -Pinene	2.06	Monoterpene
Camphene	0.01	Monoterpene
$\beta$ -Pinene	0.62	Monoterpene
Sabinene	0.37	Monoterpene
Myrcene	0.64	Monoterpene
$\alpha$ -Phellandrene	0.46	Monoterpene
Pseudolimonene	0.01	Monoterpene
(3Z)-Hexenyl acetate	0.02	Aliphatic ester
$\alpha$ -Terpinene	8.36	Monoterpene
para-Cymene	1.90	Monoterpene
Limonene	0.84	Monoterpene
1,8-Cineole	2.89	Monoterpenic ether
(E)- $\beta$ -Ocimene	0.01	Monoterpene
$\gamma$ -Terpinene	18.14	Monoterpene
cis-Sabinene hydrate	0.08	Monoterpenic alcohol
para-Cymenene	0.02	Monoterpene
Terpinolene	3.38	Monoterpene
trans-Sabinene hydrate	0.10	Monoterpenic alcohol
Linalool	0.07	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.02	Monoterpene
cis-para-Menth-2-en-1-ol	0.22	Monoterpenic alcohol
Cosmene isomer I	0.01	Monoterpene
trans-Pinocarveol	0.07	Monoterpenic alcohol
trans-para-Menth-2-en-1-ol	0.12	Monoterpenic alcohol
$\delta$ -Terpineol	0.02	Monoterpenic alcohol
Terpinen-4-ol	42.30	Monoterpenic alcohol
Dill ether	0.01	Monoterpenic ether
para-Cymen-8-ol	0.07	Monoterpenic alcohol
$\alpha$ -Terpineol	2.34	Monoterpenic alcohol
cis-Piperitol	0.07	Monoterpenic alcohol
trans-Piperitol	0.13	Monoterpenic alcohol
exo-2-Hydroxycineole	0.02	Monoterpenic alcohol
Nerol	0.02	Monoterpenic alcohol
Unknown	0.02	Oxygenated monoterpene
Piperitone	0.05	Monoterpenic ketone
cis-Carvenone oxide?	0.02	Monoterpenic ketone
trans-Ascaridole glycol	0.10	Monoterpenic alcohol
cis-Ascaridole glycol	0.07	Monoterpenic alcohol
Unknown	0.10	Monoterpenic alcohol
Bicycloelemene	0.03	Sesquiterpene
$\alpha$ -Cubebene	0.09	Sesquiterpene
Unknown	0.03	Unknown

Isoledene	0.10	Sesquiterpene
$\alpha$ -Copaene	0.15	Sesquiterpene
7-Cubebene	0.10	Sesquiterpene
7-Cubebene epimer?	0.04	Aliphatic alcohol
$\beta$ -Cubebene	0.02	Sesquiterpene
$\beta$ -Elemene	0.05	Sesquiterpene
$\alpha$ -Gurjunene	0.51	Sesquiterpene
Methyleugenol	0.03	Phenylpropanoid
$\beta$ -Maaliene	0.02	Sesquiterpene
$\beta$ -Caryophyllene	0.67	Sesquiterpene
$\gamma$ -Maaliene	0.09	Sesquiterpene
$\beta$ -Gurjunene	0.03	Sesquiterpene
$\alpha$ -Maaliene	0.09	Sesquiterpene
Aromadendrene	1.69	Sesquiterpene
Selina-5,11-diene	0.20	Sesquiterpene
<i>trans</i> -Muurolo-3,5-diene	0.19	Sesquiterpene
$\alpha$ -Humulene	0.13	Sesquiterpene
allo-Aromadendrene	0.68	Sesquiterpene
Valerena-4,7(11)-diene	0.02	Sesquiterpene
$\gamma$ -Gurjunene	0.08	Sesquiterpene
Selina-4,11-diene	0.03	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.43	Sesquiterpene
$\gamma$ -Muurolole	0.05	Sesquiterpene
$\beta$ -Selinene	0.11	Sesquiterpene
allo-Aromadendr-9-ene	0.14	Sesquiterpene
<i>trans</i> -Muurolo-4(15),5-diene	0.11	Sesquiterpene
$\delta$ -Selinene	0.16	Sesquiterpene
Viridiflorene	1.29	Sesquiterpene
$\alpha$ -Selinene	0.11	Sesquiterpene
Bicyclogermacrene	0.92	Sesquiterpene
$\alpha$ -Muurolole	0.21	Sesquiterpene
$\gamma$ -Cadinene	0.04	Sesquiterpene
<i>trans</i> -Calamenene	0.07	Sesquiterpene
Zonarene	0.29	Sesquiterpene
$\delta$ -Cadinene	1.35	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.23	Sesquiterpene
$\alpha$ -Calacorene	0.01	Sesquiterpene
Epiglobulol	0.08	Sesquiterpenic alcohol
Maaliol	0.03	Sesquiterpenic alcohol
Unknown	0.02	Oxygenated sesquiterpene
Eudesma-5,7(11)-diene	0.04	Sesquiterpene
Spathulenol	0.09	Sesquiterpenic alcohol
Globulol	0.28	Sesquiterpenic alcohol
Gleenol	0.03	Sesquiterpenic alcohol
Viridiflorol	0.12	Sesquiterpenic alcohol
Cubeban-11-ol	0.10	Sesquiterpenic alcohol
Eudesm-5-en-11-ol analog	0.07	Sesquiterpenic alcohol
Ledol	0.01	Sesquiterpenic alcohol
Eudesm-5-en-11-ol	0.02	Sesquiterpenic alcohol
10-epi-Cubenol	0.02	Sesquiterpenic alcohol
Rosifoliol	0.10	Sesquiterpenic alcohol
1-epi-Cubenol	0.15	Sesquiterpenic alcohol

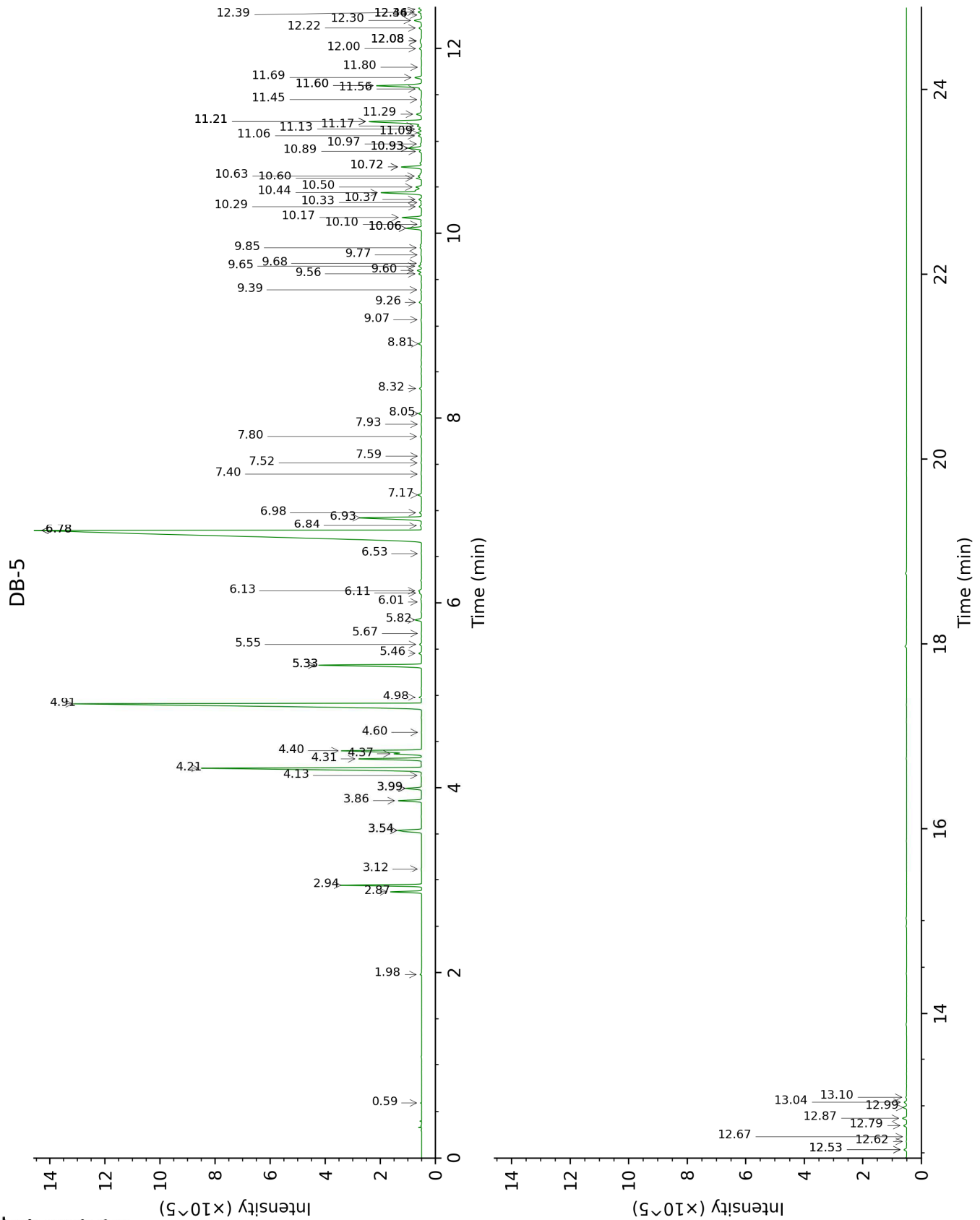
Isospathulenol	0.12	Sesquiterpenic alcohol
Cubenol	0.09	Sesquiterpenic alcohol
$\alpha$ -Muurolol	0.03	Sesquiterpenic alcohol
<b>Consolidated total</b>	<b>98.59%</b>	

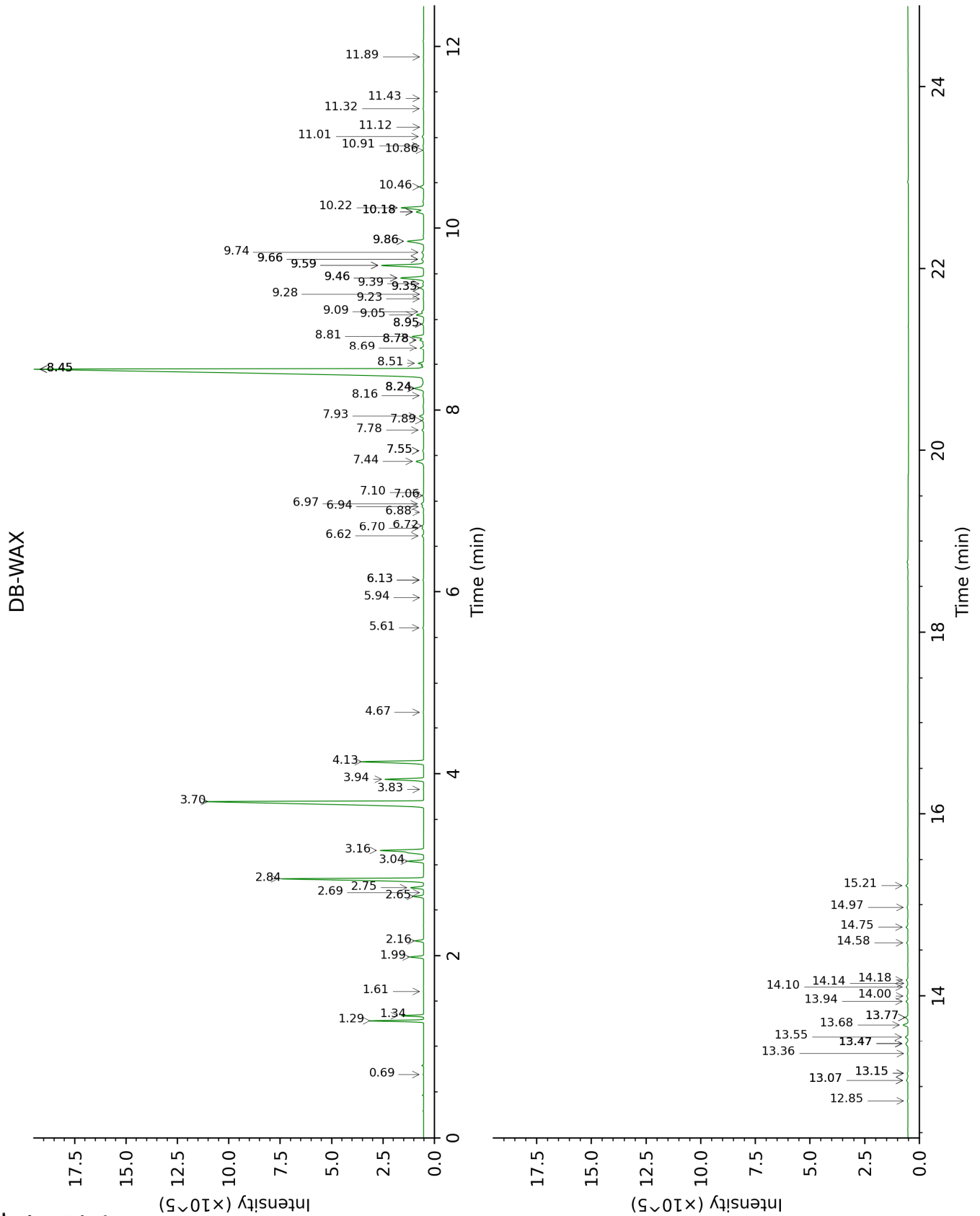
Note: no correction factor was applied

**About "consolidated" data:** The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm is set to prioritize data from the most standard DB-5 column, and smallest values so as to avoid overestimating individual content. This process is semi-automatic. Advanced users are invited to consult the "Full analysis data" table after the chromatograms in this report to access the full untreated data and perform their own calculations if needed.

**Unknowns:** Unknown compounds' mass spectral data is presented in the "Full analysis data" table. The occurrence of unknown compounds is to be expected in many samples, and does not denote particular problems unless noted otherwise in the conclusion.

This page was intentionally left blank. The following pages present the complete data of the analysis.







FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
2-Methylbutyral	0.59	650	0.01	0.69	881	0.01
(3Z)-Hexenol	1.98	856	0.04	5.61	1347	0.05
$\alpha$ -Thujene	2.87	927	0.78	1.34	1001	0.79
$\alpha$ -Pinene	2.94	932	2.06	1.29	992	2.07
Camphene	3.12	944	0.01	1.61	1028	0.01
$\beta$ -Pinene	3.54*	972	1.00	1.99	1066	0.62
Sabinene	3.54*	972	[1.00]	2.16	1084	0.37
Myrcene	3.86	994	0.64	2.74	1134	0.64
$\alpha$ -Phellandrene	3.99*	1003	0.47	2.65	1126	0.46
Pseudolimonene	3.99*	1003	[0.47]	2.69	1130	0.01
(3Z)-Hexenyl acetate	4.13	1012	0.02	4.67	1282	0.02
$\alpha$ -Terpinene	4.21	1017	8.36	2.84	1142	8.36
para-Cymene	4.31	1023	1.90	3.94	1228	1.91
Limonene	4.37	1027	0.84	3.04	1158	0.75
1,8-Cineole	4.40	1029	2.89	3.16	1167	2.99
(E)- $\beta$ -Ocimene	4.60	1041	0.01	3.83	1219	0.02
$\gamma$ -Terpinene	4.91	1061	18.14	3.70	1209	18.20
cis-Sabinene hydrate	4.98	1066	0.08	6.72	1429	0.07
para-Cymenene	5.33*	1088	3.41	6.13*	1385	0.03
Terpinolene	5.33*	1088	[3.41]	4.13	1242	3.38
trans-Sabinene hydrate	5.46	1096	0.10	7.78	1509	0.09
Linalool	5.55	1102	0.07	7.89	1517	0.07
para-Mentha-1,3,8-triene	5.67	1110	0.02	5.94	1371	0.02
cis-para-Menth-2-en-1-ol	5.82	1119	0.22	7.94	1521	0.25
Cosmene isomer I	6.01	1131	0.01	6.13*	1385	[0.03]
trans-Pinocarveol	6.11	1138	0.07	8.95*	1600	0.08
trans-para-Menth-2-en-1-ol	6.13	1139	0.12	8.78*	1586	0.20
$\delta$ -Terpineol	6.53	1165	0.02	9.28	1627	0.01
Terpinen-4-ol	6.78*	1181	42.30	8.45*	1561	44.44
Dill ether	6.78*	1181	[42.30]	7.10	1457	0.01
para-Cymen-8-ol	6.84	1184	0.07	11.32	1798	0.03
$\alpha$ -Terpineol	6.93	1190	2.34	9.59*	1653	2.47
cis-Piperitol	6.98	1194	0.07	9.35*	1632	0.21
trans-Piperitol	7.17	1206	0.13	10.18*	1701	0.46
exo-2-Hydroxycineole	7.40	1221	0.02	11.43	1808	0.02
Nerol	7.52	1229	0.02	10.86	1759	0.03
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.59	1234	0.02	11.12	1780	0.01
Piperitone	7.80	1248	0.05	9.66*	1658	0.15

<i>cis</i> -Carvenone oxide?	7.94	1257	0.02			
<i>trans</i> -Ascaridole glycol	8.05	1265	0.10	13.94	2039	0.10
<i>cis</i> -Ascaridole glycol	8.32	1283	0.07	14.58	2101	0.07
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.81	1317	0.10	14.75	2118	0.10
Bicycloelemene	9.07	1335	0.03	6.88	1441	0.02
$\alpha$ -Cubebene	9.26	1348	0.09	6.62	1421	0.10
Unknown [m/z 43, 95 (62), 107 (45), 110 (41), 55 (28), 67 (25)...]	9.39	1358	0.03	13.76*	2022	0.15
Isoledene	9.56	1370	0.10	6.70	1427	0.09
$\alpha$ -Copaene	9.60	1373	0.15	6.97	1448	0.15
7-Cubebene	9.65	1376	0.10	6.94	1446	0.09
7-Cubebene epimer?	9.68	1378	0.04	7.06	1455	0.04
$\beta$ -Cubebene	9.77	1385	0.02	7.56*	1492	0.06
$\beta$ -Elemene	9.84	1390	0.05	8.24*	1544	0.77
$\alpha$ -Gurjunene	10.06*	1405	0.55	7.44	1483	0.51
Methyleugenol	10.06*	1405	[0.55]	13.15*	1963	0.04
$\beta$ -Maaliene	10.10	1408	0.02	7.56*	1492	[0.06]
$\beta$ -Caryophyllene	10.17	1414	0.67	8.24*	1544	[0.77]
$\gamma$ -Maaliene	10.29	1422	0.09	8.24*	1544	[0.77]
$\beta$ -Gurjunene	10.33	1426	0.03	8.16	1538	0.05
$\alpha$ -Maaliene	10.37	1428	0.09	8.45*	1561	[44.44]
Aromadendrene	10.44	1434	1.69	8.45*	1561	[44.44]
Selina-5,11-diene	10.50	1438	0.20	8.51	1566	0.25
<i>trans</i> -Muuroala-3,5-diene	10.60	1445	0.19	8.69	1580	0.19
$\alpha$ -Humulene	10.63	1447	0.13	9.09	1611	0.10
allo-Aromadendrene	10.72*	1455	0.70	8.81	1589	0.68
Valerena-4,7(11)-diene	10.72*	1455	[0.70]	8.78*	1586	[0.20]
$\gamma$ -Gurjunene	10.89	1467	0.08	8.95*	1600	[0.08]
Selina-4,11-diene	10.93*	1470	0.50	9.23	1623	0.03
<i>trans</i> -Cadina-1(6),4-diene	10.93*	1470	[0.50]	9.05	1608	0.43
$\gamma$ -Muurolene	10.97	1473	0.05	9.39	1636	0.04
$\beta$ -Selinene	11.06	1480	0.11	9.66*	1658	[0.15]
allo-Aromadendr-9-ene	11.09	1482	0.14	9.35*	1632	[0.21]
<i>trans</i> -Muuroala-4(15),5-diene	11.13	1485	0.11	9.59*	1653	[2.47]
$\delta$ -Selinene	11.17	1488	0.16	9.46*	1641	1.45
Viridiflorene	11.21*	1491	2.33	9.46*	1641	[1.45]
$\alpha$ -Selinene	11.21*	1491	[2.33]	9.74	1664	0.11

Bicyclogermacrene	11.21*	1491	[2.33]	9.86*	1674	1.13
α-Muurolene	11.29	1497	0.21	9.86*	1674	[1.13]
γ-Cadinene	11.45	1509	0.04	10.18*	1701	[0.46]
<i>trans</i> -Calamenene	11.56	1518	0.07	11.01	1772	0.09
Zonarene	11.60*	1521	1.67	10.18*	1701	[0.46]
δ-Cadinene	11.60*	1521	[1.67]	10.22	1704	1.35
<i>trans</i> -Cadina-1,4-diene	11.69	1528	0.23	10.46	1724	0.23
α-Calacorene	11.80	1537	0.01	11.89	1848	0.02
Epiglobulol	12.00	1552	0.08	13.07*	1956	0.09
Maaliol	12.08*	1559	0.11	12.85	1935	0.03
Unknown [m/z 161, 109 (98), 82 (93), 43 (72), 105 (68), 93 (59), 69 (56), 119 (55)... 222 (7)]	12.08*	1559	[0.11]	13.07*	1956	[0.09]
Eudesma-5,7(11)-diene	12.08*	1559	[0.11]	10.91	1763	0.04
Spathulenol	12.22	1570	0.09	14.18	2061	0.09
Globulol	12.30	1576	0.28	13.68	2014	0.28
Gleenol	12.36	1581	0.03	13.36	1983	0.03
Viridiflorol	12.40	1584	0.12	13.76*	2022	[0.15]
Cubeban-11-ol	12.44	1587	0.10	13.47*	1993	0.18
Eudesm-5-en-11-ol analog	12.53*	1595	0.09	14.00	2044	0.07
Ledol	12.53*	1595	[0.09]	13.15*	1963	[0.04]
Eudesm-5-en-11-ol	12.62	1602	0.02	14.14	2058	0.01
10-epi-Cubenol	12.67	1606	0.02	13.47*	1993	[0.18]
Rosifoliol	12.79	1615	0.10	14.10	2054	0.10
1-epi-Cubenol	12.87	1622	0.15	13.55	2001	0.15
Isospathulenol	12.99	1631	0.12	15.21	2164	0.11
Cubenol	13.04	1636	0.09	13.47*	1993	[0.18]
α-Muurolol	13.10	1640	0.03	14.97	2140	0.06
<b>Total identified</b>		<b>98.56%</b>			<b>98.89%</b>	
<b>Total reported</b>		<b>98.72%</b>			<b>99.00%</b>	

\*: Two or more compounds are coeluting on this column

[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total

†: Peaks apexes were resolved, but peaks overlapped and were summed for analysis

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index