

**Date :** May 21, 2019

**CERTIFICATE OF ANALYSIS – GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 19E10-PTH04-1-SCC

**Customer identification :** Cajeput - C1010491R

**Type :** Essential oil

**Source :** *Melaleuca cajuputi*

**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 :** Sylvain Mercier, M. Sc., Chimiste

**Analysis date :** May 19, 2019

Checked and approved by :

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

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*PHYSICOCHEMICAL DATA*

**Physical aspect:** Faintly yellow liquid

**Refractive index:**  $1.4701 \pm 0.0003$  (20 °C)

*CONCLUSION*

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

## ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Isovaleral	0.01	0.01	Aliphatic aldehyde
2-Methylbutyral	0.03	0.03	Aliphatic aldehyde
Isoamyl alcohol	tr	0.03*	Aliphatic alcohol
2-Methylbutanol	0.01	[0.03]*	Aliphatic alcohol
Methyl 2-methylbutyrate	0.04	0.03	Aliphatic ester
2,4-Dimethyl-3-pentanone	0.02	0.02	Aliphatic ketone
2-Methylbutyl acetate	0.01	0.01	Aliphatic ester
$\alpha$ -Thujene	0.62	0.60	Monoterpene
$\alpha$ -Pinene	3.60	3.45	Monoterpene
Camphene	0.04*	0.03	Monoterpene
$\alpha$ -Fenchene	[0.04]*	0.01	Monoterpene
Benzaldehyde	0.11	0.11	Simple phenolic
$\beta$ -Pinene	2.55*	2.41	Monoterpene
Sabinene	[2.55]*	0.07	Monoterpene
Myrcene	1.12	1.10	Monoterpene
$\alpha$ -Phellandrene	0.23*	0.16	Monoterpene
Pseudolimonene	[0.23]*	0.07	Monoterpene
$\Delta^3$ -Carene	0.05	0.05	Monoterpene
$\alpha$ -Terpinene	0.59	0.58	Monoterpene
para-Cymene	1.14	1.20	Monoterpene
Limonene	57.58*	6.44	Monoterpene
1,8-Cineole	[57.58]*	50.45	Monoterpenic ether
(Z)- $\beta$ -Ocimene	0.01	3.05*	Monoterpene
(E)- $\beta$ -Ocimene	0.03	0.03	Monoterpene
$\gamma$ -Terpinene	3.05	[3.05]*	Monoterpene
para-Cymenene	1.67*	0.01	Monoterpene
Terpinolene	[1.67]*	1.64	Monoterpene
Linalool	0.37	0.38	Monoterpenic alcohol
para-Mentha-1,3,8-triene	0.01	0.01	Monoterpene
cis-Rose oxide	0.04*	0.02	Monoterpenic ether
endo-Fenchol	[0.04]*	4.65*	Monoterpenic alcohol
trans-Rose oxide	0.01	0.01	Monoterpenic ether
Isopulegol	0.03	0.04	Monoterpenic alcohol
Borneol	0.01	7.83*	Monoterpenic alcohol
$\delta$ -Terpineol	0.18	[0.56]*	Monoterpenic alcohol
Terpinen-4-ol	0.82	0.77	Monoterpenic alcohol
Cryptone	0.01	0.04*	Normonoterpenic ketone
para-Cymen-8-ol	0.04	0.05	Monoterpenic alcohol
$\alpha$ -Terpineol	7.50	[7.83]*	Monoterpenic alcohol
Citronellol	0.04	0.05	Monoterpenic alcohol
Geraniol	0.04	0.06	Monoterpenic alcohol
$\delta$ -Terpinyl acetate	0.03	[0.04]*	Monoterpenic ester
$\delta$ -Elemene	0.05	0.05	Sesquiterpene
$\alpha$ -Terpinyl acetate	0.98*	1.01	Monoterpenic ester
$\alpha$ -Cubebene	[0.98]*	0.01	Sesquiterpene
Eugenol	0.06	0.08	Phenylpropanoid
$\alpha$ -Ylangene	0.17	0.17	Sesquiterpene
$\alpha$ -Copaene	0.09	0.09	Sesquiterpene

7-Cubebene	0.04	0.04	Sesquiterpene
Geranyl acetate	0.05	0.03	Monoterpenic ester
$\beta$ -Elemene	0.21	[4.65]*	Sesquiterpene
$\alpha$ -Gurjunene	0.09	0.08	Sesquiterpene
$\beta$ -Maaliene	0.01	0.01	Sesquiterpene
$\beta$ -Caryophyllene	4.40	[4.65]*	Sesquiterpene
$\beta$ -Gurjunene	0.02	0.03	Sesquiterpene
Aromadendrene	0.19	0.08	Sesquiterpene
$\alpha$ -Guaiene	[0.19]*	[4.65]*	Sesquiterpene
Unknown	[0.19]*	0.07	Sesquiterpene
6,9-Guaiadiene	0.08	0.07	Sesquiterpene
Unknown	0.03	0.04	Sesquiterpene
$\alpha$ -Humulene	2.01	2.18*	Sesquiterpene
allo-Aromadendrene	0.26	0.27	Sesquiterpene
4,5-diepi-Aristolochene	0.05	0.56	Sesquiterpene
Unknown	0.57*	[2.18]*	Sesquiterpene
Selina-4,11-diene	[0.57]*	[0.56]*	Sesquiterpene
$\alpha$ -Amorphene	0.30	0.32	Sesquiterpene
$\beta$ -Selinene	1.46	1.51	Sesquiterpene
$\delta$ -Selinene	0.32*	0.56*	Sesquiterpene
Valencene	[0.32]*	0.10	Sesquiterpene
Viridiflorene	1.71*	[0.56]*	Sesquiterpene
$\alpha$ -Selinene	[1.71]*	1.59*	Sesquiterpene
$\delta$ -Amorphene	0.26	[1.59]*	Sesquiterpene
$\gamma$ -Cadinene	0.13	0.37*	Sesquiterpene
$\delta$ -Cadinene	0.22*	[0.37]	Sesquiterpene
<i>trans</i> -Calamenene	[0.22]*	0.01	Sesquiterpene
Zonarene	[0.22]*	[0.37]*	Sesquiterpene
Selina-4(15),7(11)-diene	0.11	0.21*	Sesquiterpene
$\alpha$ -Calacorene	0.14*	0.08	Sesquiterpene
Selina-3,7(11)-diene	[0.14]*	[0.21]*	Sesquiterpene
Germacrene B	0.28	0.30	Sesquiterpene
Spathulenol	0.02	0.02	Sesquiterpenic alcohol
Caryophyllene oxide	0.23*	0.23	Sesquiterpenic ether
Caryophyllene oxide isomer	[0.23]*	0.01	Sesquiterpenic ether
Globulol	0.41	0.43	Sesquiterpenic alcohol
Viridiflorol	0.65	0.65	Sesquiterpenic alcohol
Guaiol	0.10	0.14	Sesquiterpenic alcohol
Ledol	0.11	0.18*	Sesquiterpenic alcohol
Humulene epoxide II	0.09	[0.18]*	Sesquiterpenic ether
Unknown	0.05	0.08	Oxygenated sesquiterpene
Isoleptospermone	0.04	0.03	Sesquiterpenic ketone
Unknown	0.10	0.07	Sesquiterpenic alcohol
Cubenol	0.05	0.05	Sesquiterpenic alcohol
$\beta$ -Eudesmol	0.16	0.16	Sesquiterpenic alcohol
Unknown	0.27*	0.12	Oxygenated sesquiterpene
$\alpha$ -Eudesmol	[0.27]*	0.14	Sesquiterpenic alcohol
Selin-11-en-4 $\alpha$ -ol	[0.27]*	0.09	Sesquiterpenic alcohol
Bulnesol	0.03	0.03	Sesquiterpenic alcohol
<b>Total identified</b>	<b>98.08%</b>	<b>97.51%</b>	

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

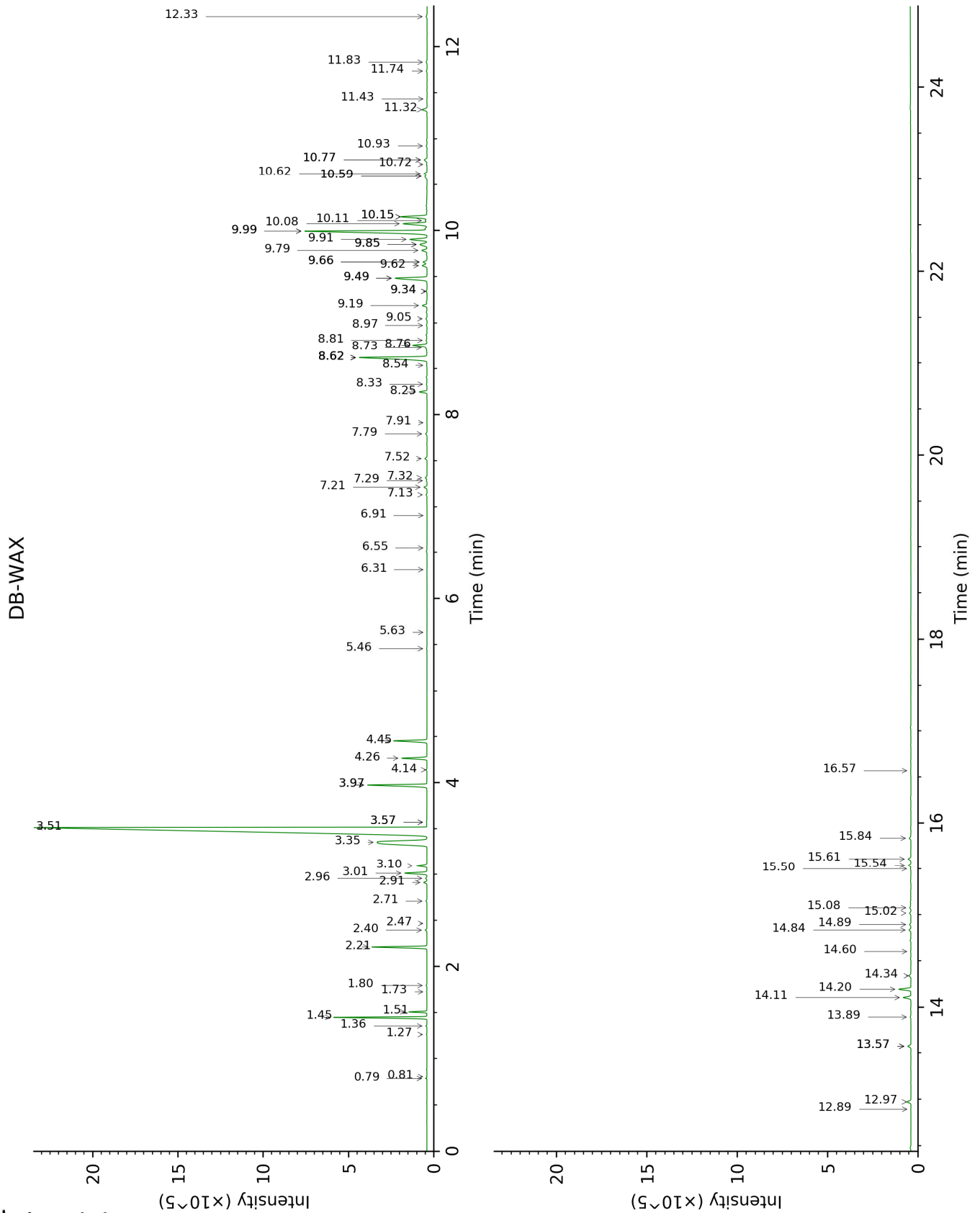
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	%
Isovaleral	0.60	641	0.01	0.80	887	0.01
2-Methylbutyral	0.63	652	0.03	0.78	880	0.03
Isoamyl alcohol	0.97	735	tr	3.57*	1176	0.03
2-Methylbutanol	0.99	737	0.01	3.57*	1176	[0.03]
Methyl 2-methylbutyrate	1.27	776	0.04	1.36	978	0.03
2,4-Dimethyl-3-pentanone	1.39	793	0.02	1.27	964	0.02
2-Methylbutyl acetate	2.40	880	0.01	2.47	1091	0.01
$\alpha$ -Thujene	3.02	925	0.62	1.51	999	0.60
$\alpha$ -Pinene	3.09	930	3.60	1.45	992	3.45
Camphene	3.28*	942	0.04	1.80	1026	0.03
$\alpha$ -Fenchene	3.28*	942	[0.04]	1.73	1020	0.01
Benzaldehyde	3.40	951	0.11	7.52	1461	0.11
$\beta$ -Pinene	3.71*	971	2.55	2.21	1066	2.41
Sabinene	3.71*	971	[2.55]	2.40	1084	0.07
Myrcene	4.02	992	1.12	3.01	1133	1.10
$\alpha$ -Phellandrene	4.16*	1001	0.23	2.91	1126	0.16
Pseudolimonene	4.16*	1001	[0.23]	2.96	1129	0.07
$\Delta^3$ -Carene	4.25	1007	0.05	2.71	1110	0.05
$\alpha$ -Terpinene	4.36	1014	0.59	3.10	1140	0.58
para-Cymene	4.51	1023	1.14	4.26	1226	1.20
Limonene	4.63*	1031	57.58	3.35	1159	6.44
1,8-Cineole	4.63*	1031	[57.58]	3.51	1172	50.45
(Z)- $\beta$ -Ocimene	4.77	1040	0.01	3.97*	1206	3.05
(E)- $\beta$ -Ocimene	4.92	1049	0.03	4.14	1218	0.03
$\gamma$ -Terpinene	5.05	1057	3.05	3.97*	1206	[3.05]
para-Cymenene	5.50*	1086	1.67	6.55	1389	0.01
Terpinolene	5.50*	1086	[1.67]	4.45	1240	1.64
Linalool	5.73	1100	0.37	8.25	1515	0.38
para-Mentha-1,3,8-triene	5.78	1104	0.01	6.31	1372	0.01
cis-Rose oxide	5.88*	1110	0.04	5.46	1312	0.02
endo-Fenchol	5.88*	1110	[0.04]	8.62*	1544	4.65
trans-Rose oxide	6.13	1126	0.01	5.64	1324	0.01
Isopulegol	6.36	1141	0.03	8.33	1522	0.04
Borneol	6.67	1162	0.01	10.00*	1652	7.83
$\delta$ -Terpineol	6.70	1164	0.18	9.66*†	1625	[0.56]
Terpinen-4-ol	6.86	1174	0.82	8.76	1554	0.77
Cryptone	6.94	1180	0.01	9.34*	1600	0.04
para-Cymen-8-ol	7.02	1185	0.04	11.74	1797	0.05
$\alpha$ -Terpineol	7.12	1192	7.50	10.00*	1652	[7.83]
Citronellol	7.74	1234	0.04	10.92	1729	0.05
Geraniol	8.12	1260	0.04	11.83	1806	0.06
$\delta$ -Terpinyl acetate	9.00	1315	0.03	9.34*	1600	[0.04]
$\delta$ -Elemene	9.30	1336	0.05	7.13	1432	0.05
$\alpha$ -Terpinyl acetate	9.46*	1348	0.98	9.91	1645	1.01

α-Cubebene	9.46*	1348	[0.98]	6.91	1416	0.01
Eugenol	9.53	1353	0.06	15.02	2099	0.08
α-Ylangene	9.75	1369	0.17	7.22	1438	0.17
α-Copaene	9.82	1374	0.09	7.32	1446	0.09
7-Cubebene	9.86	1377	0.04	7.29	1443	0.04
Geranyl acetate	9.99	1386	0.05	10.72	1712	0.03
β-Elemene	10.06	1391	0.21	8.62*	1544	[4.65]
α-Gurjunene	10.28	1406	0.09	7.79	1481	0.08
β-Maaliene	10.32	1409	0.01	7.91	1490	0.01
β-Caryophyllene	10.40	1416	4.40	8.62*	1544	[4.65]
β-Gurjunene	10.51	1424	0.02	8.54	1537	0.03
Aromadendrene	10.66†	1434	0.19	8.73	1552	0.08
α-Guaiene	10.69*†	1437	[0.19]	8.62*	1544	[4.65]
Unknown [m/z 161, 105 (69), 119 (42), 91 (41), 204 (38)]	10.69*†	1437	[0.19]	9.05	1577	0.07
6,9-Guaiadiene	10.74	1441	0.08	8.81	1559	0.07
Unknown [m/z 91, 161 (92), 105 (85), 119 (63), 133 (53), 79 (49), 204 (46)]	10.81	1446	0.03	8.97	1571	0.04
α-Humulene	10.85	1449	2.01	9.49*	1611	2.18
allo- Aromadendrene	10.94	1456	0.26	9.19	1588	0.27
4,5-diepi- Aristolochene	11.07	1466	0.05	9.62†	1622	0.56
Unknown [m/z 161, 91 (97), 105 (76), 119 (61), 41 (55)... 204 (44)]	11.18*	1473	0.57	9.49*	1611	[2.18]
Selina-4,11-diene	11.18*	1473	[0.57]	9.66*†	1625	[0.56]
α-Amorphene	11.24	1478	0.30	9.79	1636	0.32
β-Selinene	11.29	1482	1.46	10.08	1659	1.51
δ-Selinene	11.38*	1489	0.32	9.85*	1641	0.56
Valencene	11.38*	1489	[0.32]	10.11	1662	0.10
Viridiflorene	11.42*	1492	1.71	9.85*	1641	[0.56]
α-Selinene	11.42*	1492	[1.71]	10.15*	1665	1.59
δ-Amorphene	11.60	1505	0.26	10.15*	1665	[1.59]
γ-Cadinene	11.67	1511	0.13	10.59*†	1701	0.37
δ-Cadinene	11.81*	1522	0.22	10.62†	1703	[0.37]
<i>trans</i> -Calamenene	11.81*	1522	[0.22]	11.43	1772	0.01
Zonarene	11.81*	1522	[0.22]	10.59*†	1701	[0.37]
Selina-4(15),7(11)- diene	11.92	1530	0.11	10.77*	1716	0.21
α-Calacorene	12.01*	1538	0.14	12.33	1849	0.08
Selina-3,7(11)- diene	12.01*	1538	[0.14]	10.77*	1716	[0.21]
Germacrene B	12.19	1551	0.28	11.32	1762	0.30
Spathulenol	12.44	1572	0.02	14.60	2059	0.02
Caryophyllene	12.50*	1576	0.23	12.97	1907	0.23

oxide						
Caryophyllene oxide isomer	12.50*	1576	[0.23]	12.89	1900	0.01
Globulol	12.53	1578	0.41	14.10	2012	0.43
Viridiflorol	12.62	1586	0.65	14.20	2020	0.65
Guaiol	12.74	1595	0.10	14.34	2034	0.14
Ledol	12.76	1597	0.11	13.57*	1962	0.18
Humulene epoxide II	12.82	1602	0.09	13.57*	1962	[0.18]
Unknown [m/z 179, 161 (66), 119 (44), 95 (38), 105 (35)... 204 (24), 222 (1)]	12.89	1607	0.05	14.90	2087	0.08
Isoleptospermone	12.95	1612	0.04	16.57	2256	0.03
Unknown [m/z 161, 59 (61), 91 (45), 105 (43), 119 (41), 107 (36)... 204 (26), 222 (1)]	13.06	1621	0.10	15.08	2105	0.07
Cubenol	13.25	1636	0.05	13.89	1991	0.05
β-Eudesmol	13.33	1643	0.16	15.61	2158	0.16
Unknown [m/z 161, 59 (67), 95 (45), 93 (40), 105 (40), 149 (39), 81 (39), 43 (38), 204 (37)... 220 (5)]	13.38*	1647	0.27	14.84	2082	0.12
α-Eudesmol	13.38*	1647	[0.27]	15.54	2151	0.14
Selin-11-en-4α-ol	13.38*	1647	[0.27]	15.84	2181	0.09
Bulnesol	13.57	1663	0.03	15.50	2148	0.03
<b>Total identified</b>		<b>98.08%</b>			<b>97.51%</b>	
<b>Total reported</b>		<b>98.26%</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

†: 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