

Date : May 31, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19E22-BUB02-1-SCC

Customer identification : Organic Lavender Oil - Bulgaria - Lot# 06003

Type : Essential oil

Source : *Lavandula angustifolia*

Customer : Buhbli Organics

ANALYSIS

Method: PC-PA-014-17J19 - 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 : May 27, 2019

Checked and approved by :

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

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PHYSICOCHEMICAL DATA

Physical aspect: Faintly yellow liquid

Refractive index: 1.4604 ± 0.0003 (20 °C)

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method.

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Ethanol	0.01	0.02	Aliphatic alcohol
Methacrolein	0.01	tr	Aliphatic aldehyde
3-Buten-2-one	tr	0.01	Aliphatic ketone
2-Methyl-3-buten-2-ol	0.02	0.02	Aliphatic alcohol
Isovaleral	0.06	0.06	Aliphatic aldehyde
2-Methylbutyral	0.02	0.02	Aliphatic aldehyde
Isoamyl alcohol	0.02	0.03*	Aliphatic alcohol
2-Methylbutanol	0.01	[0.03]*	Aliphatic alcohol
Toluene	tr	tr	Simple phenolic
Prenal	tr	0.35*	Aliphatic aldehyde
Hexanal	0.01	0.01	Aliphatic aldehyde
Butyl acetate	0.02	0.02	Aliphatic ester
Methyl hexyl ether	0.11	0.11	Aliphatic ether
(3Z)-Hexenol	0.06	0.05	Aliphatic alcohol
Hexanol	0.19	0.22*	Aliphatic alcohol
Tricyclene	0.02	0.02	Monoterpene
α -Thujene	0.12	0.10	Monoterpene
α -Pinene	0.21	0.20	Monoterpene
Camphene	0.13	0.12	Monoterpene
5,5-Dimethyl-2(5H)-furanone	0.01	2.72*	Aliphatic lactone
Butyl isobutyrate	0.01	0.01	Aliphatic ester
β -Pinene	0.08*	0.04	Monoterpene
Sabinene	[0.08]*	0.05	Monoterpene
Octen-3-ol	0.32	0.34	Aliphatic alcohol
Octan-3-one	1.65*	1.67	Aliphatic ketone
6-Methyl-5-hepten-2-one	[1.65]*	0.02	Aliphatic ketone
Myrcene	0.72	0.69	Monoterpene
Octan-3-ol	0.43*	0.34	Aliphatic alcohol
Butyl butyrate	[0.43]*	0.11	Aliphatic ester
α -Phellandrene	0.03	0.03	Monoterpene
Δ^3 -Carene	0.10	0.09	Monoterpene
α -Terpinene	0.05	0.06	Monoterpene
Hexyl acetate	0.59	0.69*	Aliphatic ester
ortho-Cymene	0.03	0.27*	Monoterpene
para-Cymene	0.24	[0.27]*	Monoterpene
1,8-Cineole	1.22*	0.85*	Monoterpenic ether
β -Phellandrene	[1.22]*	[0.85]*	Monoterpene
Limonene	[1.22]*	[0.35]*	Monoterpene
(Z)- β -Ocimene	3.36	3.31	Monoterpene
(E)- β -Ocimene	2.26	2.14	Monoterpene
γ -Terpinene	0.16	0.14	Monoterpene
cis-Sabinene hydrate	0.08	0.31*	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.30	0.32	Monoterpenic alcohol
Octanol	0.01	[61.91]*	Aliphatic alcohol
α -Pinene oxide analog	0.02	[0.22]*	Monoterpenic ether
Terpinolene	0.35*	[0.69]*	Monoterpene
trans-Linalool oxide (fur.)	[0.35]*	[0.31]*	Monoterpenic alcohol
α -Pinene oxide	0.02	[0.22]*	Monoterpenic ether

Rosefuran	0.08	0.07	Monoterpenic ether
Linalool	33.73	61.91	Monoterpenic alcohol
(Z)-6-Methyl-3,5-heptadien-2-one	0.09	[61.91]*	Aliphatic ketone
Octen-3-yl acetate	0.96	0.94	Aliphatic ester
Unknown	0.04	1.41*	Unknown
Octan-3-yl acetate	0.17	0.16	Aliphatic ester
allo-Ocimene	0.04	0.04	Monoterpene
(Z)-Myroxide	0.05	0.05	Monoterpenic ether
Camphor	0.26	0.17	Monoterpenic ketone
(E)-Myroxide	0.06	0.02	Monoterpenic ether
Hexyl isobutyrate	0.12*	0.07	Aliphatic ester
Nerol oxide	[0.12]*	0.03	Aliphatic ether
Borneol	0.54	1.99*	Monoterpenic alcohol
cis-Linalool oxide (pyr.)	0.04	0.03	Monoterpenic alcohol
Lavandulol	1.46	[1.41]*	Monoterpenic alcohol
(3E,5Z)-Undeca-1,3,5-triene	4.54*	0.01	Alkene
Terpinen-4-ol	[4.54]*	4.48	Monoterpenic alcohol
Cryptone	0.22	0.30*	Normonoterpenic ketone
meta-Cymen-8-ol	0.06	0.05	Monoterpenic alcohol
para-Cymen-8-ol	0.03	0.04	Monoterpenic alcohol
α-Terpineol	1.18	[1.99]*	Monoterpenic alcohol
Myrtenal	0.05	0.03	Monoterpenic aldehyde
Hexyl butyrate	0.42*	0.36	Aliphatic ester
Hodiendiol	[0.42]*	0.49*	Monoterpenic alcohol
Verbenone	0.02	2.63*	Monoterpenic ketone
Unknown	0.04	0.03	Unknown
(3E,5E)-2,6-Dimethylocta-3,5,7-trien-2-ol	0.06	0.06	Monoterpenic alcohol
trans-Carveol	0.03	0.02	Monoterpenic alcohol
Bornyl formate	0.03	0.02	Monoterpenic ester
Nerol	0.20	0.20	Monoterpenic alcohol
Cuminal	0.08*	0.56*	Monoterpenic aldehyde
Hexyl 2-methylbutyrate	[0.08]*	0.06	Aliphatic ester
Carvone	0.04*	0.03	Monoterpenic ketone
Neral	[0.04]*	0.02	Monoterpenic aldehyde
Linalyl acetate	28.65*	[61.91]*	Monoterpenic ester
Geraniol	[28.65]*	0.47	Monoterpenic alcohol
Unknown	0.02	0.02	Unknown
Geranial	0.03	0.02	Monoterpenic aldehyde
Bornyl acetate	0.14	0.49*	Monoterpenic ester
Cuminol	0.04	0.04	Monoterpenic alcohol
Lavandulyl acetate	3.08	3.12	Monoterpenic ester
Hexyl tiglate	0.04	0.03	Aliphatic ester
Hodiendiol derivative	0.05	0.06	Oxygenated monoterpene
Unknown	0.07	0.07	Oxygenated monoterpene
Unknown	0.06	0.06	Oxygenated monoterpene
Neryl acetate	0.32	0.33	Monoterpenic ester
7-Cubebene	0.02	0.02	Sesquiterpene
β-Bourbonene	0.07	0.05	Sesquiterpene
Geranyl acetate	0.55	[0.56]*	Monoterpenic ester
Hexyl hexanoate	0.11	0.12	Aliphatic ester
7-epi-Sesquithujene	0.07	0.07	Sesquiterpene

Isocaryophyllene	0.02	[61.91]*	Sesquiterpene
β -Caryophyllene	2.71	[2.72]*	Sesquiterpene
α -Santalene	0.42	[0.49]*	Sesquiterpene
Coumarin	0.02	0.10	Coumarin
<i>trans</i> - α -Bergamotene	0.12	[2.72]*	Sesquiterpene
<i>cis</i> - β -Bergamotene?	0.07		Sesquiterpene
α -Humulene	0.11	0.09	Sesquiterpene
Lavandulyl butyrate?	0.11	0.10	Monoterpenic ester
(<i>E</i>)- β -Farnesene	2.60*	[2.63]*	Sesquiterpene
β -Santalene	[2.60]*	[0.30]*	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	0.03	0.05	Sesquiterpene
Germacrene D	0.36	[1.99]*	Sesquiterpene
<i>trans</i> - β -Bergamotene	0.05	[2.63]*	Sesquiterpene
Hodiendiol derivative II	0.02	0.01	Oxygenated monoterpene
Lavandulyl isovalerate	0.15*	0.01	Monoterpenic ester
β -Bisabolene	[0.15]*	0.04	Sesquiterpene
γ -Cadinene	[0.15]*	0.10*	Sesquiterpene
<i>trans</i> -Calamenene	0.05*	0.03	Sesquiterpene
δ -Cadinene	[0.05]*	[0.10]*	Sesquiterpene
Isocaryophyllene epoxide B	0.06	0.06	Sesquiterpenic ether
(<i>E</i>)-Nerolidol	0.02	0.01	Sesquiterpenic alcohol
Caryophyllene oxide isomer	0.54*	0.06	Sesquiterpenic ether
Caryophyllene oxide	[0.54]*	[0.49]*	Sesquiterpenic ether
Humulene epoxide II	0.01	0.02	Sesquiterpenic ether
τ -Cadinol	0.05	0.06	Sesquiterpenic alcohol
(3 <i>Z</i>)-Caryophylla-3,8(13)-dien-5 β -ol	0.02	0.01	Sesquiterpenic alcohol
Herniarin	0.01	0.01	Coumarin
Total identified	98.37%	97.46%	

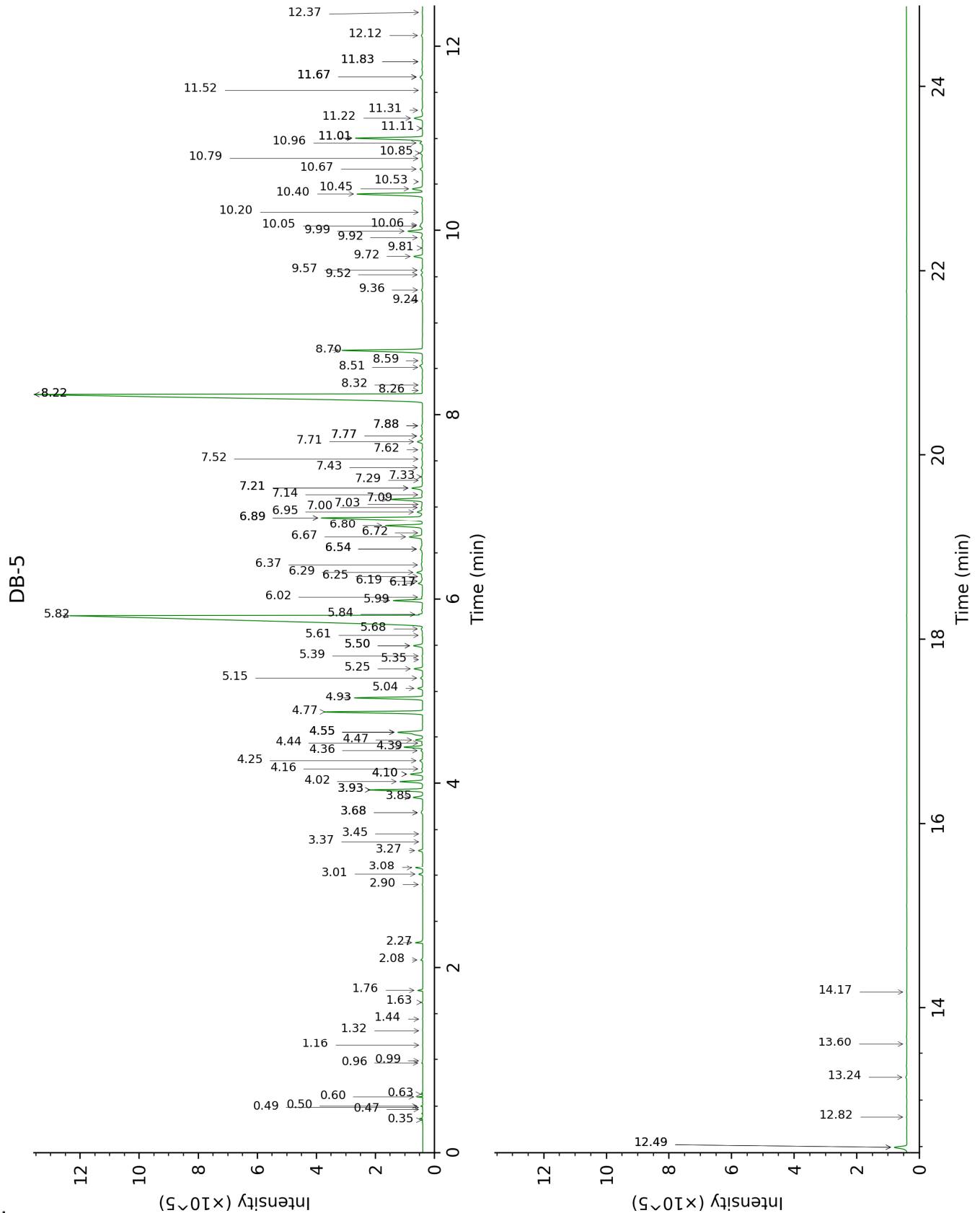
*: Two or more compounds are coeluting on this column

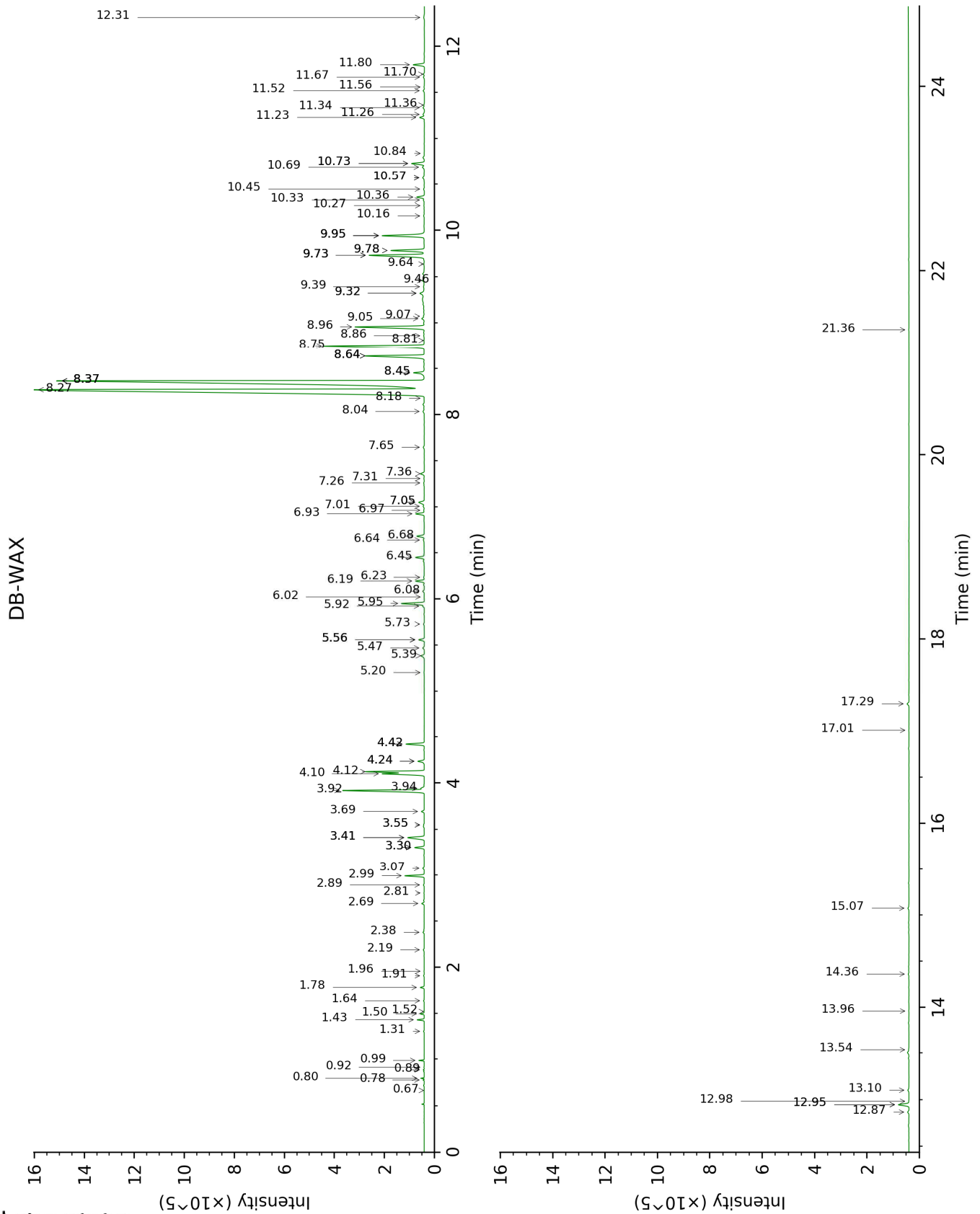
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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

Note: no correction factor was applied

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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Ethanol	0.35	515	0.01	0.89	908	0.02
Methacrolein	0.47	563	0.01	0.67	844	tr
3-Buten-2-one	0.49	579	tr	0.92	912	0.01
2-Methyl-3-buten-2-ol	0.50	590	0.02	1.64	1014	0.02
Isovaleral	0.60	639	0.06	0.80	888	0.06
2-Methylbutyral	0.63	650	0.02	0.78	882	0.02
Isoamyl alcohol	0.96	734	0.02	3.55*	1178	0.03
2-Methylbutanol	0.99	737	0.01	3.55*	1178	[0.03]
Toluene	1.16	760	tr	1.52	1003	tr
Prenal	1.32	783	tr	3.30*	1160	0.35
Hexanal	1.44	800	0.01	1.96	1045	0.01
Butyl acetate	1.63	817	0.02	1.91	1040	0.02
Methyl hexyl ether	1.76	828	0.11	0.99	924	0.11
(3Z)-Hexenol	2.08	854	0.06	5.92	1347	0.05
Hexanol	2.27	870	0.19	5.56*	1321	0.22
Tricyclene	2.90	918	0.02	1.31	973	0.02
α -Thujene	3.01	925	0.12	1.50	1001	0.10
α -Pinene	3.08	930	0.21	1.43	993	0.20
Camphene	3.28	942	0.13	1.78	1028	0.12
5,5-Dimethyl-2(5H)-furanone	3.37	949	0.01	8.64*	1550	2.72
Butyl isobutyrate	3.45	954	0.01	2.80	1121	0.01
β -Pinene	3.68*	970	0.08	2.19	1067	0.04
Sabinene	3.68*	970	[0.08]	2.38	1086	0.05
Octen-3-ol	3.85	980	0.32	6.93	1420	0.34
Octan-3-one	3.93*	986	1.65	4.10	1220	1.67
6-Methyl-5-hepten-2-one	3.93*	986	[1.65]	5.20	1300	0.02
Myrcene	4.02	992	0.72	2.99	1135	0.69
Octan-3-ol	4.10*	997	0.43	6.19	1367	0.34
Butyl butyrate	4.10*	997	[0.43]	3.69	1190	0.11
α -Phellandrene	4.16	1001	0.03	2.89	1128	0.03
Δ 3-Carene	4.25	1006	0.10	2.69	1112	0.09
α -Terpinene	4.36	1013	0.05	3.07	1142	0.06
Hexyl acetate	4.39	1016	0.59	4.42*	1243	0.69
ortho-Cymene	4.44	1018	0.03	4.24*	1230	0.27
para-Cymene	4.47	1020	0.24	4.24*	1230	[0.27]
1,8-Cineole	4.55*	1026	1.22	3.41*	1168	0.85
β -Phellandrene	4.55*	1026	[1.22]	3.41*	1168	[0.85]
Limonene	4.55*	1026	[1.22]	3.30*	1160	[0.35]
(Z)- β -Ocimene	4.77	1040	3.36	3.92	1207	3.31
(E)- β -Ocimene	4.93	1049	2.26	4.12	1222	2.14
γ -Terpinene	5.04	1056	0.16	3.94	1208	0.14
cis-Sabinene hydrate	5.15	1063	0.08	7.05*	1430	0.31
cis-Linalool	5.25	1070	0.30	6.68	1402	0.32

oxide (fur.)						
Octanol	5.35	1076	0.01	8.37*†	1528	[61.91]
α-Pinene oxide analog	5.39	1078	0.02	5.56*	1321	[0.22]
Terpinolene	5.50*	1085	0.35	4.42*	1243	[0.69]
<i>trans</i> -Linalool oxide (fur.)	5.50*	1085	[0.35]	7.05*	1430	[0.31]
α-Pinene oxide	5.61	1092	0.02	5.56*	1321	[0.22]
Rosefuran	5.68	1097	0.08	6.08	1359	0.07
Linalool	5.82	1106	33.73	8.27†	1521	61.91
(<i>Z</i>)-6-Methyl-3,5-heptadien-2-one	5.84	1107	0.09	8.37*†	1528	[61.91]
Octen-3-yl acetate	5.99	1116	0.96	5.95	1349	0.94
Unknown [m/z 82, 81 (72), 43 (64), 54 (32), 41 (20)...]	6.02	1119	0.04	9.78*	1640	1.41
Octan-3-yl acetate	6.17	1128	0.17	5.39	1308	0.16
allo-Ocimene	6.19	1130	0.04	5.73	1333	0.04
(<i>Z</i>)-Myroxide	6.24	1133	0.05	7.01	1426	0.05
Camphor	6.29	1136	0.26	7.36	1453	0.17
(<i>E</i>)-Myroxide	6.37	1141	0.06	7.26	1445	0.02
Hexyl isobutyrate	6.54*	1153	0.12	5.47	1315	0.07
Nerol oxide	6.54*	1153	[0.12]	6.97	1423	0.03
Borneol	6.67	1161	0.54	9.94*	1653	1.99
<i>cis</i> -Linalool oxide (pyr.)	6.72	1164	0.04	10.45	1694	0.03
Lavandulol	6.80	1169	1.46	9.78*	1640	[1.41]
(3 <i>E</i> ,5 <i>Z</i>)-Undeca-1,3,5-triene	6.89*	1175	4.54	6.02	1354	0.01
Terpinen-4-ol	6.89*	1175	[4.54]	8.75	1558	4.48
Cryptone	6.95	1179	0.22	9.32*	1603	0.30
meta-Cymen-8-ol	7.00	1182	0.06	11.67	1797	0.05
para-Cymen-8-ol	7.03	1184	0.03	11.70	1800	0.04
α-Terpineol	7.09	1188	1.18	9.94*	1653	[1.99]
Myrtenal	7.14	1191	0.05	8.86	1567	0.03
Hexyl butyrate	7.21*	1196	0.42	6.45	1385	0.36
Hodiendiol	7.21*	1196	[0.42]	12.95*	1911	0.49
Verbenone	7.29	1202	0.02	9.73*	1636	2.63
Unknown [m/z 43, 71 (66), 59 (52), 41 (47), 68 (46)...]	7.33	1204	0.04	6.23	1370	0.03
(3 <i>E</i> ,5 <i>E</i>)-2,6-Dimethylocta-3,5,7-trien-2-ol	7.43	1211	0.06	11.52	1785	0.06
<i>trans</i> -Carveol	7.52	1217	0.03	11.56	1788	0.02
Bornyl formate	7.62	1224	0.03	8.18	1514	0.02

Nerol	7.71	1230	0.20	11.23	1760	0.20
Cuminal	7.77*	1234	0.08	10.73*	1718	0.56
Hexyl 2-methylbutyrate	7.77*	1234	[0.08]	6.64	1399	0.06
Carvone	7.88*	1242	0.04	10.16	1670	0.03
Neral	7.88*	1242	[0.04]	9.64	1628	0.02
Linalyl acetate	8.22*	1265	28.65	8.37*†	1528	[61.91]
Geraniol	8.22*	1265	[28.65]	11.80	1809	0.47
Unknown [m/z 43, 111 (47), 93 (41), 55 (28), 67 (23), 41 (22)...]	8.26	1268	0.02	8.81	1563	0.02
Geranial	8.32	1272	0.03	10.27	1680	0.02
Bornyl acetate	8.51	1286	0.14	8.45*	1535	0.49
Cuminol	8.59	1290	0.04	14.36	2043	0.04
Lavandulyl acetate	8.70	1298	3.08	8.96	1574	3.12
Hexyl tiglate	9.24	1332	0.04	9.07	1583	0.03
Hodiendiol derivative	9.36	1340	0.05	13.10	1925	0.06
Unknown [m/z 43, 79 (47), 71 (31), 94 (27), 81 (23), 41 (22)... 197 (0)]	9.52	1352	0.07	11.26	1763	0.07
Unknown [m/z 43, 79 (46), 71 (30), 94 (25), 41 (23), 81 (21)... 197 (0)]	9.57	1355	0.06	11.34	1769	0.06
Neryl acetate	9.72	1366	0.32	10.36	1687	0.33
7-Cubebene	9.81	1372	0.02	7.31	1449	0.02
β-Bourbonene	9.92	1380	0.07	7.65	1474	0.05
Geranyl acetate	9.99	1385	0.55	10.73*	1718	[0.56]
Hexyl hexanoate	10.05	1389	0.11	9.05	1581	0.12
7-epi-Sesquithujene	10.06	1390	0.07	8.04	1503	0.07
Isocaryophyllene	10.20	1400	0.02	8.37*†	1528	[61.91]
β-Caryophyllene	10.40	1414	2.71	8.64*	1550	[2.72]
α-Santalene	10.45	1418	0.42	8.45*	1535	[0.49]
Coumarin	10.53	1424	0.02	17.29	2341	0.10
<i>trans</i> -α-Bergamotene	10.67	1435	0.12	8.64*	1550	[2.72]
<i>cis</i> -β-Bergamotene?	10.79	1444	0.07			
α-Humulene	10.85	1448	0.11	9.46	1614	0.09
Lavandulyl butyrate?	10.96	1456	0.11	10.69	1715	0.10
(<i>E</i>)-β-Farnesene	11.01*	1460	2.60	9.73*	1636	[2.63]
β-Santalene	11.01*	1460	[2.60]	9.32*	1603	[0.30]
<i>trans</i> -Cadina-1(6),4-diene	11.11	1468	0.03	9.39	1608	0.05

Germacrene D	11.22	1476	0.36	9.94*	1653	[1.99]
<i>trans</i> -β-Bergamotene	11.31	1482	0.05	9.73*	1636	[2.63]
Hodiendiol derivative II	11.52	1499	0.02	12.98	1914	0.01
Lavandulyl isovalerate	11.67*	1510	0.15	10.84	1727	0.01
β-Bisabolene	11.67*	1510	[0.15]	10.33	1684	0.04
γ-Cadinene	11.67*	1510	[0.15]	10.57*	1704	0.10
<i>trans</i> -Calamenene	11.83*	1523	0.05	11.36	1772	0.03
δ-Cadinene	11.83*	1523	[0.05]	10.57*	1704	[0.10]
Isocaryophyllene epoxide B	12.12	1545	0.06	12.31	1854	0.06
(<i>E</i>)-Nerolidol	12.37	1565	0.02	13.96	2005	0.01
Caryophyllene oxide isomer	12.49*	1574	0.54	12.87	1904	0.06
Caryophyllene oxide	12.49*	1574	[0.54]	12.95*	1911	[0.49]
Humulene epoxide II	12.82	1600	0.01	13.54	1966	0.02
τ-Cadinol	13.24	1635	0.05	15.08	2112	0.06
(3 <i>Z</i>)-Caryophylla-3,8(13)-dien-5β-ol	13.60	1665	0.02	17.01	2310	0.01
Herniarin	14.17	1712	0.01	21.36	2814	0.01
Total identified		98.37%			97.46%	
Total reported		98.60%			97.64%	

*: Two or more compounds are coeluting on this column

[xx]: Duplicate percentage due to coelutions, not taken account in the identified 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