

Date : 2023-12-01

CERTIFICATE OF ANALYSIS - GC PROFILING

SAMPLE IDENTIFICATION

**Internal code :** 23K24-PTH02

**Customer Identification :** Organic Frankincense Frereana - Somalia - FE0108R

**Type :** Essential Oil

**Source :** *Boswellia frereana*

**Customer :** Plant Therapy

Checked and approved by:

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

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## GAS CHROMATOGRAPHIC ANALYSIS

**Method :** PC-MAT-014 - Analysis of the composition of an essential oil or other volatile liquide by FAST GC-FID

**\*ISO**

**Results :** See analysis summary (next page)

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

**Date :** 2023-11-30

## PHYSICOCHEMICAL DATA

**Refractive index :**  $1.4659 \pm 0.0003$  (20 °C)

**Method :** PC-MAT-016 - Measure of the refractive index of a liquid.

**Analyst :** Cindy Caron B. Sc.

**Date :** 2023-11-27

## 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
3-Methyl-2-butanone	0.06	Aliphatic ketone
4-Methyl-2-pentanone	0.02	Aliphatic ketone
Toluene	0.06	Simple phenolic
Unknown	tr	Alkene
(Z)-Salvene	0.05	Normonoterpene
(E)-Salvene	0.02	Normonoterpene
Unknown	0.04	Unknown
Unknown	0.08	Monoterpene
Unknown	0.16	Unknown
Hashishene	0.47	Monoterpene
Tricyclene	0.05	Monoterpene
$\alpha$ -Thujene	43.02	Monoterpene
$\alpha$ -Pinene	12.12	Monoterpene
Thujadiene isomer	3.03	Monoterpene
Unknown	tr	Monoterpene
Camphene	0.32	Monoterpene
Thuja-2,4(10)-diene	0.27	Monoterpene
Sabinene	5.35	Monoterpene
$\beta$ -Pinene	0.60	Monoterpene
Pseudolimonene isomer	0.03	Monoterpene
6-Methyl-5-hepten-2-one	0.08	Aliphatic ketone
Dehydro-1,8-cineole	0.05	Monoterpenic ether
Myrcene	0.21	Monoterpene
2,7-Dimethyl-2,6-octadiene	0.15	Monoterpene
6-Methyl-5-hepten-2-ol	0.01	Aliphatic alcohol
$\alpha$ -Phellandrene	1.18	Monoterpene
Pseudolimonene	0.02	Monoterpene
<i>ortho</i> -Methylanisole	0.02	Simple phenolic
$\Delta^3$ -Carene	0.04	Monoterpene
Unknown	0.02	Monoterpene
Unknown	0.01	Monoterpene
$\alpha$ -Terpinene	0.52	Monoterpene
<i>meta</i> -Cymene	0.39	Monoterpene
Carvomenthene	0.16	Aliphatic alcohol
<i>para</i> -Cymene	13.11	Monoterpene
Unknown	0.63	Unknown
$\beta$ -Phellandrene	0.62	Monoterpene
Limonene	1.63	Monoterpene
1,8-Cineole	1.64	Monoterpenic ether
<i>ortho</i> -Cymene	0.02	Monoterpene

Unknown	0.05	Unknown
(Z)-β-Ocimene	0.03	Monoterpene
Unknown	0.28	Unknown
(E)-β-Ocimene	0.02	Monoterpene
Unknown	0.01	Unknown
γ-Terpinene	0.80	Monoterpene
cis-Sabinene hydrate	0.02	Monoterpenic alcohol
Unknown	0.06	Oxygenated monoterpene
cis-Linalool oxide (fur.)	0.03	Monoterpenic alcohol
Unknown	0.03	Oxygenated monoterpene
para-Cymenene	0.12	Monoterpene
Terpinolene	0.18	Monoterpene
trans-Sabinene hydrate	0.06	Monoterpenic alcohol
α-Thujone	0.13	Monoterpenic ketone
Linalool	0.20	Monoterpenic alcohol
Verbenol analog?	0.02	Monoterpenic alcohol
Unknown	0.02	Oxygenated monoterpene
β-Thujone	0.90	Monoterpenic ketone
Unknown	0.08	Oxygenated monoterpene
trans-para-Mentha-2,8-dien-1-ol	0.25	Monoterpenic alcohol
cis-para-Menth-2-en-1-ol	0.03	Monoterpenic alcohol
α-Campholenal	0.08	Monoterpenic aldehyde
Unknown	0.02	Unknown
Unknown	0.02	Unknown
trans-Pinocarveol	0.26	Monoterpenic alcohol
Camphor	0.08	Monoterpenic ketone
trans-Sabinol	0.26	Monoterpenic alcohol
cis-Verbenol	0.07	Monoterpenic alcohol
trans-Verbenol	0.26	Monoterpenic alcohol
meta-Mentha-4,6-dien-8-ol	0.14	Monoterpenic alcohol
Sabinaketone	0.07	Normonoterpenic ketone
Unknown	0.06	Oxygenated monoterpene
Pinocamphone	0.06	Monoterpenic ketone
Pinocarvone	0.02	Monoterpenic ketone
Unknown	0.08	Oxygenated monoterpene
α-Phellandren-8-ol	0.34	Monoterpenic alcohol
Unknown	0.05	Oxygenated monoterpene
Umbellulone	0.26	Monoterpenic ketone
cis-Sabinol	0.20	Monoterpenic alcohol
Terpinen-4-ol	2.58	Monoterpenic alcohol
Cryptone	0.17	Normonoterpenic ketone
Thuj-3-en-10-al	0.04	Monoterpenic aldehyde
para-Cymen-8-ol	0.28	Monoterpenic alcohol
Myrtenal	0.12	Monoterpenic aldehyde
α-Terpineol	0.33	Monoterpenic alcohol

Myrtenol	0.10	Monoterpenic alcohol
<i>cis</i> - $\alpha$ -Phellandrene epoxide (iPr vs Me)	0.14	Monoterpenic ether
Verbenone	0.26	Monoterpenic ketone
<i>trans</i> -Piperitol	0.08	Monoterpenic alcohol
<i>trans</i> -Carveol	0.08	Monoterpenic alcohol
<i>cis</i> -Carveol	0.03	Monoterpenic alcohol
Citronellol	0.10	Monoterpenic alcohol
Cuminal	0.02	Monoterpenic aldehyde
Carvone	0.03	Monoterpenic ketone
Carvotanacetone	0.06	Monoterpenic ketone
Unknown	0.12	Unknown
Piperitone	0.04	Monoterpenic ketone
Unknown	0.02	Unknown
Bornyl acetate	0.25	Monoterpenic ester
Thymol	0.08	Monoterpenic alcohol
Carvacrol	0.02	Monoterpenic alcohol
<i>exo</i> -2-Hydroxycineole acetate	0.02	Monoterpenic ester
$\alpha$ -Cubebene	0.02	Sesquiterpene
Citronellyl acetate	0.04	Monoterpenic ester
$\alpha$ -Copaene	0.04	Sesquiterpene
1,5-diepi- $\beta$ -Bourbonene	0.06	Sesquiterpene
$\beta$ -Bourbonene	0.76	Sesquiterpene
$\beta$ -Elemene	0.07	Sesquiterpene
$\beta$ -Caryophyllene	0.02	Sesquiterpene
$\beta$ -Ylangene	0.08	Sesquiterpene
$\beta$ -Copaene	0.09	Sesquiterpene
Isogermacrene D	0.05	Sesquiterpene
$\alpha$ -Humulene	0.01	Sesquiterpene
allo-Aromadendrene	0.01	Sesquiterpene
Unknown	0.01	Sesquiterpene
Germacrene D	0.02	Sesquiterpene
$\beta$ -Selinene	0.01	Sesquiterpene
$\gamma$ -Cadinene	0.02	Sesquiterpene
$\delta$ -Cadinene	0.02	Sesquiterpene
Caryophyllene oxide	0.01	Sesquiterpenic ether
$\tau$ -Cadinol	0.02	Sesquiterpenic alcohol
$\alpha$ -Phellandrene dimer I	0.03	Diterpene
$\alpha$ -Phellandrene dimer II	0.55	Diterpene
$\alpha$ -Phellandrene dimer III	0.01	Diterpene
$\alpha$ -Phellandrene dimer IV	0.02	Diterpene
<b>Consolidated total</b>	<b>98.81</b>	

tr: The compound has been detected below 0.005% of the 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

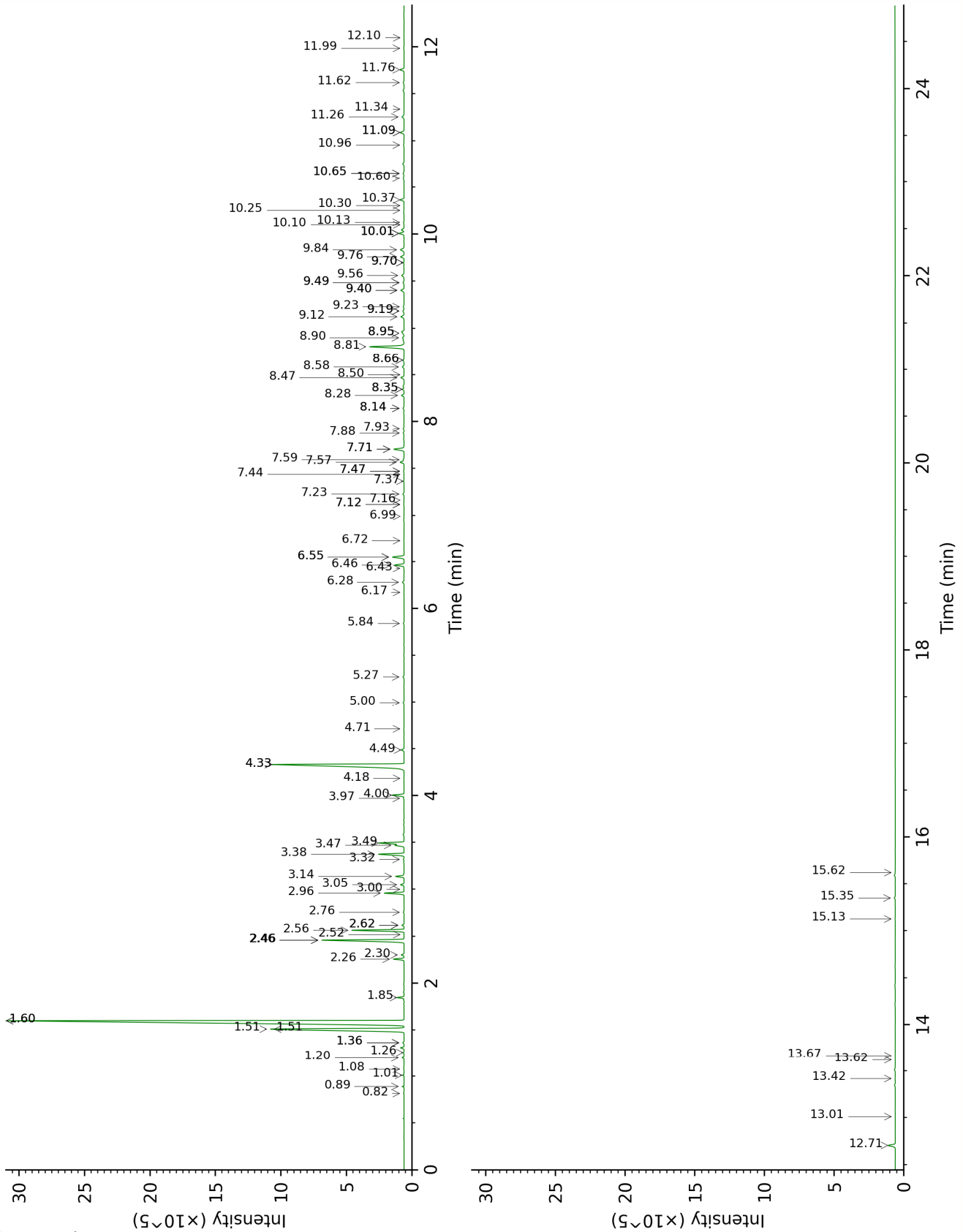
overestimating individual content. This process is semi-automatic. Advanced users are invited to consult the "Full analysis data" table after the chromatograms in this report to access the full untreated data and perform their own calculations if needed.

**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.

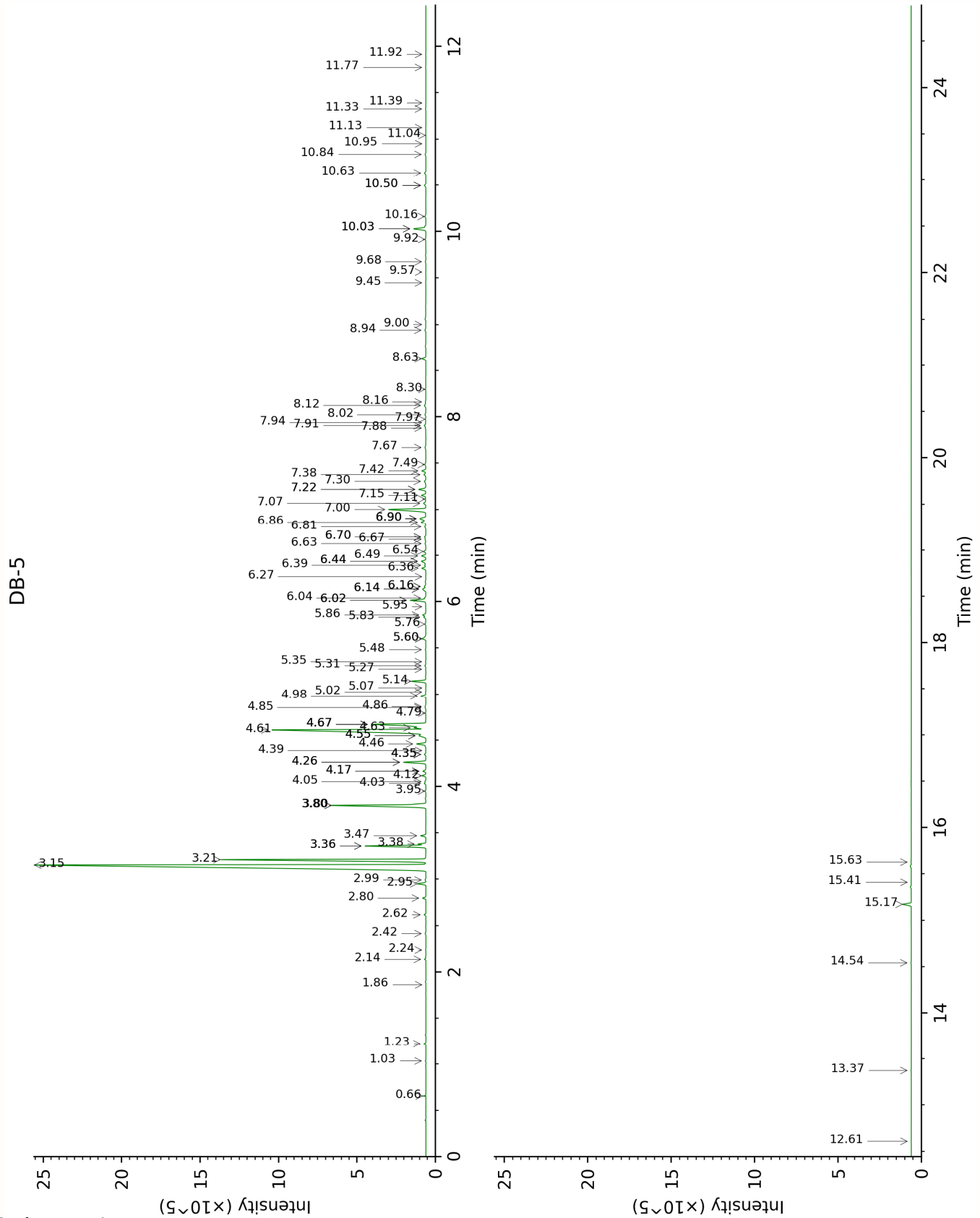
**Bracketed value ([xx]):** A bracketed percent value indicate that two or more compound percentage could not be solved due to coelution.

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

DB-WAX







FULL ANALYSIS DATA

3-Methyl-2-butanone	Column DB-WAX			Column DB-5		
	0.89	901.2	0.06	0.66	646.6	0.06
4-Methyl-2-pentanone	1.36*	972.6	[0.08]	1.04	733.8	0.02
Toluene	1.60*	1004.4	[42.86]	1.22	759.8	0.06
Unknown BOCA I [m/z 109, 67 (32), 81 (14), 41 (12), 124 (10)]	0.82	878.5	0.02	1.86	830.6	tr
(Z)-Salvene	1.01	919.3	0.05	2.14	853.0	0.05
(E)-Salvene	1.08	929.2	0.02	2.24	861.2	0.02
Unknown BOCA II [m/z 79, 78 (45), 91 (28), 77 (28), 41 (13), 80 (12), 107 (11)... 122 (1)]	1.26	956.7	0.03	2.42	875.7	0.04
Unknown BOFR I [m/z 93, 91 (75), 121 (61), 77 (58), 79 (38), 92 (26), 43 (24), 41 (23), 105 (22), 107 (19), 136 (16)]	1.20	947.7	0.08	2.62	892.3	0.08
Unknown BOFR II [m/z 93, 91 (72), 121 (58), 77 (49), 79 (41), 43 (22), 105 (20), 107 (20), 41 (18), 136 (17), 92 (17)]				2.80	906.7	0.16
Hashishene	1.51*	994.5	[12.44]	2.95	916.8	0.47
Tricyclene	1.36*	972.6	[0.08]	2.99	919.5	0.05
$\alpha$ -Thujene	1.60*	1004.4	[42.86]	3.15	930.1	43.02
$\alpha$ -Pinene	1.51*	994.5	[12.44]	3.21	933.9	12.12
Thujadiene isomer	2.56	1095.2	3.03	3.36*	943.5	[3.08]
Unknown SAOF I [m/z 91, 92 (47), 65 (11)... 134 (1)]	2.52	1090.9	tr	3.36*	943.5	[3.08]
Camphene	1.85	1027.7	0.35	3.38	944.9	0.32
Thuja-2,4(10)-diene	2.46*	1085.2	[5.60]	3.47	950.8	0.27
Sabinene	2.46*	1085.2	[5.60]	3.80*	972.2	[5.96]

β-Pinene	2.26	1066.2	0.60	3.80*	972.2	[5.96]
Pseudolimonene isomer	2.62*	1099.7	[0.12]	3.95	982.4	0.03
6-Methyl-5-hepten-2-one	5.27	1293.4	0.08	4.03	987.8	0.08
Dehydro-1,8-cineole	3.32	1152.7	0.04	4.05	989.1	0.05
Myrcene	3.05	1132.3	0.20	4.12	993.3	0.21
2,7-Dimethyl-2,6-octadiene	2.30	1070.5	0.15	4.16*	996.4	[0.17]
6-Methyl-5-hepten-2-ol	7.12*	1428.4	[0.03]	4.16*	996.4	[0.17]
α-Phellandrene	2.96	1125.5	1.18	4.26*	1002.8	[1.25]
Pseudolimonene	3.00	1128.6	0.02	4.26*	1002.8	[1.25]
ortho-Methylanisole	6.17	1360.5	0.02	4.35*	1008.1	[0.08]
Δ3-Carene	2.76	1110.1	0.04	4.35*	1008.1	[0.08]
Unknown BOFR V [m/z 119, 91 (86), 41 (24), 79 (19), 77 (19), 134 (16)]				4.35*	1008.1	[0.08]
Unknown BOSA III [m/z 117, 132 (88), 115 (68), 91 (55), 77 (20)]				4.39	1010.8	0.01
α-Terpinene	3.14	1139.0	0.51	4.46	1015.2	0.52
meta-Cymene	4.33*	1227.0	[13.50]	4.55*	1020.8	[0.54]
Carvomenthene	2.62*	1099.7	[0.12]	4.55*	1020.8	[0.54]
para-Cymene	4.33*	1227.0	[13.50]	4.61	1024.6	13.11
Unknown BODA IV [m/z 109, 43 (58), 95 (26)... 137 (15)...]	6.46	1381.1	0.64	4.63	1026.1	0.63
β-Phellandrene	3.47	1164.1	0.62	4.67*	1028.4	[3.89]
Limonene	3.38	1156.9	1.63	4.67*	1028.4	[3.89]
1,8-Cineole	3.49	1165.9	1.64	4.67*	1028.4	[3.89]
ortho-Cymene	4.71	1253.8	0.02	4.79	1035.9	0.02
Unknown ARAN I [m/z 43, 55 (65), 41 (34), 67 (32), 107 (30), 122 (26)... 125 (10)]	5.84	1337.0	0.05	4.85	1039.7	0.05
(Z)-β-Ocimene	3.97	1201.5	0.03	4.86	1040.5	0.03
Unknown BOFR	7.57	1461.4	0.28	4.98	1047.7	0.28

III [m/z 109, 43 (57), 91 (28), 67 (25), 93 (24), 95 (22), 77 (21), 137 (21), 41 (17), 79 (14)...]						
(E)-β-Ocimene	4.18	1216.6	0.02	5.02	1050.4	0.02
Unknown BOFR IV [m/z 109, 45 (67), 41 (40), 67 (39), 81 (33), 79 (27), 95 (24), 91 (23), 82 (21), 55 (21), 93 (20)...]	7.16	1431.8	0.02	5.07	1053.3	0.01
γ-Terpinene	4.00	1203.9	0.80	5.14	1057.8	0.80
cis-Sabinene hydrate	7.12*	1428.4	[0.03]	5.27	1065.9	0.02
Unknown PIMA I [m/z 79, 93 (60), 43 (40), 94 (35), 137 (33), 77 (26), 91 (20), 152 (18)]	5.00	1274.0	0.06	5.31	1068.3	0.06
cis-Linalool oxide (fur.)	6.72	1399.6	0.02	5.35	1071.0	0.03
Unknown BODA VI [m/z 43, 94 (63), 109 (61), 59 (55), 79 (51)...152 (2)]	7.47*	1454.4	[0.04]	5.48	1079.1	0.03
para-Cymenene	6.55*	1387.1	[0.86]	5.60*	1086.4	[0.30]
Terpinolene	4.49	1237.9	0.18	5.60*	1086.4	[0.30]
trans-Sabinene hydrate	8.14*	1503.8	[0.08]	5.76	1096.2	0.06
α-Thujone	6.28	1368.1	0.12	5.83	1100.9	0.13
Linalool	8.28	1514.4	0.17	5.86	1102.4	0.20
Verbenol analog?	8.50	1531.3	0.01	5.95	1108.0	0.02
Unknown BOSE I [m/z 109, 81 (54), 91 (32), 79 (22)...]	6.43	1378.6	0.02	6.02*	1112.4	[0.92]
β-Thujone	6.55*	1387.1	[0.86]	6.02*	1112.4	[0.92]
Unknown BOSE II [m/z 109, 91 (57), 93 (47), 81 (44), 77 (40)...]				6.04	1113.9	0.08

154 (1)]						
<i>trans-para</i> -Mentha-2,8-dien-1-ol	9.18*	1583.7	[0.10]	6.14*	1120.1	[0.28]
<i>cis-para</i> -Menth-2-en-1-ol	8.34*	1519.4	[0.11]	6.14*	1120.1	[0.28]
$\alpha$ -Campholenal	7.23	1436.5	0.08	6.16*	1121.9	[0.10]
Unknown BOSE III [m/z 111, 43 (22), 55 (14), 41 (12), 110 (11)...]				6.16*	1121.9	[0.10]
Unknown BONE I [m/z 95, 43 (41), 110 (36), 41 (19), 67 (18)... 150 (tr)]				6.27	1128.6	0.02
<i>trans</i> -Pinocarveol	9.40*	1600.8	[0.26]	6.36	1134.4	0.26
Camphor	7.44	1451.9	0.01	6.39	1136.5	0.08
<i>trans</i> -Sabinol	10.01*	1649.2	[0.38]	6.44*	1139.2	[0.33]
<i>cis</i> -Verbenol	9.49*	1607.3	[0.08]	6.44*	1139.2	[0.33]
<i>trans</i> -Verbenol	9.76	1629.3	0.28	6.49	1142.9	0.26
<i>meta</i> -Mentha-4,6-dien-8-ol	9.56	1613.5	0.20	6.54	1145.9	0.14
Sabinaketon	8.95*	1565.6	[0.07]	6.63	1151.3	0.07
Unknown BOCA III [m/z 97, 81 (96), 109 (80), 43 (53), 53 (40), 41 (36), 56 (29), 95 (25)... 152 (1)]	7.71*	1471.6	[0.80]	6.67	1154.3	0.06
Pinocamphone	7.47*	1454.4	[0.04]	6.70*	1155.9	[0.08]
Pinocarvone	8.14*	1503.8	[0.08]	6.70*	1155.9	[0.08]
Unknown CALU II [m/z 95, 110 (38), 81 (21), 79 (16)... 152 (7)]	7.88	1484.2	0.06	6.81	1163.0	0.08
$\alpha$ -Phellandren-8-ol	10.36	1677.9	0.27	6.86	1166.3	0.34
Unknown CALU III [m/z 95, 110 (43), 81 (28), 41 (15)... 152 (8)]	7.93	1487.7	0.05	6.90*	1168.8	[0.49]
Umbellulone	9.12	1579.0	0.26	6.90*	1168.8	[0.49]
<i>cis</i> -Sabinol	11.09*	1738.0	[0.30]	6.90*	1168.8	[0.49]
Terpinen-4-ol	8.81	1554.7	2.71	7.00	1175.2	2.58

Cryptone	9.40*	1600.8	[0.26]	7.07	1179.4	0.17
Thuj-3-en-10-al	8.95*	1565.6	[0.07]	7.11	1182.3	0.04
<i>para</i> -Cymen-8-ol	11.76	1794.3	0.29	7.15	1184.9	0.28
Myrtenal	8.90	1561.9	0.12	7.22*	1189.0	[0.44]
$\alpha$ -Terpineol	10.01*	1649.2	[0.38]	7.22*	1189.0	[0.44]
Myrtenol	11.09*	1738.0	[0.30]	7.30	1194.5	0.10
<i>cis</i> - $\alpha$ -Phellandrene epoxide (iPr vs Me)	11.26	1751.9	0.18	7.38	1199.1	0.14
Verbenone	9.84	1635.3	0.33	7.42	1201.7	0.26
<i>trans</i> -Piperitol	10.65*	1701.3	[0.08]	7.49	1206.1	0.08
<i>trans</i> -Carveol	11.62	1782.6	0.07	7.67	1218.4	0.08
<i>cis</i> -Carveol	11.99	1814.3	0.03	7.88	1232.3	0.03
Citronellol	10.96	1726.7	0.05	7.91	1234.1	0.10
Cuminal				7.94	1236.3	0.02
Carvone	10.25	1668.9	0.03	7.98	1238.7	0.03
Carvotanacetone	9.70*	1624.4	[0.04]	8.02	1241.9	0.06
Unknown CALU IV [m/z 43, 97 (69), 107 (46), 41 (28), 55 (21), 109 (20)...]	11.34	1758.9	0.01	8.12	1248.6	0.12
Piperitone	10.13	1658.7	0.04	8.16	1251.2	0.04
Unknown CIGL III [m/z 43, 97 (78), 41 (45), 55 (35), 69 (28), 107 (24), 83 (23)...]	13.67	1965.1	0.01	8.30	1260.2	0.02
Bornyl acetate	8.47	1528.9	0.25	8.63	1282.2	0.25
Thymol	15.35	2126.6	0.07	8.94	1303.1	0.08
Carvacrol	15.62	2153.6	0.01	9.00	1307.4	0.02
<i>exo</i> -2-Hydroxycineole acetate	10.30	1673.0	0.03	9.45	1338.9	0.02
$\alpha$ -Cubebene	6.99	1419.1	0.01	9.57	1347.0	0.02
Citronellyl acetate	9.70*	1624.4	[0.04]	9.68	1354.8	0.04
$\alpha$ -Copaene	7.36	1446.5	0.03	9.92	1371.7	0.04
1,5-diepi- $\beta$ -Bourbonene	7.59	1463.3	0.06	10.03*†	1379.7	[0.78]
$\beta$ -Bourbonene	7.71*	1471.6	[0.80]	10.03*†	1379.7	[0.78]
$\beta$ -Elemene	8.66*	1543.2	[0.09]	10.16	1389.0	0.07
$\beta$ -Caryophyllene	8.66*	1543.2	[0.09]	10.50*	1412.9	[0.10]
$\beta$ -Ylangene	8.34*	1519.4	[0.11]	10.50*	1412.9	[0.10]

β-Copaene	8.58	1537.6	0.13	10.64	1423.3	0.09
Isogermacrene D	9.18*	1583.7	[0.10]	10.84	1438.2	0.05
α-Humulene	9.49*	1607.3	[0.08]	10.95	1446.8	0.01
allo-Aromadendrene	9.23	1587.2	0.06	11.04	1453.5	0.01
Unknown MISC XLIX [m/z 161, 105 (56), 91 (50), 93 (36), 119 (33), 79 (31)...204 (5)]				11.13	1459.7	0.01
Germacrene D	10.01*	1649.2	[0.38]	11.33	1474.6	0.02
β-Selinene	10.10	1656.6	0.01	11.39	1479.4	0.01
γ-Cadinene	10.60	1696.6	0.10	11.77	1508.1	0.02
δ-Cadinene	10.65*	1701.3	[0.08]	11.92	1519.2	0.02
Caryophyllene oxide	13.01	1905.0	0.01	12.61	1573.5	0.01
τ-Cadinol	15.13	2104.3	0.02	13.37	1634.9	0.02
α-Phellandrene dimer I	12.10	1824.2	0.01	14.54	1732.6	0.03
α-Phellandrene dimer II	12.70	1877.4	0.55	15.17	1787.3	0.55
α-Phellandrene dimer III	13.42	1942.3	0.02	15.41	1808.0	0.01
α-Phellandrene dimer IV	13.62	1960.9	0.01	15.63	1827.8	0.02
Total reported		97.22%			98.91%	

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

[xx]: Duplicate percentage due to coelutions, only the first one is 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