

**Date :** September 30, 2019

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 19I27-PTH01-1-SCC

**Customer identification :** Lemongrass Organic - India - L90108810R

**Type :** Essential oil

**Source :** *Cymbopogon flexuosus*

**Customer :** Plant Therapy

**ANALYSIS**

**Method:** PC-PA-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 :** September 30, 2019

Checked and approved by :

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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Yellow liquid

**Refractive index:** 1.4835 ± 0.0003 (20 °C)

*ISO 4718:2004 - OIL OF LEMONGRASS*

<b>Compound</b>	<b>Min. %</b>	<b>Max. %</b>	<b>Observed %</b>	<b>Complies?</b>
Geraniol	1.5	8.0	6.0	Yes
Geranyl acetate	0.5	6.0	4.2	Yes
Geranial	35.0	47.0	35.7	Yes
Neral	25.0	35.0	27.8	Yes
β-Caryophyllene	0.2	3.5	1.5	Yes
6-Methyl-5-hepten-2-one	0.1	2.0	2.8	No
Limonene	0.5	3.5	0.7	Yes
<b>Refractive index</b>	1.4830	1.4890	1.4835	Yes

*CONCLUSION*

No adulterant, contaminant or diluent has been detected using this method. The oil marginally does not comply with the ISO standard for lemongrass oil.

## ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

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

Identification	%	Classe
Acetone	0.01	Aliphatic ketone
Ethanol	0.02	Aliphatic alcohol
Dimethylsulfide	tr	Aliphatic sulfide
Isobutyral	tr	Aliphatic aldehyde
Methacrolein	tr	Aliphatic aldehyde
2-Methyl-3-buten-2-ol	0.04	Aliphatic alcohol
Isovaleral	0.02	Aliphatic aldehyde
2-Methylbutyral	0.01	Aliphatic aldehyde
2-Ethylfuran	0.01	Furan
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	tr	Aliphatic alcohol
Toluene	tr	Simple phenolic
Hexanal	0.01	Aliphatic aldehyde
Unknown	0.01	Unknown
(3Z)-Hexenol	0.01	Aliphatic alcohol
4-Heptanone	0.03	Aliphatic ketone
Tricyclene	0.27	Monoterpene
$\alpha$ -Pinene	0.37	Monoterpene
Camphene	1.98	Monoterpene
Benzaldehyde	0.01	Simple phenolic
Sabinene	0.01	Monoterpene
$\beta$ -Pinene	0.02	Monoterpene
6-Methyl-5-hepten-2-one	2.82	Aliphatic ketone
Myrcene	0.18	Monoterpene
6-Methyl-5-hepten-2-ol	0.08	Aliphatic alcohol
Menthatriene isomer I	0.02	Monoterpene
$\alpha$ -Phellandrene	0.02	Monoterpene
Octanal	0.08	Aliphatic aldehyde
$\alpha$ -Terpinene	0.02	Monoterpene
para-Cymene	0.04	Monoterpene
1,8-Cineole	0.08	Monoterpenic ether
Limonene	0.72	Monoterpene
Benzeneacetaldehyde	0.02	Simple phenolic
(Z)- $\beta$ -Ocimene	0.42	Monoterpene
(E)- $\beta$ -Ocimene	0.28	Monoterpene
2,6-Dimethyl-5-heptenal (melonal)	0.04	Aliphatic aldehyde
$\gamma$ -Terpinene	0.02	Monoterpene
cis-Linalool oxide (fur.)	0.03	Monoterpenic alcohol
4-Nonanone	1.45	Aliphatic ketone
Camphenilone	0.02	Normonoterpenic ketone
Terpinolene	0.08	Monoterpene
trans-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
4-Nonanol	0.04	Aliphatic alcohol
Rosefuran	0.24	Monoterpenic ether
Linalool	1.47	Monoterpenic alcohol
Perillene	0.01	Monoterpenic ether
cis-Chrysanthemal?	0.02	Monoterpenic aldehyde

<i>trans</i> -para-Mentha-2,8-dien-1-ol	0.06	Monoterpenic alcohol
Unknown	0.27	Unknown
Unknown	0.02	Unknown
exo-Isocitral	0.13	Monoterpenic aldehyde
<i>trans</i> -Chrysanthemal	0.42	Monoterpenic aldehyde
Citronellal	0.57	Monoterpenic aldehyde
Borneol	0.21	Monoterpenic alcohol
Isoneral	0.70	Monoterpenic aldehyde
$\alpha$ -Phellandren-8-ol	0.05	Monoterpenic alcohol
Rosefuran oxide	0.06	Monoterpenic ether
Terpinen-4-ol	0.06	Monoterpenic alcohol
Unknown	0.24	Oxygenated monoterpene
Isogeranial	1.09	Monoterpenic aldehyde
$\alpha$ -Terpineol	0.17	Monoterpenic alcohol
Myrtenal	0.01	Monoterpenic aldehyde
Unknown	0.09	Unknown
Unknown	0.11	Oxygenated monoterpene
Decanal	0.15	Aliphatic aldehyde
<i>cis</i> -Isopiperitenol	0.05	Monoterpenic alcohol
2,3-Epoxyneral?	0.03	Monoterpenic aldehyde
Nerol	0.11	Monoterpenic alcohol
Citronellol	0.22	Monoterpenic alcohol
Neral	27.80	Monoterpenic aldehyde
Piperitone	0.04	Monoterpenic ketone
Geraniol	5.99	Monoterpenic alcohol
Geranial	35.72	Monoterpenic aldehyde
Unknown	0.12	Oxygenated monoterpene
2-Undecanone	0.01	Aliphatic ketone
Geranyl formate	0.04	Monoterpenic ester
Unknown	0.03	Unknown
Neric acid	0.09	Monoterpenic acid
$\alpha$ -Cubebene	0.02	Sesquiterpene
Citronellyl acetate	0.09	Monoterpenic ester
Cyclosativene I	0.08	Sesquiterpene
Cyclosativene II	0.04	Sesquiterpene
Neryl acetate	0.04	Monoterpenic ester
Geranic acid	0.21	Aliphatic acid
$\alpha$ -Copaene	0.07	Sesquiterpene
$\beta$ -Bourbonene	0.05	Sesquiterpene
Geranyl acetate	4.19	Monoterpenic ester
$\beta$ -Cubebene	0.06	Sesquiterpene
$\beta$ -Elemene	0.11	Sesquiterpene
Longifolene	0.03	Sesquiterpene
$\beta$ -Caryophyllene	1.45	Sesquiterpene
$\beta$ -Copaene	0.02	Sesquiterpene
<i>trans</i> - $\alpha$ -Bergamotene	0.03	Sesquiterpene
( <i>E</i> )-Isoeugenol	0.33	Phenylpropanoid
$\alpha$ -Humulene	0.16	Sesquiterpene
<i>cis</i> -Muurolo-4(15),5-diene	0.04	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.05	Sesquiterpene
Germacrene D	0.23	Sesquiterpene
$\gamma$ -Amorphene	0.04	Sesquiterpene

α-Selinene	0.03	Sesquiterpene
epi-Cubebol	0.04	Sesquiterpenic alcohol
α-Murolene	0.08	Sesquiterpene
δ-Amorphene	0.03	Sesquiterpene
Cubebol	0.10	Sesquiterpenic alcohol
γ-Cadinene	1.12	Sesquiterpene
δ-Cadinene	0.37	Sesquiterpene
(E)-γ-Bisabolene	0.19	Sesquiterpene
α-Cadinene	0.05	Sesquiterpene
Neryl butyrate	0.02	Monoterpenic ester
α-Elemol	0.07	Sesquiterpenic alcohol
Germacrene B	0.03	Sesquiterpene
Geranyl butyrate	0.11	Monoterpenic ester
Caryophyllene oxide	0.45	Sesquiterpenic ether
Humulene epoxide II	0.04	Sesquiterpenic ether
1-epi-Cubebol	0.04	Sesquiterpenic alcohol
Cubebol	0.05	Sesquiterpenic alcohol
β-Eudesmol	0.02	Sesquiterpenic alcohol
α-Eudesmol	0.02	Sesquiterpenic alcohol
(2Z,6Z)-Farnesol	0.02	Sesquiterpenic alcohol
Farnesal isomer	0.01	Sesquiterpenic aldehyde
(2E,6E)-Farnesal	0.01	Sesquiterpenic aldehyde
Neophytadiene	0.05	Diterpene
meta-Camphorene	0.03	Diterpene
Octadecanal	0.08	Aliphatic aldehyde
Unknown	0.02	Unknown
Unknown	0.12	Unknown
Unknown	0.18	Unknown
Phytol isomer	0.02	Diterpenic alcohol
Unknown	0.75	Unknown
Unknown	0.02	Unknown
Unknown	0.01	Unknown
Unknown	0.03	Unknown
<b>Consolidated total</b>	<b>97.27%</b>	

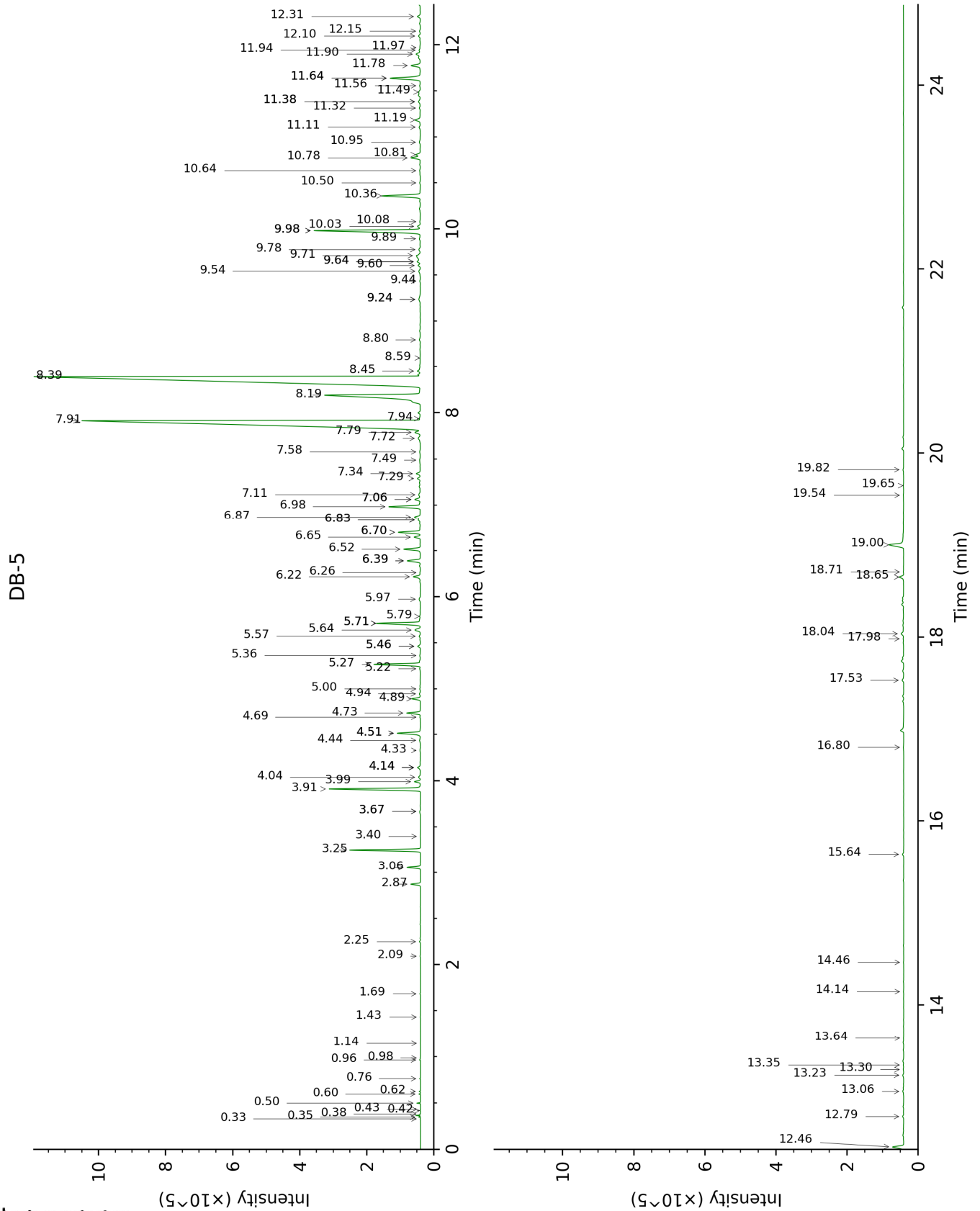
tr: The compound has been detected below 0.005% of total signal.

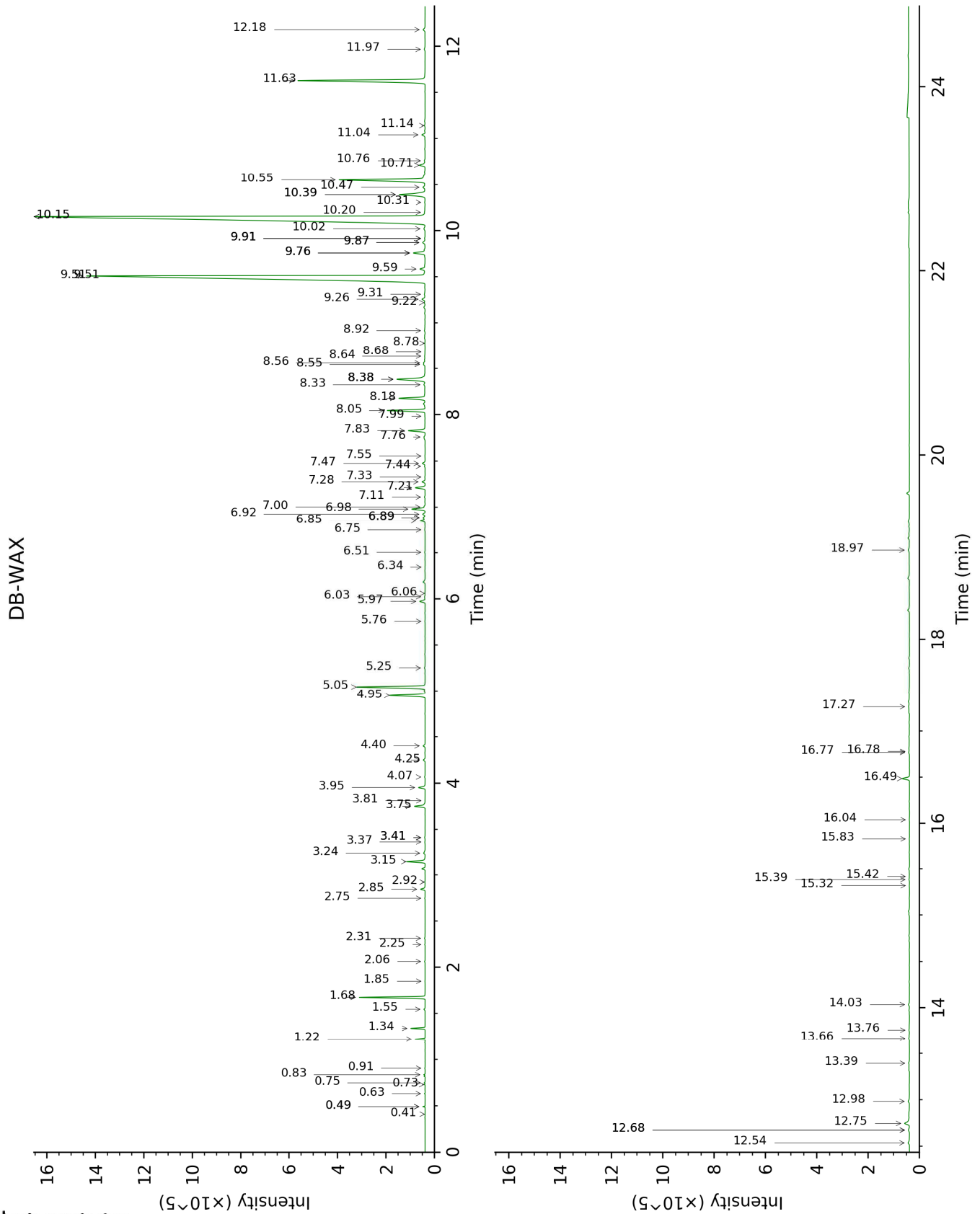
Note: no correction factor was applied

**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	%
Acetone	0.33	522	0.01	0.49*	784	0.04
Ethanol	0.35	522	0.02	0.84	910	0.02
Dimethylsulfide	0.38	522	tr	0.41	716	tr
Isobutyral	0.42	534	tr	0.49*	784	[0.04]
Methacrolein	0.43	544	tr	0.63	846	0.01
2-Methyl-3-buten-2-ol	0.50	592	0.04	1.55	1015	0.04
Isovaleral	0.60	641	0.02	0.75	888	0.02
2-Methylbutyral	0.62	651	0.01	0.73	881	0.01
2-Ethylfuran	0.76	702	0.01	0.90	921	0.01
Isoamyl alcohol	0.96	735	0.01	3.41*	1177	0.03
2-Methylbutanol	0.98	738	tr	3.41*	1177	[0.03]
Toluene	1.14	760	tr			
Hexanal	1.43	800	0.01	1.85	1044	0.01
Unknown [m/z 81, 69 (80), 41 (65), 83 (52), 109 (48), 55 (47)...]	1.68	823	0.01			
(3Z)-Hexenol	2.09	856	0.01	5.76	1349	0.01
4-Heptanone	2.25	869	0.03	2.32	1090	0.03
Tricyclene	2.87	917	0.27	1.22	972	0.25
α-Pinene	3.06	929	0.37	1.34	991	0.37
Camphene	3.25	942	1.98	1.68	1027	1.99
Benzaldehyde	3.40	951	0.01	7.33	1463	0.02
Sabinene	3.67*	969	0.04	2.25	1083	0.01
β-Pinene	3.67*	969	[0.04]	2.06	1065	0.02
6-Methyl-5-hepten-2-one	3.91	985	2.82	5.05	1297	2.78
Myrcene	3.99	990	0.18	2.85	1133	0.18
6-Methyl-5-hepten-2-ol	4.04	994	0.08	6.89*	1431	0.10
Menthatriene isomer I	4.14*	1001	0.11	3.36	1173	0.02
α-Phellandrene	4.14*	1001	[0.11]	2.75	1125	0.02
Octanal	4.14*	1001	[0.11]	4.40	1250	0.08
α-Terpinene	4.33	1012	0.02	2.92	1139	0.01
para-Cymene	4.44	1019	0.04	4.07	1226	0.02
1,8-Cineole	4.52*	1024	0.79	3.24	1164	0.08
Limonene	4.52*	1024	[0.79]	3.15	1157	0.72
Benzeneacetaldehyde	4.69	1035	0.02	8.78	1574	0.01
(Z)-β-Ocimene	4.73	1038	0.42	3.75	1203	0.46
(E)-β-Ocimene	4.89	1048	0.28	3.95	1218	0.27
2,6-Dimethyl-5-heptenal (melonal)	4.94	1051	0.04	5.25	1312	0.04
γ-Terpinene	5.00	1055	0.02	3.81	1207	0.01
cis-Linalool oxide (fur.)	5.22	1069	0.03	6.51	1402	0.02
4-Nonanone	5.27	1072	1.45	4.95	1290	1.46
Camphenilone	5.36	1078	0.02	6.34	1392	0.01
Terpinolene	5.46*	1084	0.09	4.25	1239	0.08

<i>trans</i> -Linalool oxide (fur.)	5.46*	1084	[0.09]	6.89*	1431	[0.10]
4-Nonanol	5.57	1091	0.04			
Rosefuran	5.64	1096	0.24	5.98	1364	0.24
Linalool	5.71*	1100	1.52	8.05	1517	1.47
Perillene	5.71*	1100	[1.52]	6.06	1371	0.01
<i>cis</i> -Chrysanthemal?	5.79	1105	0.02	6.02	1368	0.04
<i>trans</i> -para-Mentha-2,8-dien-1-ol	5.97	1117	0.06	8.92	1584	0.03
Unknown [m/z 81, 70 (98), 67 (63), 82 (53), 41 (46), 69 (46), 109 (43)...]	6.22	1133	0.27	6.85	1428	0.23
Unknown [m/z 95, 67 (86), 41 (68), 82 (64), 123 (62)...]	6.26	1136	0.02	7.55	1480	0.02
exo-Isocitral	6.39*	1144	0.49	7.48	1474	0.13
<i>trans</i> -Chrysanthemal	6.39*	1144	[0.49]	7.21	1455	0.42
Citronellal	6.52	1153	0.57	6.98	1438	0.57
Borneol	6.65	1161	0.21	9.76*†	1651	0.61
Isoneral	6.70*	1165	0.75	7.83	1500	0.70
α-Phellandren-8-ol	6.70*	1165	[0.75]	10.15*	1683	36.37
Rosefuran oxide	6.84*	1174	0.07	8.55	1556	0.06
Terpinen-4-ol	6.84*	1174	[0.07]	8.56	1557	0.06
Unknown [m/z 84, 83 (74), 137 (56), 41 (47), 93 (43), 108 (40)... 152 (2)]	6.87	1176	0.24	9.58	1637	0.25
Isogeranial	6.98	1184	1.09	8.18	1527	1.13
α-Terpineol	7.06*	1189	0.21	9.76*†	1651	[0.61]
Myrtenal	7.06*	1189	[0.21]	8.68	1566	0.01
Unknown [m/z 43, 81 (47), 67 (45), 69 (44), 41 (42), 59 (40), 55 (39)...]	7.11	1192	0.09			
Unknown [m/z 84, 41 (83), 83 (79), 91 (76), 93 (67), 119 (64), 137 (63), 109 (54), 108 (54)... 152 (4)]	7.29	1204	0.11			
Decanal	7.34	1207	0.15	7.28	1459	0.13
<i>cis</i> -Isopiperitenol	7.49	1218	0.05	10.31	1695	0.02
2,3-Epoxyneral?	7.58	1224	0.03			
Nerol	7.72	1234	0.11	11.04	1758	0.15
Citronellol	7.79	1238	0.22	10.72	1730	0.28
Neral	7.91	1247	27.80	9.51*	1631	28.29
Piperitone	7.94	1249	0.04	9.92*†	1664	[0.17]
Geraniol	8.19	1265	5.99	11.63	1808	6.18
Geranial	8.39	1278	35.72	10.15*	1683	[36.37]
Unknown [m/z 43, 69 (77), 41 (70), 109 (54)... 152 (6)]	8.45	1282	0.12	12.98	1928	0.09

2-Undecanone	8.59	1292	0.01	8.64	1562	0.02
Geranyl formate	8.80	1305	0.04	9.87*†	1660	0.17
Unknown [m/z 82, 59 (44), 41 (43), 95 (31), 43 (29), 81 (24)...]	9.24*	1336	0.12	12.68*	1900	0.08
Neric acid	9.24*	1336	[0.12]	16.77†	2301	0.16
α-Cubebene	9.44	1349	0.02	6.75	1420	0.02
Citronellyl acetate	9.54	1357	0.09	9.51*	1631	[28.29]
Cyclosativene I	9.60	1361	0.08	6.92	1433	0.11
Cyclosativene II	9.64*†	1364	0.42	7.00	1439	0.04
Neryl acetate	9.64*†	1364	[0.42]	10.20	1687	0.04
Geranic acid	9.71†	1369	[0.42]	17.26	2355	0.21
α-Copaene	9.78	1373	0.07	7.11	1447	0.03
β-Bourbonene	9.89	1382	0.05	7.44	1472	0.03
Geranyl acetate	9.98*	1388	4.09	10.55	1716	4.19
β-Cubebene	9.98*	1388	[4.09]	7.76	1495	0.06
β-Elementene	10.03	1391	0.11	8.38*	1543	1.49
Longifolene	10.08	1394	0.03	7.98	1512	0.01
β-Caryophyllene	10.36	1414	1.45	8.38*	1543	[1.49]
β-Copaene	10.50	1425	0.02	8.33	1538	0.05
trans-α-Bergamotene	10.64	1435	0.03	8.38*	1543	[1.49]
(E)-Isoeugenol	10.78	1445	0.33	16.49	2272	0.33
α-Humulene	10.81	1448	0.16	9.26	1611	0.17
cis-Muurolo-4(15),5-diene	10.95	1458	0.04	9.31	1615	0.06
trans-Cadina-1(6),4-diene	11.11	1470	0.05	9.22	1608	0.04
Germacrene D	11.19	1476	0.23	9.76*†	1651	[0.61]
γ-Amorphene	11.32	1485	0.04	9.87*†	1660	[0.17]
α-Selinene	11.38*	1490	0.10	9.92*†	1664	[0.17]
epi-Cubebol	11.38*	1490	[0.10]	11.97	1837	0.04
α-Muurolo-4(15),5-diene	11.49	1498	0.08	10.02	1672	0.08
δ-Amorphene	11.56	1503	0.03	9.92*†	1664	[0.17]
Cubebol	11.64*	1509	1.25	12.54	1888	0.10
γ-Cadinene	11.64*	1509	[1.25]	10.39*	1702	1.49
δ-Cadinene	11.78	1520	0.37	10.39*	1702	[1.49]
(E)-γ-Bisabolene	11.90	1530	0.19	10.47	1709	0.14
α-Cadinene	11.94	1533	0.05	10.76	1734	0.04
Neryl butyrate	11.97	1535	0.02			
α-Elementol	12.10	1545	0.07	14.03	2026	0.05
Germacrene B	12.15	1549	0.03	11.14	1766	0.03
Geranyl butyrate	12.31	1561	0.11	12.18	1856	0.11
Caryophyllene oxide	12.46	1574	0.45	12.75	1906	0.34
Humulene epoxide II	12.79	1599	0.04	13.39	1966	0.05
1-epi-Cubenol	13.06	1621	0.04	13.76	2000	0.03
Cubenol	13.24	1635	0.05	13.66	1991	0.04
β-Eudesmol	13.30	1640	0.02	15.42	2162	0.02
α-Eudesmol	13.34	1644	0.02	15.32	2152	0.01
(2Z,6Z)-Farnesol	13.64	1668	0.02	16.04	2225	0.02
Farnesal isomer	14.14	1711	0.01			
(2E,6E)-Farnesal	14.46	1738	0.01	15.83	2204	0.02
Neophytadiene	15.64	1842	0.05	12.68*	1900	[0.08]

meta-Camphorene	16.80	1950	0.03	15.39	2159	0.03
Octadecanal	17.53	2021	0.08	16.78†	2302	[0.16]
Unknown [m/z 93, 69 (95), 135 (76), 107 (53), 41 (53), 109 (50)... 235 (10)...]	17.98	2066	0.02			
Unknown [m/z 57, 85 (55), 163 (47), 41 (44), 120 (35), 202 (30), 145 (25)... 219 (17), 304 (t)]	18.04	2071	0.12	18.97	2546	0.07
Unknown [m/z 69, 41 (38), 151 (36), 123 (34), 82 (24), 43 (23), 109 (21)...]	18.65	2134	0.18			
Phytol isomer	18.71	2140	0.02			
Unknown [m/z 94, 43 (85), 93 (81), 69 (76), 137 (76), 95 (60), 134 (51)...]	19.00	2170	0.75			
Unknown [m/z 94, 43 (56), 123 (55), 69 (53), 95 (42), 79 (39)...]	19.54	2228	0.02			
Unknown [m/z 93, 69 (79), 43 (70), 137 (53), 41 (41), 119 (37)... 289 (33)...]	19.65	2240	0.01			
Unknown [m/z 123, 94 (100), 43 (86), 69 (75), 95 (47), 41 (47), 93 (45)...]	19.82	2258	0.03			
<b>Total identified</b>		<b>95.28%</b>			<b>96.12%</b>	
<b>Total reported</b>		<b>97.27%</b>			<b>96.78%</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