

Date : 2024-04-23

CERTIFICATE OF ANALYSIS - GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 24D09-NSO01

Customer Identification : Palo Santo - PLS-JUL.OCT23

Type : Essential Oil

Source : *Bursera graveolens*

Customer : Natural Sourcing LLC

Checked and approved by:

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 : Sylvain Mercier, M. Sc., Chimiste 2014-005

Date : 2024-04-17

PHYSICOCHEMICAL DATA

Refractive index : 1.4774 ± 0.0003 (20 °C)

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

Analyst : Cindy Caron B. Sc.

Date : 2024-04-11

Optical rotation : $+64.9^\circ$ (22 °C, methanol, $c = 1.6$)

Method : PC-MAT-032 - Rotation index determination

Analyst : Cindy Caron B. Sc.

Date : 2024-04-10

Density : 0.881

Method : PC-MAT-017 - Density of a liquid measurement

Analyst : Cindy Caron B. Sc.

Date : 2024-04-10

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
Toluene	0.01	Simple phenolic
3-Methylcyclopentanone	0.16	Aliphatic ketone
α -Thujene	tr	Monoterpene
α -Pinene	0.10	Monoterpene
3-Methylcyclohexanone	0.03	Aliphatic ketone
β -Pinene	tr	Monoterpene
Sabinene	0.01	Monoterpene
Hexahydroacetophenone epimer I	0.14	Aliphatic ketone
Hexahydroacetophenone epimer II	0.16	Aliphatic ketone
Dehydro-1,8-cineole	0.16	Monoterpenic ether
Myrcene	0.29	Monoterpene
α -Phellandrene	0.02	Monoterpene
Pseudolimonene	0.04	Monoterpene
Δ^3 -Carene	tr	Monoterpene
α -Terpinene	0.01	Monoterpene
Carvomenthene	0.02	Aliphatic alcohol
<i>para</i> -Cymene	0.76	Monoterpene
β -Phellandrene	0.10	Monoterpene
Limonene	68.13	Monoterpene
(Z)- β -Ocimene	tr	Monoterpene
γ -Terpinene	0.02	Monoterpene
<i>cis</i> -Sabinene hydrate	tr	Monoterpenic alcohol
<i>cis</i> -Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Terpinolene	0.02	Monoterpene
<i>para</i> -Cymenene	0.10	Monoterpene
<i>trans</i> -Sabinene hydrate	0.02	Monoterpenic alcohol
Linalool	0.08	Monoterpenic alcohol
1,3,8- <i>para</i> -Menthatriene	0.02	Monoterpene
<i>cis-para</i> -Menth-2-en-1-ol	0.03	Monoterpenic alcohol
<i>trans-para</i> -Mentha-2,8-dien-1-ol	0.31	Monoterpenic alcohol
Limona ketone	0.07	Normonoterpenic ketone
<i>cis</i> -Limonene oxide	0.05	Monoterpenic ether
<i>trans</i> -Limonene oxide	0.12	Monoterpenic ether
<i>cis-para</i> -Mentha-2,8-dien-1-ol	0.35	Monoterpenic alcohol
<i>cis</i> - β -Terpineol	0.24	Monoterpenic alcohol
Menthone	0.23	Monoterpenic ketone
Menthofuran	11.45	Monoterpenic ether
<i>trans</i> - β -Terpineol	0.05	Monoterpenic alcohol
Isomenthone	0.38	Monoterpenic ketone
neo-Menthol	0.05	Monoterpenic alcohol

<i>trans</i> -Isopulegone	0.12	Monoterpenic ketone
Terpinen-4-ol	0.04	Monoterpenic alcohol
Unknown	0.20	Oxygenated monoterpene
4-Methylacetophenone	0.05	Simple phenolic
<i>para</i> -Cymen-8-ol	0.04	Monoterpenic alcohol
<i>trans</i> -Isocarveol	0.05	Monoterpenic alcohol
α -Terpineol	5.31	Monoterpenic alcohol
<i>cis</i> -Dihydrocarvone	0.28	Monoterpenic ketone
Unknown	0.37	Unknown
<i>trans</i> -Isopiperitenol	0.05	Monoterpenic alcohol
<i>cis</i> - α -Phellandrene epoxide (iPr vs Me)	0.01	Monoterpenic ether
<i>trans</i> -Dihydrocarvone	0.03	Monoterpenic ketone
<i>trans</i> -Piperitol	0.05	Monoterpenic alcohol
4,7-Dimethylbenzofuran?	0.02	Furan
<i>cis</i> -Isopiperitenol	0.09	Monoterpenic alcohol
<i>trans</i> -Carveol	0.44	Monoterpenic alcohol
<i>cis</i> -Isocarveol	0.06	Monoterpenic alcohol
<i>cis</i> -Carveol	0.19	Monoterpenic alcohol
Pulegone	1.09	Monoterpenic ketone
Carvone	0.87	Monoterpenic ketone
Unknown	0.05	Unknown
Unknown	0.02	Unknown
Perillaldehyde	0.04	Monoterpenic aldehyde
Bornyl acetate	0.02	Monoterpenic ester
Limonen-10-ol	0.01	Monoterpenic alcohol
<i>cis-para</i> -Mentha-2,8-diene-1-hydroperoxide	0.01	Monoterpenic peroxide
Unknown	0.13	Unknown
Unknown	0.09	Unknown
Menthofuro lactone isomer I	0.12	Monoterpenic lactone
Menthofuro lactone isomer II	0.17	Monoterpenic lactone
α -Ylangene	0.08	Sesquiterpene
α -Copaene	0.13	Sesquiterpene
<i>cis</i> - β -Elemene	0.01	Sesquiterpene
β -Cubebene	0.04	Sesquiterpene
β -Elemene	0.28	Sesquiterpene
Unknown	0.02	Unknown
α -Cedrene	0.06	Sesquiterpene
β -Funebrene	0.01	Sesquiterpene
β -Ylangene	0.10	Sesquiterpene
8-Hydroxycarvotanacetone	0.01	Monoterpenic alcohol
<i>cis</i> -Thujopsene	0.17	Sesquiterpene
β -Copaene	0.11	Sesquiterpene
β -Humulene	0.09	Sesquiterpene
Menthofuro lactone isomer III	0.14	Monoterpenic lactone
β -Barbatene	0.06	Sesquiterpene

<i>cis</i> - β -Bergamotene?	0.04	Sesquiterpene
Unknown	0.22	Sesquiterpene
α -Humulene	0.04	Sesquiterpene
allo-Aromadendrene	0.03	Sesquiterpene
<i>cis</i> -Muurolo-4(15),5-diene	0.01	Sesquiterpene
9-epi- β -Caryophyllene	0.05	Sesquiterpene
γ -Gurjunene	0.02	Sesquiterpene
γ -Muurolole	0.40	Sesquiterpene
Germacrene D	0.89	Sesquiterpene
β -Selinene	0.13	Sesquiterpene
Menthylactone	0.29	Monoterpenic lactone
Bicyclogermacrene	0.07	Sesquiterpene
α -Selinene	0.09	Sesquiterpene
α -Muurolole	0.15	Sesquiterpene
Germacrene A	0.05	Sesquiterpene
γ -Cadinene	0.14	Sesquiterpene
(3 <i>E</i> ,6 <i>E</i>)- α -Farnesene	0.23	Sesquiterpene
β -Bisabolene	0.07	Sesquiterpene
<i>trans</i> -Calamenene	0.03	Sesquiterpene
δ -Cadinene	0.24	Sesquiterpene
Menthofuroloactone analog	0.08	Monoterpenic lactone
Unknown	0.01	Oxygenated sesquiterpene
α -Cadinene	0.03	Sesquiterpene
α -Calacorene	0.02	Sesquiterpene
Germacrene B	0.03	Sesquiterpene
1,5-Epoxyalvial-4(14)-ene	0.04	Sesquiterpenic ether
7 α -Hydroxymintlactone	0.03	Monoterpenic alcohol
Spathulenol	0.03	Sesquiterpenic alcohol
Salvial-4(14)-en-1-one	0.02	Aliphatic alcohol
Unknown	0.02	Oxygenated sesquiterpene
10-epi- γ -Eudesmol	0.03	Sesquiterpenic alcohol
Junenol	0.13	Sesquiterpenic alcohol
1-epi-Cubenol	0.01	Sesquiterpenic alcohol
τ -Cadinol	0.01	Sesquiterpenic alcohol
τ -Muurolol	0.02	Sesquiterpenic alcohol
Cubenol	0.01	Sesquiterpenic alcohol
β -Eudesmol	0.02	Sesquiterpenic alcohol
Unknown	0.03	Sesquiterpenic alcohol
α -Cadinol	0.02	Sesquiterpenic alcohol
Germacra-4(15),5,10(14)-trien-1 α -ol	0.01	Sesquiterpenic alcohol
Unknown	0.08	Unknown
Consolidated total	98.90	

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

Note: no correction factor was applied

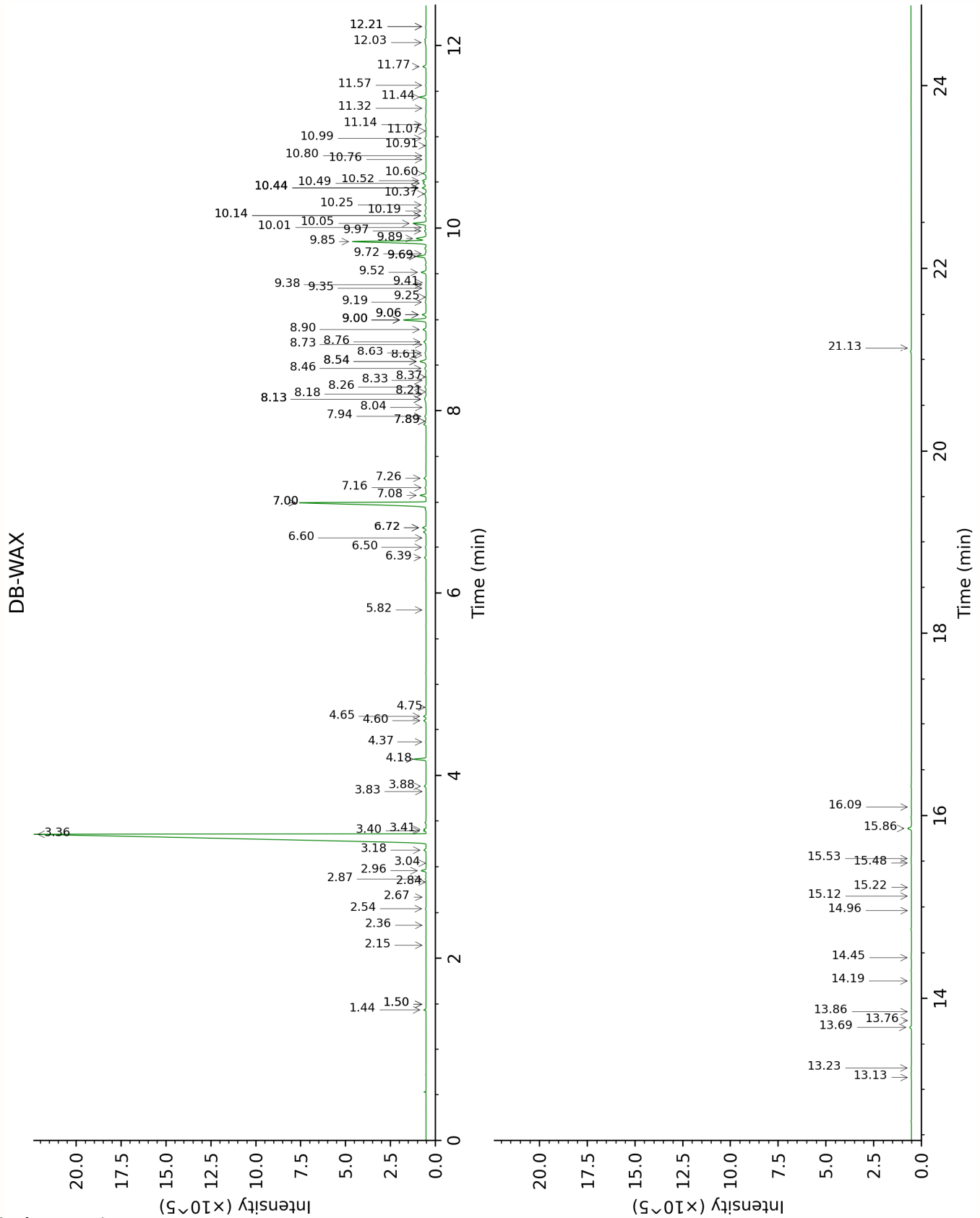
About "consolidated" data: The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies

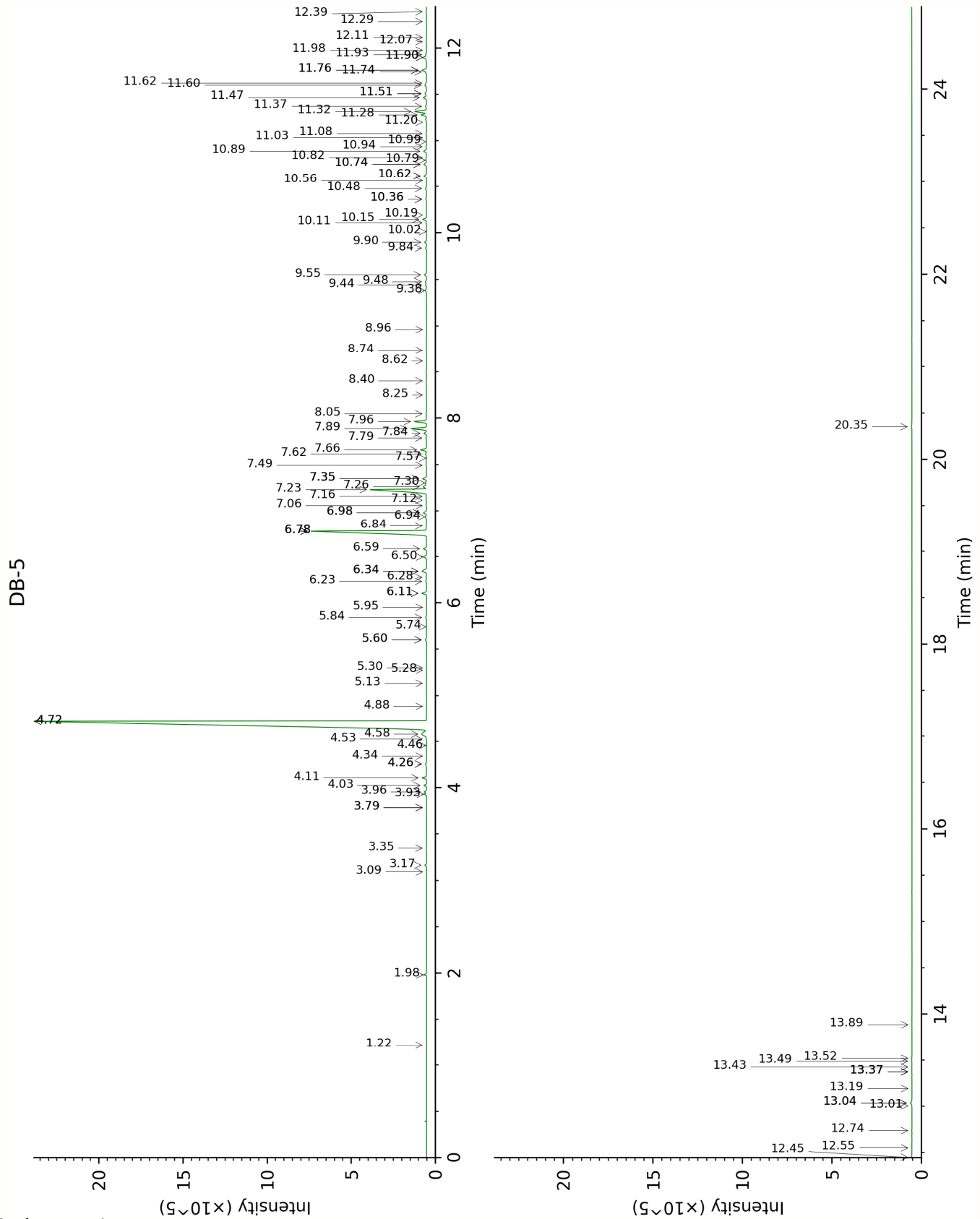
between columns, the algorithm is set to prioritize data from the most standard DB-5 column, and smallest values so as to avoid overestimating individual content. This process is semi-automatic. Advanced users are invited to consult the "Full analysis data" table after the chromatograms in this report 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.

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FULL ANALYSIS DATA

Toluene	Column DB-WAX			Column DB-5		
	1.50*	1003.8	[0.01]	1.22	759.2	0.01
3-Methylcyclopentanone	3.41	1170.1	0.10	1.98	840.5	0.16
α -Thujene	1.50*	1003.8	[0.01]	3.09	926.6	tr
α -Pinene	1.44	994.8	0.09	3.16	931.3	0.10
3-Methylcyclohexanone	4.75	1267.3	0.03	3.35	943.5	0.03
β -Pinene	2.14	1066.3	tr	3.79*	972.2	[0.02]
Sabinene	2.36	1086.8	0.01	3.79*	972.2	[0.02]
Hexahydroacetophenone epimer I	4.60	1256.9	0.14	3.93	981.7	0.14
Hexahydroacetophenone epimer II	4.65	1260.3	0.15	3.96	983.4	0.16
Dehydro-1,8-cineole	3.18	1152.9	0.15	4.02	988.0	0.16
Myrcene	2.96	1135.9	0.28	4.11	993.4	0.29
α -Phellandrene	2.84	1126.6	0.02	4.26*	1003.2	[0.12]
Pseudolimonene	2.87	1129.0	0.04	4.26*	1003.2	[0.12]
Δ^3 -Carene	2.67	1114.1	tr	4.34	1008.7	tr
α -Terpinene	3.04	1142.1	0.01	4.46	1015.9	0.01
Carvomenthene	2.54	1103.8	0.03	4.53	1020.2	0.02
<i>para</i> -Cymene	4.18	1226.9	0.71	4.58	1023.5	0.76
β -Phellandrene	3.40	1168.9	0.10	4.72*	1032.2	[68.47]
Limonene	3.36	1166.0	68.13	4.72*	1032.2	[68.47]
(<i>Z</i>)- β -Ocimene	3.82	1201.5	tr	4.88	1042.2	tr
γ -Terpinene	3.88	1205.9	0.11	5.13	1058.3	0.02
<i>cis</i> -Sabinene hydrate	7.00*	1430.2	[11.46]	5.28	1067.2	tr
<i>cis</i> -Linalool oxide (fur.)	6.60	1401.0	0.02	5.30	1068.7	0.01
Terpinolene	4.37	1240.3	0.02	5.60*	1087.7	[0.12]
<i>para</i> -Cymenene	6.39	1385.5	0.10	5.60*	1087.7	[0.12]
<i>trans</i> -Sabinene hydrate	8.04	1508.7	tr	5.74	1096.5	0.02
Linalool	8.13*	1515.7	[0.20]	5.84	1102.7	0.08
1,3,8- <i>para</i> -Menthatriene	5.82	1344.1	0.02	5.95	1109.6	0.02
<i>cis-para</i> -Menth-2-en-1-ol	8.21	1522.0	0.03	6.10*	1119.3	[0.34]
<i>trans-para</i> -Mentha-2,8- dien-1-ol	9.00*	1584.4	[1.59]	6.10*	1119.3	[0.34]
Limona ketone	7.89*	1497.2	[0.05]	6.23	1127.5	0.07
<i>cis</i> -Limonene oxide	6.50	1393.6	0.05	6.28	1130.3	0.05
<i>trans</i> -Limonene oxide	6.72*†	1409.2	[0.24]	6.34*	1134.4	[0.47]
<i>cis-para</i> -Mentha-2,8- dien-1-ol	9.52	1626.3	0.35	6.34*	1134.4	[0.47]
<i>cis</i> - β -Terpineol	9.06*	1589.0	[0.25]	6.50	1144.4	0.24
Menthone	6.72*†	1409.2	[0.24]	6.59	1150.0	0.23
Menthofuran	7.00*	1430.2	[11.46]	6.78*	1162.1	[11.79]
<i>trans</i> - β -Terpineol	9.72	1643.0	0.05	6.78*	1162.1	[11.79]
Isomenthone	7.08	1436.3	0.38	6.78*	1162.1	[11.79]

neo-Menthol	8.64	1555.6	0.08	6.84	1166.0	0.05
<i>trans</i> -Isopulegone	9.00*	1584.4	[1.59]	6.94	1172.4	0.12
Terpinen-4-ol	8.61	1553.4	0.04	6.98*	1175.2	[0.25]
Unknown CASA XVIII [m/z 69, 84 (62), 41 (30), 123 (26), 97 (24), 109 (23)...]	9.69*†	1640.6	[0.68]	6.98*	1175.2	[0.25]
4-Methylacetophenone	10.49	1706.9	0.26	7.06	1180.1	0.05
<i>para</i> -Cymen-8-ol	11.57	1791.0	0.04	7.12	1183.9	0.04
<i>trans</i> -Isocarveol	10.99	1750.1	0.08	7.16	1186.5	0.05
α -Terpineol	9.85	1654.0	5.29	7.23	1191.1	5.31
<i>cis</i> -Dihydrocarvone	8.54*	1548.1	[0.51]	7.26	1193.2	0.28
Unknown MISC XXXII [m/z 121, 79 (61), 93 (55), 94 (40), 91 (39), 84 (37)...]	8.13*	1515.7	[0.20]	7.30*†	1195.8	[0.14]
<i>trans</i> -Isopiperitenol	10.44*	1702.6	[0.28]	7.35*†	1198.6	[0.31]
<i>cis</i> - α -Phellandrene epoxide (iPr vs Me)	11.07	1757.2	0.01	7.35*†	1198.6	[0.31]
<i>trans</i> -Dihydrocarvone	8.73	1563.3	0.03	7.35*†	1198.6	[0.31]
<i>trans</i> -Piperitol	10.44*	1702.6	[0.28]	7.49	1208.0	0.05
4,7-Dimethylbenzofuran?				7.57	1213.2	0.02
<i>cis</i> -Isopiperitenol	10.37	1697.2	0.10	7.62	1216.2	0.09
<i>trans</i> -Carveol	11.44	1779.7	0.44	7.66	1219.2	0.44
<i>cis</i> -Isocarveol	12.03	1833.0	0.08	7.79	1227.7	0.06
<i>cis</i> -Carveol	11.77	1809.1	0.21	7.84	1231.0	0.19
Pulegone	9.00*	1584.4	[1.59]	7.89	1234.5	1.09
Carvone	10.05	1670.5	0.93	7.96	1239.6	0.87
Unknown BUGR I [m/z 112, 43 (70), 70 (63), 59 (53), 97 (46), 84 (25)...]	10.25	1687.3	0.10	8.05	1245.2	0.05
Unknown MEPU IV [m/z 112, 70 (63), 43 (59), 59 (51), 97 (45), 84 (22)...]	10.91	1743.1	0.01	8.25	1258.7	0.02
Perillaldehyde	10.76	1729.9	0.02	8.40	1269.0	0.04
Bornyl acetate	8.33	1531.9	0.01	8.62	1283.4	0.02
Limonen-10-ol	13.24	1944.0	0.03	8.74	1291.2	0.01
<i>cis-para</i> -Mentha-2,8- diene-1-hydroperoxide				8.96	1306.3	0.01
Unknown BUGR II [m/z 124, 123 (43), 121 (35), 166 (30), 93 (30), 136 (17)...]				9.38	1336.0	0.13
Unknown BUGR III [m/z 150, 71 (67), 107 (54), 43 (44), 109 (42)...]				9.44	1340.2	0.09

Menthofuroolactone isomer I				9.48	1342.6	0.12
Menthofuroolactone isomer II				9.55	1347.9	0.17
α -Ylangene	7.16	1442.6	0.07	9.84	1368.1	0.08
α -Copaene	7.26	1450.3	0.15	9.90	1372.6	0.13
<i>cis</i> - β -Elemene	8.37	1534.9	0.01	10.02	1380.6	0.01
β -Cubebene	7.89*	1497.2	[0.05]	10.11	1387.3	0.04
β -Elemene	8.54*	1548.1	[0.51]	10.15	1389.9	0.28
Unknown CALU VIII [m/z 71, 100 (92), 111 (79), 69 (46), 109 (45)...]				10.19	1393.2	0.02
α -Cedrene	8.13*	1515.7	[0.20]	10.36*	1405.2	[0.08]
β -Funebrene	8.18	1520.0	0.01	10.36*	1405.2	[0.08]
β -Ylangene	8.26	1526.2	0.08	10.48	1413.8	0.10
8-Hydroxycarvotanacetone				10.56	1420.1	0.01
<i>cis</i> -Thujopsene	8.76	1565.7	0.17	10.62*	1424.1	[0.20]
β -Copaene	8.46	1542.2	0.11	10.62*	1424.1	[0.20]
β -Humulene	7.94	1501.2	0.09	10.74*	1433.5	[0.24]
Menthofuroolactone isomer III				10.74*	1433.5	[0.24]
β -Barbatene	9.19	1599.8	0.07	10.79	1436.9	0.06
<i>cis</i> - β -Bergamotene?				10.82	1439.0	0.04
Unknown BOCA IV [m/z 91, 161 (92), 105 (85), 119 (63), 133 (53), 79 (49), 204 (46)]	8.90	1576.3	0.22	10.89	1444.1	0.22
α -Humulene	9.35	1611.9	0.02	10.94	1447.7	0.04
allo-Aromadendrene	9.06*	1589.0	[0.25]	10.99	1451.8	0.03
<i>cis</i> -Muurolo-4(15),5-diene	9.41	1617.1	tr	11.03	1455.0	0.01
9-epi- β -Caryophyllene	9.38	1615.1	0.03	11.08	1458.3	0.05
γ -Gurjunene	9.25	1604.1	0.02	11.20	1467.4	0.02
γ -Muurolole	9.69*†	1640.6	[0.68]	11.28	1473.3	0.40
Germacrene D	9.89	1656.8	0.82	11.32	1476.0	0.89
β -Selinene	9.97	1663.6	0.11	11.37	1480.2	0.13
Menthylactone	15.86	2203.1	0.27	11.47	1487.2	0.29
Bicyclogermacrene	10.14*	1677.5	[0.13]	11.51*	1490.3	[0.16]
α -Selinene	10.01	1666.8	0.09	11.51*	1490.3	[0.16]
α -Muurolole	10.14*	1677.5	[0.13]	11.60	1497.2	0.15
Germacrene A	10.44*	1702.6	[0.28]	11.62	1498.8	0.05
γ -Cadinene	10.44*	1702.6	[0.28]	11.74*†	1507.9	[0.06]
(3E,6E)- α -Farnesene	10.60	1716.7	0.23	11.76*†	1509.3	[0.37]
β -Bisabolene	10.19	1681.7	0.07	11.76*†	1509.3	[0.37]
<i>trans</i> -Calamenene	11.32	1769.1	0.03	11.90*	1520.2	[0.31]

δ-Cadinene	10.52	1709.2	0.24	11.90*	1520.2	[0.31]
Menthofuro lactone analog				11.93	1522.5	0.08
Unknown CASA XXIV [m/z 122, 105 (39), 107 (38), 91 (32), 81 (31), 161 (30), 119 (28)... 207? (20)]				11.98	1526.2	0.01
α-Cadinene	10.80	1733.5	0.03	12.07	1533.5	0.03
α-Calacorene	12.21*	1849.0	[0.05]	12.11	1537.0	0.02
Germacrene B	11.14	1763.3	0.07	12.29	1550.6	0.03
1,5-Epoxysalvial-4(14)-ene	12.21*	1849.0	[0.05]	12.39	1559.0	0.04
7α-Hydroxymint lactone	21.13	2803.0	0.01	12.44	1563.0	0.03
Spathulenol	14.45	2060.9	0.05	12.55	1571.3	0.03
Salvial-4(14)-en-1-one	13.13	1934.0	0.02	12.74	1586.0	0.02
Unknown CULO XXIII [m/z 43, 93 (88), 91 (76), 79 (73), 69 (64), 41 (63), 95 (53).. 220 (3)]				13.00	1607.0	0.02
10-epi-γ-Eudesmol	14.19	2035.9	0.03	13.04*	1609.5	[0.15]
Junenol	13.69	1986.8	0.13	13.04*	1609.5	[0.15]
1-epi-Cubenol	13.86	2003.0	0.02	13.19	1622.5	0.01
τ-Cadinol	14.96	2111.4	0.01	13.37*	1637.3	[0.03]
τ-Muurolol	15.12	2127.5	0.02	13.37*	1637.3	[0.03]
Cubenol	13.76	1993.8	0.01	13.37*	1637.3	[0.03]
β-Eudesmol	15.48	2164.6	0.03	13.42	1641.7	0.02
Unknown cadinol analog II [m/z 95, 121 (73), 43 (57), 79 (43), 161 (43), 109 (40)... 204 (35), 222 (2)]	15.22	2137.2	0.02	13.49	1646.8	0.03
α-Cadinol	15.53	2169.5	0.06	13.52	1649.4	0.02
Germacre-4(15),5,10(14)-trien-1α-ol	16.10	2227.5	0.02	13.89	1679.9	0.01
Unknown MEPU XVI [m/z 165, 166 (48), 137 (11), 67 (9), 124 (7), 43 (7)...]				20.35	2300.1	0.08
Total reported		98.05%			99.07%	

*: 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