

## GC/MS BATCH NUMBER: L40111

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**ESSENTIAL OIL:** LAVENDER  
**BOTANICAL NAME:** LAVENDULA ANGUSTIFOLIA  
**ORIGIN:** BULGARIA

KEY CONSTITUENTS PRESENT IN THIS BATCH OF LAVENDER OIL	%
LINALYL ACETATE	32.9
LINALOOL	31.1
(Z)- $\beta$ -OCIMENE	3.7
TERPINEN-4-ol	3.4
(E)- $\beta$ -FARNESENE	3.1
LAVANDULYL ACETATE	3.0
$\beta$ -CARYOPHYLLENE	2.8
(E)- $\beta$ -OCIMENE	2.3
OCTAN-3-ONE	1.4
$\alpha$ -TERPINEOL	1.1

Date : October 05, 2018

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

**Internal code :** 18I26-PTH3-1-CC

**Customer identification :** Lavender - Bulgaria - L4011188R

**Type :** Essential oil

**Source :** *Lavandula angustifolia*

**Customer :** Plant Therapy

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 :** Lindsay Girard, B. Sc.

**Analysis date :** September 27, 2018

Checked and approved by :



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

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*This report is digitally signed, it is only considered valid if the digital signature is intact.*

*PHYSICOCHEMICAL DATA*

**Physical aspect:** Faintly yellow liquid

**Refractive index:**  $1.4590 \pm 0.0003$  (20 °C)

*CONCLUSION*

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

## ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
2-Methyl-3-buten-2-ol	0.02	0.01	Aliphatic alcohol
Isovaleral	0.02	0.02	Aliphatic aldehyde
2-Methylbutyral	0.01	0.01	Aliphatic aldehyde
Isoamyl alcohol	0.01	0.01	Aliphatic alcohol
2-Methylbutanol	tr	0.02	Aliphatic alcohol
Toluene	tr	0.10*	Simple phenolic
Prenal	0.01	0.39*	Aliphatic aldehyde
Butyl acetate	0.01	0.01	Aliphatic ester
Methyl hexyl ether	0.12	0.12	Aliphatic ether
(3Z)-Hexenol	0.02	0.89*	Aliphatic alcohol
Hexanol	0.09	0.16*	Aliphatic alcohol
Tricyclene	0.02	0.02	Monoterpene
$\alpha$ -Thujene	0.11	[0.10]*	Monoterpene
$\alpha$ -Pinene	0.20	0.19	Monoterpene
Camphene	0.14	0.14	Monoterpene
Butyl isobutyrate	0.02	0.01	Aliphatic ester
Sabinene	0.07	0.04	Monoterpene
$\beta$ -Pinene	[0.07]	0.04	Monoterpene
Octen-3-ol	0.29	0.31*	Aliphatic alcohol
Octan-3-one	1.44	1.43	Aliphatic ketone
Myrcene	0.77	0.74	Monoterpene
Butyl butyrate	0.10	0.10	Aliphatic ester
Octan-3-ol	[0.31]	0.27*	Aliphatic alcohol
$\alpha$ -Phellandrene	0.31	0.04	Monoterpene
$\Delta^3$ -Carene	0.10	0.09	Monoterpene
$\alpha$ -Terpinene	0.06	0.06	Monoterpene
Hexyl acetate	0.60	0.60	Aliphatic ester
para-Cymene	0.17	0.17	Monoterpene
Limonene	1.31*	[0.39]*	Monoterpene
1,8-Cineole	[1.31]*	0.91*	Monoterpenic ether
$\beta$ -Phellandrene	[1.31]*	[0.91]*	Monoterpene
(Z)- $\beta$ -Ocimene	3.71	3.72	Monoterpene
(E)- $\beta$ -Ocimene	2.26	2.24	Monoterpene
$\gamma$ -Terpinene	0.16	0.16	Monoterpene
cis-Sabinene hydrate	0.07	0.25*	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.20	0.19	Monoterpenic alcohol
Octanol	0.01	32.85*	Aliphatic alcohol
$\alpha$ -Pinene oxide analog	0.03	[0.16]*	Monoterpenic ether
Terpinolene	0.28*	0.14	Monoterpene
trans-Linalool oxide (fur.)	[0.28]*	[0.25]*	Monoterpenic alcohol
$\alpha$ -Pinene oxide	0.02	0.01	Monoterpenic ether
trans-Sabinene hydrate	0.04	0.06	Monoterpenic alcohol
Rosefuran	0.02	[0.27]*	Monoterpenic ether
Linalool	31.14	31.32	Monoterpenic alcohol
Octen-3-yl acetate	0.90	[0.89]*	Aliphatic ester
Unknown	0.03	3.06*	Unknown
Octan-3-yl acetate	0.11	0.12	Aliphatic ester
allo-Ocimene	0.06	0.04	Monoterpene

(Z)-Myroxide	0.02	0.02	Monoterpenic ether
Camphor	0.37	0.34	Monoterpenic ketone
(E)-Myroxide	0.03	0.03	Monoterpenic ether
<i>trans</i> -Verbenol	0.02	0.02	Monoterpenic alcohol
Unknown	0.01	0.01	Oxygenated monoterpene
Hexyl isobutyrate	0.07	[0.16]*	Aliphatic ester
Unknown	0.01	0.01	Oxygenated monoterpene
Borneol	0.51	1.59*	Monoterpenic alcohol
Lavandulol	0.98*	0.90*	Monoterpenic alcohol
$\delta$ -Terpineol	[0.98]*	0.09	Monoterpenic alcohol
Terpinen-4-ol	3.44	3.42	Monoterpenic alcohol
meta-Cymen-8-ol	0.20*	0.04	Monoterpenic alcohol
Cryptone	[0.20]*	0.15	Normonoterpenic ketone
para-Cymen-8-ol	0.08	0.46*	Monoterpenic alcohol
$\alpha$ -Terpineol	1.05	[1.59]*	Monoterpenic alcohol
Myrtenal	0.46*	0.02	Monoterpenic aldehyde
Hexyl butyrate	[0.46]*	0.37	Aliphatic ester
Myrtenol	[0.46]*	0.01	Monoterpenic alcohol
Hodiendiol	0.02	0.40*	Monoterpenic alcohol
Verbenone	0.06	0.05	Monoterpenic ketone
Unknown	0.02	0.01	Unknown
Bornyl formate	0.05	0.07	Monoterpenic ester
Nerol	0.19	0.19	Monoterpenic alcohol
Hexyl 2-methylbutyrate	0.09	0.05	Aliphatic ester
Carvone	0.01	0.03	Monoterpenic ketone
Neral	0.01	0.03	Monoterpenic aldehyde
Hexyl isovalerate	0.01	[0.31]*	Aliphatic ester
Linalyl acetate	33.37	[32.85]*	Monoterpenic ester
Geraniol	[33.37]	[0.46]*	Monoterpenic alcohol
Unknown	0.06		Unknown
Geranial	0.04	0.02	Monoterpenic aldehyde
Bornyl acetate	0.10	0.12*	Monoterpenic ester
Lavandulyl acetate	3.02	2.96	Monoterpenic ester
Hexyl tiglate	0.05	0.03	Aliphatic ester
Hodiendiol derivative	0.03	0.03	Oxygenated monoterpene
Unknown	0.04	0.05	Oxygenated monoterpene
Unknown	0.03	0.05	Oxygenated monoterpene
Neryl acetate	0.34	0.33	Monoterpenic ester
$\alpha$ -Copaene	0.02	0.01	Sesquiterpene
Geranyl acetate	0.56	0.63	Monoterpenic ester
Hexyl hexanoate	0.20*	0.14	Aliphatic ester
7-epi-Sesquithujene	[0.20]*	0.01	Sesquiterpene
$\beta$ -Elemene	[0.20]*	2.85*	Sesquiterpene
Isocaryophyllene	0.05	[0.12]*	Sesquiterpene
$\beta$ -Caryophyllene	2.75	[2.85]*	Sesquiterpene
$\alpha$ -Santalene	0.43	0.40	Sesquiterpene
Coumarin	0.06	0.06	Coumarin
<i>trans</i> - $\alpha$ -Bergamotene	0.12	[2.85]*	Sesquiterpene
Sesquisabinene A	0.06	0.04	Sesquiterpene
$\alpha$ -Humulene	0.10	0.09	Sesquiterpene
Lavandulyl butyrate?	0.07	0.17*	Monoterpenic ester
(E)- $\beta$ -Farnesene	3.05	[3.06]*	Sesquiterpene

Germacrene D	0.36	0.34	Sesquiterpene
<i>trans</i> -β-Bergamotene	0.05	[0.90]*	Sesquiterpene
β-Bisabolene	0.03	0.05	Sesquiterpene
γ-Cadinene	0.11	[0.17]*	Sesquiterpene
δ-Cadinene	0.04	[0.17]*	Sesquiterpene
β-Sesquiphellandrene	0.01	0.01	Sesquiterpene
Isocaryophyllene epoxide B	0.04	0.05	Sesquiterpenic ether
Caryophyllene oxide	0.48*	[0.40]*	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.48]*	0.07	Sesquiterpenic ether
τ-Cadinol	0.06	0.07	Sesquiterpenic alcohol
(3 <i>Z</i> )-Caryophylla-3,8(13)-dien-5β-ol	0.01	0.02	Sesquiterpenic alcohol
α-Bisabolol	0.02	0.02	Sesquiterpenic alcohol
<b>Total identified</b>	<b>98.33%</b>	<b>97.88%</b>	

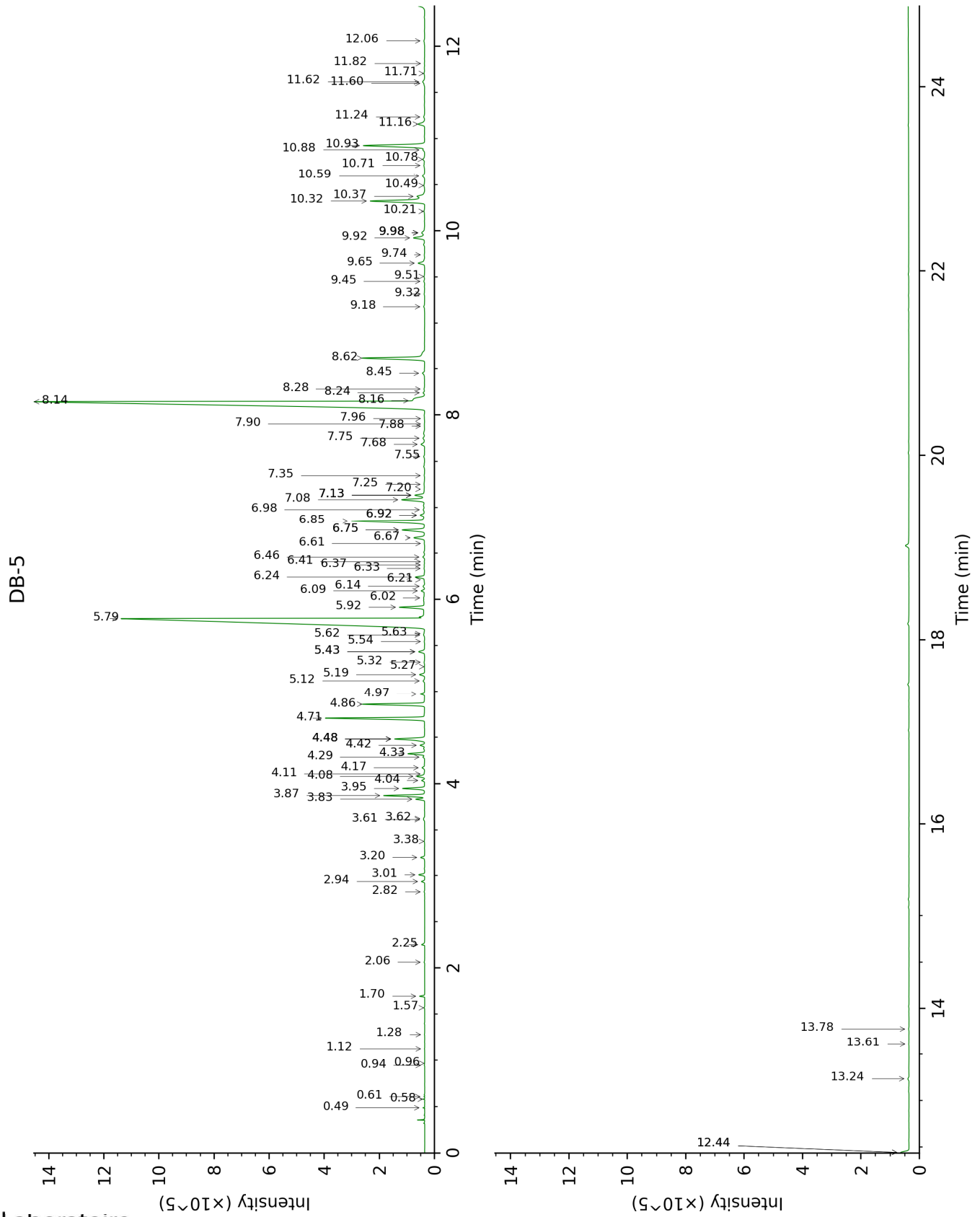
\*: Two or more compounds are coeluting on this column

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

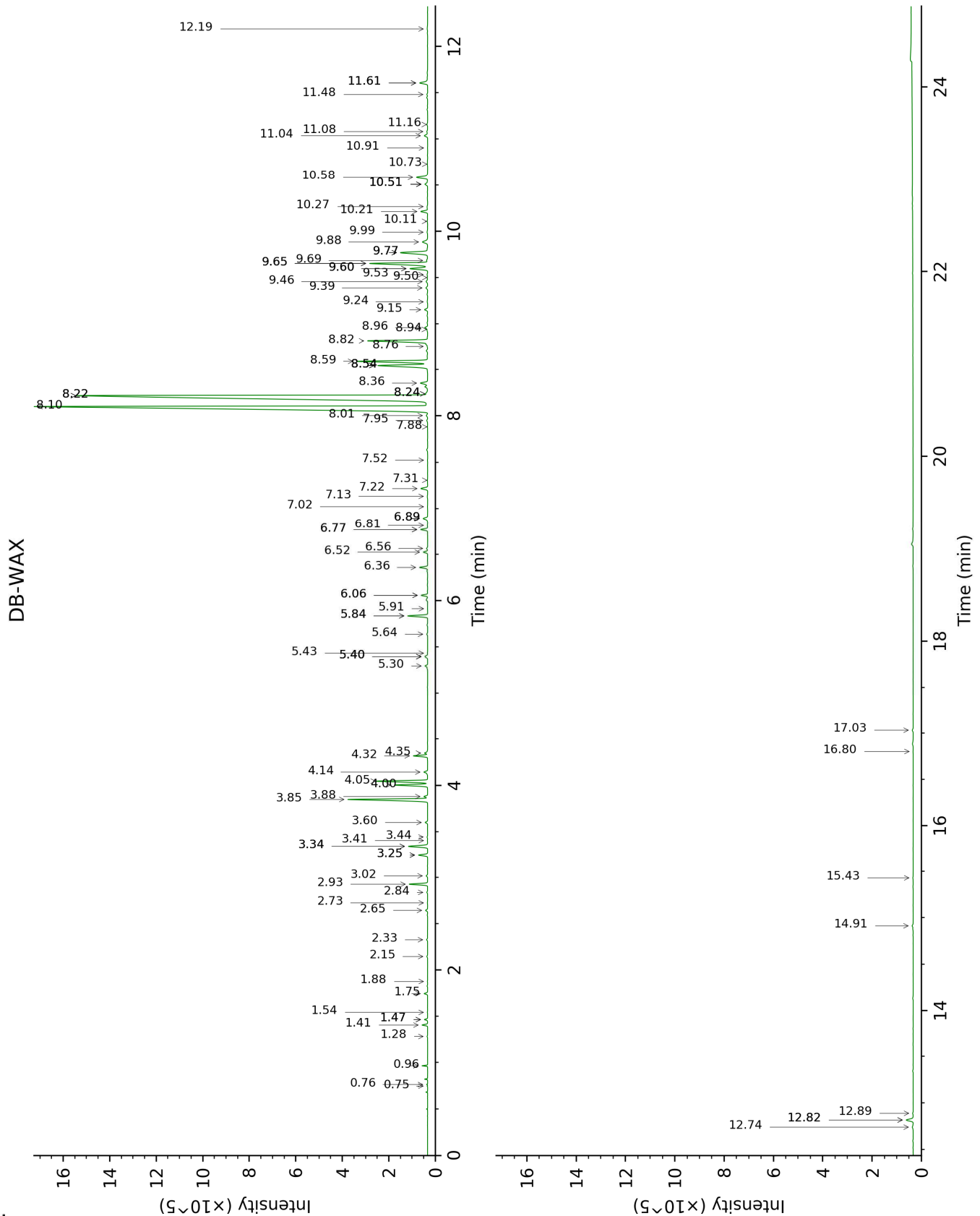
tr: The compound has been detected below 0.005% of total signal.

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	%
2-Methyl-3-buten-2-ol	0.49	603	0.02	1.54	1011	0.01
Isovaleral	0.58	637	0.02	0.76	884	0.02
2-Methylbutyral	0.61	647	0.01	0.75	878	0.01
Isoamyl alcohol	0.94	728	0.01	3.41	1174	0.01
2-Methylbutanol	0.96	731	tr	3.44	1177	0.02
Toluene	1.12	754	tr	1.47*	1004	0.10
Prenal	1.28	778	0.01	3.25*	1162	0.39
Butyl acetate	1.57	811	0.01	1.88	1044	0.01
Methyl hexyl ether	1.70	822	0.12	0.96	925	0.12
(3Z)-Hexenol	2.06	853	0.02	5.84*	1350	0.89
Hexanol	2.25	869	0.09	5.40*	1319	0.16
Tricyclene	2.82	914	0.02	1.28	977	0.02
$\alpha$ -Thujene	2.94	921	0.11	1.47*	1004	[0.10]
$\alpha$ -Pinene	3.01	926	0.20	1.41	997	0.19
Camphene	3.20	939	0.14	1.75	1031	0.14
Butyl isobutyrate	3.38	950	0.02	2.73	1121	0.01
Sabinene	3.61†	966	0.07	2.33	1088	0.04
$\beta$ -Pinene	3.62†	967	[0.07]	2.15	1070	0.04
Octen-3-ol	3.83	981	0.29	6.77*	1418	0.31
Octan-3-one	3.87	984	1.44	4.00	1219	1.43
Myrcene	3.95	989	0.77	2.93	1137	0.74
Butyl butyrate	4.04	994	0.10	3.60	1189	0.10
Octan-3-ol	4.08†	997	[0.31]	6.06*	1366	0.27
$\alpha$ -Phellandrene	4.11†	999	0.31	2.84	1130	0.04
$\Delta$ 3-Carene	4.17	1003	0.10	2.64	1115	0.09
$\alpha$ -Terpinene	4.29	1010	0.06	3.02	1144	0.06
Hexyl acetate	4.32	1013	0.60	4.32	1241	0.60
para-Cymene	4.42	1018	0.17	4.14	1229	0.17
Limonene	4.48*	1023	1.31	3.25*	1162	[0.39]
1,8-Cineole	4.48*	1023	[1.31]	3.34*	1169	0.91
$\beta$ -Phellandrene	4.48*	1023	[1.31]	3.34*	1169	[0.91]
(Z)- $\beta$ -Ocimene	4.71	1037	3.71	3.85	1207	3.72
(E)- $\beta$ -Ocimene	4.86	1046	2.26	4.05	1222	2.24
$\gamma$ -Terpinene	4.97	1053	0.16	3.88	1210	0.16
cis-Sabinene hydrate	5.12	1062	0.07	6.89*	1427	0.25
cis-Linalool oxide (fur.)	5.19	1067	0.20	6.52	1400	0.19
Octanol	5.27	1072	0.01	8.22*	1527	32.85
$\alpha$ -Pinene oxide analog	5.32	1075	0.03	5.40*	1319	[0.16]
Terpinolene	5.44*	1082	0.28	4.35	1243	0.14
trans-Linalool oxide (fur.)	5.44*	1082	[0.28]	6.89*	1427	[0.25]
$\alpha$ -Pinene oxide	5.54	1089	0.02	5.43	1321	0.01
trans-Sabinene hydrate	5.62	1094	0.04	7.95	1506	0.06

Rosefuran	5.63	1095	0.02	6.06*	1366	[0.27]
Linalool	5.79	1105	31.14	8.10	1518	31.32
Octen-3-yl acetate	5.92	1113	0.90	5.84*	1350	[0.89]
Unknown [m/z 82, 81 (72), 43 (64), 54 (32), 41 (20)...]	6.02	1119	0.03	9.65*	1641	3.06
Octan-3-yl acetate	6.09	1124	0.11	5.30	1311	0.12
allo-Ocimene	6.14	1127	0.06	5.64	1336	0.04
(Z)-Myroxide	6.21	1132	0.02	6.81	1421	0.02
Camphor	6.24	1134	0.37	7.22	1451	0.34
(E)-Myroxide	6.34	1140	0.03	7.13	1445	0.03
trans-Verbenol	6.37	1142	0.02	9.50	1628	0.02
Unknown [m/z 95, 43 (74), 109 (72), 82 (62), 110 (50)... 152 (14)]	6.41	1144	0.01	7.02	1437	0.01
Hexyl isobutyrate	6.46	1147	0.07	5.40*	1319	[0.16]
Unknown [m/z 97, 81 (96), 109 (80), 43 (53), 53 (40), 41 (36), 56 (29), 95 (25)... 152 (1)]	6.60	1157	0.01	7.52	1474	0.01
Borneol	6.67	1161	0.51	9.77*	1650	1.59
Lavandulol	6.75*	1166	0.98	9.60*	1636	0.90
δ-Terpineol	6.75*	1166	[0.98]	9.46	1625	0.09
Terpinen-4-ol	6.85	1172	3.44	8.59	1556	3.42
meta-Cymen-8-ol	6.92*	1177	0.20	11.48	1794	0.04
Cryptone	6.92*	1177	[0.20]	9.15	1600	0.15
para-Cymen-8-ol	6.98	1180	0.08	11.61*	1805	0.46
α-Terpineol	7.08	1187	1.05	9.77*	1650	[1.59]
Myrtenal	7.13*	1190	0.46	8.76	1569	0.02
Hexyl butyrate	7.13*	1190	[0.46]	6.36	1388	0.37
Myrtenol	7.13*	1190	[0.46]	10.91	1745	0.01
Hodiendiol	7.20	1195	0.02	12.82*	1914	0.40
Verbenone	7.25	1198	0.06	9.68	1643	0.05
Unknown [m/z 43, 71 (66), 59 (52), 41 (47), 68 (46)...]	7.35	1204	0.02	5.91	1356	0.01
Bornyl formate	7.55	1218	0.05	8.00	1510	0.07
Nerol	7.68	1227	0.19	11.04	1756	0.19
Hexyl 2-methylbutyrate	7.75	1231	0.09	6.56	1403	0.05
Carvone	7.88	1240	0.01	9.99	1668	0.03
Neral	7.90	1242	0.01	9.53	1631	0.03
Hexyl isovalerate	7.96	1245	0.01	6.77*	1418	[0.31]
Linalyl acetate	8.14†	1258	33.37	8.22*	1527	[32.85]
Geraniol	8.16†	1258	[33.37]	11.61*	1805	[0.46]
Unknown [m/z 43, 111 (47), 93 (41), 55 (28), 67 (23), 41 (22)...]	8.24	1264	0.06			
Geranial	8.28	1267	0.04	10.11	1678	0.02

Bornyl acetate	8.45	1278	0.10	8.24*	1529	0.12
Lavandulyl acetate	8.62	1289	3.02	8.82	1574	2.96
Hexyl tiglate	9.18	1328	0.05	8.94	1583	0.03
Hodiendiol derivative	9.32	1338	0.03	12.89	1920	0.03
Unknown [m/z 43, 79 (47), 71 (31), 94 (27), 81 (23), 41 (22)... 197 (0)]	9.45	1347	0.04	11.08	1760	0.05
Unknown [m/z 43, 79 (46), 71 (30), 94 (25), 41 (23), 81 (21)... 197 (0)]	9.51	1351	0.03	11.16	1766	0.05
Neryl acetate	9.65	1361	0.34	10.21	1686	0.33
$\alpha$ -Copaene	9.74	1368	0.02	7.31	1458	0.01
Geranyl acetate	9.92	1380	0.56	10.58	1717	0.63
Hexyl hexanoate	9.98*	1384	0.20	8.96	1585	0.14
7-epi-Sesquithujene	9.98*	1384	[0.20]	7.88	1501	0.01
$\beta$ -Elemene	9.98*	1384	[0.20]	8.54*	1552	2.85
Isocaryophyllene	10.21	1401	0.05	8.24*	1529	[0.12]
$\beta$ -Caryophyllene	10.32	1409	2.75	8.54*	1552	[2.85]
$\alpha$ -Santalene	10.37	1413	0.43	8.36	1538	0.40
Coumarin	10.49	1422	0.06	17.03	2334	0.06
<i>trans</i> - $\alpha$ -Bergamotene	10.59	1429	0.12	8.54*	1552	[2.85]
Sesquisabinene A	10.71	1438	0.06	9.24	1607	0.04
$\alpha$ -Humulene	10.78	1443	0.10	9.39	1619	0.09
Lavandulyl butyrate?	10.88	1451	0.07	10.51*	1711	0.17
( <i>E</i> )- $\beta$ -Farnesene	10.93	1454	3.05	9.65*	1641	[3.06]
Germacrene D	11.16	1471	0.36	9.88	1660	0.34
<i>trans</i> - $\beta$ -Bergamotene	11.24	1477	0.05	9.60*	1636	[0.90]
$\beta$ -Bisabolene	11.60	1504	0.03	10.27	1691	0.05
$\gamma$ -Cadinene	11.62	1506	0.11	10.51*	1711	[0.17]
$\delta$ -Cadinene	11.71	1513	0.04	10.51*	1711	[0.17]
$\beta$ -Sesquiphellandrene	11.82	1521	0.01	10.73	1730	0.01
Isocaryophyllene epoxide B	12.06	1540	0.04	12.19	1857	0.05
Caryophyllene oxide	12.44*	1570	0.48	12.82*	1914	[0.40]
Caryophyllene oxide isomer	12.44*	1570	[0.48]	12.74	1906	0.07
$\tau$ -Cadinol	13.24	1634	0.06	14.91	2114	0.07
(3 <i>Z</i> )-Caryophylla-3,8(13)-dien-5 $\beta$ -ol	13.61	1665	0.01	16.80	2309	0.02
$\alpha$ -Bisabolol	13.78	1678	0.02	15.43	2166	0.02
<b>Total identified</b>		<b>98.33%</b>			<b>97.88%</b>	
<b>Total reported</b>		<b>98.54%</b>			<b>98.01%</b>	

\*: 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