

Date : October 14, 2020

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code** : 20J13-PTH01


**Customer identification** : Chamomile (Roman) Organic - CC3101202R

**Type** : Essential oil

**Source** : *Anthemis nobilis*

**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** : Fanny Charlier, B. Sc., chimiste à l'entraînement

**Analysis date** : October 14, 2020

Checked and approved by :



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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Clear liquid

**Refractive index:** 1.4381 ± 0.0003 (20 °C; method PC-MAT-016)

*NFT 75-253:2006 - OIL OF ROMAN CHAMOMILE*

<b>Compound</b>	<b>Min. %</b>	<b>Max. %</b>	<b>Observed %</b>	<b>Complies?</b>
trans-Pinocarveol	2	7	6	Yes
Pinocarvone	1.3	6.0	2.0	Yes
Isoamyl angelate	12	22	4	No
2-Methylbutyl angelate	3	7	8	No
Methallyl angelate	6	10	12	No
2-Methylbutyl methacrylate	0.5	1.5	0.6	Yes
Isoamyl isobutyrate	2.5	5.0	8.4	No
Isobutyl methacrylate	0.5	3.0	0.6	Yes
Isobutyl isobutyrate	2	9	0	No
α-Pinene	1	5	9	No
Isobutyl angelate + isoamyl methacrylate	30	45	4	No
<b>Refractive index</b>	1.4380	1.4470	1.4381	Yes

*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
Isobutyral	tr	Aliphatic aldehyde
Methacrolein	0.01	Aliphatic aldehyde
Isobutanol	0.06	Aliphatic alcohol
Methallyl alcohol	0.07	Aliphatic alcohol
Isovaleral	0.02	Aliphatic aldehyde
3-Methyl-2-butanone	0.01	Aliphatic ketone
2-Methylbutyral	tr	Aliphatic aldehyde
3-Methyl-3-buten-2-one	tr	Aliphatic ketone
Methyl isobutyrate	tr	Aliphatic ester
2-Ethylfuran	tr	Furan
2-Vinylfuran	0.01	Furan
Isoamyl alcohol	0.24	Aliphatic alcohol
2-Methylbutanol	0.27	Aliphatic alcohol
(2Z)-Pentenol	tr	Aliphatic alcohol
Ethyl isobutyrate	tr	Aliphatic ester
Toluene	0.01	Simple phenolic
Methyl isovalerate	0.08	Aliphatic ester
Isobutyl acetate	0.01	Aliphatic ester
Methyl 2-methylbutyrate	tr	Aliphatic ester
Octene	0.01	Alkene
Hexanal	0.02	Aliphatic aldehyde
Methyl angelate	0.04	Aliphatic ester
3-Methylpentanol	tr	Aliphatic alcohol
Ethyl 2-methylbutyrate	0.42	Aliphatic ester
(2E)-Hexenal	0.77	Aliphatic aldehyde
(3Z)-Hexenol	0.08	Aliphatic alcohol
Isobutyl propionate	0.02	Aliphatic ester
(2E)-Hexenol	0.03	Aliphatic alcohol
Hexanol	0.03	Aliphatic alcohol
2-Methylbutyl acetate	0.22	Aliphatic ester
Propyl methacrylate	0.07	Aliphatic ester
Nonene	tr	Alkene
Ethyl angelate	0.14	Aliphatic ester
2-Methylcrotonic acid	0.10	Aliphatic acid
Isobutyl isobutyrate	0.47	Aliphatic ester
Tiglyl acetate?	0.02	Aliphatic ester
$\alpha$ -Pinene	8.91	Monoterpene
Methallyl isobutyrate	0.37	Aliphatic ester
Camphene	0.02	Monoterpene
$\alpha$ -Fenchene	0.02	Monoterpene
Propyl 2-methylbutyrate	0.01	Aliphatic ester
Isobutyl methacrylate	0.61	Aliphatic ester
Propyl isovalerate	0.01	Aliphatic ester
Benzaldehyde	0.08	Simple phenolic
Butyl isobutyrate	0.03	Aliphatic ester

Methallyl methacrylate	0.55	Aliphatic ester
Isobutyl butyrate	8.27	Aliphatic ester
β-Pinene	0.09	Monoterpene
Sabinene	0.12	Monoterpene
Butyl methacrylate	0.08	Aliphatic ester
Octan-3-one	0.41	Aliphatic ketone
2-Pentylfuran	0.02	Furan
Myrcene	0.03	Monoterpene
Propyl angelate	0.66	Aliphatic ester
Isobutyl 2-methylbutyrate	0.02	Aliphatic ester
Isobutyl isovalerate	0.08	Aliphatic ester
Isoamyl isobutyrate	8.42	Aliphatic ester
2-Methylbutyl isobutyrate	1.47	Aliphatic ester
Methallyl 2-methylbutyrate	0.08	Aliphatic ester
3-Methyl-3-butenyl isobutyrate?	0.02	Aliphatic ester
para-Cymene	0.05	Monoterpene
Methallyl isovalerate?	0.03	Aliphatic ester
1,8-Cineole	0.06	Monoterpenic ether
Limonene	0.11	Monoterpene
Propyl tiglate	0.02	Aliphatic ester
2-Methylbutyl methacrylate	0.57	Aliphatic ester
Isoamyl methacrylate	0.39	Aliphatic ester
Isobutyl angelate	3.47	Aliphatic ester
γ-Terpinene	0.07	Monoterpene
Prenyl isobutyrate	0.04	Aliphatic ester
Tiglyl isobutyrate?	0.01	Aliphatic ester
Unknown	0.06	Unknown
Methallyl angelate	12.01	Aliphatic ester
Isobutyl senecioate	0.06	Aliphatic ester
3-Methylpentyl propionate?	0.30	Aliphatic ester
para-Cymenene	0.02	Monoterpene
Tiglyl methacrylate	0.02	Aliphatic ester
Butyl angelate	0.27	Aliphatic ester
Isobutyl tiglate	0.17	Aliphatic ester
2-Methylbutyl isovalerate?	0.04	Aliphatic ester
Isoamyl 2-methylbutyrate	0.01	Aliphatic ester
2-Methylbutyl 2-methylbutyrate	0.16	Aliphatic ester
Amyl isovalerate	0.18	Aliphatic ester
Methallyl tiglate	0.18	Aliphatic ester
3-Methylpentyl isobutyrate	6.22	Aliphatic ester
α-Campholenal	0.01	Monoterpenic aldehyde
<i>trans</i> -Pinocarveol	5.57	Monoterpenic alcohol
<i>trans</i> -Verbenol	0.13	Monoterpenic alcohol
Camphene hydrate	0.21	Monoterpenic alcohol
3-Methylpentyl methacrylate	1.35	Aliphatic ester
Isoamyl angelate	4.31	Aliphatic ester
Pinocarvone	1.97	Monoterpenic ketone
2-Methylbutyl angelate	7.69	Aliphatic ester
Unknown	0.08	Oxygenated monoterpene
Borneol	0.20	Monoterpenic alcohol
Benzyl acetate	0.01	Phenolic ester
Angelyl angelate?	0.62	Aliphatic ester

Isopinocampnone	0.06	Monoterpenic ketone
Terpinen-4-ol	0.03	Monoterpenic alcohol
Isobutyl 3-hydroxy-2-methylenebutyrate	0.08	Aliphatic ester
para-Cymen-8-ol	0.02	Monoterpenic alcohol
Amyl angelate	0.04	Aliphatic ester
Myrtenal	0.58	Monoterpenic aldehyde
Myrtenol	0.35	Monoterpenic alcohol
Tiglyl angelate	0.06	Aliphatic ester
Verbenone	0.12	Monoterpenic ketone
3-Methylpentyl 2-methylbutyrate?	0.91	Aliphatic ester
3-Methylpentyl isovalerate?	0.03	Aliphatic ester
<i>trans</i> -Carveol	0.01	Monoterpenic alcohol
4-Methylhexyl isobutyrate	0.04	Aliphatic ester
2-Hydroxy-2-methylbut-3-enyl angelate	0.02	Aliphatic ester
Linalyl acetate	0.09	Monoterpenic ester
3-Methylpentyl angelate	14.93	Aliphatic ester
(3Z)-Hexenyl angelate	0.06	Aliphatic ester
Isoamyl 3-hydroxy-2-methylenebutyrate	0.01	Aliphatic ester
Hexyl angelate	0.02	Aliphatic ester
<i>trans</i> -Pinocarvyl acetate	0.01	Monoterpenic ester
3-Methylpentyl tiglate	0.09	Aliphatic ester
Unknown	tr	Unknown
7βH-Silphiperfol-5-ene	0.02	Sesquiterpene
Cyclosativene II	0.03	Sesquiterpene
α-Copaene	0.02	Sesquiterpene
Isobutyl phenylacetate	0.02	Phenolic ester
4-Methylpentyl 3-hydroxy-2-methylenebutyrate	0.01	Aliphatic ester
β-Caryophyllene	0.01	Sesquiterpene
Unknown	0.02	Sesquiterpene
Myrtenyl propionate?	0.01	Monoterpenic ester
Benzyl angelate	0.01	Phenolic ester
( <i>E</i> )-β-Farnesene	0.02	Sesquiterpene
β-Selinene	0.02	Sesquiterpene
Caryophyllene oxide	0.01	Sesquiterpenic ether
Unknown	0.01	Unknown
<b>Consolidated total</b>	<b>98.07%</b>	

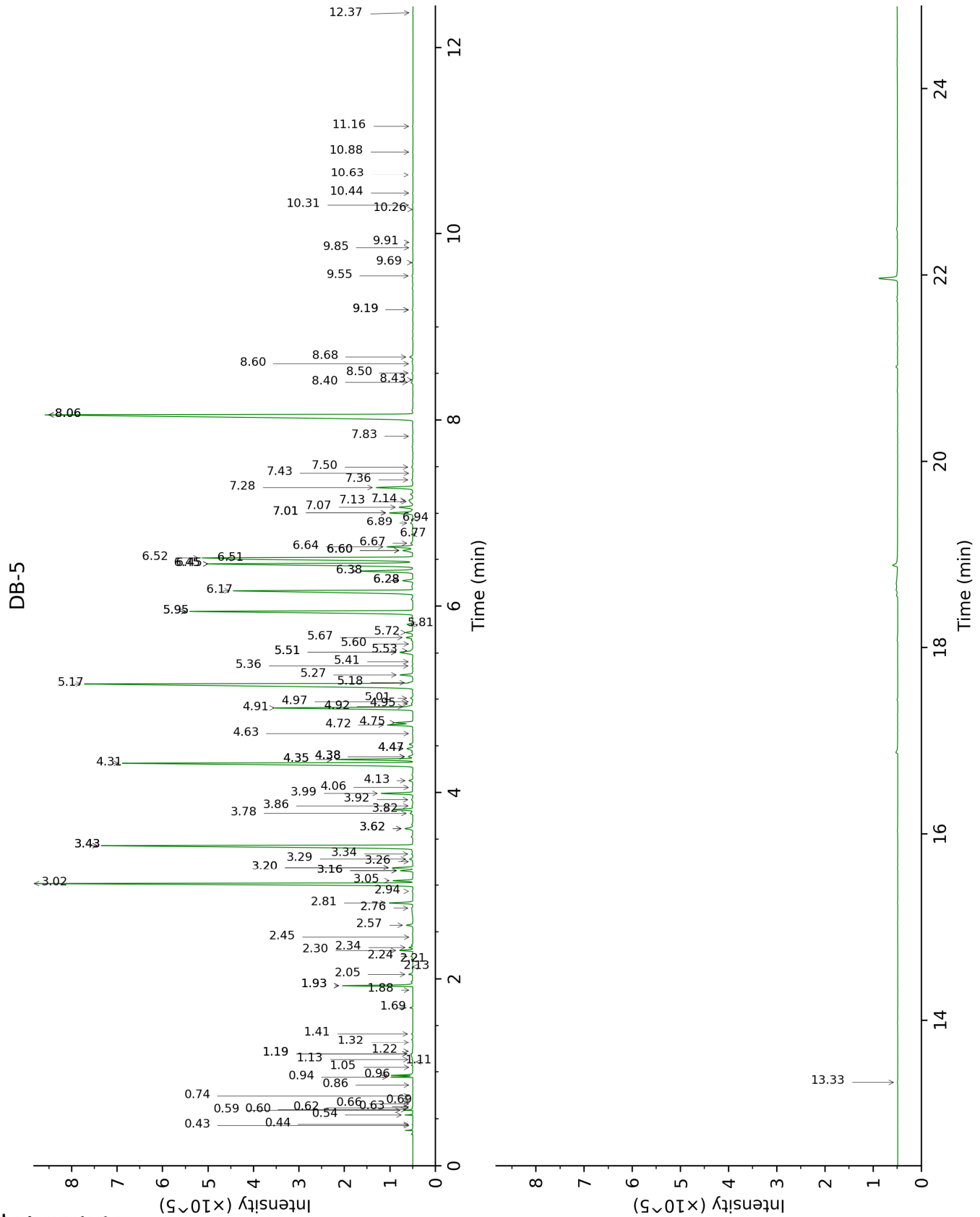
tr: The compound has been detected below 0.005% of total signal.

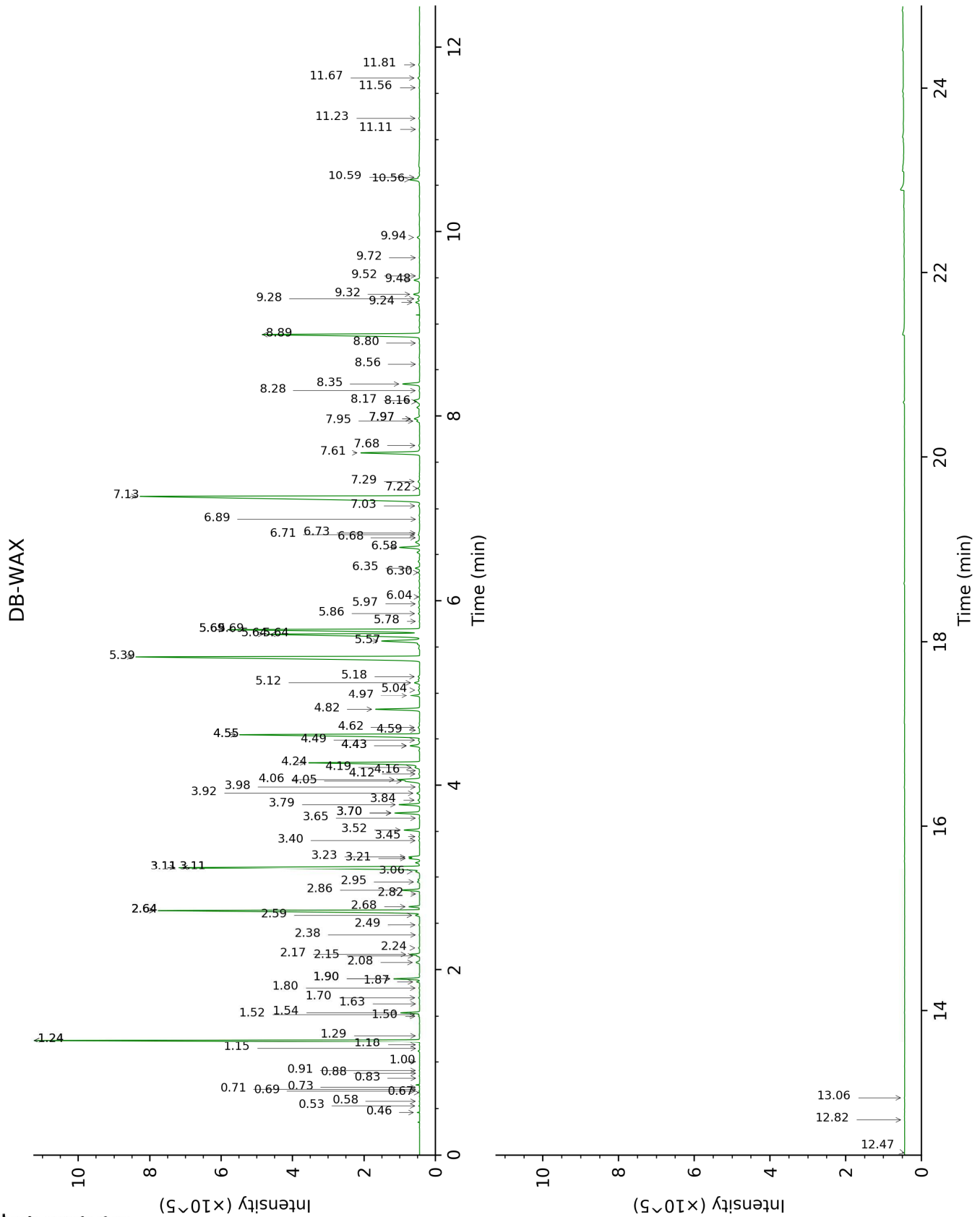
Note: no correction factor was applied

**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	%
Isobutyral	0.43	532	tr	0.46	778	0.02
Methacrolein	0.44	544	0.01	0.58	838	0.01
Isobutanol	0.54	617	0.06	1.87	1061	0.06
Methallyl alcohol	0.59	636	0.07	3.11*	1170	9.95
Isovaleral	0.60	639	0.02	0.69	885	0.01
3-Methyl-2-butanone	0.62	646	0.01	0.73	898	tr
2-Methylbutyral	0.63	650	tr	0.67	878	tr
3-Methyl-3-buten-2-one	0.66	663	tr	1.00	949	tr
Methyl isobutyrate	0.69	675	tr	0.71	894	tr
2-Ethylfuran	0.74	695	tr	0.83	916	tr
2-Vinylfuran	0.86	718	0.01	1.63	1036	tr
Isoamyl alcohol	0.94	731	0.24	3.23†	1179	[0.52]
2-Methylbutanol	0.96	734	0.27	3.21†	1178	0.52
(2Z)-Pentenol	1.05	747	tr			
Ethyl isobutyrate	1.11	755	tr	0.91	932	tr
Toluene	1.13	759	0.01	1.29	999	0.01
Methyl isovalerate	1.19*	768	0.08	1.24*	992	8.91
Isobutyl acetate	1.19*	768	[0.08]	1.18	982	0.01
Methyl 2-methylbutyrate	1.22	772	tr	1.14	975	tr
Octene	1.32	787	0.01	0.53	817	0.01
Hexanal	1.41	801	0.02	1.70	1042	0.02
Methyl angelate	1.69	826	0.04	2.15	1090	0.05
3-Methylpentanol	1.88	842	tr	4.82	1298	1.24
Ethyl 2-methylbutyrate	1.93*	847	1.19	1.54	1025	0.42
(2E)-Hexenal	1.93*	847	[1.19]	3.11*	1170	[9.95]
(3Z)-Hexenol	2.05	857	0.08	5.57	1350	1.34
Isobutyl propionate	2.13	864	0.02	1.80	1054	0.01
(2E)-Hexenol	2.20	870	0.03	5.86	1372	0.03
Hexanol	2.24	873	0.03	5.18	1323	0.05
2-Methylbutyl acetate	2.30	879	0.22	2.17	1092	0.24
Propyl methacrylate	2.34	882	0.07	2.24	1099	0.02
Nonene	2.45	891	tr	0.88	926	tr
Ethyl angelate	2.57	902	0.14	2.64*	1131	8.25
2-Methylcrotonic acid	2.76	915	0.10			
Isobutyl isobutyrate	2.81	918	0.47	1.90*	1064	0.60
Tiglyl acetate?	2.94	927	0.02	3.65	1212	0.01
α-Pinene	3.02	932	8.91	1.24*	992	[8.91]
Methallyl isobutyrate	3.05	935	0.37	2.86	1149	0.47

Camphene	3.16*†	942	0.67	1.52	1023	0.02
α-Fenchene	3.16*†	942	[0.67]	1.50	1021	0.02
Propyl 2-methylbutyrate	3.20*†	944	[0.67]	2.38	1110	0.01
Isobutyl methacrylate	3.20*†	944	[0.67]	2.64*	1131	[8.25]
Propyl isovalerate	3.26	949	0.01	2.59	1127	0.11
Benzaldehyde	3.29	951	0.08	7.03	1459	0.05
Butyl isobutyrate	3.34	954	0.03	2.49	1119	0.02
Methallyl methacrylate	3.43*	960	8.82	3.79	1222	0.55
Isobutyl butyrate	3.43*	960	[8.82]	2.64*	1131	[8.25]
β-Pinene	3.62*	972	0.21	1.90*	1064	[0.60]
Sabinene	3.62*	972	[0.21]	2.08	1083	0.12
Butyl methacrylate	3.78	984	0.08	3.40	1193	0.02
Octan-3-one	3.82	986	0.41	3.70*	1216	0.69
2-Pentylfuran	3.86	989	0.02	3.45	1197	0.02
Myrcene	3.92	993	0.03	2.68	1135	0.24
Propyl angelate	3.99	998	0.66	3.70*	1216	[0.69]
Isobutyl 2-methylbutyrate	4.06	1002	0.02	2.82	1146	tr
Isobutyl isovalerate	4.13	1007	0.08	3.06	1165	0.12
Isoamyl isobutyrate	4.31	1019	8.42	3.11*	1170	[9.95]
2-Methylbutyl isobutyrate	4.35*	1021	1.55	3.11*	1170	[9.95]
Methallyl 2-methylbutyrate	4.35*	1021	[1.55]	3.92	1231	0.08
3-Methyl-3-butenyl isobutyrate?	4.38*	1023	0.12	3.98	1236	0.02
para-Cymene	4.38*	1023	[0.12]	3.84	1226	0.05
Methallyl isovalerate?	4.38*	1023	[0.12]	4.12	1247	0.03
1,8-Cineole	4.47*	1028	0.17	3.11*	1170	[9.95]
Limonene	4.47*	1028	[0.17]	2.95	1156	0.11
Propyl tiglate	4.63	1039	0.02	4.60	1282	0.01
2-Methylbutyl methacrylate	4.72	1044	0.57	4.06	1242	0.63
Isoamyl methacrylate	4.75	1046	0.39	4.05	1241	0.40
Isobutyl angelate	4.91	1056	3.47	4.24	1256	3.52
γ-Terpinene	4.92	1057	0.07	3.52	1202	0.43
Prenyl isobutyrate	4.95	1059	0.04	4.62	1284	0.05
Tiglyl isobutyrate?	4.97	1060	0.01	4.55*	1278	6.24
Unknown [m/z 71, 43 (28), 41 (21), 57 (19), 98 (11)... 116 (4), 129 (1), 156 (t)]	5.01	1062	0.06	6.71	1435	0.05
Methallyl angelate	5.17	1073	12.01	5.39	1338	11.95
Isobutyl	5.18	1074	0.06	5.04	1312	0.05

senecioate						
3-Methylpentyl propionate?	5.27	1079	0.30	4.43*	1269	0.30
para-Cymenene	5.36	1085	0.02	6.04	1385	0.02
Tiglyl methacrylate	5.41	1088	0.02	5.69*†	1359	[12.67]
Butyl angelate	5.51*	1094	0.42	4.97	1308	0.27
Isobutyl tiglate	5.51*	1094	[0.42]	5.12	1318	0.17
2-Methylbutyl isovalerate?	5.53	1095	0.04	4.49	1274	0.04
Isoamyl 2-methylbutyrate	5.60	1100	0.01	4.16	1249	0.01
2-Methylbutyl 2-methylbutyrate	5.67	1104	0.16	4.19	1252	0.16
Amyl isovalerate	5.72	1107	0.18	4.43*	1269	[0.30]
Methallyl tiglate	5.81	1113	0.18	6.35	1408	0.13
3-Methylpentyl isobutyrate	5.95*	1122	6.28	4.55*	1278	[6.24]
α-Campholenal	5.95*	1122	[6.28]	6.68	1433	0.01
trans-Pinocarveol	6.17	1136	5.57	8.89	1602	5.56
trans-Verbenol	6.28*	1143	0.25	9.24	1630	0.13
Camphene hydrate	6.28*	1143	[0.25]	8.17	1546	0.21
3-Methylpentyl methacrylate	6.38	1150	1.35	5.64*†	1356	12.67
Isoamyl angelate	6.45*	1154	6.28	5.69*†	1359	[12.67]
Pinocarvone	6.45*	1154	[6.28]	7.60	1502	1.97
2-Methylbutyl angelate	6.51†	1158	7.77	5.64*†	1356	[12.67]
Unknown [m/z 96, 95 (72), 67 (45), 41 (42), 55 (32), 70 (27)... 152 (t)]	6.52†	1159	[7.77]	9.94	1687	0.08
Borneol	6.60*	1164	0.30	9.48	1650	0.20
Benzyl acetate	6.60*	1164	[0.30]	9.72	1670	0.01
Angelyl angelate?	6.64	1166	0.62	6.58	1425	0.62
Isopinocampone	6.68	1169	0.06	7.30	1478	0.06
Terpinen-4-ol	6.77	1175	0.03	8.28	1554	0.02
Isobutyl 3-hydroxy-2-methylenebutyrate	6.89	1182	0.08	10.59	1742	0.05
para-Cymen-8-ol	6.94	1186	0.02	11.23	1797	0.02
Amyl angelate	7.01*†	1190	0.59	6.30	1404	0.04
Myrtenal	7.01*†	1190	[0.59]	8.35	1560	0.58
Myrtenol	7.07	1194	0.35	10.56	1740	0.35
Tiglyl angelate	7.13	1198	0.06	7.22	1473	0.05
Verbenone	7.14	1199	0.12	9.32	1637	0.22
3-Methylpentyl 2-methylbutyrate?	7.28	1208	0.91	5.69*†	1359	[12.67]
3-Methylpentyl isovalerate?	7.36	1213	0.03	5.78	1366	0.01
trans-Carveol	7.43	1218	0.01	11.11	1787	0.01
4-Methylhexyl isobutyrate	7.50	1222	0.04			

2-Hydroxy-2-methylbut-3-enyl angelate	7.83	1244	0.02	11.56	1826	0.02
Linalyl acetate	8.06*	1260	15.24	7.95	1528	0.09
3-Methylpentyl angelate	8.06*	1260	[15.24]	7.14	1466	14.93
(3Z)-Hexenyl angelate	8.40	1283	0.06	7.97*	1530	0.20
Isoamyl 3-hydroxy-2-methylenebutyrate	8.43	1285	0.01	11.81	1848	0.03
Hexyl angelate	8.50	1290	0.02	7.68	1508	0.03
<i>trans</i> -Pinocarvyl acetate	8.60	1296	0.01	8.80	1595	0.01
3-Methylpentyl tiglate	8.68	1301	0.09	7.97*	1530	[0.20]
Unknown [m/z 83, 55 (79), 82 (26), 43 (25), 45 (18), 69 (15)...166 (8)]	9.19*	1337	0.02			
7βH-Silphiperfol-5-ene	9.19*	1337	[0.02]	5.97	1380	0.02
Cyclosativene II	9.55	1363	0.03	6.73	1436	0.02
α-Copaene	9.69	1373	0.02	6.89	1448	0.01
Isobutyl phenylacetate	9.85	1384	0.02	11.67	1836	0.06
4-Methylpentyl 3-hydroxy-2-methylenebutyrate	9.91	1388	0.01	13.06	1962	0.01
β-Caryophyllene	10.26	1414	0.01	8.16	1545	0.07
Unknown [m/z 121, 93 (72), 107 (50), 105 (47), 91 (47), 119 (39), 79 (34), 133 (33)... 204 (14)]	10.31	1417	0.02	8.56	1576	0.01
Myrtenyl propionate?	10.44	1426	0.01			
Benzyl angelate	10.63	1441	0.01	12.82	1940	0.01
(E)-β-Farnesene	10.88	1460	0.02	9.28	1633	0.07
β-Selinene	11.16	1480	0.02	9.52	1654	0.01
Caryophyllene oxide	12.37	1574	0.01	12.47	1907	0.01
Unknown [m/z 81, 41 (46), 79 (46), 93 (39), 91 (33), 107 (33)... 206 (8)]	13.33	1652	0.01			
<b>Total identified</b>		<b>98.22%</b>			<b>97.39%</b>	
<b>Total reported</b>		<b>98.32%</b>			<b>97.53%</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