

Date : August 19, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 21H05-PTH01

Customer identification : Lemongrass - India - L80112211

Type : Essential oil

Source : *Cymbopogon flexuosus*

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

Analysis date : August 09, 2021

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Light yellow liquid

Refractive index: 1.4853 ± 0.0003 (20 °C; method PC-MAT-016)

ISO 4718:2004 - OIL OF LEMONGRASS

Compound	Min. %	Max. %	Observed %	Complies?
Limonene	0.5	3.5	0.8	Yes
6-Methyl-5-hepten-2-one	0.1	2.0	1.0	Yes
β-Caryophyllene	0.2	3.5	1.5	Yes
Neral	25.0	35.0	30.9	Yes
Geranial	35.0	47.0	40.4	Yes
Geranyl acetate	0.5	6.0	3.0	Yes
Geraniol	1.5	8.0	7.0	Yes
Refractive index	1.4830	1.4890	1.4853	Yes

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies 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	%	Class
Ethanol	tr	Aliphatic alcohol
2-Methyl-3-buten-2-ol	0.03	Aliphatic alcohol
Isovaleral	0.01	Aliphatic aldehyde
2-Methylbutyral	tr	Aliphatic aldehyde
2-Ethylfuran	tr	Furan
Isoamyl alcohol	0.01	Aliphatic alcohol
2-Methylbutanol	tr	Aliphatic alcohol
Hexanal	0.01	Aliphatic aldehyde
Unknown	0.01	Unknown
(2E)-Hexenal	tr	Aliphatic aldehyde
(3Z)-Hexenol	0.01	Aliphatic alcohol
4-Heptanone	0.02	Aliphatic ketone
Hexanol	tr	Aliphatic alcohol
Tricyclene	0.13	Monoterpene
α-Pinene	0.18	Monoterpene
α-Fenchene	tr	Monoterpene
Camphene	1.04	Monoterpene
Benzaldehyde	0.01	Simple phenolic
β-Pinene	tr	Monoterpene
Sabinene	0.01	Monoterpene
6-Methyl-5-hepten-2-one	1.04	Aliphatic ketone
Myrcene	0.08	Monoterpene
6-Methyl-5-hepten-2-ol	0.07	Aliphatic alcohol
α-Phellandrene	0.01	Monoterpene
Octanal	0.09	Aliphatic aldehyde
α-Terpinene	0.01	Monoterpene
para-Cymene	0.01	Monoterpene
1,8-Cineole	0.05	Monoterpenic ether
Limonene	0.76	Monoterpene
Benzeneacetaldehyde	0.01	Simple phenolic
(Z)-β-Ocimene	0.34	Monoterpene
(E)-β-Ocimene	0.22	Monoterpene
2,6-Dimethyl-5-heptenal (melonal)	0.02	Aliphatic aldehyde
γ-Terpinene	0.01	Monoterpene
cis-Sabinene hydrate	0.01	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
4-Nonanone	0.94	Aliphatic ketone
Terpinolene	0.05	Monoterpene
trans-Linalool oxide (fur.)	tr	Monoterpenic alcohol
4-Nonanol	0.03	Aliphatic alcohol
Rosefuran	0.21	Monoterpenic ether
Linalool	1.03	Monoterpenic alcohol
cis-Chrysanthemal?	0.03	Monoterpenic aldehyde
(Z)-6-Methyl-3,5-heptadien-2-one	0.03	Aliphatic ketone
trans-para-Mentha-2,8-dien-1-ol	0.03	Monoterpenic alcohol

Unknown	0.02	Unknown
Unknown	0.03	Unknown
<i>trans</i> -Chrysanthemal	0.32	Monoterpenic aldehyde
exo-Isocitral	0.06	Monoterpenic aldehyde
Citronellal	0.22	Monoterpenic aldehyde
Borneol	0.16	Monoterpenic alcohol
Isoneral	0.76	Monoterpenic aldehyde
α -Phellandren-8-ol	0.01	Monoterpenic alcohol
Unknown	0.04	Oxygenated monoterpene
Terpinen-4-ol	0.22*	Monoterpenic alcohol
Rosefuran oxide	[0.22]*	Monoterpenic ether
Unknown	0.06	Unknown
Isogeranial	1.18	Monoterpenic aldehyde
α -Terpineol	0.13	Monoterpenic alcohol
Myrtenal	0.01	Monoterpenic aldehyde
Unknown	0.06	Unknown
<i>trans</i> -Isopiperitenol	0.03	Monoterpenic alcohol
Unknown	0.08	Oxygenated monoterpene
Decanal	0.16	Aliphatic aldehyde
<i>cis</i> -Isopiperitenol	0.03	Monoterpenic alcohol
2,3-Epoxyneral?	0.04	Monoterpenic aldehyde
Nerol	0.18	Monoterpenic alcohol
Citronellol	0.08	Monoterpenic alcohol
Neral	30.87	Monoterpenic aldehyde
Piperitone	0.05	Monoterpenic ketone
(<i>E</i>)-Isogeraniol?	0.03	Monoterpenic alcohol
Geraniol	7.02	Monoterpenic alcohol
Geranial	40.44	Monoterpenic aldehyde
Unknown	0.11	Oxygenated monoterpene
Bornyl acetate	0.02	Monoterpenic ester
Geranyl formate	0.05	Monoterpenic ester
Neric acid	0.06	Monoterpenic acid
Unknown	0.04	Unknown
α -Cubebene	0.03	Sesquiterpene
Citronellyl acetate	0.04	Monoterpenic ester
Cyclosativene I	0.11	Sesquiterpene
Cyclosativene II	0.11	Sesquiterpene
Geranic acid	0.20	Aliphatic acid
α -Ylangene	0.04	Sesquiterpene
α -Copaene	0.02	Sesquiterpene
β -Bourbonene	0.02	Sesquiterpene
Geranyl acetate	3.02	Monoterpenic ester
β -Cubebene	0.08	Sesquiterpene
β -Elemene	0.08	Sesquiterpene
Longifolene	0.03	Sesquiterpene
β -Caryophyllene	1.48	Sesquiterpene
β -Ylangene	0.06	Sesquiterpene
β -Copaene	0.02	Sesquiterpene
<i>trans</i> - α -Bergamotene	0.01	Sesquiterpene
α -Humulene	0.15	Sesquiterpene
(<i>E</i>)-Isoeugenol	0.53	Phenylpropanoid
<i>cis</i> -Muurola-4(15),5-diene	0.04	Sesquiterpene

<i>trans</i> -Cadina-1(6),4-diene	0.04	Sesquiterpene
Germacrene D	0.26	Sesquiterpene
γ -Amorphene	0.03	Sesquiterpene
epi-Cubebol	0.11	Sesquiterpenic alcohol
α -Muurolene	0.09	Sesquiterpene
δ -Amorphene	0.03	Sesquiterpene
γ -Cadinene	1.08	Sesquiterpene
Cubebol	0.24	Sesquiterpenic alcohol
δ -Cadinene	0.25	Sesquiterpene
10-epi-Cubebol?	0.06	Sesquiterpenic alcohol
(<i>E</i>)- γ -Bisabolene	0.17	Sesquiterpene
α -Cadinene	0.04	Sesquiterpene
Neryl butyrate	0.04	Monoterpenic ester
(<i>E</i>)- α -Bisabolene	0.01	Sesquiterpene
α -Elemol	0.06	Sesquiterpenic alcohol
Germacrene B	0.04	Sesquiterpene
Geranyl butyrate	0.14	Monoterpenic ester
Caryophyllene oxide isomer	0.03	Sesquiterpenic ether
Caryophyllene oxide	0.34	Sesquiterpenic ether
Humulene epoxide II	0.04	Sesquiterpenic ether
1-epi-Cubebol	0.03	Sesquiterpenic alcohol
Cubebol	0.03	Sesquiterpenic alcohol
β -Eudesmol	0.02	Sesquiterpenic alcohol
α -Eudesmol	0.02	Sesquiterpenic alcohol
Unknown	0.01	Oxygenated sesquiterpene
(2 <i>Z</i> ,6 <i>Z</i>)-Farnesol	0.02	Sesquiterpenic alcohol
(2 <i>E</i> ,6 <i>Z</i>)-Farnesol	0.02	Sesquiterpenic aldehyde
(2 <i>E</i> ,6 <i>E</i>)-Farnesol	0.02	Sesquiterpenic aldehyde
Neophytadiene	0.04	Diterpene
Phytone	0.02	Terpenic ketone
Unknown	0.03	Unknown
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Dicitral	0.05	Diterpenic aldehyde
Unknown	0.03	Unknown
Unknown	0.05	Unknown
Phytol isomer I	0.02	Diterpenic alcohol
Unknown	0.01	Unknown
Unknown	0.01	Unknown
Consolidated total	98.71%	

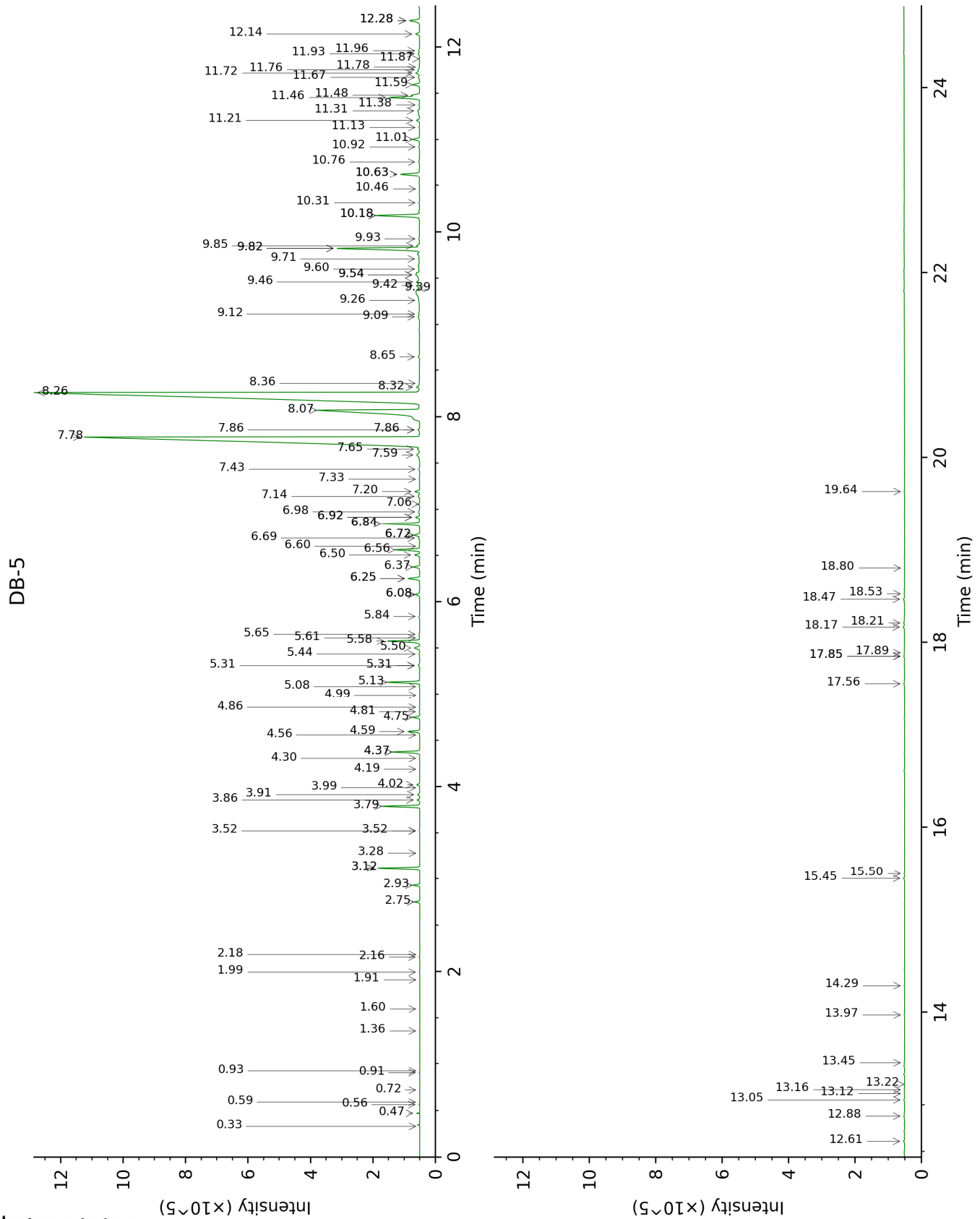
*: Individual compounds concentration could not be found due to overlapping coelutions on columns considered
[xx]: Duplicate percentage due to coelutions, not taken into account in the consolidated total
tr: The compound has been detected below 0.005% of total signal.

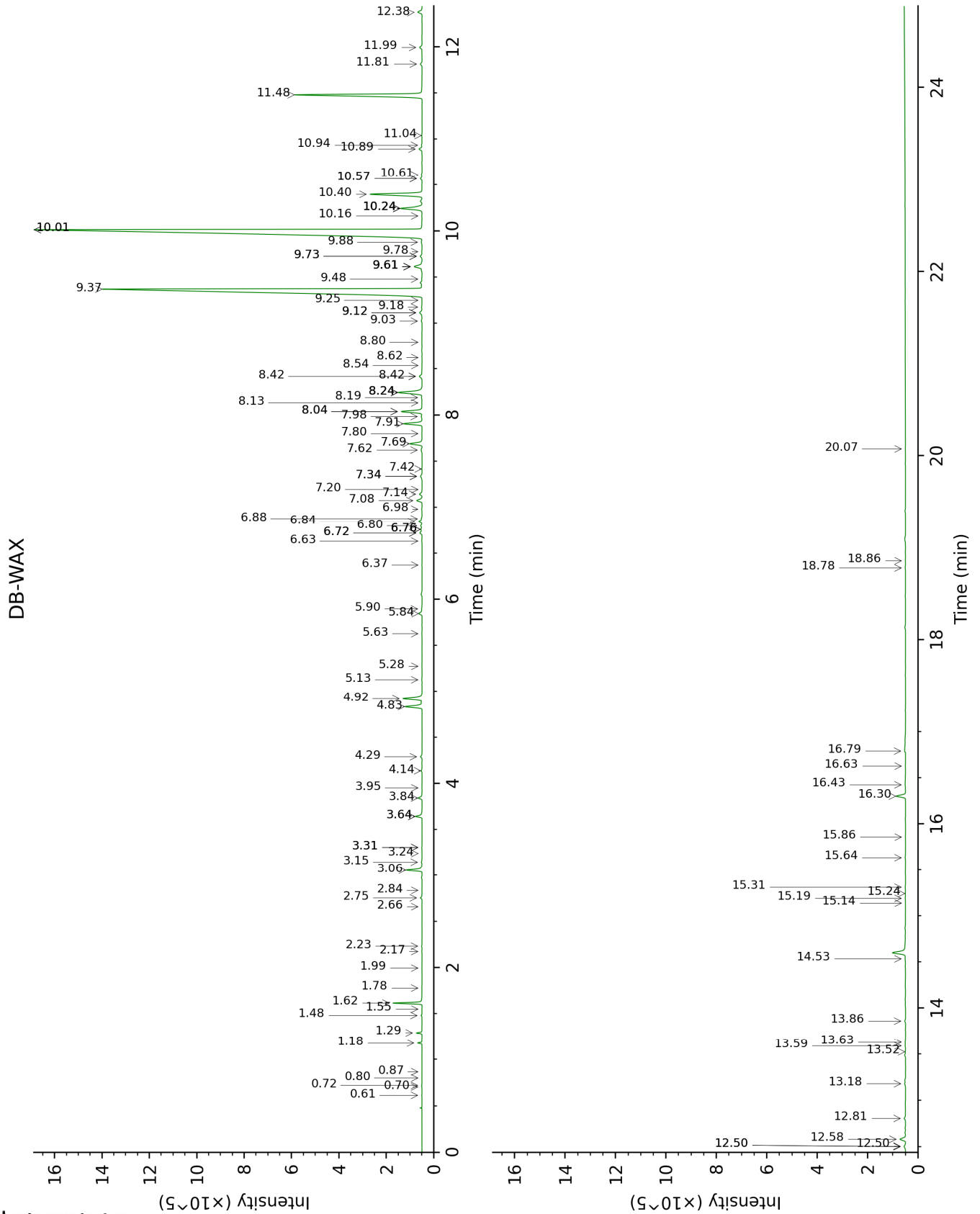
Note: no correction factor was applied

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	%
Ethanol	0.33	499	tr	0.80	908	tr
2-Methyl-3-buten-2-ol	0.47	606	0.03	1.48	1013	0.02
Isovaleral	0.56	641	0.01	0.72	887	0.01
2-Methylbutyral	0.59	651	tr	0.70	881	tr
2-Ethylfuran	0.72	701	tr	0.87	919	tr
Isoamyl alcohol	0.90	731	0.01	3.31*	1178	0.02
2-Methylbutanol	0.92	734	tr	3.31*	1178	[0.02]
Hexanal	1.36	800	0.01	1.78	1043	0.01
Unknown [m/z 81, 69 (80), 41 (65), 83 (52), 109 (48), 55 (47)...]	1.60	822	0.01	0.61	846	0.01
(2E)-Hexenal	1.91	850	tr	3.24	1173	0.01
(3Z)-Hexenol	1.99	857	0.01	5.63	1346	0.02
4-Heptanone	2.16	871	0.02	2.23	1090	0.02
Hexanol	2.18	873	tr	5.28	1321	0.02
Tricyclene	2.75	918	0.13	1.18	972	0.13
α-Pinene	2.93	930	0.18	1.29	991	0.17
α-Fenchene	3.12*	943	1.07	1.55	1020	tr
Camphene	3.12*	943	[1.07]	1.62	1027	1.04
Benzaldehyde	3.28	954	0.01	7.20	1462	0.01
β-Pinene	3.52*	970	0.02	1.99	1065	tr
Sabinene	3.52*	970	[0.02]	2.17	1084	0.01
6-Methyl-5-hepten-2-one	3.79	988	1.04	4.92	1301	1.05
Myrcene	3.86	993	0.08	2.75	1133	0.08
6-Methyl-5-hepten-2-ol	3.91	997	0.07	6.76*	1429	0.08
α-Phellandrene	3.99	1002	0.01	2.66	1126	0.01
Octanal	4.02	1004	0.09	4.29	1253	0.09
α-Terpinene	4.19	1014	0.01	2.84	1140	0.01
para-Cymene	4.30	1022	0.01	3.95	1228	0.01
1,8-Cineole	4.37*	1026	0.80	3.15	1165	0.05
Limonene	4.37*	1026	[0.80]	3.06	1158	0.76
Benzeneacetaldehyde	4.56	1038	0.01	8.62	1572	0.01
(Z)-β-Ocimene	4.59	1040	0.34	3.64*	1205	0.34
(E)-β-Ocimene	4.75	1050	0.22	3.84	1220	0.21
2,6-Dimethyl-5-heptenal (melonal)	4.81	1054	0.02	5.13	1310	0.02
γ-Terpinene	4.86	1057	0.01	3.64*	1205	[0.34]
cis-Sabinene hydrate	4.99	1065	0.01	6.76*	1429	[0.08]
cis-Linalool oxide (fur.)	5.08	1071	0.01	6.37	1400	0.01
4-Nonanone	5.13	1074	0.94	4.83	1295	0.94
Terpinolene	5.31*	1086	0.06	4.14	1242	0.05
trans-Linalool oxide (fur.)	5.31*	1086	[0.06]	6.76*	1429	[0.08]
4-Nonanol	5.44	1094	0.03			

Rosefuran	5.50	1098	0.21	5.84	1362	0.21
Linalool	5.58	1102	1.03	7.91	1516	1.00
<i>cis</i> -Chrysanthemal?	5.61	1104	0.03	5.90	1366	0.04
(<i>Z</i>)-6-Methyl-3,5-heptadien-2-one	5.65	1107	0.03	8.04*	1526	1.21
<i>trans</i> -para-Mentha-2,8-dien-1-ol	5.84	1119	0.03	8.80	1585	0.02
Unknown [m/z 95, 67 (86), 41 (68), 82 (64), 123 (62)...]	6.08*	1134	0.16	7.42	1479	0.02
Unknown [m/z 81, 70 (98), 67 (63), 82 (53), 41 (46), 69 (46), 109 (43)...]	6.08*	1134	[0.16]	6.72*	1426	0.14
<i>trans</i> -Chrysanthemal	6.25*	1146	0.38	7.08	1453	0.32
exo-Isocitral	6.25*	1146	[0.38]	7.34*	1473	0.13
Citronellal	6.37	1154	0.22	6.84	1436	0.20
Borneol	6.50	1162	0.16	9.61*	1651	0.57
Isoneral	6.56	1166	0.76	7.69	1499	0.71
α -Phellandren-8-ol	6.60	1168	0.01	10.01*	1684	40.57
Unknown [m/z 84, 83 (74), 137 (56), 41 (47), 93 (43), 108 (40)... 152 (2)]	6.69†	1174	0.26	9.48	1640	0.04
Terpinen-4-ol	6.72*†	1176	[0.26]	8.42*	1556	0.19
Rosefuran oxide	6.72*†	1176	[0.26]	8.42*	1556	[0.19]
Unknown [m/z 69, 41 (65), 109 (36), 67 (16), 84 (11), 43 (10), 55 (9)...]	6.84*	1184	1.24			
Isogeranial	6.84*	1184	[1.24]	8.04*	1526	[1.21]
α -Terpineol	6.92*	1188	0.15	9.61*	1651	[0.57]
Myrtenal	6.92*	1188	[0.15]	8.54	1565	0.01
Unknown [m/z 43, 81 (47), 67 (45), 69 944), 41 (42), 59 (40), 55 (39)...]	6.98	1192	0.06	9.02	1603	0.05
<i>trans</i> -Isopiperitenol	7.06	1198	0.03	10.24*	1703	1.37
Unknown [m/z 84, 41 (83), 83 (79), 91 (76), 93 (67), 119 (64), 137 (63), 109 (54), 108 (54)... 152 (4)]	7.14	1203	0.08			
Decanal	7.20	1206	0.16	7.14	1458	0.16
<i>cis</i> -Isopiperitenol	7.33	1215	0.03	10.16	1696	0.02
2,3-Epoxyneral?	7.44	1222	0.04			
Nerol	7.59	1233	0.18	10.89	1758	0.18
Citronellol	7.65	1237	0.08	10.57*	1730	0.09
Neral	7.78†	1246	30.94	9.37	1631	30.87
Piperitone	7.86*†	1251	[30.94]	9.73*	1660	0.12
(<i>E</i>)-Isogeraniol?	7.86*†	1251	[30.94]	11.04	1770	0.03
Geraniol	8.07	1265	7.02	11.48	1808	7.14

Geranial	8.26	1278	40.44	10.01*	1684	[40.57]
Unknown [m/z 43, 69 (77), 41 (70), 109 (54)... 152 (6)]	8.32	1282	0.11	12.81	1927	0.10
Bornyl acetate	8.36	1285	0.02	8.13	1534	0.02
Geranyl formate	8.65	1304	0.05	9.73*	1660	[0.12]
Neric acid	9.08	1335	0.06	16.43	2283	0.05
Unknown [m/z 82, 59 (44), 41 (43), 95 (31), 43 (29), 81 (24)...]	9.12	1337	0.04	12.50*	1899	0.11
α-Cubebene	9.26	1347	0.03	6.63	1420	0.03
Citronellyl acetate	9.39	1357	0.04	9.25	1622	0.01
Cyclosativene I	9.42	1359	0.11	6.72*	1426	[0.14]
Cyclosativene II	9.46	1362	0.11	6.80	1432	0.09
Geranic acid	9.54*	1367	0.25	16.79	2322	0.20
α-Ylangene	9.54*	1367	[0.25]	6.88	1438	0.04
α-Copaene	9.60	1371	0.02	6.98	1446	0.03
β-Bourbonene	9.71	1379	0.02	7.34*	1473	[0.13]
Geranyl acetate	9.82*	1387	3.09	10.40	1716	3.02
β-Cubebene	9.82*	1387	[3.09]	7.62	1494	0.08
β-Elementene	9.85	1389	0.08	8.24*	1542	1.59
Longifolene	9.93	1394	0.03	7.80	1508	0.02
β-Caryophyllene	10.18*	1413	1.54	8.24*	1542	[1.59]
β-Ylangene	10.18*	1413	[1.54]	7.98	1522	0.06
β-Copaene	10.31	1423	0.02	8.19	1538	0.04
trans-α-Bergamotene	10.46	1434	0.01	8.24*	1542	[1.59]
α-Humulene	10.63*	1446	0.67	9.12*	1610	0.19
(E)-Isoeugenol	10.63*	1446	[0.67]	16.30	2270	0.53
cis-Muurolo-4(15),5-diene	10.76	1456	0.04	9.18	1616	0.05
trans-Cadina-1(6),4-diene	10.92	1468	0.04	9.12*	1610	[0.19]
Germacrene D	11.00	1474	0.26	9.61*	1651	[0.57]
γ-Amorphene	11.13	1484	0.03	9.61*	1651	[0.57]
epi-Cubebol	11.21	1490	0.11	11.81	1838	0.10
α-Muurolole	11.31	1497	0.09	9.88	1673	0.06
δ-Amorphene	11.38	1502	0.03	9.78	1664	0.03
γ-Cadinene	11.46	1508	1.08	10.24*	1703	[1.37]
Cubebol	11.48	1510	0.24	12.38	1888	0.27
δ-Cadinene	11.59	1519	0.25	10.24*	1703	[1.37]
10-epi-Cubebol?	11.67	1525	0.06	13.59	1999	0.03
(E)-γ-Bisabolene	11.72	1529	0.17	10.24*	1703	[1.37]
α-Cadinene	11.76†	1532	0.08	10.61	1734	0.04
Neryl butyrate	11.78†	1534	[0.08]			
(E)-α-Bisabolene	11.87	1541	0.01	10.57*	1730	[0.09]
α-Elementol	11.93	1545	0.06	13.86	2026	0.05
Germacrene B	11.96	1548	0.04	10.94	1761	0.04
Geranyl butyrate	12.14	1562	0.14	11.99	1854	0.15
Caryophyllene oxide isomer	12.28*	1573	0.41	12.50*	1899	[0.11]
Caryophyllene oxide	12.28*	1573	[0.41]	12.58	1906	0.34
Humulene epoxide II	12.61	1599	0.04	13.18	1962	0.07

1-epi-Cubenol	12.88	1621	0.03	13.63	2003	0.04
Cubenol	13.05	1636	0.03	13.52	1993	0.02
β-Eudesmol	13.12	1641	0.02	15.24	2161	0.01
α-Eudesmol	13.16	1645	0.02	15.14	2151	0.01
Unknown [m/z 43, 81 (84), 41 (64), 67 (62), 95 (58), 79 (58)... 204 (48), 220 (2)]	13.22	1649	0.01	15.31	2168	0.03
(2Z,6Z)-Farnesol	13.45	1668	0.02	15.86	2224	0.02
(2E,6Z)-Farnesal	13.97	1712	0.02	15.19	2156	0.02
(2E,6E)-Farnesal	14.29	1739	0.02	15.64	2201	0.04
Neophytadiene	15.45	1842	0.04	12.50*	1899	[0.11]
Phytone	15.50	1846	0.02	14.53	2090	0.02
Unknown [m/z 69, 41 (94), 81 (42), 109 (39), 107 (33), 43 (31)...]	17.56	2041	0.03			
Unknown [m/z 93, 69 (95), 135 (76), 107 (53), 41 (53), 109 (50)... 235 (10)...]	17.85*	2071	0.02			
Unknown [m/z 57, 85 (55), 163 (47), 41 (44), 120 (35), 202 (30), 145 (25)... 219 (17), 304 (t)]	17.85*	2071	[0.02]	18.86	2552	0.01
Unknown [m/z 69, 41 (73), 55 (46), 95 (40), 109 (39), 91 (39)...]	17.89	2074	0.01			
Dicitral	18.17	2102	0.05	16.63	2304	0.01
Unknown [m/z 69, 41 (37), 81 (23), 95 (19), 109 (18)...]	18.21	2106	0.03	18.78	2543	0.03
Unknown [m/z 69, 41 (38), 151 (36), 123 (34), 82 (24), 43 (23), 109 (21)...]	18.47	2133	0.05	20.08	2696	0.01
Phytol isomer I	18.53	2139	0.02			
Unknown [m/z 94, 43 (85), 93 (81), 69 (76), 137 (76), 95 (60), 134 (51)...]	18.80	2168	0.01			
Unknown [m/z 123, 94 (100), 43 (86), 69 (75), 95 (47), 41 (47), 93 (45)...]	19.64	2256	0.01			
Total identified		98.18%			98.02%	
Total reported		98.90%			98.30%	

*: 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)

