

Date : April 12, 2022

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code :** 22C29-PTH05

**Customer identification :** Tea Tree (BUY ATTIA) - Australia - T20112R

**Type :** Essential oil

**Source :** *Melaleuca alternifolia* ct. Terpinen-4-ol (Tea Tree)

**Customer :** Plant Therapy

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 :** Pamela Lavoie, M.Sc., Chimiste

**Analysis date :** April 11, 2022

Checked and approved by :

\_\_\_\_\_  
Alexis St-Gelais, Ph. D., Chimiste 2013-174

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### PHYSICOCHEMICAL DATA

**Physical aspect:** Clear liquid

**Refractive index:**  $1.4764 \pm 0.0003$  (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
Ethanol	0.48	Aliphatic alcohol
Isobutyral	0.07	Aliphatic aldehyde
Ethyl acetate	0.02	Aliphatic ester
Isobutanol	0.01	Aliphatic alcohol
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	0.03	Aliphatic aldehyde
Isoamyl alcohol	0.01	Aliphatic alcohol
Isobutyric acid	0.01	Aliphatic acid
(3Z)-Hexenol	0.04	Aliphatic alcohol
Hexanol	0.01	Aliphatic alcohol
$\alpha$ -Thujene	0.88	Monoterpene
$\alpha$ -Pinene	2.36	Monoterpene
$\alpha$ -Fenchene	0.01	Monoterpene
Camphene	0.01	Monoterpene
Thuja-2,4(10)-diene	tr	Monoterpene
$\beta$ -Pinene	0.68	Monoterpene
Sabinene	0.26	Monoterpene
3-Methyl-3-cyclohexenone	0.01	Aliphatic ketone
<i>cis</i> -Carane	0.01	Monoterpene
Myrcene	0.83	Monoterpene
$\alpha$ -Phellandrene	0.45	Monoterpene
(3Z)-Hexenyl acetate	0.01	Aliphatic ester
$\alpha$ -Terpinene	9.64	Monoterpene
Carvomenthene	0.01	Aliphatic alcohol
para-Cymene	2.16	Monoterpene
Limonene	0.82	Monoterpene
1,8-Cineole	2.83	Monoterpenic ether
(Z)- $\beta$ -Ocimene	0.01	Monoterpene
(E)- $\beta$ -Ocimene	0.02	Monoterpene
$\gamma$ -Terpinene	20.11	Monoterpene
<i>cis</i> -Sabinene hydrate	0.04	Monoterpenic alcohol
para-Cymenene	0.06	Monoterpene
Terpinolene	3.36	Monoterpene
<i>trans</i> -Sabinene hydrate	0.06	Monoterpenic alcohol
Linalool	0.06	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.01	Monoterpene
endo-Fenchol	0.01	Monoterpenic alcohol
<i>cis</i> -para-Menth-2-en-1-ol	0.25	Monoterpenic alcohol
4-Hydroxy-4-methylcyclohex-2-enone	0.01	Aliphatic alcohol
Cosmene isomer I	0.02	Monoterpene
<i>trans</i> -Pinocarveol	0.01	Monoterpenic alcohol
<i>trans</i> -para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol
Unknown	0.19	Oxygenated monoterpene
Unknown	0.03	Unknown
Borneol	0.01	Monoterpenic alcohol

δ-Terpineol	0.01	Monoterpenic alcohol
Terpinen-4-ol	42.47	Monoterpenic alcohol
Dill ether	0.01	Monoterpenic ether
para-Cymen-8-ol	0.07	Monoterpenic alcohol
α-Terpineol	2.86	Monoterpenic alcohol
cis-Piperitol	0.02	Monoterpenic alcohol
Unknown	0.09	Oxygenated monoterpene
trans-Piperitol	0.12	Monoterpenic alcohol
exo-2-Hydroxycineole	0.02	Monoterpenic alcohol
cis-para-Mentha-1(7),8-dien-2-ol	0.01	Monoterpenic alcohol
Nerol	0.02	Monoterpenic alcohol
Unknown	0.02	Oxygenated monoterpene
Piperitone	0.04	Monoterpenic ketone
cis-Carvenone oxide?	0.01	Monoterpenic ketone
trans-Ascaridole glycol	0.04	Monoterpenic alcohol
Thymol	0.01	Monoterpenic alcohol
Carvacrol	0.01	Monoterpenic alcohol
Unknown	0.01	Monoterpenic alcohol
Myrtenyl acetate	0.04	Monoterpenic ester
Bicycloelemene	0.02	Sesquiterpene
α-Cubebene	0.05	Sesquiterpene
Unknown	0.01	Unknown
Isoledene	0.06	Sesquiterpene
α-Copaene	0.09	Sesquiterpene
7-Cubebene	0.05	Sesquiterpene
7-Cubebene epimer?	0.02	Aliphatic alcohol
β-Elemene	0.04	Sesquiterpene
Methyleugenol	0.03	Phenylpropanoid
α-Gurjunene	0.30	Sesquiterpene
β-Maaliene	0.04	Sesquiterpene
β-Caryophyllene	0.33	Sesquiterpene
γ-Maaliene	0.06	Sesquiterpene
β-Gurjunene	0.02	Sesquiterpene
α-Maaliene	0.06	Sesquiterpene
Aromadendrene	0.94	Sesquiterpene
Selina-5,11-diene	0.13	Sesquiterpene
Cadina-3,5-diene isomer I?	0.01	Sesquiterpene
trans-Muurola-3,5-diene	0.10	Sesquiterpene
α-Humulene	0.10	Sesquiterpene
allo-Aromadendrene	0.43	Sesquiterpene
Valerena-4,7(11)-diene	0.04	Sesquiterpene
γ-Gurjunene	0.05	Sesquiterpene
trans-Cadina-1(6),4-diene	0.26	Sesquiterpene
Selina-4,11-diene	0.03	Sesquiterpene
γ-Muurolene	0.01	Sesquiterpene
β-Selinene	0.08	Sesquiterpene
allo-Aromadendr-9-ene	0.08	Sesquiterpene
trans-Muurola-4(15),5-diene	0.12	Sesquiterpene
δ-Selinene	0.06	Sesquiterpene
α-Selinene	0.09	Sesquiterpene
Bicyclogermacrene	0.69	Sesquiterpene
Viridiflorene	0.74	Sesquiterpene

α-Muurolene	0.15	Sesquiterpene
γ-Cadinene	0.04	Sesquiterpene
δ-Cadinene	0.93	Sesquiterpene
<i>trans</i> -Calamenene	0.09	Sesquiterpene
Zonarene	0.16	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	0.15	Sesquiterpene
α-Calacorene	0.02	Sesquiterpene
Eudesma-5,7(11)-diene	0.02	Sesquiterpene
Unknown	0.06	Oxygenated sesquiterpene
Spathulenol	0.06	Sesquiterpenic alcohol
Globulol	0.19	Sesquiterpenic alcohol
Gleenol	0.02	Sesquiterpenic alcohol
Viridiflorol	0.10	Sesquiterpenic alcohol
Cubeban-11-ol	0.08	Sesquiterpenic alcohol
10-epi-Cubenol	0.01	Sesquiterpenic alcohol
Rosifoliol	0.08	Sesquiterpenic alcohol
1-epi-Cubenol	0.11	Sesquiterpenic alcohol
Isospathulenol	0.04	Sesquiterpenic alcohol
Cubenol	0.08	Sesquiterpenic alcohol
α-Muurolol	0.03	Sesquiterpenic alcohol
α-Cadinol	0.01	Sesquiterpenic alcohol
<b>Consolidated total</b>	<b>99.31%</b>	

tr: The compound has been detected below 0.005% of total signal.

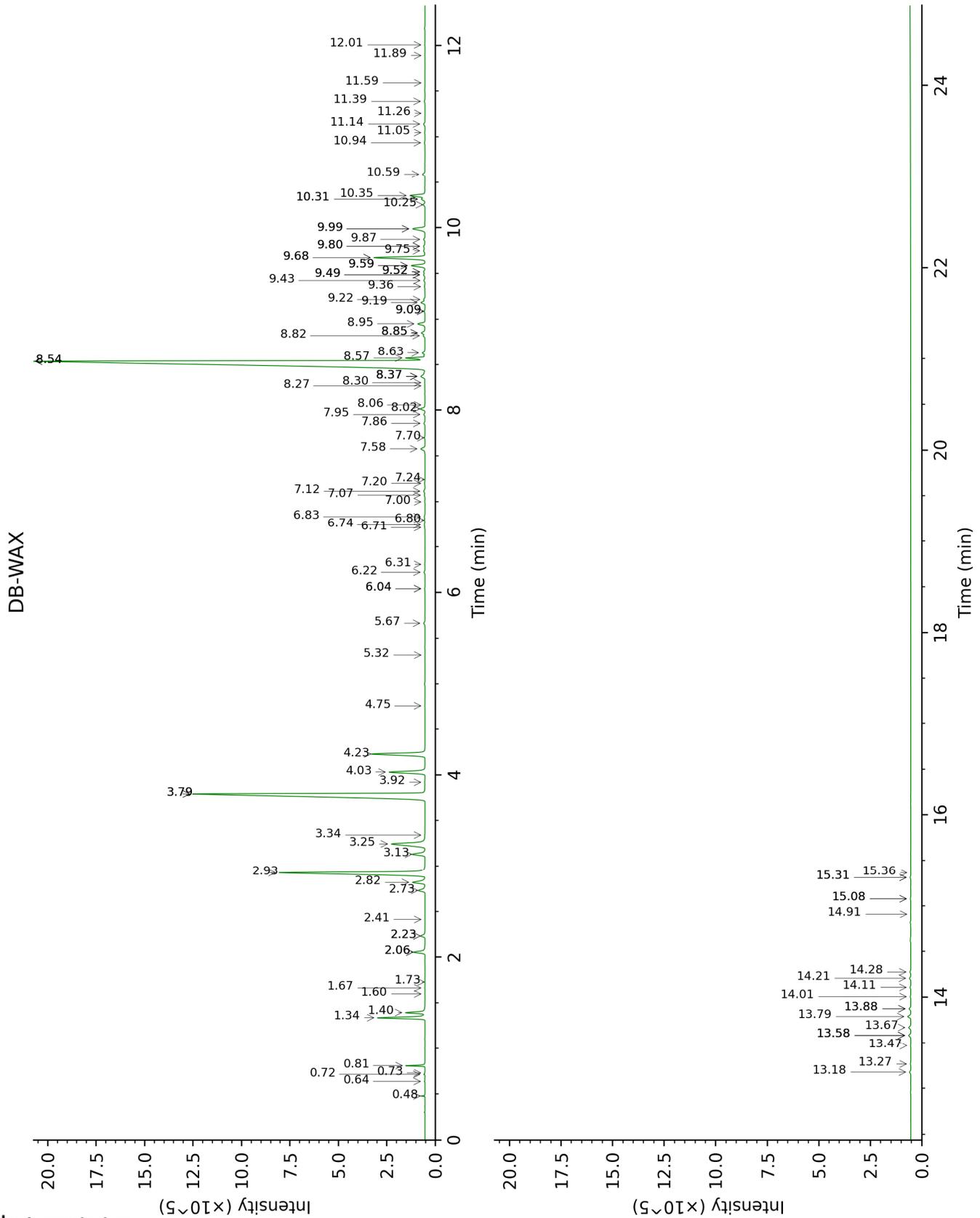
Note: no correction factor was applied

**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	%
Ethanol	0.32	499	0.48	0.81	906	0.51
Isobutyral	0.38	536	0.07	0.48	777	0.07
Ethyl acetate	0.46	607	0.02	0.64	849	0.01
Isobutanol	0.50	620	0.01	2.06*	1064	0.69
Isovaleral	0.55	641	0.01	0.73	882	0.01
2-Methylbutyral	0.57	650	0.03	0.72	876	0.03
Isoamyl alcohol	0.91	735	0.01	3.34	1173	0.02
Isobutyric acid	1.17	776	0.01	8.06	1520	0.01
(3Z)-Hexenol	1.98	858	0.04	5.66	1344	0.08
Hexanol	2.17	875	0.01	5.32	1319	0.01
$\alpha$ -Thujene	2.82	925	0.88	1.40	999	0.94
$\alpha$ -Pinene	2.89	930	2.36	1.34	990	2.26
$\alpha$ -Fenchene	3.07*	942	0.02	1.60	1020	0.01
Camphene	3.07*	942	[0.02]	1.66	1026	0.01
Thuja-2,4(10)-diene	3.19	951	tr	2.23*	1082	0.26
$\beta$ -Pinene	3.49*	971	0.95	2.06*	1064	[0.69]
Sabinene	3.49*	971	[0.95]	2.23*	1082	[0.26]
3-Methyl-3-cyclohexenone	3.64	981	0.01	6.04*	1371	0.03
<i>cis</i> -Carane	3.74	988	0.01	1.73	1032	0.01
Myrcene	3.81	993	0.83	2.82	1132	0.82
$\alpha$ -Phellandrene	3.95	1002	0.45	2.73	1125	0.44
(3Z)-Hexenyl acetate	4.10	1012	0.01	4.76	1280	0.02
$\alpha$ -Terpinene	4.17	1016	9.64	2.93	1140	9.61
Carvomenthene	4.22	1019	0.01	2.41	1100	0.01
para-Cymene	4.28	1023	2.16	4.03	1226	2.18
Limonene	4.33†	1026	3.66	3.13	1156	0.82
1,8-Cineole	4.35†	1028	[3.66]	3.25	1165	2.83
(Z)- $\beta$ -Ocimene	4.55	1040	0.01	3.79*	1208	20.06
(E)- $\beta$ -Ocimene	4.71	1050	0.02	3.92	1218	0.03
$\gamma$ -Terpinene	4.86	1060	20.11	3.79*	1208	[20.06]
<i>cis</i> -Sabinene hydrate	4.97	1067	0.04	6.83†	1429	[0.09]
para-Cymenene	5.28*	1087	3.41	6.22	1384	0.06
Terpinolene	5.28*	1087	[3.41]	4.23	1241	3.36
<i>trans</i> -Sabinene hydrate	5.46	1098	0.06	7.86	1505	0.07
Linalool	5.56	1104	0.06	7.95	1512	0.06
para-Mentha-1,3,8-triene	5.63	1109	0.01	6.04*	1371	[0.03]
endo-Fenchol	5.69	1113	0.01	8.30	1539	0.02
<i>cis</i> -para-Menth-2-en-1-ol	5.82	1121	0.25	8.02	1517	0.27
4-Hydroxy-4-methylcyclohex-2-enone	5.96	1130	0.01	14.01	2031	0.04

Cosmene isomer I	5.98	1131	0.02	6.31	1390	0.02
<i>trans</i> -Pinocarveol	6.03	1135	0.01	9.09*	1600	0.05
<i>trans</i> -para-Menth-2-en-1-ol	6.08	1138	0.01	8.85*	1582	0.22
Unknown [m/z 109, 43 (73), 71 (54), 124 (51), 69 (37), 41 (35)...152 (5)]	6.12	1140	0.19			
Unknown [m/z 109, 124 (45), 119 (41), 43 (35), 91 (28), 95 (25)...]	6.21	1146	0.03	6.74†	1422	[0.07]
Borneol	6.43	1160	0.01	9.68*	1648	2.87
δ-Terpineol	6.51	1165	0.01	9.42	1628	0.07
Terpinen-4-ol	6.78*	1182	42.48	8.54*	1558	42.71
Dill ether	6.78*	1182	[42.48]	7.24	1459	0.01
para-Cymen-8-ol	6.79	1184	0.07	11.39	1792	0.04
α-Terpineol	6.94*	1193	2.81	9.68*	1648	[2.87]
<i>cis</i> -Piperitol	6.94*	1193	[2.81]	9.49*	1633	0.09
Unknown [m/z 121, 43 (99), 91 (85), 77 (73), 93 (41), 136 (33)... 166 (3)]	6.99	1196	0.09			
<i>trans</i> -Piperitol	7.19	1209	0.12	10.25	1695	0.11
exo-2-Hydroxycineole	7.42	1224	0.02	11.59	1809	0.01
<i>cis</i> -para-Mentha-1(7),8-dien-2-ol	7.45	1227	0.01	11.89	1836	0.01
Nerol	7.53	1232	0.02	10.94	1753	0.04
Unknown [m/z 137, 152 (28), 43 (25), 91 (24), 109 (23), 119 (19)]	7.56	1234	0.02	11.26	1780	tr
Piperitone	7.80	1250	0.04	9.80*	1658	0.11
<i>cis</i> -Carvenone oxide?	7.86	1254	0.01			
<i>trans</i> -Ascaridole glycol	8.13	1272	0.04	14.11	2041	0.05
Thymol	8.60	1304	0.01	15.08*	2137	0.04
Carvacrol	8.67	1308	0.01	15.31*	2160	0.05
Unknown [m/z 97, 112 (92), 83 (62), 43 (44), 41 (25)... 170? (4)]	8.77	1316	0.01	14.91	2119	0.01
Myrtenyl acetate	8.89	1324	0.04	9.52*	1635	0.09
Bicycloelemene	9.02	1333	0.02	7.00	1441	0.02
α-Cubebene	9.20	1346	0.05	6.71†	1420	0.07
Unknown [m/z 43, 95 (62), 107 (45),	9.38	1359	0.01	13.88*	2018	0.11

110 (41), 55 (28), 67 (25)...]						
Isoledene	9.50	1368	0.06	6.80†	1426	0.09
α-Copaene	9.55	1371	0.09	7.12†	1450	[0.14]
7-Cubebene	9.59	1374	0.05	7.07†	1446	0.14
7-Cubebene epimer?	9.62	1376	0.02	7.20	1456	0.03
β-Elemene	9.80	1389	0.04	8.37*	1545	0.37
Methyleugenol	10.00*	1403	0.31	13.27	1961	0.03
α-Gurjunene	10.00*	1403	[0.31]	7.58	1484	0.30
β-Maaliene	10.06	1408	0.04	7.70	1493	0.04
β-Caryophyllene	10.12	1412	0.33	8.37*	1545	[0.37]
γ-Maaliene	10.24	1420	0.06	8.37*	1545	[0.37]
β-Gurjunene	10.28	1424	0.02	8.27	1537	0.01
α-Maaliene	10.32	1426	0.06	8.54*	1558	[42.71]
Aromadendrene	10.39	1432	0.94	8.57	1560	0.84
Selina-5,11-diene	10.45	1436	0.13	8.63	1565	0.14
Cadina-3,5-diene isomer I?	10.49	1439	0.01			
<i>trans</i> -Muuroala-3,5- diene	10.55	1444	0.10	8.82	1580	0.09
α-Humulene	10.58	1446	0.10	9.22	1611	0.07
allo- Aromadendrene	10.68	1453	0.43	8.95	1590	0.43
Valerena-4,7(11)- diene	10.71	1456	0.04	8.85*	1582	[0.22]
γ-Gurjunene	10.84	1466	0.05	9.09*	1600	[0.05]
<i>trans</i> -Cadina- 1(6),4-diene	10.88	1468	0.26	9.18	1608	0.23
Selina-4,11-diene	10.93	1472	0.03	9.36	1622	0.04
γ-Murolene	10.97	1475	0.01	9.52*	1635	[0.09]
β-Selinene	11.02	1479	0.08	9.80*	1658	[0.11]
allo-Aromadendr- 9-ene	11.05	1481	0.08	9.49*	1633	[0.09]
<i>trans</i> -Muuroala- 4(15),5-diene	11.09†	1484	0.17	9.75	1654	0.12
δ-Selinene	11.12†	1486	[0.17]	9.59*	1641	0.81
α-Selinene	11.17*	1490	1.52	9.87	1664	0.09
Bicyclogermacrene	11.17*	1490	[1.52]	9.99*	1674	0.84
Viridiflorene	11.17*	1490	[1.52]	9.59*	1641	[0.81]
α-Murolene	11.25	1496	0.15	9.99*	1674	[0.84]
γ-Cadinene	11.41	1508	0.04	10.32*	1700	0.22
δ-Cadinene	11.56*	1520	1.17	10.35	1703	0.93
<i>trans</i> -Calamenene	11.56*	1520	[1.17]	11.14	1770	0.09
Zonarene	11.56*	1520	[1.17]	10.32*	1700	[0.22]
<i>trans</i> -Cadina-1,4- diene	11.65	1527	0.15	10.59	1723	0.16
α-Calacorene	11.77	1537	0.02	12.01	1846	0.02
Eudesma-5,7(11)- diene	12.02	1557	0.02	11.05	1762	0.02
Unknown [m/z 161, 109 (98), 82	12.08	1561	0.06	13.18	1953	0.08

(93), 43 (72), 105 (68), 93 (59), 69 (56), 119 (55)... 222 (7)]						
Spathulenol	12.22	1572	0.06	14.28	2057	0.06
Globulol	12.30	1578	0.19	13.79	2010	0.20
Gleenol	12.35	1583	0.02	13.47	1980	0.02
Viridiflorol	12.39	1586	0.10	13.88*	2018	[0.11]
Cubeban-11-ol	12.42	1588	0.08	13.58*	1990	0.14
10-epi-Cubenol	12.66	1607	0.01	13.58*	1990	[0.14]
Rosifoliol	12.78	1617	0.08	14.21	2051	0.08
1-epi-Cubenol	12.85	1623	0.11	13.67	1998	0.14
Isospathulenol	12.99	1634	0.04	15.31*	2160	[0.05]
Cubenol	13.02	1637	0.08	13.58*	1990	[0.14]
α-Muurolol	13.09	1643	0.03	15.08*	2137	[0.04]
α-Cadinol	13.16	1648	0.01	15.36	2166	0.01
<b>Total identified</b>		<b>98.82%</b>			<b>99.18%</b>	
<b>Total reported</b>		<b>99.24%</b>			<b>99.27%</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

tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

R.T.: Retention time (minutes)

R.I.: Retention index