

Date : July 10, 2019

CERTIFICATE OF ANALYSIS – GC PROFILING

SAMPLE IDENTIFICATION

Internal code : 19G04-CHS01-1-SCC

Customer identification : Tea Tree New Zealand (Manuka Oil) - 05131W

Type : Essential oil

Source : *Leptospermum scoparium* ct. Triketones

Customer : American College of Healthcare Sciences

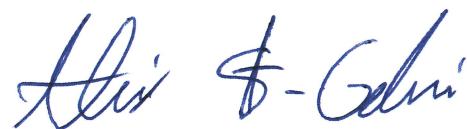
ANALYSIS

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 : Alexis St-Gelais, M. Sc., chimiste

Analysis date : July 08, 2019

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: 1.5026 ± 0.0003 (20 °C)

Relative density: 0.959 (21 °C)

Optical rotation: -23.59° (21 °C, c = 5.1, methanol/acetone 1:1)

CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. This sample belongs to the triketones-rich chemotype of manuka.

ANALYSIS SUMMARY – CONSOLIDATED CONTENTS

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

Identification	%	Classe
Isovaleral	tr	Aliphatic aldehyde
2,4-Dimethyl-3-pentanone	0.01	Aliphatic ketone
Hexanal	tr	Aliphatic aldehyde
Ethylbenzene	0.01	Simple phenolic
Styrene	0.01	Simple phenolic
α-Thujene	0.02	Monoterpene
α-Pinene	0.73	Monoterpene
β-Pinene	0.08	Monoterpene
6-Methyl-5-hepten-2-one	0.01	Aliphatic ketone
Myrcene	0.28	Monoterpene
Δ3-Carene	0.01	Monoterpene
α-Terpinene	0.02	Monoterpene
para-Cymene	0.11	Monoterpene
Limonene	0.07	Monoterpene
β-Phellandrene	0.17	Monoterpene
1,8-Cineole	0.01	Monoterpenic ether
(Z)-β-Ocimene	0.01	Monoterpene
(E)-β-Ocimene	0.03	Monoterpene
γ-Terpinene	0.10	Monoterpene
cis-Sabinene hydrate	0.01	Monoterpenic alcohol
cis-Linalool oxide (fur.)	0.01	Monoterpenic alcohol
Octanol	0.02	Aliphatic alcohol
Terpinolene	0.03	Monoterpene
para-Cymenene	0.01	Monoterpene
trans-Sabinene hydrate	0.01	Monoterpenic alcohol
Linalool	0.03	Monoterpenic alcohol
2-Methylbutyl 2-methylbutyrate	0.03	Aliphatic ester
Nonanal	0.01	Aliphatic aldehyde
Isoamyl isovalerate	0.02	Aliphatic ester
Amyl isovalerate	0.09	Aliphatic ester
3-Methyl-3-butenoil isovalerate	0.04	Aliphatic ester
α-Campholenal	0.17	Monoterpenic aldehyde
trans-Pinocarveol	0.02	Monoterpenic alcohol
Prenyl 2-methylbutyrate	0.01	Aliphatic ester
Prenyl isovalerate	0.03	Aliphatic ester
Dimethyloctanedione isomer	0.02	β-Diketone
2,7-Dimethyl-3,5-octanedione	0.03	β-Diketone
Terpinen-4-ol	0.05	Monoterpenic alcohol
α-Terpineol	0.04	Monoterpenic alcohol
2-Methylbutyl tiglate	0.09	Aliphatic ester
3-Methyl-3-butenoil tiglate	0.05	Aliphatic ester
Benzylacetone	0.01	Simple phenolic
Prenyl tiglate	0.06	Aliphatic ester
Geraniol	0.02	Monoterpenic alcohol
(2E)-Decenal	0.02	Aliphatic aldehyde
Geranial	0.02	Monoterpenic aldehyde
Undec-(5Z)-en-2-one	0.01	Aliphatic ketone

Bicycloelemene	0.02	Sesquiterpene
α -Cubebene	3.29	Sesquiterpene
Longicyclene	0.02	Sesquiterpene
α -Ylangene	0.22	Sesquiterpene
α -Copaene	4.39	Sesquiterpene
Methyl (<i>E</i>)-cinnamate	0.04	Phenylpropanoid ester
β -Bourbonene	0.04	Sesquiterpene
α -Isocomene	0.03	Sesquiterpene
Benzyl 2-methylbutyrate?	0.07	Phenolic ester
β -Cubebene	0.11	Sesquiterpene
β -Elemene	0.51	Sesquiterpene
Benzyl isovalerate	0.03	Phenolic ester
α -Gurjunene	0.97	Sesquiterpene
Unknown	0.04	Sesquiterpene
β -Ylangene	0.15	Sesquiterpene
β -Caryophyllene	2.46	Sesquiterpene
γ -Maaliene	0.01	Sesquiterpene
β -Gurjunene	0.15	Sesquiterpene
β -Copaene	0.11	Sesquiterpene
α -Maaliene	0.07	Sesquiterpene
α -Guaiene	1.81	Sesquiterpene
Selina-5,11-diene	0.06	Sesquiterpene
6,9-Guaidiene	0.24	Sesquiterpene
<i>trans</i> -Muurola-3,5-diene	4.56	Sesquiterpene
α -Humulene	0.18	Sesquiterpene
allo-Aromadendrene	0.60	Sesquiterpene
4,5-diepi-Aristolochene	0.06	Sesquiterpene
Unknown	0.05	Sesquiterpene
<i>trans</i> -Cadina-1(6),4-diene	3.14	Sesquiterpene
Selina-4,11-diene	0.43	Sesquiterpene
γ -Murolene	1.01	Sesquiterpene
Germacrene D	0.24	Sesquiterpene
β -Selinene	4.19	Sesquiterpene
Eudesma-3,5,11-triene	0.01	Sesquiterpene
allo-Aromadendr-9-ene	0.18	Sesquiterpene
<i>trans</i> -Muurola-4(15),5-diene	1.00	Sesquiterpene
Viridiflorene	0.42	Sesquiterpene
epi-Cubebol	0.18	Sesquiterpenic alcohol
α -Selinene	4.05	Sesquiterpene
α -Murolene	0.75	Sesquiterpene
δ -Amorphene	0.22	Sesquiterpene
δ -Guaiene	0.13	Sesquiterpene
Unknown	0.22	Sesquiterpene
γ -Cadinene	0.44	Sesquiterpene
(3E,6E)- α -Farnesene	0.11	Sesquiterpene
7-epi- α -Selinene	1.14	Sesquiterpene
<i>cis</i> -Calamenene?	0.16	Sesquiterpene
<i>trans</i> -Calamenene	11.44	Sesquiterpene
δ -Cadinene	4.96	Sesquiterpene
<i>trans</i> -Cadina-1,4-diene	4.88	Sesquiterpene
α -Calacorene	0.59	Sesquiterpene
Unknown	0.34	Sesquiterpene

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Flavone	5.00	Norsesquiterpenic ketone
Isocaryophyllene epoxide B	0.07	Sesquiterpenic ether
Unknown	0.08	Oxygenated sesquiterpene
Palustrol	0.19	Sesquiterpenic alcohol
(E)-Nerolidol	0.09	Sesquiterpenic alcohol
β-Calacorene	0.01	Sesquiterpene
Spathulenol	0.59	Sesquiterpenic alcohol
Caryophyllene oxide	0.53	Sesquiterpenic ether
Globulol	0.31	Sesquiterpenic alcohol
Gleenol	0.22	Sesquiterpenic alcohol
Viridiflorol	0.09	Sesquiterpenic alcohol
Cubeban-11-ol	0.09	Sesquiterpenic alcohol
Ledol	0.30	Sesquiterpenic alcohol
Eudesm-5-en-11-ol	0.06	Sesquiterpenic alcohol
Unknown	0.17	Oxygenated sesquiterpene
Unknown	0.04	Oxygenated sesquiterpene
Isoleptospermone	3.32	Sesquiterpenic ketone
1-epi-Cubenol	1.30	Sesquiterpenic alcohol
Leptospermone	16.36	Sesquiterpenic ketone
τ-Muurolol	0.17	Sesquiterpenic alcohol
τ-Cadinol	0.13	Sesquiterpenic alcohol
Cubenol	0.95	Sesquiterpenic alcohol
β-Eudesmol	0.15	Sesquiterpenic alcohol
α-Eudesmol	0.18	Sesquiterpenic alcohol
α-Cadinol	0.12	Sesquiterpenic alcohol
Selin-11-en-4a-ol	0.26	Sesquiterpenic alcohol
cis-Calamenen-10-ol	0.13	Sesquiterpenic alcohol
Unknown	0.05	Unknown
trans-Calamenen-10-ol	0.07	Sesquiterpenic alcohol
Unknown	0.11	Oxygenated sesquiterpene
Cadalene	0.19	Sesquiterpene
Unknown	0.25	Unknown
Unknown	0.19	Oxygenated sesquiterpene
trans-14-nor-Cadina-5-en-4-one	0.25	Norsesquiterpenic ketone
14-Hydroxy-trans-calamenene	0.08	Sesquiterpenic alcohol
Grandiflorone	0.93	Terpenophenolic
Caryophylladienol II	0.08	Sesquiterpenic alcohol
Consolidated total	96.28%	

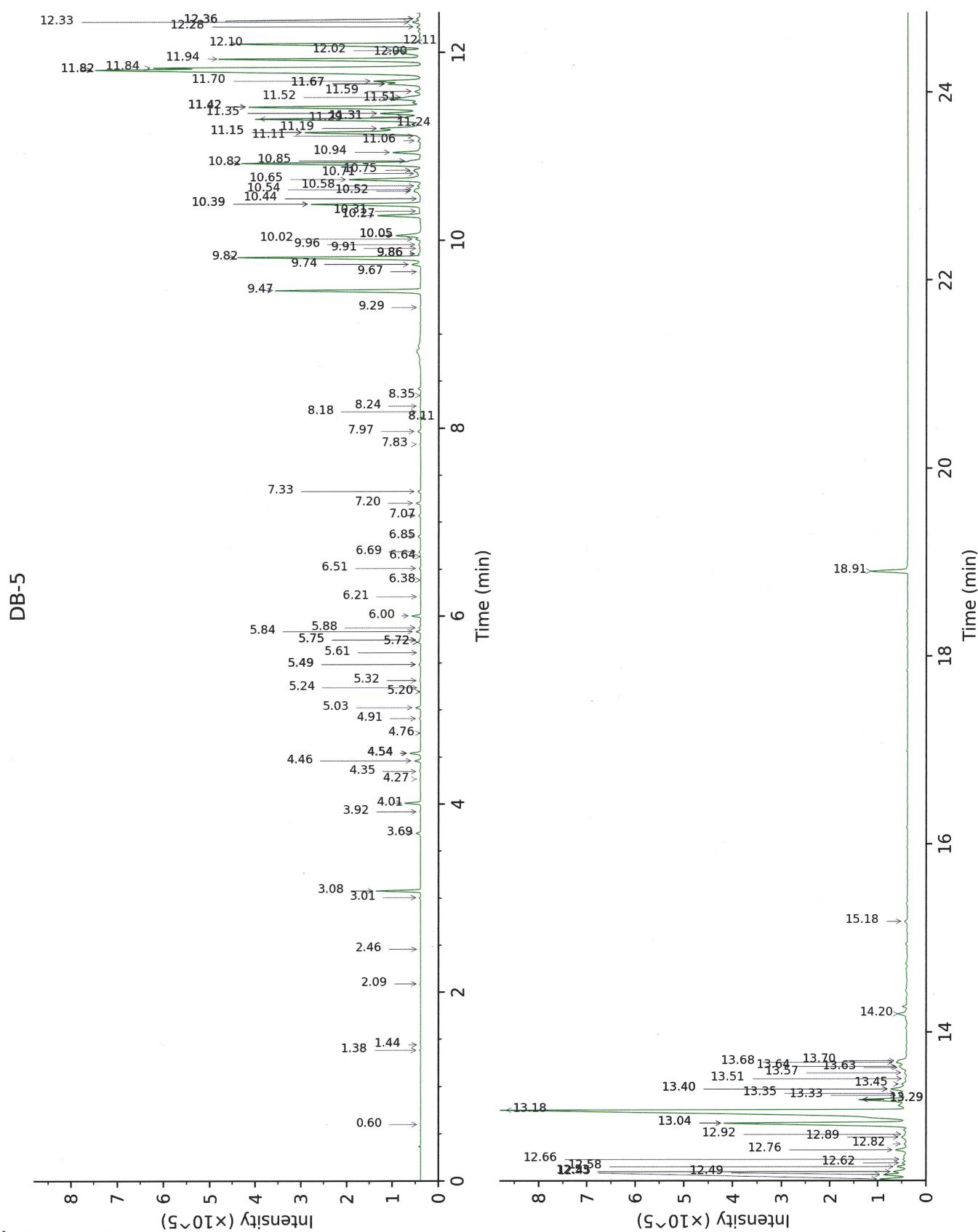
tr: The compound has been detected below 0.005% of total signal.

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.

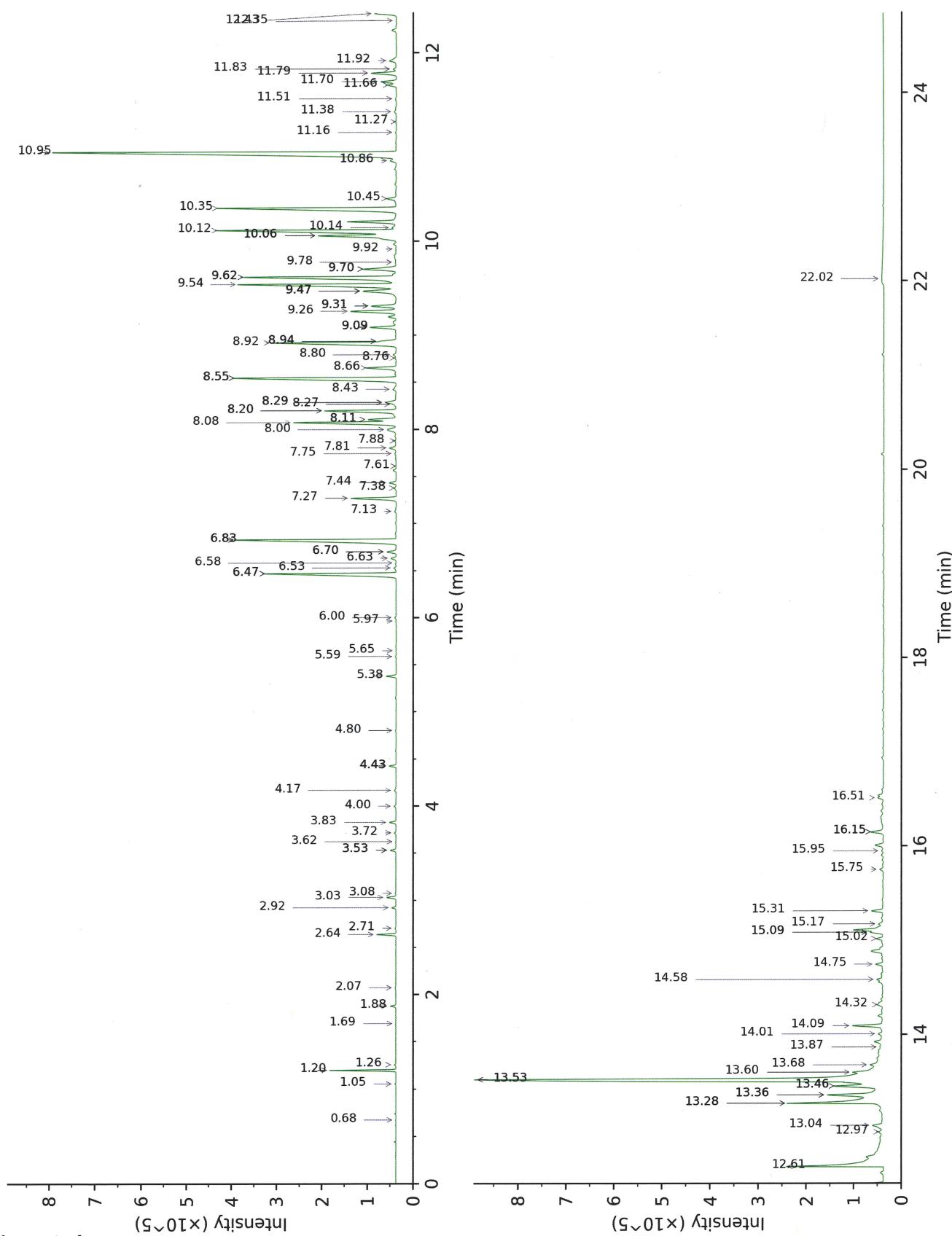
This page was intentionally left blank. The following pages present the complete data of the analysis.



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DB-WAX



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FULL ANALYSIS DATA

Identification	Column DB-5			Column DB-WAX		
	R.T	R.I	%	R.T	R.I	%
Isovaleral	0.60	640	tr	0.68	891	tr
2,4-Dimethyl-3-pentanone	1.38	792	0.01	1.06	964	0.01
Hexanal	1.44	800	tr	1.69	1045	tr
Ethylbenzene	2.09	855	0.01	2.07	1086	0.01
Styrene	2.46	885	0.01	3.62	1213	tr
α -Thujene	3.01	925	0.02	1.26	1000	0.02
α -Pinene	3.08	930	0.73	1.20	991	0.76
β -Pinene	3.69	970	0.08	1.88	1065	0.08
6-Methyl-5-hepten-2-one	3.92	985	0.01	4.80	1300	0.01
Myrcene	4.01	991	0.28	2.64	1134	0.29
Δ^3 -Carene	4.27	1008	0.01			
α -Terpinene	4.35	1013	0.02	2.71	1140	0.02
para-Cymene	4.46	1020	0.11	3.83	1228	0.11
Limonene	4.54*	1025	0.22	2.92	1157	0.07
β -Phellandrene	4.54*	1025	[0.22]	3.03	1166	0.17
1,8-Cineole	4.54*	1025	[0.22]	3.08	1170	0.01
(Z)- β -Ocimene	4.76	1039	0.01	3.53*	1206	0.09
(E)- β -Ocimene	4.91	1048	0.03	3.72	1220	0.02
γ -Terpinene	5.03	1056	0.10	3.53*	1206	[0.09]
cis-Sabinene hydrate	5.20	1066	0.01	6.58	1429	0.01
cis-Linalool oxide (fur.)	5.24	1069	0.01			
Octanol	5.32	1074	0.02	7.88	1526	0.03
Terpinolene	5.49*	1085	0.04	4.00	1241	0.03
para-Cymenene	5.49*	1085	[0.04]	5.97	1383	0.01
trans-Sabinene hydrate	5.61	1093	0.01	7.61	1506	tr
Linalool	5.72*	1100	0.05	7.75	1516	0.03
2-Methylbutyl 2-methylbutyrate	5.72*	1100	[0.05]	4.17	1254	0.03
Nonanal	5.75*	1102	0.03	5.59	1356	0.01
Isoamyl isovalerate	5.75*	1102	[0.03]	4.43*	1273	0.12
Amyl isovalerate	5.84	1107	0.09	4.43*	1273	[0.12]
3-Methyl-3-butenyl isovalerate	5.88	1110	0.04	5.38	1341	0.18
α -Campholenal	6.00	1118	0.17			
trans-Pinocarveol	6.21	1131	0.02	8.80	1597	0.07
Prenyl 2-methylbutyrate	6.38	1143	0.01	5.65	1361	0.01
Prenyl isovalerate	6.51	1151	0.03	6.00	1386	0.03
Dimethyloctanedione isomer	6.64	1159	0.02	6.47*	1420	3.30
2,7-Dimethyl-3,5-octanedione	6.69	1162	0.03	6.53	1425	0.05
Terpinen-4-ol	6.85	1173	0.05	8.27	1557	0.04
α -Terpineol	7.07	1188	0.04	9.47*	1652	1.03

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2-Methylbutyl tiglate	7.20	1196	0.09	6.63	1432	0.11
3-Methyl-3-butenyl tiglate	7.33	1205	0.05			
Benzylacetone	7.83	1239	0.01	11.16	1793	0.02
Prenyl tiglate	7.97	1249	0.06			
Geraniol	8.11	1259	0.02	11.27	1803	0.02
(2E)-Decenal	8.18	1263	0.02	8.76	1595	0.02
Geranial	8.24	1268	0.02	9.78	1677	0.02
Undec-(5Z)-en-2-one	8.35	1275	0.01	8.55*	1578	4.41
Bicycloelemene	9.29	1336	0.02	6.70*	1438	0.21
α -Cubebene	9.47	1348	3.29	6.47*	1420	[3.30]
Longicyclene	9.67	1362	0.02	6.83*	1447	4.43
α -Ylangene	9.74	1368	0.22	6.70*	1438	[0.21]
α -Copaene	9.82	1373	4.39	6.83*	1447	[4.43]
Methyl (<i>E</i>)-cinnamate	9.86*	1376	0.07	13.46*	2002	1.33
β -Bourbonene	9.86*	1376	[0.07]	7.13	1470	0.04
α -Isocomene	9.92	1380	0.03	7.38	1488	0.05
Benzyl 2-methylbutyrate?	9.96	1383	0.07	11.38	1812	0.06
β -Cubebene	10.02	1387	0.11	7.44	1492	0.15
β -Elemene	10.05*	1390	0.67	8.11*	1544	0.62
Benzyl isovalerate	10.05*	1390	[0.67]	11.51	1825	0.03
α -Gurjunene	10.26	1405	0.97	7.27	1480	0.97
Unknown [m/z 119, 107 (86), 105 (85), 93 (78), 189 (66), 81 (65), 121 (64)... 204 (23)]	10.31	1408	0.04			
β -Ylangene	10.39*	1414	2.58	7.81	1521	0.15
β -Caryophyllene	10.39*	1414	[2.58]	8.08	1542	2.46
γ -Maaliene	10.44	1418	0.01	8.20*	1551	1.63
β -Gurjunene	10.52	1424	0.15	8.00	1536	0.30
β -Copaene	10.54	1426	0.11	8.11*	1544	[0.62]
α -Maaliene	10.58	1428	0.07	8.29*	1558	0.28
α -Guaiene	10.65	1434	1.81	8.20*	1551	[1.63]
Selina-5,11-diene	10.71	1438	0.06	8.43	1569	0.07
6,9-Guaadiene	10.75	1441	0.24	8.29*	1558	[0.28]
trans-Muurola-3,5-diene	10.82	1447	4.56	8.55*	1578	[4.41]
α -Humulene	10.85	1448	0.18	8.94*	1609	0.21
allo-Aromadendrene	10.94	1455	0.60	8.66	1586	0.68
4,5-diepi-Aristolochene	11.06	1464	0.06	9.09*	1621	0.56
Unknown [m/z 161, 91 (97), 105 (76), 119 (61), 41 (55)... 204 (44)]	11.11	1468	0.05	8.94*	1609	[0.21]
trans-Cadina-1(6),4-diene	11.15*	1471	3.57	8.92	1608	3.14
Selina-4,11-diene	11.15*	1471	[3.57]	9.09*	1621	[0.56]
γ -Murolene	11.19	1474	1.01	9.26	1635	1.12
Germacrene D	11.24	1478	0.24	9.47*	1652	[1.03]
β -Selinene	11.29	1482	4.19	9.54	1658	4.18

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Eudesma-3,5,11-triene	11.31*	1483	0.19	9.92	1688	0.01
allo-Aromadendr-9-ene	11.31*	1483	[0.19]	9.31*	1639	0.59
<i>trans</i> -Muurola-4(15),5-diene	11.35	1486	1.00	9.47*	1652	[1.03]
Viridiflorene	11.42*	1492	4.77	9.31*	1639	[0.59]
epi-Cubebol	11.42*	1492	[4.77]	11.66	1838	0.18
α -Selinene	11.42*	1492	[4.77]	9.62*	1664	4.18
α -Muurolene	11.51	1498	0.75	9.70*	1671	0.90
δ -Amorphene	11.52	1499	0.22	9.70*	1671	[0.90]
δ -Guaiene	11.59	1504	0.13	9.62*	1664	[4.18]
Unknown [m/z 159, 145 (91), 131 (67), 105 (46), 202 (43)]	11.67*	1510	0.78	10.45	1733	0.22
γ -Cadinene	11.67*	1510	[0.78]	10.06*	1700	1.93
(3E,6E)- α -Farnesene	11.67*	1510	[0.78]	10.14	1707	0.11
7-epi- α -Selinene	11.70	1512	1.14	10.06*	1700	[1.93]
<i>cis</i> -Calamenene?	11.82*	1522	12.40	10.86	1768	0.16
<i>trans</i> -Calamenene	11.82*	1522	[12.40]	10.95	1775	11.44
δ -Cadinene	11.84	1524	4.96	10.12	1705	4.78
<i>trans</i> -Cadina-1,4-diene	11.94	1531	4.88	10.35	1725	4.86
α -Calacorene	12.00†	1536	0.97	11.79	1849	0.59
Unknown [m/z 157, 143 (86), 200 (43), 142 (36), 141 (28), 128 (25)]	12.02†	1538	[0.97]	11.70	1841	0.34
Flavesone	12.10	1544	5.00	12.61	1923	4.10
Isocaryophyllene epoxide B	12.11	1545	0.07	11.83	1853	0.07
Unknown [m/z 161, 109 (98), 82 (93), 43 (72), 105 (68), 93 (59), 69 (56), 119 (55)... 222 (7)]	12.28	1558	0.08	12.97	1956	0.11
Palustrol	12.33	1562	0.19	11.92	1861	0.23
(E)-Nerolidol	12.36*	1565	0.10	13.53*†	2008	15.19
β -Calacorene	12.36*	1565	[0.10]	12.35	1899	0.01
Spathulenol	12.45	1572	0.59	14.09	2063	0.70
Caryophyllene oxide	12.50	1575	0.53	12.42	1906	0.50
Globulol	12.53	1578	0.31	13.60†	2016	[15.19]
Gleenol	12.58	1582	0.22	13.28*†	1985	4.58
Viridiflorol	12.62	1585	0.09	13.68†	2023	[15.19]
Cubeban-11-ol	12.66	1588	0.09	13.36*†	1993	[4.58]
Ledol	12.76	1596	0.30	13.04	1963	0.29
Eudesm-5-en-11-ol	12.82	1601	0.06	14.01	2055	0.11
Unknown [m/z 179, 161 (66), 119 (44), 95 (38), 105 (35)... 204 (24), 222 (1)]	12.89	1606	0.17	14.32	2084	0.13

Unknown [m/z 151, 41 (15), 81 (13), 111 (13), 91 (13)...]	12.92	1609	0.04	13.87	2041	0.08
Isoleptospermone	13.04*	1619	4.97	13.28*†	1985	[4.58]
1-epi-Cubenol	13.04*	1619	[4.97]	13.46*	2002	[1.33]
Leptospermone	13.18	1630	16.36	13.53*†	2008	[15.19]
τ-Muurolol	13.29*	1639	1.25	14.75	2127	0.17
τ-Cadinol	13.29*	1639	[1.25]	14.58	2111	0.13
Cubenol	13.29*	1639	[1.25]	13.36*†	1993	[4.58]
β-Eudesmol	13.33	1643	0.15	15.08*	2161	0.24
α-Eudesmol	13.35	1645	0.18	15.02	2154	0.15
α-Cadinol	13.40*	1648	0.43	15.17	2170	0.12
Selin-11-en-4α-ol	13.40*	1648	[0.43]	15.31	2184	0.26
cis-Calamenen-10-ol	13.45	1653	0.13	16.15*	2271	0.30
Unknown [m/z 175, 157 (15), 105 (13), 119 (13), 176 (13), 142 (9)...]	13.51	1658	0.05	15.95	2250	0.04
trans-Calamenen-10-ol	13.57	1663	0.07	16.51	2309	0.12
Unknown [m/z 159, 118 (33), 91 (30), 131 (30)... 220? (4)]	13.63	1667	0.11	16.15*	2271	[0.30]
Cadalene	13.64	1668	0.19	15.08*	2161	[0.24]
Unknown [m/z 175, 91 (94), 105 (51), 218 (33), 104 (17), 176 (12)...]	13.68	1672	0.25			
Unknown [m/z 107, 91 (95), 93 (87), 79 (86), 105 (78), 41 (76), 95 (72)... 220 (18)]	13.70	1673	0.19			
trans-14-nor-Cadin-5-en-4-one	14.20	1715	0.25			
14-Hydroxy-trans-calamenene	15.18	1800	0.08			
Grandiflorone	18.91	2158	0.93	22.02	2969	0.93
Caryophylladienol II				15.75	2229	0.08
Total identified		96.65%			91.93%	
Total reported		97.62%			92.85%	

*: 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

American College Of Healthcare Sciences

5940 SW Hood Ave
Portland, OR 97239

Report Number: P191638

Report Date: July 16, 2019

Client Project ID:

Client Sample ID: Tea Tree New Zealand essential oil 05131W

PAL Sample ID: P191638-01

Sample Date: 07/09/2019

Received Date: 07/10/2019

Extraction Date: 07/12/2019

Certificate of Analysis

Analysis Date	Analyte	Amount Detected	LOQ (mg/kg)	Notes	Analysis Date	Analyte	Amount Detected	LOQ (mg/kg)	Notes
Modified EPA 8270D (GC-MS/MS)									
07/13/2019	2,6-Dichlorobenzamide	ND	0.50		07/13/2019	a-BHC	ND	0.50	
07/13/2019	Acetochlor	ND	0.50		07/13/2019	Alachlor	ND	0.50	
07/13/2019	Aldrin	ND	0.50		07/13/2019	Ametryn	ND	0.50	
07/13/2019	b-BHC	ND	0.50		07/13/2019	Benfluralin	ND	0.50	
07/13/2019	Bifenthrin	ND	0.50		07/13/2019	Bromopropylate	ND	0.50	
07/13/2019	Buprofezin	ND	0.50		07/13/2019	Captan	ND	10	
07/13/2019	Chlordane	ND	0.50		07/13/2019	Chloroneb	ND	0.50	
07/13/2019	Chlorothalonil	ND	0.50		07/13/2019	Chlorpropham	ND	0.50	
07/13/2019	Chlorpyrifos	ND	0.50		07/13/2019	Chlorpyrifos-methyl	ND	0.50	
07/13/2019	cis-Nonachlor	ND	0.50		07/13/2019	Cyfluthrin	ND	2.5	
07/13/2019	Cypermethrin	ND	2.5		07/13/2019	Dacthal	ND	0.50	
07/13/2019	d-BHC	ND	0.50		07/13/2019	Deltamethrin	ND	2.5	
07/13/2019	Diazinon	ND	0.50		07/13/2019	Dichlobenil	ND	0.50	
07/13/2019	Dichlorofenthion	ND	0.50		07/13/2019	Dichlorvos	ND	0.50	
07/13/2019	Diclofop-methyl	ND	0.50		07/13/2019	Dicloran	ND	2.5	
07/13/2019	Dicofol	ND	0.50		07/13/2019	Dieldrin	ND	0.50	
07/13/2019	Dimethenamid	ND	0.50		07/13/2019	Diphenamid	ND	0.50	
07/13/2019	Diphenylamine	ND	0.50		07/13/2019	Disulfoton	ND	0.50	
07/13/2019	Dithiopyr	ND	0.50		07/13/2019	Endosulfan I	ND	1.0	
07/13/2019	Endosulfan II	ND	1.0		07/13/2019	Endosulfan sulfate	ND	1.0	
07/13/2019	Endrin	ND	0.50		07/13/2019	Endrin aldehyde	ND	0.50	
07/13/2019	Endrin ketone	ND	0.50		07/13/2019	Esfenvalerate	ND	0.50	
07/13/2019	Ethalfluralin	ND	0.50		07/13/2019	Ethofumesate	ND	0.50	
07/13/2019	Ethoprop	ND	0.50		07/13/2019	Ethoxyquin	ND	0.50	
07/13/2019	Etoxazole	ND	0.50		07/13/2019	Etridiazole	ND	0.50	
07/13/2019	Fenarimol	ND	0.50		07/13/2019	Fenoaxaprop-ethyl	ND	0.50	
07/13/2019	Fenvalerate	ND	0.50		07/13/2019	Fipronil	ND	0.50	
07/13/2019	Fluazifop-p-butyl	ND	0.50		07/13/2019	Fludioxonil	ND	0.50	
07/13/2019	Fluroxypyr-meptyl	ND	0.50		07/13/2019	Flutolanil	ND	0.50	
07/13/2019	g-BHC	ND	0.50		07/13/2019	Heptachlor	ND	0.50	
07/13/2019	Heptachlor epoxide	ND	0.50		07/13/2019	Hexachlorobenzene	ND	0.50	
07/13/2019	Kresoxim-methyl	ND	0.50		07/13/2019	lambda-Cyhalothrin	ND	1.0	
07/13/2019	Malathion	ND	0.50		07/13/2019	Mefenoxam	ND	0.50	
07/13/2019	Methoxychlor	ND	0.50		07/13/2019	Metolachlor	ND	0.50	
07/13/2019	MGK-264	ND	0.50		07/13/2019	Myclobutanil	ND	0.50	
07/13/2019	Napropamide	ND	0.50		07/13/2019	o-Phenylphenol	ND	0.50	
07/13/2019	Oxadiazon	ND	0.50		07/13/2019	Oxyfluorfen	ND	0.50	

Rick Jordan, Laboratory Manager

American College Of Healthcare Sciences

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Client Sample ID: Tea Tree New Zealand essential oil 05131W
PAL Sample ID: P191638-01

Report Number: P191638
Report Date: July 16, 2019
Client Project ID:

Sample Date: 07/09/2019
Received Date: 07/10/2019
Extraction Date: 07/12/2019

Certificate of Analysis (Continued)

Analysis Date	Analyte	Amount Detected	LOQ (mg/kg)	Notes	Analysis Date	Analyte	Amount Detected	LOQ (mg/kg)	Notes
Modified EPA 8270D (GC-MS/MS) (Continued)									
07/13/2019	p,p'-DDD	ND	0.50		07/13/2019	p,p'-DDE	ND	0.50	
07/13/2019	p,p'-DDT	ND	0.50		07/13/2019	Parathion-methyl	ND	0.50	
07/13/2019	PCA	ND	0.50		07/13/2019	PCB	ND	0.50	
07/13/2019	PCNB	ND	0.50		07/13/2019	Pendimethalin	ND	0.50	
07/13/2019	Pentachlorophenyl methyl sulfide	ND	0.50		07/13/2019	Permethrin	ND	2.5	
07/13/2019	Procymidone	ND	0.50		07/13/2019	Prodiamine	ND	0.50	
07/13/2019	Pronamide	ND	0.50		07/13/2019	Propachlor	ND	0.50	
07/13/2019	Pyriproxyfen	ND	0.50		07/13/2019	Quinoxifen	ND	0.50	
07/13/2019	Spirodiclofen	ND	0.50		07/13/2019	Tetraconazole	ND	0.50	
07/13/2019	Tetradifon	ND	0.50		07/13/2019	trans-Nonachlor	ND	0.50	
07/13/2019	Trifluralin	ND	0.50		07/13/2019	Vinclozalin	ND	0.50	
Modified EPA 8321B (HPLC MS-MS)									
07/12/2019	3-Hydroxycarbofuran	ND	0.50		07/12/2019	Abamectin	ND	0.50	
07/12/2019	Acephate	ND	0.50		07/12/2019	Acetamiprid	ND	0.50	
07/12/2019	Acibenzolar-S-methyl	ND	1.0		07/12/2019	Aldicarb	ND	0.50	
07/12/2019	Aldicarb Sulfone	ND	0.50		07/12/2019	Aldicarb Sulfoxide	ND	0.50	
07/12/2019	Allethrin	ND	0.50		07/12/2019	Ametoctradin	ND	0.50	
07/12/2019	Atrazine	ND	0.50		07/12/2019	Azinphos-ethyl	ND	0.50	
07/12/2019	Azinphos-methyl	ND	1.0		07/12/2019	Azoxystrobin	ND	0.50	
07/12/2019	Bendiocarb	ND	0.50		07/12/2019	Bensulide	ND	0.50	
07/12/2019	Bifenazate	ND	0.50		07/12/2019	Bitertanol	ND	0.50	
07/12/2019	Boscalid	ND	0.50		07/12/2019	Bromacil	ND	0.50	
07/12/2019	Carbaryl	ND	0.50		07/12/2019	Carbendazim	ND	0.50	
07/12/2019	Carbofuran	ND	0.50		07/12/2019	Carfentrazone-ethyl	ND	0.50	
07/12/2019	Chlorantraniliprole	ND	0.50		07/12/2019	Clethodim	ND	1.0	
07/12/2019	Clofentezine	ND	0.50		07/12/2019	Clothianidin	ND	0.50	
07/12/2019	Cyanazine	ND	0.50		07/12/2019	Cyantraniliprole	ND	0.50	
07/12/2019	Cyazofamid	ND	0.50		07/12/2019	Cycloate	ND	1.0	
07/12/2019	Cyflufenamid	ND	0.50		07/12/2019	Cyflumetofen	ND	0.50	
07/12/2019	Cymoxanil	ND	0.50		07/12/2019	Cyprodinil	ND	0.50	
07/12/2019	Cyromazine	ND	0.50		07/12/2019	DCPMU	ND	0.50	
07/12/2019	Diazoxon	ND	0.50		07/12/2019	Difenconazole	ND	0.50	
07/12/2019	Diflubenzuron	ND	0.50		07/12/2019	Dimethoate	ND	0.50	
07/12/2019	Dimethomorph	ND	0.50		07/12/2019	Dinotefuran	ND	0.50	
07/12/2019	Disulfoton sulfone	ND	0.50		07/12/2019	Diuron	ND	0.50	

Rick Jordan, Laboratory Manager

American College Of Healthcare Sciences

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Report Date: July 16, 2019

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Sample Date: 07/09/2019

Received Date: 07/10/2019

Extraction Date: 07/12/2019

Certificate of Analysis (Continued)

Analysis Date	Analyte	Amount Detected	LOQ (mg/kg)	Notes	Analysis Date	Analyte	Amount Detected	LOQ (mg/kg)	Notes
Modified EPA 8321B (HPLC MS-MS) (Continued)									
07/12/2019	Dodine	ND	0.50		07/12/2019	d-Phenothrin	ND	0.50	
07/12/2019	Emamectin Benzoate	ND	0.50		07/12/2019	Ethion	ND	0.50	
07/12/2019	Famoxadone	ND	0.50		07/12/2019	Famphur	ND	0.50	
07/12/2019	Fenamidone	ND	0.50		07/12/2019	Fenamiphos sulfone	ND	0.50	
07/12/2019	Fenamiphos sulfoxide	ND	0.50		07/12/2019	Fenazaquin	ND	0.50	
07/12/2019	Fenbuconazole	ND	0.50		07/12/2019	Fenbutatin oxide	ND	0.50	
07/12/2019	Fenhexamid	ND	0.50		07/12/2019	Fenobucarb	ND	0.50	
07/12/2019	Fenpropathrin	ND	0.50		07/12/2019	Fenpyroximate	ND	0.50	
07/12/2019	Fenuron	ND	0.50		07/12/2019	Flonicamid	ND	0.50	
07/12/2019	Fluazinam	ND	0.50		07/12/2019	Flubendiamide	ND	1.0	
07/12/2019	Flumioxazin	ND	0.50		07/12/2019	Fluometuron	ND	0.50	
07/12/2019	Fluopicolide	ND	0.50		07/12/2019	Fluopyram	ND	0.50	
07/12/2019	Fluoxastrobin	ND	0.50		07/12/2019	Flupyradifurone	ND	0.50	
07/12/2019	Fluridone	ND	0.50		07/12/2019	Flutriafol	ND	0.50	
07/12/2019	Fluvalinate	ND	0.50		07/12/2019	Fluxapyroxad	ND	0.50	
07/12/2019	Fonofos	ND	1.0		07/12/2019	Formetanate HCl	ND	0.50	
07/12/2019	Hexaconazole	ND	0.50		07/12/2019	Hexazinone	ND	0.50	
07/12/2019	Hexythiazox	ND	0.50		07/12/2019	Imazalil	ND	0.50	
07/12/2019	Imidacloprid	ND	0.50		07/12/2019	Indaziflam	ND	0.50	
07/12/2019	Indoxacarb	ND	0.50		07/12/2019	Iprodione	ND	2.5	
07/12/2019	Isoxaben	ND	0.50		07/12/2019	Linuron	ND	0.50	
07/12/2019	Malaoxon	ND	0.50		07/12/2019	Mandipropamid	ND	0.50	
07/12/2019	Metconazole	ND	0.50		07/12/2019	Methamidophos	ND	1.0	
07/12/2019	Methidathion	ND	0.50		07/12/2019	Methiocarb	ND	0.50	
07/12/2019	Methomyl	ND	0.50		07/12/2019	Methoxyfenozide	ND	0.50	
07/12/2019	Metrafenone	ND	0.50		07/12/2019	Metribuzin	ND	0.50	
07/12/2019	Mevinphos	ND	0.50		07/12/2019	Norflurazon	ND	0.50	
07/12/2019	Novaluron	ND	0.50		07/12/2019	Ometoate	ND	0.50	
07/12/2019	Oryzalin	ND	0.50		07/12/2019	Oxadixyl	ND	0.50	
07/12/2019	Oxamyl	ND	0.50		07/12/2019	Oxydemeton-Methyl	ND	0.50	
07/12/2019	Penthiopyrad	ND	0.50		07/12/2019	Phorate Sulfone	ND	0.50	
07/12/2019	Phorate Sulfoxide	ND	0.50		07/12/2019	Phosalone	ND	0.50	
07/12/2019	Phosmet	ND	0.50		07/12/2019	Phosphamidon	ND	0.50	
07/12/2019	Piperonyl Butoxide	ND	0.50		07/12/2019	Pirimicarb	ND	0.50	
07/12/2019	Pirimiphos-methyl	ND	0.50		07/12/2019	Prometon	ND	0.50	
07/12/2019	Prometryn	ND	0.50		07/12/2019	Propargite	ND	0.50	
07/12/2019	Propazine	ND	0.50		07/12/2019	Propiconazole	ND	1.0	

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Certificate of Analysis (Continued)

Analysis Date	Analyte	Amount Detected	LOQ (mg/kg)	Notes	Analysis Date	Analyte	Amount Detected	LOQ (mg/kg)	Notes
Modified EPA 8321B (HPLC MS-MS) (Continued)									
07/12/2019	Prothioconazole	ND	1.0		07/12/2019	Pymetrozine	ND	0.50	
07/12/2019	Pyraclostrobin	ND	0.50		07/12/2019	Pyraflufen-ethyl	ND	0.50	
07/12/2019	Pyrethrin	ND	2.5		07/12/2019	Pyridaben	ND	0.50	
07/12/2019	Pyrimethanil	ND	0.50		07/12/2019	Rotenone	ND	0.50	
07/12/2019	Saflufenacil	ND	0.50		07/12/2019	Sethoxydim	ND	1.0	
07/12/2019	Siduron	ND	0.50		07/12/2019	Simazine	ND	0.50	
07/12/2019	Simetryn	ND	0.50		07/12/2019	Spinetoram	ND	0.50	
07/12/2019	Spinosad	ND	0.50		07/12/2019	Spiromesifen	ND	1.0	
07/12/2019	Spirotetramat	ND	0.50		07/12/2019	Spiroxamine	ND	0.50	
07/12/2019	Sulfentrazone	ND	0.50		07/12/2019	Sulfoxaflor	ND	0.50	
07/12/2019	Tebuconazole	ND	0.50		07/12/2019	Tebufenozide	ND	0.50	
07/12/2019	Tebuthiuron	ND	0.50		07/12/2019	Terbacil	ND	0.50	
07/12/2019	Terbutylazine	ND	0.50		07/12/2019	Terbutryn	ND	0.50	
07/12/2019	Thiabendazole	ND	0.50		07/12/2019	Thiacloprid	ND	0.50	
07/12/2019	Thiamethoxam	ND	0.50		07/12/2019	Thiobencarb	ND	0.50	
07/12/2019	Thiodicarb	ND	0.50		07/12/2019	Thiophanate methyl	ND	0.50	
07/12/2019	Tolfenpyrad	ND	0.50		07/12/2019	Triadimefon	ND	0.50	
07/12/2019	Triadimenol	ND	1.0		07/12/2019	Trifloxystrobin	ND	0.50	
07/12/2019	Triflumizole	ND	0.50						

Notes and Definitions

<u>Notes</u>	<u>Definition</u>
LOQ	Limit of Quantitation
ND	Not Detected
*	Not included under current scope of accreditation

The results contained in this report relate only to the items tested.

The results reflect the condition of the samples as received by PAL.

Samples will be stored for a minimum of 60 days after the final report is issued, as described in our Quality Manual.

Reports should not be reproduced, except in full, without written approval from PAL.

PAL is accredited to ISO/IEC 17025:2017 Standard, by PJLA, Accreditation #64422, Testing.

Rick Jordan, Laboratory Manager