

**Date :** March 16, 2021

**CERTIFICATE OF ANALYSIS – GC PROFILING**

*SAMPLE IDENTIFICATION*

**Internal code :** 21B23-FEP13


**Customer identification :** Lavander - India - 53014-01

**Type :** Essential oil

**Source :** *Lavandula angustifolia*

**Customer :** Fern & Petal

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

**Analysis date :** March 16, 2021

Checked and approved by :

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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Faintly yellow viscous liquid

**Refractive index:**  $1.4623 \pm 0.0003$  (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
3-Buten-2-one	0.02	Aliphatic ketone
2-Methyl-3-buten-2-ol	0.03	Aliphatic alcohol
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	tr	Aliphatic alcohol
Toluene	0.01	Simple phenolic
Prenal	0.01	Aliphatic aldehyde
Butyl acetate	0.02	Aliphatic ester
Methyl hexyl ether	0.09	Aliphatic ether
(3Z)-Hexenol	0.02	Aliphatic alcohol
Hexanol	0.10	Aliphatic alcohol
Unknown	0.01	Unknown
Hashishene	0.01	Monoterpene
Tricyclene	0.03	Monoterpene
$\alpha$ -Thujene	0.10	Monoterpene
$\alpha$ -Pinene	0.20	Monoterpene
Camphene	0.16	Monoterpene
5,5-Dimethyl-2(5H)-furanone	0.01	Aliphatic lactone
Thuja-2,4(10)-diene	0.01	Monoterpene
Butyl isobutyrate	0.01	Aliphatic ester
endo-Isocamphane	0.01	Monoterpene
Sabinene	0.04	Monoterpene
$\beta$ -Pinene	0.04	Monoterpene
Octen-3-ol	0.28	Aliphatic alcohol
Octan-3-one	1.09	Aliphatic ketone
6-Methyl-5-hepten-2-one	0.02	Aliphatic ketone
Dehydro-1,8-cineole	0.05	Monoterpenic ether
<i>trans</i> -Dehydroxylinalool oxide	0.02	Monoterpenic ether
Myrcene	0.54	Monoterpene
Butyl butyrate	0.11	Aliphatic ester
Octan-3-ol	0.24	Aliphatic alcohol
$\alpha$ -Phellandrene	0.03	Monoterpene
Pseudolimonene	0.01	Monoterpene
<i>cis</i> -Dehydroxylinalool oxide	0.09	Monoterpenic ether
$\Delta^3$ -Carene	0.13	Monoterpene
(3Z)-Hexenyl acetate	0.01	Aliphatic ester
$\alpha$ -Terpinene	0.03	Monoterpene
Hexyl acetate	0.58	Aliphatic ester
ortho-Cymene	0.04	Monoterpene
para-Cymene	0.24	Monoterpene
Limonene	0.32	Monoterpene
1,8-Cineole	0.87	Monoterpenic ether
Lavender lactone	0.02	Aliphatic lactone
(Z)- $\beta$ -Ocimene	3.77	Monoterpene

(E)-β-Ocimene	1.75	Monoterpene
γ-Terpinene	0.09	Monoterpene
cis-Sabinene hydrate	0.06	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.15	Monoterpenic alcohol
Octanol	0.01	Aliphatic alcohol
α-Pinene oxide analog	0.02	Monoterpenic ether
Isoterpinolene	0.04	Monoterpene
Terpinolene	0.07	Monoterpene
trans-Linalool oxide (fur.)	0.11	Monoterpenic alcohol
Rosefuran	0.08	Monoterpenic ether
Linalool	30.77	Monoterpenic alcohol
(Z)-6-Methyl-3,5-heptadien-2-one	0.05	Aliphatic ketone
Octen-3-yl acetate	0.94	Aliphatic ester
Octan-3-yl acetate	0.16	Aliphatic ester
(Z)-Myroxide	0.10	Monoterpenic ether
Camphor	0.25	Monoterpenic ketone
(E)-Myroxide	0.04	Monoterpenic ether
Hexyl isobutyrate	0.08	Aliphatic ester
Borneol	0.65	Monoterpenic alcohol
cis-Linalool oxide (pyr.)	0.02	Monoterpenic alcohol
Lavandulol	1.10	Monoterpenic alcohol
Terpinen-4-ol	4.14	Monoterpenic alcohol
(3E,5Z)-Undeca-1,3,5-triene	0.03	Alkene
Cryptone	0.22	Normonoterpenic ketone
meta-Cymen-8-ol	0.07	Monoterpenic alcohol
para-Cymen-8-ol	0.07	Monoterpenic alcohol
Butyl hexanoate	0.02	Aliphatic ester
α-Terpineol	1.17	Monoterpenic alcohol
Myrtenal	0.01	Monoterpenic aldehyde
Hexyl butyrate	0.37	Aliphatic ester
Hodiendiol	0.04	Monoterpenic alcohol
Unknown	0.01	Unknown
Verbenone	0.03	Monoterpenic ketone
(3E,5E)-2,6-Dimethylocta-3,5,7-trien-2-ol	0.05	Monoterpenic alcohol
Octyl acetate	tr	Aliphatic ester
trans-Carveol	0.03	Monoterpenic alcohol
Bornyl formate	0.03	Monoterpenic ester
Nerol	0.21	Monoterpenic alcohol
Hexyl 2-methylbutyrate	0.05	Aliphatic ester
Cuminal	0.03	Monoterpenic aldehyde
Carvone	0.05	Monoterpenic ketone
Neral	0.03	Monoterpenic aldehyde
Hexyl isovalerate	0.02	Aliphatic ester
Linalyl acetate	30.29	Monoterpenic ester
Geraniol	0.54	Monoterpenic alcohol
Geranial	0.03	Monoterpenic aldehyde
Bornyl acetate	0.17	Monoterpenic ester
Cuminol	0.04	Monoterpenic alcohol
Lavandulyl acetate	3.30	Monoterpenic ester
Hexyl tiglate	0.05	Aliphatic ester
Hodiendiol derivative	0.04	Oxygenated monoterpene
Unknown	0.10	Oxygenated monoterpene

Unknown	0.06	Oxygenated monoterpene
Hodiendiol derivative III	0.03	Oxygenated monoterpene
Neryl acetate	0.36	Monoterpenic ester
Daucene	0.02	Sesquiterpene
$\beta$ -Bourbonene	0.07	Sesquiterpene
Geranyl acetate	0.61	Monoterpenic ester
$\beta$ -Elemene	0.02	Sesquiterpene
7-epi-Sesquithujene	0.07	Sesquiterpene
Hexyl hexanoate	0.11	Aliphatic ester
$\alpha$ -Funebrene	0.01	Sesquiterpene
Isocaryophyllene	0.04	Sesquiterpene
Sesquithujene	0.04	Sesquiterpene
$\beta$ -Caryophyllene	3.74	Sesquiterpene
<i>cis</i> - $\alpha$ -Bergamotene	tr	Sesquiterpene
$\alpha$ -Santalene	0.48	Sesquiterpene
Coumarin	0.04	Coumarin
Lavandulyl isobutyrate	0.02	Monoterpenic ester
<i>trans</i> - $\alpha$ -Bergamotene	0.16	Sesquiterpene
Sesquisabinene A	0.04	Sesquiterpene
<i>cis</i> - $\beta$ -Bergamotene?	0.07	Sesquiterpene
$\alpha$ -Humulene	0.16	Sesquiterpene
Lavandulyl butyrate?	0.16	Monoterpenic ester
( <i>E</i> )- $\beta$ -Farnesene	3.20	Sesquiterpene
$\beta$ -Santalene	0.02	Sesquiterpene
Germacrene D	0.41	Sesquiterpene
<i>trans</i> - $\beta$ -Bergamotene	0.07	Sesquiterpene
Isodaucene	0.02	Sesquiterpene
$\beta$ -Bisabolene	0.06	Sesquiterpene
Lavandulyl isovalerate	0.04	Monoterpenic ester
$\gamma$ -Cadinene	0.09	Sesquiterpene
Unknown	0.05	Oxygenated sesquiterpene
$\delta$ -Cadinene	0.02	Sesquiterpene
<i>trans</i> -Calamenene	0.02	Sesquiterpene
Isocaryophyllene epoxide B	0.06	Sesquiterpenic ether
( <i>E</i> )-Nerolidol	0.03	Sesquiterpenic alcohol
Dendrolasin	0.03	Sesquiterpenic ether
Caryophyllene oxide	0.41	Sesquiterpenic ether
Caryophyllene oxide isomer	0.08	Sesquiterpenic ether
Humulene epoxide II	0.02	Sesquiterpenic ether
$\tau$ -Cadinol	0.07	Sesquiterpenic alcohol
(3 <i>Z</i> )-Caryophylla-3,8(13)-dien-5 $\beta$ -ol	0.01	Sesquiterpenic alcohol
<i>cis</i> -14-nor-Muurool-5-en-4-one?	0.02	Norsesquiterpenic ketone
$\alpha$ -Bisabolol	0.01	Sesquiterpenic alcohol
<b>Consolidated total</b>	<b>98.26%</b>	

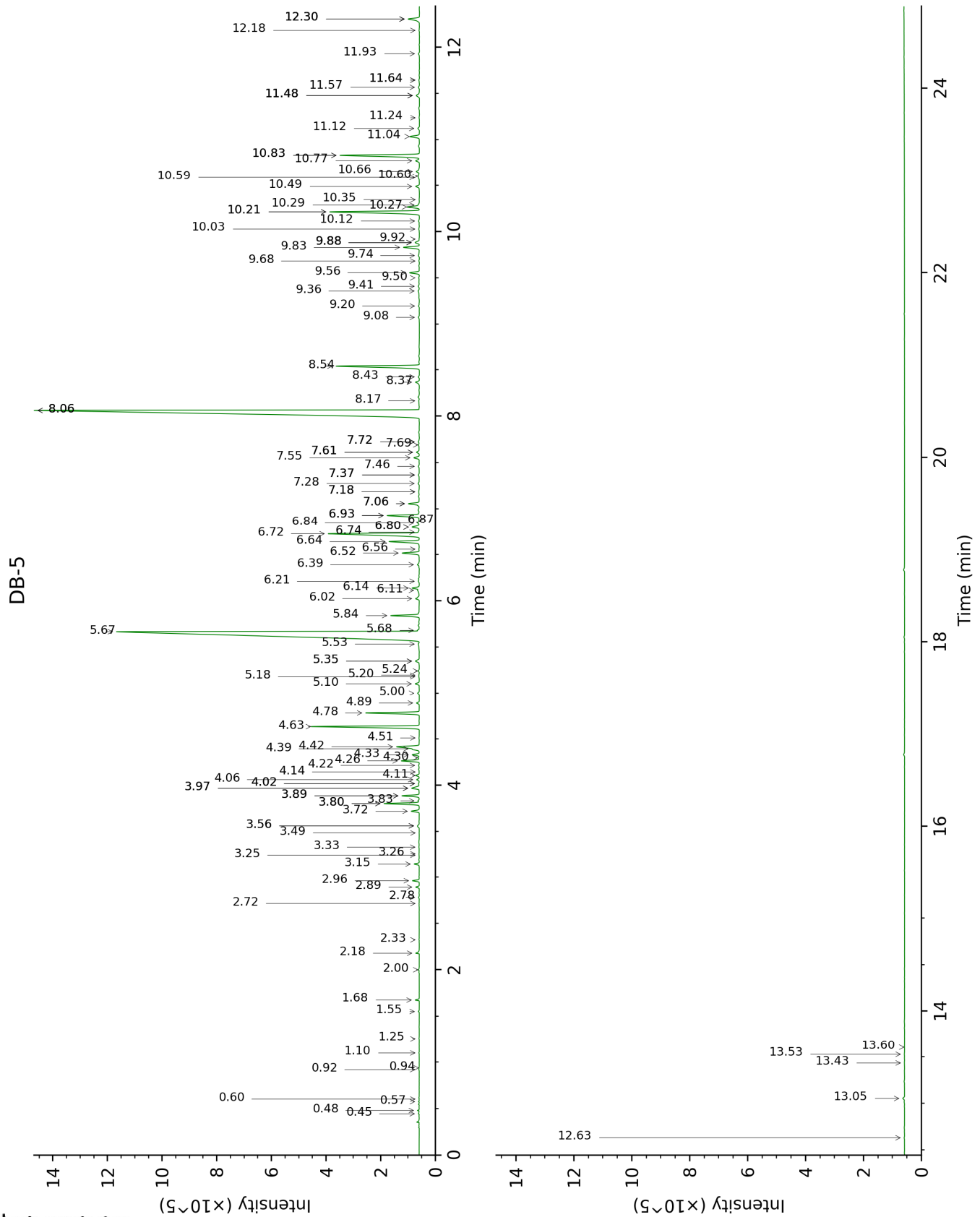
tr: The compound has been detected below 0.005% of total signal.

Note: no correction factor was applied

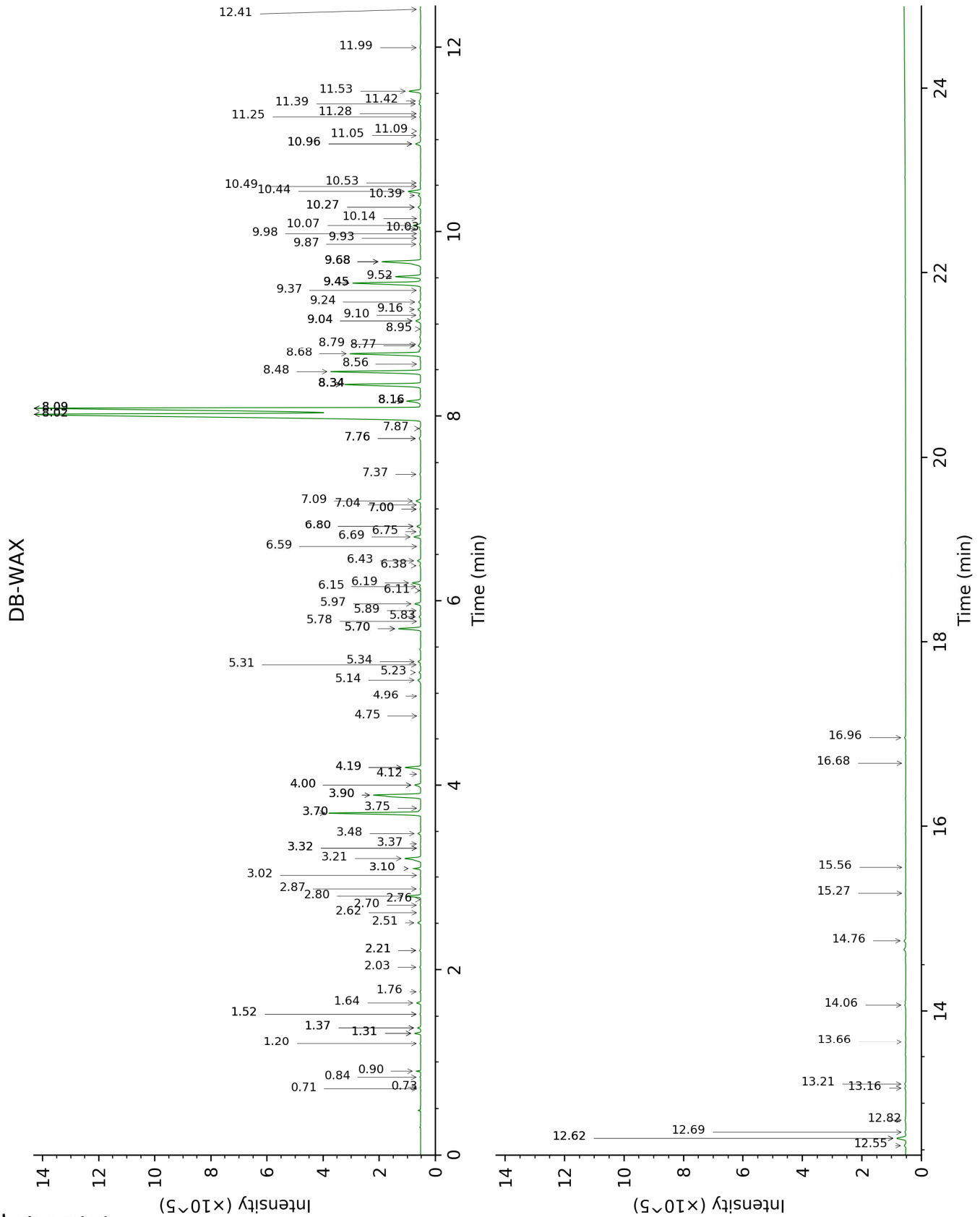
**About "consolidated" data:** The table above presents the breakdown of the sample volatile constituents after applying an algorithm to collapse data acquired from the multi-columns system of PhytoChemia into a single set of consolidated contents. In case of discrepancies between columns, the algorithm 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	%
3-Buten-2-one	0.44	576	0.02	0.84	912	0.01
2-Methyl-3-buten-2-ol	0.48	607	0.03	1.52*	1015	0.03
Isovaleral	0.58	642	0.01	0.73	888	0.01
2-Methylbutyral	0.60	653	tr	0.71	881	tr
Isoamyl alcohol	0.92	731	0.01	3.32*	1176	0.01
2-Methylbutanol	0.94	734	tr	3.32*	1176	[0.01]
Toluene	1.10	758	0.01	1.37*	1001	0.10
Prenal	1.26	781	0.01	3.10*	1158	0.32
Butyl acetate	1.55	816	0.02	1.76	1040	0.02
Methyl hexyl ether	1.68	826	0.09	0.90	923	0.09
(3Z)-Hexenol	2.00	854	0.02	5.70*	1349	0.94
Hexanol	2.18	870	0.10	5.34	1324	0.11
Unknown [m/z 59, 85 (88), 41 (57), 43 (43)...]	2.32	882	0.01	5.78	1355	0.02
Hashishene	2.72	913	0.01	1.32*	992	0.19
Tricyclene	2.78	917	0.03	1.20	972	0.02
α-Thujene	2.89	925	0.10	1.37*	1001	[0.10]
α-Pinene	2.96	930	0.20	1.32*	992	[0.19]
Camphene	3.15	942	0.16	1.64	1027	0.15
5,5-Dimethyl-2(5H)-furanone	3.25	948	0.01	8.34*	1547	3.84
Thuja-2,4(10)-diene	3.26	950	0.01	2.21*	1084	0.05
Butyl isobutyrate	3.33	954	0.01	2.62	1120	0.01
endo-Isocamphane	3.49	965	0.01	1.52*	1015	[0.03]
Sabinene	3.56*	970	0.10	2.21*	1084	[0.05]
β-Pinene	3.56*	970	[0.10]	2.03	1066	0.04
Octen-3-ol	3.72	980	0.28	6.69	1422	0.29
Octan-3-one	3.80*	986	1.11	3.90*	1220	2.90
6-Methyl-5-hepten-2-one	3.80*	986	[1.11]	4.96	1300	0.02
Dehydro-1,8-cineole	3.83	988	0.05	3.02	1152	0.03
trans-Dehydroxylinalool oxide	3.89*	992	0.55	3.37	1180	0.02
Myrcene	3.89*	992	[0.55]	2.80	1134	0.54
Butyl butyrate	3.97*	997	0.35	3.48	1188	0.11
Octan-3-ol	3.97*	997	[0.35]	5.97	1369	0.24
α-Phellandrene	4.02*	1001	0.04	2.70	1126	0.03
Pseudolimonene	4.02*	1001	[0.04]	2.76	1131	0.01
cis-Dehydroxylinalool oxide	4.06	1004	0.09	3.75	1210	0.01

$\Delta^3$ -Carene	4.11	1006	0.13	2.51	1111	0.12
(3Z)-Hexenyl acetate	4.14	1009	0.01	4.75	1284	0.01
$\alpha$ -Terpinene	4.22	1013	0.03	2.87	1140	0.03
Hexyl acetate	4.26	1016	0.58	4.19*	1242	0.65
ortho-Cymene	4.30	1018	0.04	4.00*	1228	0.28
para-Cymene	4.33	1021	0.24	4.00*	1228	[0.28]
Limonene	4.40†	1025	1.22	3.10*	1158	[0.32]
1,8-Cineole	4.42†	1026	[1.22]	3.21	1167	0.87
Lavender lactone	4.51	1032	0.02	9.10	1606	0.05
(Z)- $\beta$ -Ocimene	4.64	1040	3.77	3.70*	1206	3.96
(E)- $\beta$ -Ocimene	4.78	1049	1.75	3.90*	1220	[2.90]
$\gamma$ -Terpinene	4.89	1056	0.09	3.70*	1206	[3.96]
cis-Sabinene hydrate	5.00	1063	0.06	6.80*	1430	0.17
cis-Linalool oxide (fur.)	5.10	1070	0.15	6.43	1402	0.14
Octanol	5.18	1075	0.01	8.09*†	1527	[61.49]
$\alpha$ -Pinene oxide analog	5.20	1076	0.02	5.31	1321	0.03
Isoterpinolene	5.24	1079	0.04	4.12	1237	0.02
Terpinolene	5.35*	1085	0.18	4.19*	1242	[0.65]
trans-Linalool oxide (fur.)	5.35*	1085	[0.18]	6.80*	1430	[0.17]
Rosefuran	5.53	1097	0.08	5.89	1363	0.03
Linalool	5.67	1106	30.77	8.02*†	1522	61.49
(Z)-6-Methyl-3,5-heptadien-2-one	5.68	1107	0.05	8.09*†	1527	[61.49]
Octen-3-yl acetate	5.84	1117	0.94	5.70*	1349	[0.94]
Octan-3-yl acetate	6.02	1129	0.16	5.14	1309	0.15
(Z)-Myroxide	6.11	1135	0.10	6.75	1426	0.04
Camphor	6.14	1136	0.25	7.09	1451	0.22
(E)-Myroxide	6.21	1141	0.04	7.00*	1445	0.04
Hexyl isobutyrate	6.39	1153	0.08	5.23	1315	0.07
Borneol	6.52	1161	0.65	9.68*	1654	2.22
cis-Linalool oxide (pyr.)	6.56	1164	0.02	10.14	1692	0.01
Lavandulol	6.64	1169	1.10	9.52	1641	1.10
Terpinen-4-ol	6.72	1175	4.14	8.48	1558	4.13
(3E,5Z)-Undeca-1,3,5-triene	6.74	1176	0.03	5.83	1359	0.06
Cryptone	6.80*	1179	0.30	9.04*	1602	0.26
meta-Cymen-8-ol	6.80*	1179	[0.30]	11.39	1798	0.07
para-Cymen-8-ol	6.84	1182	0.07	11.42	1800	0.07
Butyl hexanoate	6.87	1184	0.02	6.15	1382	0.05
$\alpha$ -Terpineol	6.93*	1188	1.21	9.68*	1654	[2.22]
Myrtenal	6.93*	1188	[1.21]	8.56	1564	0.01
Hexyl butyrate	7.06*	1196	0.43	6.19	1385	0.37
Hodiendiol	7.06*	1196	[0.43]	12.69	1914	0.04

Unknown [m/z 43, 71 (66), 59 (52), 41 (47), 68 (46)...]	7.18*	1205	0.04	6.11	1379	0.01
Verbenone	7.18*	1205	[0.04]	9.45*	1635	3.45
(3E,5E)-2,6-Dimethylocta-3,5,7-trien-2-ol	7.28	1211	0.05	11.25	1786	0.04
Octyl acetate	7.37*	1217	0.04	7.00*	1445	[0.04]
trans-Carveol	7.37*	1217	[0.04]	11.28	1789	0.03
Bornyl formate	7.46	1223	0.03	7.87	1510	0.06
Nerol	7.55	1230	0.21	10.96*	1761	0.25
Hexyl 2-methylbutyrate	7.61*	1234	0.12	6.38	1398	0.05
Cuminal	7.61*	1234	[0.12]	10.49	1721	0.03
Carvone	7.69	1239	0.05	9.86	1669	0.06
Neral	7.72*	1241	0.05	9.37	1628	0.03
Hexyl isovalerate	7.72*	1241	[0.05]	6.59	1414	0.02
Linalyl acetate	8.06*	1264	30.83	8.09*†	1527	[61.49]
Geraniol	8.06*	1264	[30.83]	11.52	1810	0.54
Geranial	8.17	1272	0.03	9.98	1678	0.02
Bornyl acetate	8.37	1285	0.17	8.16*	1533	0.65
Cuminol	8.43	1289	0.04	14.06	2043	0.06
Lavandulyl acetate	8.54	1297	3.30	8.68	1573	3.29
Hexyl tiglate	9.08	1332	0.05	8.78	1582	0.03
Hodiendiol derivative	9.20	1340	0.04	12.82	1926	0.05
Unknown [m/z 43, 79 (47), 71 (31), 94 (27), 81 (23), 41 (22)... 197 (0)]	9.36	1352	0.10	10.96*	1761	[0.25]
Unknown [m/z 43, 79 (46), 71 (30), 94 (25), 41 (23), 81 (21)... 197 (0)]	9.41	1355	0.06	11.05	1768	0.05
Hodiendiol derivative III	9.50	1362	0.03	12.62*	1908	0.44
Neryl acetate	9.56	1366	0.36	10.07	1686	0.36
Daucene	9.68	1375	0.02	7.04	1448	0.02
β-Bourbonene	9.74	1379	0.07	7.37	1473	0.05
Geranyl acetate	9.83	1385	0.61	10.44	1716	0.58
β-Elemene	9.88*	1389	0.20	8.34*	1547	[3.84]
7-epi-Sesquithujene	9.88*	1389	[0.20]	7.76*	1502	0.09
Hexyl hexanoate	9.88*	1389	[0.20]	8.77	1581	0.11
α-Funebrene	9.92	1391	0.01	7.76*	1502	[0.09]
Isocaryophyllene	10.03	1399	0.04	8.09*†	1527	[61.49]
Sesquithujene	10.12	1405	0.04	8.02*†	1522	[61.49]
β-Caryophyllene	10.22*	1413	3.74	8.34*	1547	[3.84]
cis-α-Bergamotene	10.22*	1413	[3.74]	8.16*	1533	[0.65]
α-Santalene	10.27	1417	0.48	8.16*	1533	[0.65]

Coumarin	10.29	1418	0.04	16.96	2339	0.06
Lavandulyl isobutyrate	10.35	1422	0.02	9.24	1618	0.10
<i>trans</i> - $\alpha$ -Bergamotene	10.49	1433	0.16	8.34*	1547	[3.84]
Sesquisabinene A	10.59	1441	0.04	9.04*	1602	[0.26]
<i>cis</i> - $\beta$ -Bergamotene?	10.60	1442	0.07			
$\alpha$ -Humulene	10.66	1446	0.16	9.16	1612	0.15
Lavandulyl butyrate?	10.77	1454	0.16	10.39	1712	0.13
( <i>E</i> )- $\beta$ -Farnesene	10.83*	1459	3.21	9.45*	1635	[3.45]
$\beta$ -Santalene	10.83*	1459	[3.21]	8.95	1595	0.02
Germacrene D	11.04	1474	0.41	9.68*	1654	[2.22]
<i>trans</i> - $\beta$ -Bergamotene	11.12	1481	0.07	9.45*	1635	[3.45]
Isodaucene	11.24	1489	0.02	9.93	1674	0.03
$\beta$ -Bisabolene	11.48*	1507	0.19	10.03	1683	0.06
Lavandulyl isovalerate	11.48*	1507	[0.19]	10.53	1724	0.04
$\gamma$ -Cadinene	11.48*	1507	[0.19]	10.26*	1702	0.15
Unknown [m/z 121, 93 (56), 91 (12), 94 (11), 122 (10)...220]	11.57	1514	0.05	13.16	1958	0.05
$\delta$ -Cadinene	11.64*	1520	0.04	10.26*	1702	[0.15]
<i>trans</i> -Calamenene	11.64*	1520	[0.04]	11.09	1772	0.02
Isocaryophyllene epoxide B	11.93	1543	0.06	12.00	1852	0.05
( <i>E</i> )-Nerolidol	12.18	1563	0.03	13.66	2005	0.02
Dendrolasin	12.30*	1572	0.54	12.41	1889	0.03
Caryophyllene oxide	12.30*	1572	[0.54]	12.62*	1908	[0.44]
Caryophyllene oxide isomer	12.30*	1572	[0.54]	12.55	1901	0.08
Humulene epoxide II	12.63	1598	0.02	13.21	1962	0.05
$\tau$ -Cadinol	13.05	1633	0.07	14.76	2111	0.09
(3 <i>Z</i> )-Caryophylla-3,8(13)-dien-5 $\beta$ -ol	13.43	1664	0.01	16.68	2309	0.02
<i>cis</i> -14-nor-Muurool-5-en-4-one?	13.53	1672	0.02	15.56	2192	0.01
$\alpha$ -Bisabolol	13.60	1678	0.01	15.27	2163	0.01
<b>Total identified</b>		<b>98.21%</b>			<b>98.38%</b>	
<b>Total reported</b>		<b>98.42%</b>			<b>98.51%</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)

