

Date : March 16, 2021

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 21B23-FEP25

Customer identification : Rose - Bulgaria - 55078-06

Type : Essential oil

Source : Rosa x damascena

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 15, 2021

Checked and approved by :

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

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*P*HYSICO*C*HEMICAL *D*ATA

Physical aspect: Light yellow liquid

Refractive index: 1.4613 ± 0.0003 (20 °C; method PC-MAT-016)

*C*ONCLUSION

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
Acetaldehyde	0.04	Aliphatic aldehyde
Ethanol	1.04	Aliphatic alcohol
2-Methyl-3-buten-2-ol	0.01	Aliphatic alcohol
Ethyl acetate	tr	Aliphatic ester
Isobutanol	0.01	Aliphatic alcohol
Isovaleral	tr	Aliphatic aldehyde
Penten-3-ol	tr	Aliphatic alcohol
Pentanal	0.04	Aliphatic aldehyde
Acetaldehyde diethyl acetal	0.01	Aliphatic acetal
Isoamyl alcohol	0.05	Aliphatic alcohol
2-Methylbutanol	0.05	Aliphatic alcohol
Pentanol	0.03	Aliphatic alcohol
Hexanal	0.02	Aliphatic aldehyde
3-Methylpentanol	0.01	Aliphatic alcohol
(3Z)-Hexenol	0.04	Aliphatic alcohol
(2E)-Hexenol	0.01	Aliphatic alcohol
Hexanol	0.19	Aliphatic alcohol
Heptanal	0.09	Aliphatic aldehyde
α-Pinene	0.33	Monoterpene
Benzaldehyde	0.04	Simple phenolic
Sabinene	0.05	Monoterpene
β-Pinene	0.09	Monoterpene
Heptanol	0.01	Aliphatic alcohol
6-Methyl-5-hepten-2-one	0.05	Aliphatic ketone
Myrcene	0.21	Monoterpene
6-Methyl-5-hepten-2-ol	0.01	Aliphatic alcohol
Octanal	0.01	Aliphatic aldehyde
α-Terpinene	0.02	Monoterpene
para-Cymene	0.02	Monoterpene
1,8-Cineole	0.02*	Monoterpenic ether
β-Phellandrene	[0.02]*	Monoterpene
Limonene	0.04	Monoterpene
(Z)-β-Ocimene	0.02	Monoterpene
(E)-β-Ocimene	0.02	Monoterpene
γ-Terpinene	0.03	Monoterpene
cis-Sabinene hydrate	0.04	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.02	Monoterpenic alcohol
Terpinolene	0.02	Monoterpene
trans-Sabinene hydrate	0.02	Monoterpenic alcohol
Rosefuran	0.02	Monoterpenic ether
Linalool	0.70	Monoterpenic alcohol
Nonanal	0.07	Aliphatic aldehyde
Phenylethyl alcohol	0.55	Simple phenolic
cis-Rose oxide	0.24	Monoterpenic ether
β-Thujone	0.01	Monoterpenic ketone

<i>trans</i> -para-Mentha-2,8-dien-1-ol	0.01	Monoterpenic alcohol
<i>trans</i> -Rose oxide	0.12	Monoterpenic ether
<i>cis</i> -para-Mentha-2,8-dien-1-ol	0.01	Monoterpenic alcohol
<i>trans</i> -para-Menth-2-en-1-ol	0.01	Monoterpenic alcohol
neo-Isopulegol	0.01	Monoterpenic alcohol
Citronellal	0.09	Monoterpenic aldehyde
Nerol oxide	0.05	Aliphatic ether
Borneol	0.02	Monoterpenic alcohol
α -Phellandren-8-ol	0.01	Monoterpenic alcohol
Terpinen-4-ol	0.28	Monoterpenic alcohol
Isogeranial	0.02	Monoterpenic aldehyde
α -Terpineol	0.19	Monoterpenic alcohol
Hodiendiol	0.03	Monoterpenic alcohol
Decanal	0.03	Aliphatic aldehyde
γ -Isogeraniol?	0.08	Monoterpenic alcohol
Rhodinol (α -citronellol)	0.01	Monoterpenic alcohol
Nerol	10.57	Monoterpenic alcohol
Neral	0.46	Monoterpenic aldehyde
Citronellol	27.75	Monoterpenic alcohol
(Z)-Isogeraniol	0.17	Monoterpenic alcohol
(E)-Isogeraniol?	0.12	Monoterpenic alcohol
Geraniol	20.07	Monoterpenic alcohol
Geranial	1.26	Monoterpenic aldehyde
Citronellyl formate	0.02	Monoterpenic ester
Geranyl formate	0.01	Monoterpenic ester
Undecanal	0.01	Aliphatic aldehyde
Methyl geranate	0.07	Monoterpenic ester
Citronellyl acetate	0.45	Monoterpenic ester
Eugenol	0.73	Phenylpropanoid
Neryl acetate	0.11	Monoterpenic ester
β -Bourbonene	0.08	Sesquiterpene
Geranyl acetate	0.95	Monoterpenic ester
β -Elemene	0.13	Sesquiterpene
Ethyl decanoate	0.01	Aliphatic ester
Methyleugenol	1.23	Phenylpropanoid
β -Caryophyllene	0.54	Sesquiterpene
β -Copaene	0.02	Sesquiterpene
α -Guaiene	0.38	Sesquiterpene
α -Humulene	0.28	Sesquiterpene
(E)- β -Farnesene	0.02	Sesquiterpene
γ -Muurolene	0.03	Sesquiterpene
Germacrene D	0.66	Sesquiterpene
β -Selinene	0.05	Sesquiterpene
Unknown	0.05	Unknown
Phenylethyl 2-methylbutyrate	0.02	Phenolic ester
Aciphyllene	0.15	Sesquiterpene
α -Muurolene	0.08	Sesquiterpene
Pentadecane	0.24	Alkane
δ -Guaiene	0.34	Sesquiterpene
(3E,6E)- α -Farnesene	0.10	Sesquiterpene
γ -Cadinene	0.02	Sesquiterpene
δ -Cadinene	0.03	Sesquiterpene

α -Elemol	0.09	Sesquiterpenic alcohol
(E)-Nerolidol	0.08	Sesquiterpenic alcohol
Caryophyllene oxide	0.05	Sesquiterpenic ether
Phenylethyl tiglate	0.05	Phenolic ester
Ethyl dodecanoate	0.04	Aliphatic ester
Ethyl laurate	0.02	Aliphatic ester
Hexadecane	0.07	Alkane
10-epi-Cubenol	0.01	Sesquiterpenic alcohol
10-epi- γ -Eudesmol	0.04	Sesquiterpenic alcohol
γ -Eudesmol	0.11	Sesquiterpenic alcohol
τ -Cadinol	0.03	Sesquiterpenic alcohol
τ -Muurolol	0.02	Sesquiterpenic alcohol
β -Eudesmol	0.12	Sesquiterpenic alcohol
Phenylethyl hexanoate	0.25	Phenolic ester
α -Eudesmol	0.10	Sesquiterpenic alcohol
(8Z)-Heptadecene	0.25	Alkene
(2E,6Z)-Farnesol	0.31	Sesquiterpenic alcohol
Heptadecane	1.43	Alkane
(2E,6Z)-Farnesal	0.06	Sesquiterpenic aldehyde
(2E,6E)-Farnesol	2.27	Sesquiterpenic alcohol
(2E,6E)-Farnesal	0.10	Sesquiterpenic aldehyde
Benzyl benzoate	0.06	Phenolic ester
(8Z)-Octadecene	0.05	Alkene
Octadecane	0.13	Alkane
Hexadecanal	0.02	Aliphatic aldehyde
(2E,6E)-Farnesyl acetate	0.02	Sesquiterpenic ester
Phenylethyl benzoate	0.08	Phenolic ester
Nonadecadiene isomer	0.06	Alkene
(9Z)-Nonadecene	2.82	Alkene
Nonadecane	9.68	Alkane
(9Z)-Eicosene	0.12	Alkene
Ethyl palmitate	0.04	Aliphatic ester
Eicosane	0.84	Alkane
Octadecanal	0.03	Aliphatic aldehyde
Phenylethyl decanoate	0.06	Phenolic ester
(10Z)-Heneicosene	0.14	Alkene
Phenylethyl geranate	0.15	Monoterpenic ester
1-Heneicosene?	0.12	Alkene
Heneicosane	3.82	Alkane
Citronellyl caprate	0.07	Monoterpenic ester
Phenylethyl undecanoate?	0.05	Phenolic ester
Ethyl linolenate	0.06	Aliphatic ester
Docosane	0.10	Alkane
1-Tricosene?	0.13	Alkene
Tricosane	0.75	Alkane
Citronellyl laurate	0.05	Monoterpenic ester
Geranyl laurate	0.04	Monoterpenic ester
Tetracosane	0.04	Alkane
1-Pentacosene?	0.02	Alkene
Pentacosane	0.18	Alkane
Citronellyl myristate	0.01	Monoterpenic ester
Geranyl myristate	0.01	Monoterpenic ester

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Hexacosane	0.01	Alkane
Heptacosane	0.10	Alkane
Consolidated total	97.83%	

*: 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

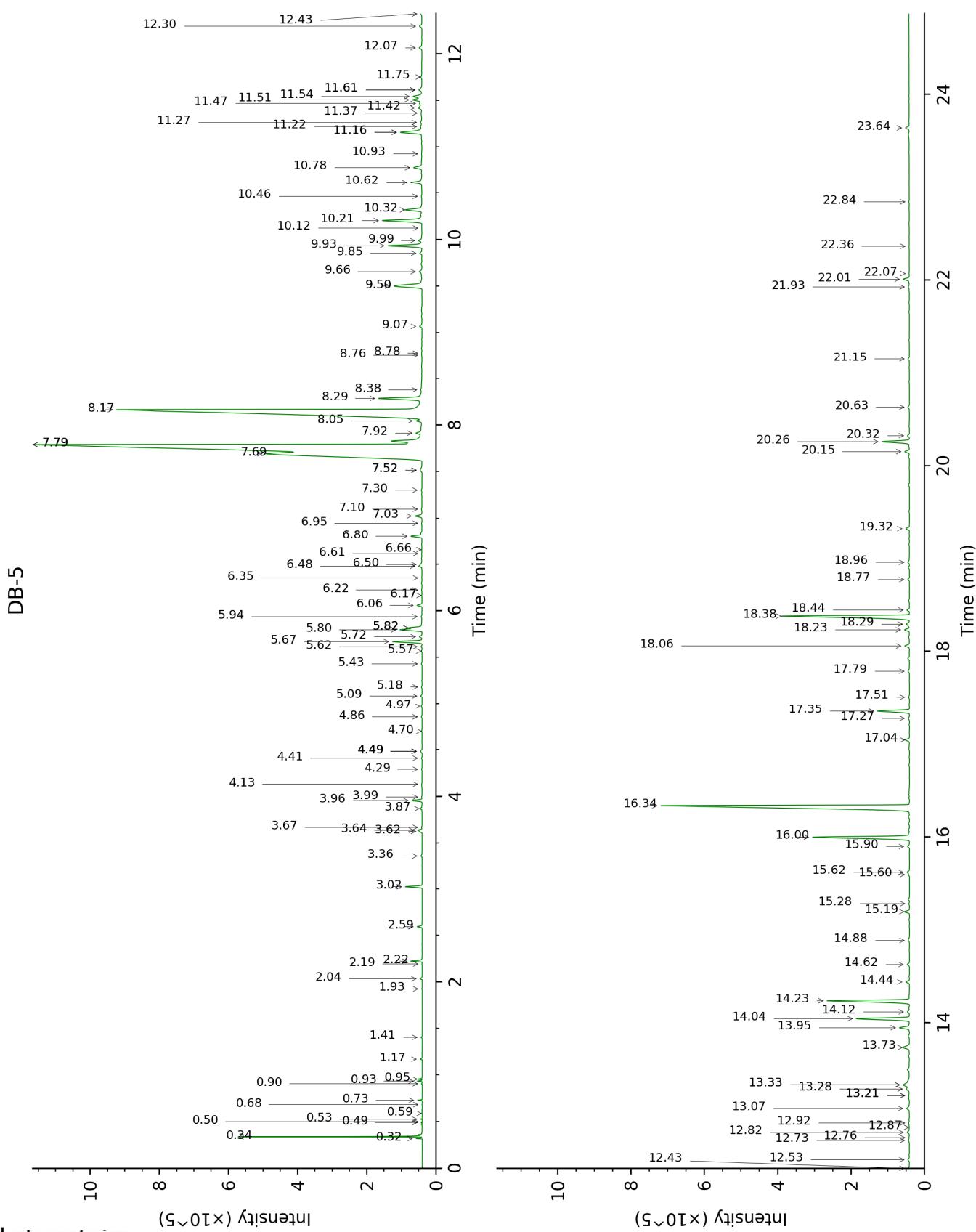
tr: The compound has been detected below 0.005% of total signal.

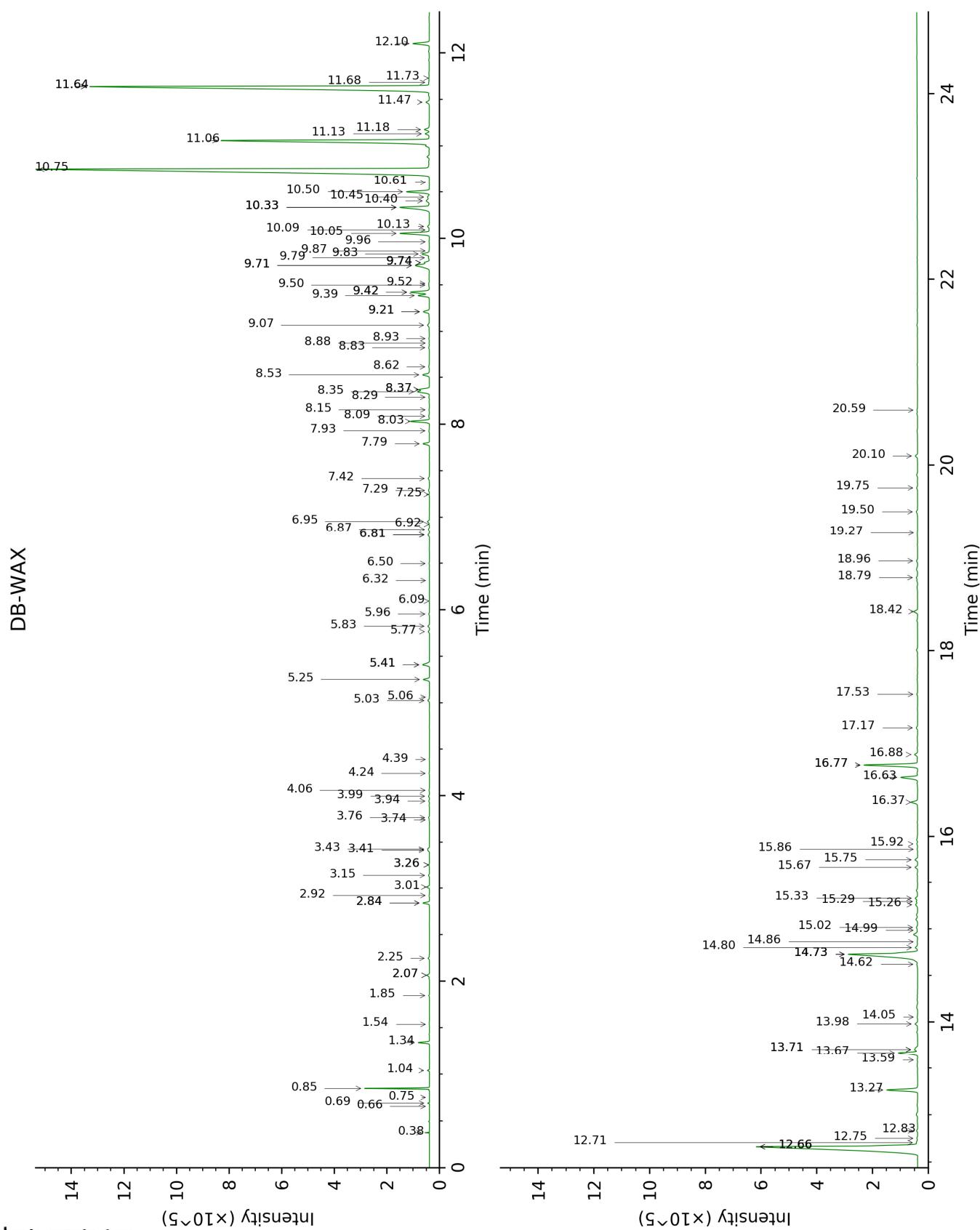
Note: no correction factor was applied

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	%
Acetaldehyde	0.32	507	0.04	0.38	651	0.04
Ethanol	0.34	508	1.04	0.85	909	1.08
2-Methyl-3-buten-2-ol	0.49	601	0.01	1.54	1014	tr
Ethyl acetate	0.50	608	tr	0.66	851	tr
Isobutanol	0.53	618	0.01	2.07*	1065	0.10
Isovaleral	0.59	642	tr	0.75	887	tr
Penten-3-ol	0.68	676	tr	2.84*	1133	0.22
Pentanal	0.73	694	0.04	1.04	941	0.04
Acetaldehyde diethyl acetal	0.90	727	0.01	0.69	864	0.03
Isoamyl alcohol	0.93	731	0.05	3.41	1178	0.05
2-Methylbutanol	0.95	734	0.05	3.43	1178	0.06
Pentanol	1.16	764	0.03	3.94	1217	0.03
Hexanal	1.41	799	0.02	1.85	1044	0.02
3-Methylpentanol	1.93	845	0.01	5.06	1298	0.01
(3Z)-Hexenol	2.04	854	0.04	5.77	1349	0.05
(2E)-Hexenol	2.19	867	0.01	6.10	1373	0.01
Hexanol	2.22	869	0.19	5.41*	1324	0.33
Heptanal	2.59	900	0.09	3.01	1146	0.10
α -Pinene	3.02	930	0.33	1.34	991	0.33
Benzaldehyde	3.36	952	0.04	7.29	1461	0.05
Sabinene	3.62†	970	0.13	2.25	1083	0.05
β -Pinene	3.64†	970	[0.13]	2.07*	1065	[0.10]
Heptanol	3.67	972	0.01	6.81*	1425	0.06
6-Methyl-5-hepten-2-one	3.87	986	0.05	5.03	1296	0.07
Myrcene	3.96	992	0.21	2.84*	1133	[0.22]
6-Methyl-5-hepten-2-ol	3.99	994	0.01	6.92	1434	0.01
Octanal	4.13	1003	0.01	4.39	1250	0.01
α -Terpinene	4.29	1013	0.02	2.92	1139	0.02
para-Cymene	4.41	1021	0.02	4.06	1226	0.02
1,8-Cineole	4.48*	1026	0.06	3.26*	1165	0.03
β -Phellandrene	4.48*	1026	[0.06]	3.26*	1165	[0.03]
Limonene	4.48*	1026	[0.06]	3.14	1157	0.04
(Z)- β -Ocimene	4.70	1039	0.02	3.74	1203	0.02
(E)- β -Ocimene	4.86	1049	0.02	3.99	1221	0.04
γ -Terpinene	4.97	1056	0.03	3.76	1204	0.04
cis-Sabinene hydrate	5.09	1063	0.04	6.87	1430	0.05
cis-Linalool oxide (fur.)	5.18	1070	0.02	6.50	1402	0.02
Terpinolene	5.43	1085	0.02	4.24	1239	0.02
trans-Sabinene hydrate	5.57	1094	0.02	7.93	1509	0.03

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Rosefuran	5.62	1097	0.02	5.96	1363	0.03
Linalool	5.67	1100	0.70	8.03	1517	0.72
Nonanal	5.72	1104	0.07	5.83	1353	0.06
Phenylethyl alcohol	5.80	1108	0.55	12.10	1853	0.69
cis-Rose oxide	5.82*	1110	0.31	5.25	1312	0.24
β -Thujone	5.82*	1110	[0.31]	6.32	1389	0.01
trans-para-Mentha-2,8-dien-1-ol	5.94	1118	0.01	8.88	1583	0.01
trans-Rose oxide	6.06	1125	0.12	5.41*	1324	[0.33]
cis-para-Mentha-2,8-dien-1-ol	6.16	1132	0.01	9.42*	1627	0.80
trans-para-Menth-2-en-1-ol	6.22	1136	0.01	8.93	1587	0.02
neo-Isopulegol	6.35	1144	0.01	8.09	1522	0.04
Citronellal	6.48	1152	0.09	6.95	1436	0.08
Nerol oxide	6.50	1154	0.05	6.81*	1425	[0.06]
Borneol	6.61	1161	0.02	9.71*†	1650	1.09
α -Phellandren-8-ol	6.66	1164	0.01	10.09	1681	0.02
Terpinen-4-ol	6.80	1173	0.28	8.53	1556	0.29
Isogeranial	6.95	1183	0.02	8.15	1527	0.02
α -Terpineol	7.02	1188	0.19	9.74*†	1653	[1.09]
Hodiendiol	7.10	1193	0.03	12.71	1910	0.06
Decanal	7.30	1206	0.03	7.25	1458	0.02
γ -Isogeraniol?	7.52*	1220	0.09			
Rhodinol (α -citronellol)	7.52*	1220	[0.09]	10.60	1724	0.01
Nerol	7.69	1232	10.57	11.06	1763	10.20
Neral	7.79*†	1239	28.21	9.42*	1627	[0.80]
Citronellol	7.79*†	1239	[28.21]	10.75	1736	27.75
(Z)-Isogeraniol	7.92	1247	0.17	11.13	1769	0.17
(E)-Isogeraniol?	8.05	1256	0.12	11.18	1773	0.22
Geraniol	8.17	1264	20.07	11.64*	1812	20.18
Geranal	8.29	1273	1.26	10.06	1678	1.22
Citronellyl formate	8.38	1279	0.02	8.83	1580	0.03
Geranyl formate	8.76	1305	0.01	9.87	1663	0.01
Undecanal	8.78	1306	0.01	8.62	1563	0.04
Methyl geranate	9.07	1327	0.07	9.74*†	1653	[1.09]
Citronellyl acetate	9.50*	1353	1.18	9.39	1624	0.45
Eugenol	9.50*	1353	[1.18]	14.73*	2099	4.80
Neryl acetate	9.66	1364	0.11	10.13	1684	0.08
β -Bourbonene	9.85	1378	0.08	7.42	1471	0.06
Geranyl acetate	9.93	1384	0.95	10.50	1715	0.95

β-Elemene	9.99	1388	0.13	8.37*†	1544	[0.93]
Ethyl decanoate	10.12	1397	0.01	9.22*†	1610	0.29
Methyleugenol	10.20	1403	1.23	13.27	1961	1.25
β-Caryophyllene	10.32	1411	0.54	8.37*†	1544	[0.93]
β-Copaene	10.46	1422	0.02	8.29	1538	0.02
α-Guaiene	10.62	1434	0.38	8.35†	1542	0.93
α-Humulene	10.78	1446	0.28	9.22*†	1610	[0.29]
(E)-β-Farnesene	10.93	1456	0.02	9.50	1633	0.03
γ-Muurolene	11.16*	1474	0.74	9.52	1635	0.03
Germacrene D	11.16*	1474	[0.74]	9.71*†	1650	[1.09]
β-Selinene	11.22	1478	0.05	9.79	1657	0.05
Unknown [m/z 43, 58 (75), 57 (58), 71 (55), 41 (41), 59 (31)...]	11.26	1482	0.05			
Phenylethyl 2-methylbutyrate	11.37	1489	0.02	12.75	1914	0.04
Aciphylene	11.42	1493	0.15	9.74*†	1653	[1.09]
α-Muurolene	11.47	1497	0.08	9.96	1671	0.02
Pentadecane	11.51†	1500	0.58	7.79	1499	0.24
δ-Guaiene	11.54†	1502	[0.58]	9.83	1660	0.34
(3E,6E)-α-Farnesene	11.61*	1508	0.12	10.44	1710	0.10
γ-Cadinene	11.61*	1508	[0.12]	10.33*	1701	1.52
δ-Cadinene	11.75	1519	0.03	10.40	1707	0.18
α-Elemol	12.07	1543	0.09	13.98	2028	0.12
(E)-Nerolidol	12.30	1561	0.08	13.70*†	2002	[1.02]
Caryophyllene oxide	12.43	1572	0.05	12.66*	1906	12.38
Phenylethyl tiglate	12.53	1580	0.05	15.02	2128	0.06
Ethyl dodecanoate	12.73	1596	0.04	11.68	1816	0.02
Ethyl laurate	12.76	1598	0.02	11.73	1820	0.02
Hexadecane	12.82	1602	0.07	9.07	1598	0.10
10-epi-Cubenol	12.87	1607	0.01	13.59	1991	0.02
10-epi-γ-Eudesmol	12.92	1611	0.04	14.06	2035	0.03
γ-Eudesmol	13.08	1623	0.11	14.80	2106	0.11
τ-Cadinol	13.21*	1635	0.03	14.86	2112	0.03
τ-Muurolol	13.21*	1635	[0.03]	14.99	2125	0.02
β-Eudesmol	13.28	1640	0.12	15.33	2159	0.10
Phenylethyl hexanoate	13.33*	1644	0.36			
α-Eudesmol	13.33*	1644	[0.36]	15.26	2152	0.10
(8Z)-Heptadecene	13.73	1678	0.25	10.33*	1701	[1.52]
(2E,6Z)-Farnesol	13.94	1695	0.31	16.37	2265	0.29
Heptadecane	14.04	1703	1.43	10.33*	1701	[1.52]
(2E,6Z)-Farnesal	14.12	1709	0.06	15.30	2156	0.05
(2E,6E)-Farnesol	14.24	1720	2.27	16.77*	2306	2.26

(2E,6E)-Farnesal	14.44	1737	0.10	15.75	2201	0.11
Benzyl benzoate	14.62	1753	0.06	18.78	2530	0.06
(8Z)-Octadecene	14.88	1776	0.05	11.64*	1812	[20.18]
Octadecane	15.19	1802	0.13	11.47	1798	0.15
Hexadecanal	15.28	1810	0.02	14.62	2089	0.05
(2E,6E)-Farnesyl acetate	15.60	1839	0.02	15.86	2213	0.02
Phenylethyl benzoate	15.62	1841	0.08	19.50	2614	0.08
Nonadecadiene isomer	15.90	1866	0.06	12.83	1922	0.04
(9Z)-Nonadecene	16.00	1875	2.82	12.66*	1906	[12.38]
Nonadecane	16.34	1906	9.68	12.66*	1906	[12.38]
(9Z)-Eicosene	17.04	1973	0.12	13.70*†	2002	[1.02]
Ethyl palmitate	17.27	1995	0.04	15.92	2219	0.03
Eicosane	17.35	2003	0.84	13.67†	1998	1.02
Octadecanal	17.51	2018	0.03	16.77*	2306	[2.26]
Phenylethyl decanoate	17.79	2046	0.06			
(10Z)-Heneicosene	18.06	2072	0.14	14.73*	2099	[4.80]
Phenylethyl geranate	18.23	2090	0.15			
1-Heneicosene?	18.29	2096	0.12			
Heneicosane	18.38	2104	3.82	14.73*	2099	[4.80]
Citronellyl caprate	18.44	2111	0.07	17.17	2350	0.06
Phenylethyl undecanoate?	18.77	2145	0.05			
Ethyl linolenate	18.96	2164	0.06	18.96	2551	0.05
Docosane	19.32	2202	0.10	15.67	2193	0.10
1-Tricosene?	20.15	2290	0.13	16.88	2319	0.14
Tricosane	20.26	2302	0.75	16.63	2292	0.74
Citronellyl laurate	20.32	2309	0.05			
Geranyl laurate	20.63	2343	0.04	19.76	2644	0.05
Tetracosane	21.15	2401	0.04	17.53	2389	0.04
1-Pentacosene?	21.93	2491	0.02			
Pentacosane	22.01	2501	0.18	18.42	2488	0.18
Citronellyl myristate	22.07	2508	0.01	20.59	2746	0.03
Geranyl myristate	22.36	2543	0.01			
Hexacosane	22.84	2601	0.01	19.27	2586	0.04
Heptacosane	23.64	2700	0.10	20.10	2686	0.11
Total identified	97.88%			97.28%		
Total reported	97.94%			97.28%		

*: 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