

Date : April 30, 2020

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code :** 20D21-PTH33

**Customer identification :** Chamomile German Organic - Bulgaria - CC110288R

**Type :** Essential oil

**Source :** *Matricaria chamomilla*

**Customer :** Plant Therapy


ANALYSIS

**Method:** PC-MAT-007 - Analysis of the composition of an essential oil or other volatile liquide by FAST GC-FID (in French); identifications validated by GC-MS.

**Analyst :** Sylvain Mercier, M. Sc., Chimiste

**Analysis date :** April 29, 2020

Checked and approved by :



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

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### PHYSICOCHEMICAL DATA

**Physical aspect:** Dark blue liquid

**Refractive index:**  $1.5172 \pm 0.0003$  (20 °C; method PC-MAT-016)

### CONCLUSION

No clear adulterant or diluent has been detected using this method. The oil features matricaria esters, which could be a less common chemotype for the species.

## ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

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

Identification	%	Classe
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Ethyl 2-methylbutyrate	0.01	Aliphatic ester
Santolinatriene	0.01	Monoterpene
$\alpha$ -Thujene	tr	Monoterpene
$\alpha$ -Pinene	0.03	Monoterpene
Camphene	tr	Monoterpene
Propyl 2-methylbutyrate	0.01	Aliphatic ester
$\beta$ -Pinene	0.04	Monoterpene
Sabinene	0.06	Monoterpene
6-Methyl-5-hepten-2-one	0.01	Aliphatic ketone
2-Pentylfuran	0.04	Furan
Myrcene	0.03	Monoterpene
Unknown	0.01	Monoterpene
Octanal	0.03	Aliphatic aldehyde
Yomogi alcohol	0.02	Monoterpenic alcohol
$\alpha$ -Terpinene	0.02	Monoterpene
para-Cymene	0.05	Monoterpene
Limonene	0.04	Monoterpene
1,8-Cineole	0.04	Monoterpenic ether
(Z)- $\beta$ -Ocimene	0.10	Monoterpene
(E)- $\beta$ -Ocimene	0.46	Monoterpene
$\gamma$ -Terpinene	0.08	Monoterpene
Artemisia ketone	0.21	Monoterpenic ketone
Artemisia alcohol	0.04	Monoterpenic alcohol
Terpinolene	0.02	Monoterpene
Linalool	0.03	Monoterpenic alcohol
Nonanal	0.05	Aliphatic aldehyde
Unknown	0.02	Oxygenated monoterpene
<i>trans</i> -Chrysanthemol	0.01	Monoterpenic alcohol
Borneol	0.01	Monoterpenic alcohol
Artemisyl acetate	0.02	Monoterpenic ester
Terpinen-4-ol	0.02	Monoterpenic alcohol
Nonanol	0.03	Aliphatic alcohol
$\alpha$ -Terpineol	0.01	Monoterpenic alcohol
Safranal	0.02	Monoterpenic aldehyde
Decanal	0.03	Aliphatic aldehyde
(3Z)-Hexenyl isovalerate	0.02	Aliphatic ester
(2E)-Hexenyl isovalerate	0.03	Aliphatic ester
Hexyl isovalerate	0.01	Aliphatic ester
$\alpha$ -Ionene	0.01	Terpene derivative
4,8-Dimethylnona-3,8-dien-2-one	0.03	Terpenic ketone
Pelargonic acid	0.02	Aliphatic acid
Tridecane	0.01	Alkane
(2E,4E)-Decadienal	0.01	Aliphatic aldehyde
$\delta$ -Elemene isomer	0.01	Sesquiterpene
Bicycloelemene	0.08	Sesquiterpene

7βH-Silphiperfol-5-ene	0.03	Sesquiterpene
α-Longipinene	0.02	Sesquiterpene
Dehydro-ar-ionene	0.03	Miscellaneous
α-Copaene	0.10	Sesquiterpene
Modhephene	0.11	Sesquiterpene
α-Isocomene	0.37	Sesquiterpene
Capric acid	0.05	Aliphatic acid
β-Elemene	0.12	Sesquiterpene
β-Isocomene	0.06	Sesquiterpene
β-Caryophyllene	0.34	Sesquiterpene
β-Ylangene	0.02	Sesquiterpene
β-Copaene	0.05	Sesquiterpene
Aromadendrene	0.12	Sesquiterpene
Striatene?	0.03	Sesquiterpene
α-Humulene	0.09	Sesquiterpene
allo-Aromadendrene	0.26	Sesquiterpene
(E)-β-Farnesene	33.20	Sesquiterpene
Dehydrosesquicineole	0.03	Sesquiterpenic ether
Precocene I	0.15	Chromane
γ-Murolene	0.03	Sesquiterpene
Germacrene D	3.93	Sesquiterpene
β-Selinene	0.11	Sesquiterpene
ar-Curcumene	0.07	Sesquiterpene
Viridiflorene	0.21	Sesquiterpene
Bicyclogermacrene	4.67	Sesquiterpene
α-Selinene	0.08	Sesquiterpene
α-Zingiberene	0.05	Sesquiterpene
(3Z,6E)-α-Farnesene	0.34	Sesquiterpene
α-Murolene	0.05	Sesquiterpene
(3E,6E)-α-Farnesene	2.07	Sesquiterpene
γ-Cadinene	0.11	Sesquiterpene
3,6-Dihydrochamazulene	0.01	Azulene
Dihydrochamazulene isomer I	0.05	Azulene
δ-Cadinene	0.20	Sesquiterpene
β-Sesquiphellandrene	0.28	Sesquiterpene
Matricaria ester isomer I	1.47	Polyyne ester
Unknown	0.08	Oxygenated sesquiterpene
(E)-α-Bisabolene	0.03	Sesquiterpene
Salviadienol?	0.08	Sesquiterpenic alcohol
Sesquirosefuran?	0.13	Sesquiterpenic ether
(E)-Nerolidol	0.30	Sesquiterpenic alcohol
Matricaria ester isomer III?	0.36	Polyyne ester
Spathulenol	2.27	Sesquiterpenic alcohol
Unknown	0.35	Oxygenated sesquiterpene
Globulol	0.02	Sesquiterpenic alcohol
Caryophyllene oxide	0.08	Sesquiterpenic ether
Caryophyllene oxide isomer	0.01	Sesquiterpenic ether
Dendrolasin	0.43	Sesquiterpenic ether
Viridiflorol	0.33	Sesquiterpenic alcohol
Ledol	0.19	Sesquiterpenic alcohol
5,6-Dihydrochamazulene	0.24	Azulene
(2,7Z)-Bisaboladien-4-ol	0.26	Sesquiterpenic alcohol

Unknown	0.32	Unknown
$\tau$ -Cadinol	0.21	Sesquiterpenic alcohol
$\tau$ -Muurolol	0.12	Sesquiterpenic alcohol
Unknown	0.09	Unknown
$\alpha$ -Bisabolol oxide B, epimer 1	8.08	Sesquiterpenic alcohol
$\alpha$ -Bisabolol oxide B, epimer 2	0.26	Sesquiterpenic alcohol
Ageratochromene	0.07	Chromane
epi- $\beta$ -Bisabolol	0.10	Sesquiterpenic alcohol
Bisabolone oxide A	5.82	Sesquiterpenic ketone
$\alpha$ -Bisabolol	0.62	Sesquiterpenic alcohol
Germacre-4(15),5,10(14)-trien-1 $\alpha$ -ol	0.13	Sesquiterpenic alcohol
Chamazulene	6.07	Azulene
$\alpha$ -Bisabolol oxide A	4.56	Sesquiterpenic alcohol
Benzyl benzoate	0.04	Phenolic ester
$\alpha$ -Costol?	0.06	Sesquiterpenic alcohol
Phytone	0.21	Terpenic ketone
(Z)-Spiroether	6.84	Polyyne
(E)-Spiroether	0.69	Polyyne
(Z)-Tibetin spiroether	0.10	Polyyne
(E)-Tibetin spiroether	0.27	Polyyne
Palmitic acid	0.50	Aliphatic acid
Eicosane	0.02	Alkane
Heneicosane	0.02	Alkane
Phytol	0.20	Diterpenic alcohol
Linoleic acid	0.09	Aliphatic acid
Oleic acid	0.15	Aliphatic acid
(9Z)-18-Octadecenolide?	0.02	Aliphatic lactone
Tricosane	0.09	Alkane
Tetracosane	0.03	Alkane
Pentacosane	0.23	Alkane
Hexacosane	0.01	Alkane
Heptacosane	0.05	Alkane
Unknown	0.65	Unknown
Unknown	0.64	Unknown
Unknown	0.22	Unknown
Unknown	0.27	Unknown
Unknown	0.86	Oxygenated triterpene
Unknown	0.31	Unknown
Unknown	0.31	Oxygenated triterpene
<b>Consolidated total</b>	<b>95.25%</b>	

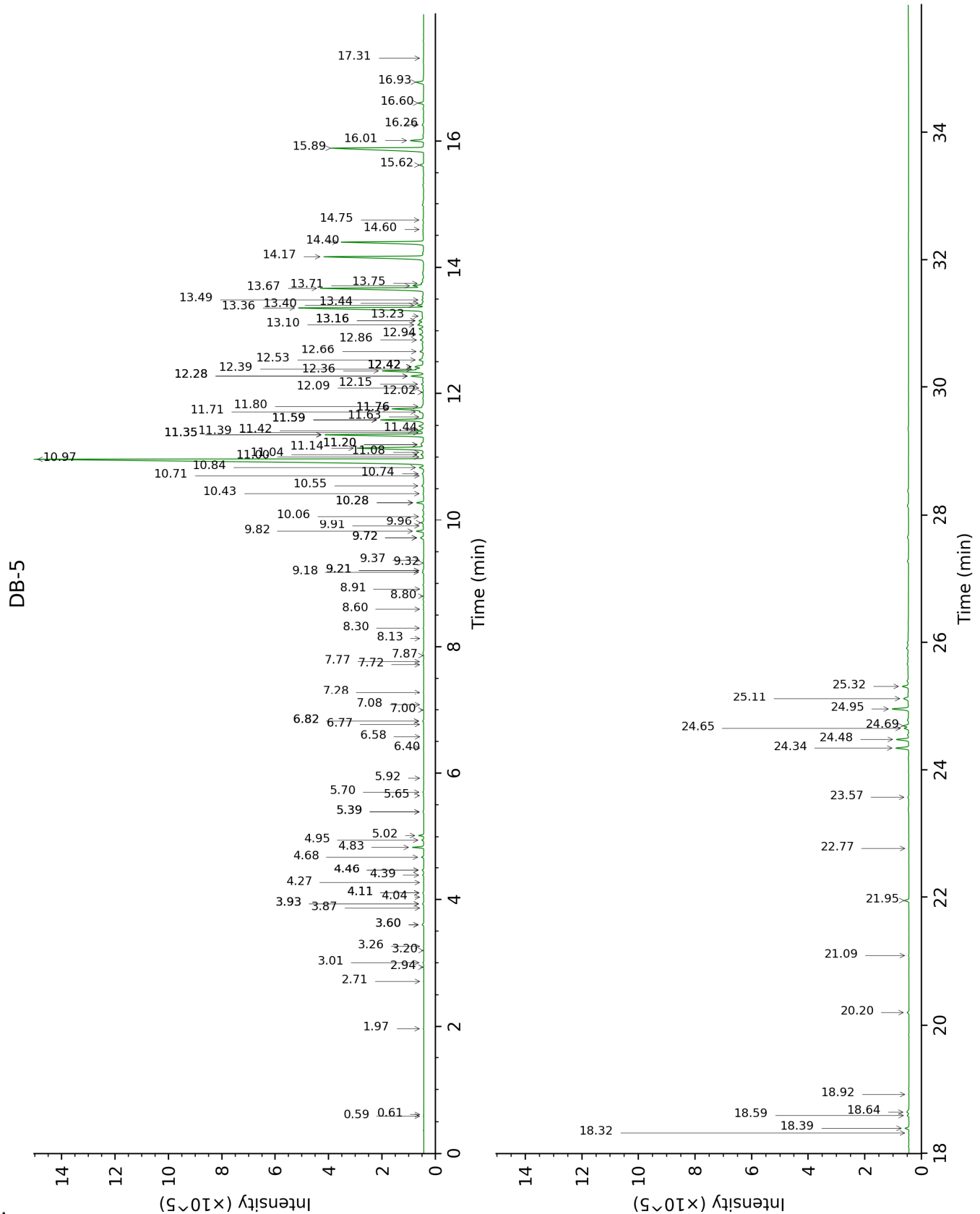
tr: The compound has been detected below 0.005% of total signal.

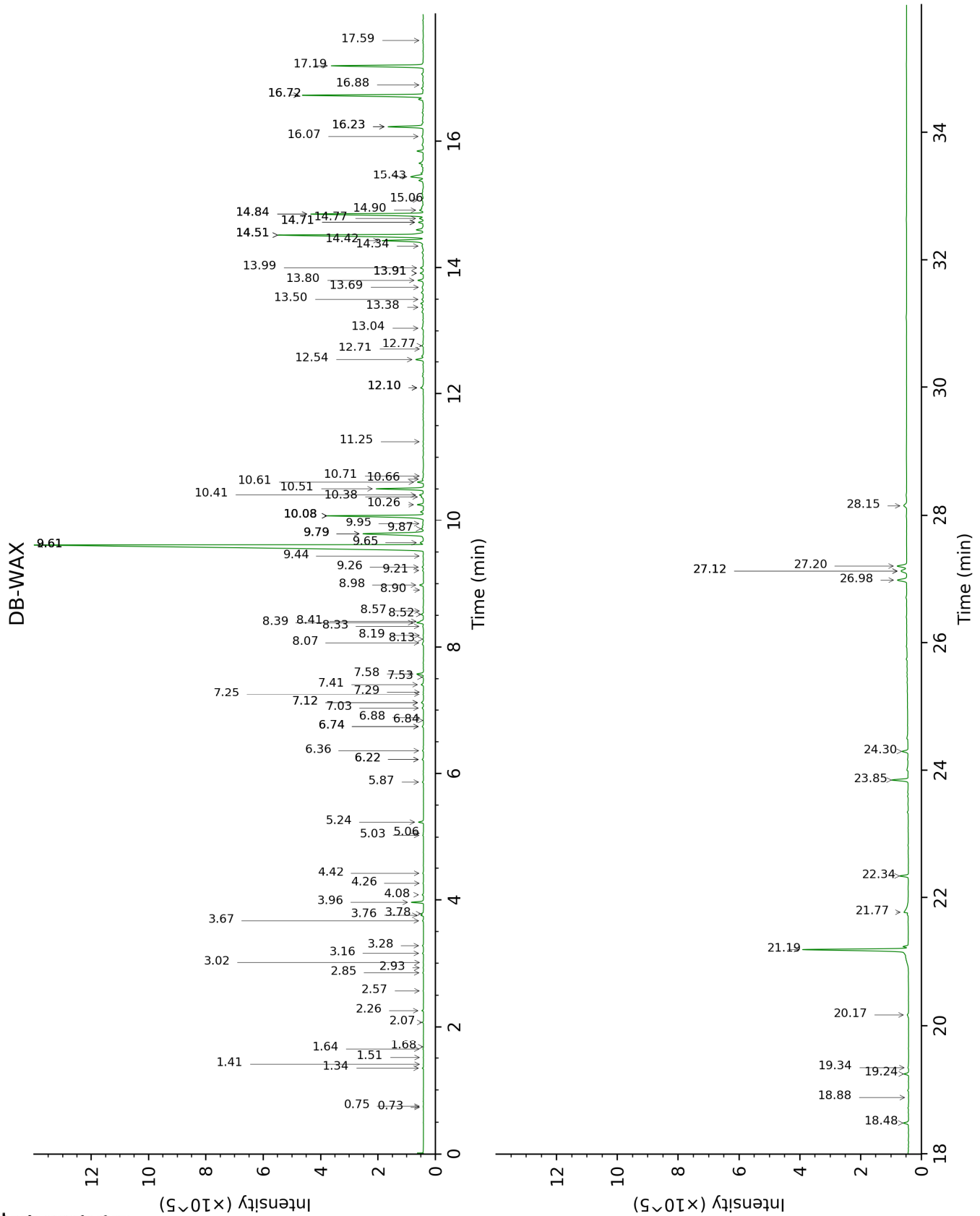
Note: no correction factor was applied

**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	%
Isovaleral	0.59	640	0.01	0.75	888	tr
2-Methylbutyral	0.61	652	tr	0.73	881	tr
Ethyl 2-methylbutyrate	1.97	850	0.01	1.64	1022	0.01
Santolinatriene	2.71	910	0.01	1.51	1009	0.01
$\alpha$ -Thujene	2.94	925	tr	1.41	999	tr
$\alpha$ -Pinene	3.01	930	0.03	1.34	990	0.03
Camphene	3.20	942	tr	1.68	1026	tr
Propyl 2-methylbutyrate	3.26	947	0.01	2.57	1110	0.02
$\beta$ -Pinene	3.60*	969	0.08	2.07	1065	0.04
Sabinene	3.60*	969	[0.08]	2.26	1083	0.06
6-Methyl-5-hepten-2-one	3.87	986	0.01	5.03	1296	0.03
2-Pentylfuran	3.93*	991	0.06	3.67	1197	0.04
Myrcene	3.93*	991	[0.06]	2.85	1132	0.03
Unknown [m/z 93, 91 (46), 80 (44), 79 (42), 77 (33), 92 (20)... 136 (4)]	4.04	998	0.01	3.02	1145	0.01
Octanal	4.11*	1002	0.06	4.42	1252	0.03
Yomogi alcohol	4.11*	1002	[0.06]	6.22*	1379	0.07
$\alpha$ -Terpinene	4.27	1013	0.02	2.93	1139	0.02
para-Cymene	4.39	1020	0.05	4.08	1227	0.05
Limonene	4.46*	1025	0.08	3.16	1156	0.04
1,8-Cineole	4.46*	1025	[0.08]	3.28	1166	0.04
(Z)- $\beta$ -Ocimene	4.68	1038	0.10	3.78†	1205	[0.19]
(E)- $\beta$ -Ocimene	4.83	1048	0.46	3.96	1218	0.48
$\gamma$ -Terpinene	4.95	1055	0.08	3.76†	1203	0.19
Artemisia ketone	5.02	1060	0.21	5.24	1308	0.22
Artemisia alcohol	5.39*	1084	0.05	7.53	1475	0.04
Terpinolene	5.39*	1084	[0.05]	4.26	1240	0.02
Linalool	5.65	1100	0.03	8.07	1516	0.02
Nonanal	5.70	1103	0.05	5.87	1353	0.05
Unknown [m/z 43, 81 (62), 59 (60), 85 (49), 82 (38)... 154 (2)]	5.92	1117	0.02			
<i>trans</i> -Chrysanthemol	6.40	1148	0.01	9.61*	1638	33.82
Borneol	6.58	1160	0.01	9.79*	1652	3.95
Artemisyl acetate	6.77	1172	0.02	6.36	1389	0.05
Terpinen-4-ol	6.82*	1176	0.05	8.57	1555	0.02
Nonanol	6.82*	1176	[0.05]	9.44	1624	0.03
$\alpha$ -Terpineol	7.00	1187	0.01	9.79*	1652	[3.95]
Safranal	7.08	1193	0.02	8.90	1581	0.01
Decanal	7.28	1206	0.03	7.30	1458	0.01
(3Z)-Hexenyl isovalerate	7.72	1236	0.02	7.12*	1445	0.12
(2E)-Hexenyl	7.77	1240	0.03	7.25	1455	0.02

isovalerate						
Hexyl isovalerate	7.87	1246	0.01	6.74*	1417	0.07
α-Ionene	8.13	1265	0.01	6.88	1427	0.01
4,8-Dimethylnona-3,8-dien-2-one	8.30	1276	0.03	9.21	1605	0.05
Pelargonic acid	8.60	1297	0.02			
Tridecane	8.80	1306	0.01	5.06	1295	0.01
(2E,4E)-Decadienal	8.91	1314	0.01	11.25	1773	0.02
δ-Elemene isomer	9.18†	1333	0.12	6.84	1424	0.01
Bicycloelemene	9.20*†	1335	[0.12]	7.03	1438	0.08
7βH-Silphiperfol-5-ene	9.20*†	1335	[0.12]	6.22*	1379	[0.07]
α-Longipinene	9.32	1343	0.02	6.74*	1417	[0.07]
Dehydro-ar-ionene	9.37	1346	0.03			
α-Copaene	9.72*	1371	0.21	7.12*	1445	[0.12]
Modhephene	9.72*	1371	[0.21]	7.41	1467	0.11
α-Isocomene	9.82	1378	0.37	7.58	1479	0.33
Capric acid	9.91	1384	0.05	16.23*	2243	1.64
β-Elemene	9.96	1388	0.12	8.41	1543	0.11
β-Isocomene	10.06	1395	0.06	8.19	1526	0.03
β-Caryophyllene	10.28*	1411	0.37	8.39	1541	0.34
β-Ylangene	10.28*	1411	[0.37]	8.13	1521	0.02
β-Copaene	10.43	1422	0.05	8.33	1537	0.05
Aromadendrene	10.55	1431	0.12	8.52	1551	0.11
Striatene?	10.71	1443	0.03			
α-Humulene	10.74	1445	0.09	9.26	1609	0.07
allo-Aromadendrene	10.84	1452	0.26	8.98	1587	0.19
(E)-β-Farnesene	10.97	1462	33.20	9.61*	1638	[33.82]
Dehydrosesquiceneole	11.00	1465	0.03	10.08*	1676	4.98
Precocene I	11.04	1468	0.15	13.91*	2013	0.17
γ-Murolene	11.08	1470	0.03	9.61*	1638	[33.82]
Germacrene D	11.14	1475	3.93	9.79*	1652	[3.95]
β-Selinene	11.20*	1479	0.25	9.87	1658	0.11
ar-Curcumene	11.20*	1479	[0.25]	10.66	1724	0.07
Viridiflorene	11.35*	1491	4.95	9.65	1640	0.21
Bicyclogermacrene	11.35*	1491	[4.95]	10.08*	1676	[4.98]
α-Selinene	11.35*	1491	[4.95]	9.95	1665	0.08
α-Zingiberene	11.39	1494	0.05	10.08*	1676	[4.98]
(3Z,6E)-α-Farnesene	11.42	1496	0.34	10.26	1690	0.28
α-Murolene	11.44	1497	0.05	10.08*	1676	[4.98]
(3E,6E)-α-Farnesene	11.59*	1509	2.21	10.51	1711	2.07
γ-Cadinene	11.59*	1509	[2.21]	10.38	1700	0.11
3,6-Dihydrochamazulene	11.59*	1509	[2.21]	12.10*	1847	0.18
Dihydrochamazulene isomer I	11.63	1512	0.05	12.10*	1847	[0.18]
δ-Cadinene	11.71	1518	0.20	10.41	1703	0.21
β-Sesquiphellandrene	11.76*	1522	1.75	10.61	1720	0.28
Matricaria ester isomer I	11.76*	1522	[1.75]	16.23*	2243	[1.64]
Unknown [m/z 93, 91 (59), 43 (55), 79 (49),	11.80	1525	0.08	13.50	1974	0.08

105 (40)... 220? (t)]						
(E)- $\alpha$ -Bisabolene	12.02	1543	0.03	10.71	1728	0.02
Salviadienol?	12.09	1548	0.08	14.34	2054	0.09
Sesquirosefuran?	12.15	1553	0.13	12.10*	1847	[0.18]
(E)-Nerolidol	12.28*	1563	0.66	13.80	2002	0.30
Matricaria ester isomer III?	12.28*	1563	[0.66]			
Spathulenol	12.36	1569	2.27	14.42	2062	2.17
Unknown [m/z 109, 43 (95), 81 (81), 93 (76), 69 (75), 95 (74), 107 (71)... 204 (22), 220 (6)]	12.39†	1571	0.89			
Globulol	12.42*†	1574	[0.89]	13.91*	2013	[0.17]
Caryophyllene oxide	12.42*†	1574	[0.89]	12.77	1907	0.08
Caryophyllene oxide isomer	12.42*†	1574	[0.89]	12.71	1902	0.01
Dendrolasin	12.42*†	1574	[0.89]	12.54	1886	0.43
Viridiflorol	12.53	1583	0.33	13.99	2021	0.15
Ledol	12.66	1593	0.19	13.38	1963	0.11
5,6-Dihydrochamazulene	12.86	1609	0.24	14.51*	2071	8.37
(2,7Z)-Bisaboladien-4-ol	12.94	1616	0.26	14.84*	2103	5.87
Unknown [m/z 93, 41 (52), 79 (46), 91 (45), 43 (38), 67 (37)...]	13.10	1628	0.32			
$\tau$ -Cadinol	13.16*	1634	0.33	14.90	2109	0.21
$\tau$ -Muurolol	13.16*	1634	[0.33]	15.06	2125	0.12
Unknown [m/z 123, 43 (86), 81 (75), 95 (73), 82 (68), 161 (64), 105 (63)... 220 (6)]	13.23	1640	0.09	13.04	1933	0.12
$\alpha$ -Bisabolol oxide B, epimer 1	13.36	1650	8.08	14.51*	2071	[8.37]
$\alpha$ -Bisabolol oxide B, epimer 2	13.40	1654	0.26	14.51*	2071	[8.37]
Ageratochromene	13.44	1656	0.07	16.88	2311	0.03
epi- $\beta$ -Bisabolol	13.49	1661	0.10	14.77	2096	0.19
Bisabolone oxide A	13.67	1676	5.82	14.84*	2103	[5.87]
$\alpha$ -Bisabolol	13.71	1679	0.62	15.43	2161	0.88
Germacra-4(15),5,10(14)-trien-1 $\alpha$ -ol	13.75	1682	0.13	16.07	2227	0.09
Chamazulene	14.17	1718	6.07	16.72*	2294	6.11
$\alpha$ -Bisabolol oxide A	14.40	1738	4.56	17.19	2344	4.62
Benzyl benzoate	14.60	1755	0.04	18.88	2532	0.01
$\alpha$ -Costol?	14.75	1768	0.06			
Phytone	15.62	1846	0.21	14.71*	2090	0.25
(Z)-Spiroether	15.89	1870	6.84	21.19	2810	6.28
(E)-Spiroether	16.01	1881	0.69	22.34	2957	0.40
(Z)-Tibetin spiroether	16.26	1904	0.10			

(E)-Tibetin spiroether	16.60	1936	0.27			
Palmitic acid	16.93	1968	0.50	21.77	2883	0.52
Eicosane	17.31	2004	0.02	13.69	1992	0.12
Heneicosane	18.32	2105	0.02	14.71*	2090	[0.25]
Phytol	18.39	2112	0.20	19.24	2574	0.22
Linoleic acid	18.59	2133	0.09			
Oleic acid	18.64	2138	0.15			
(9Z)-18-Octadecenolide?	18.92	2167	0.02			
Tricosane	20.20	2304	0.09	16.72*	2294	[6.11]
Tetracosane	21.09	2404	0.03	17.58	2387	0.04
Pentacosane	21.95	2505	0.23	18.48	2486	0.29
Hexacosane	22.78	2605	0.01	19.34	2585	0.04
Heptacosane	23.57	2706	0.05	20.17	2684	0.08
Unknown [m/z 69, 41 (41), 81 (41), 91 (22), 165 (22), 136 (20)...]	24.34	2806	0.65	26.98	3603	0.63
Unknown [m/z 69, 41 (46), 81 (31), 165 (29), 91 (20), 181 (18), 167 (15)...]	24.48	2824	0.64	27.20	3628	0.63
Unknown [m/z 69, 41 (42), 81 (31), 165 (25), 91 (18), 93 (15), 181 (15)...]	24.65	2847	0.22	27.12*	3619	0.47
Unknown [m/z 69, 41 (41), 81 (37), 136 (23), 165 (20), 91 (20)...]	24.69	2852	0.27	27.12*	3619	[0.47]
Unknown [m/z 69, 81 (32), 41 (31), 95 (16), 91 (14), 93 (13), 107 (12)... 408? (3)]	24.95	2888	0.86	23.85	3161	0.84
Unknown [m/z 69, 41 (43), 81 (36), 91 (21), 165 (20), 55 (15)...]	25.11	2910	0.31	28.15	3726	0.24
Unknown [m/z 69, 81 (36), 41 (31), 93 (24), 95 (19), 91 (14), 67 (13), 121 (12)... 408? (2)]	25.32	2938	0.31	24.30	3224	0.31
<b>Total identified</b>		<b>90.65%</b>			<b>90.12%</b>	
<b>Total reported</b>		<b>95.31%</b>			<b>92.98%</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