

**Date :** April 27, 2018

**CERTIFICATE OF ANALYSIS - GC PROFILING**

**SAMPLE IDENTIFICATION**

**Internal code :** 18D20-HBN3-1-CC

**Customer identification :** Aniseed Oil - 87726-03/2

**Type :** Essential oil

**Source :** *Pimpinella anisum*

**Customer :** Health & Beauty Natural Oils

**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 :** Benoit Roger, Ph. D.

**Analysis date :** April 24, 2018

Checked and approved by :

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

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#### PHYSICOCHEMICAL DATA

**Physical aspect:** Light yellow liquid  
**Refractive index:** 1.5535 ± 0.0003 (20 °C)

#### COMPLIANCE WITH ISO 3475:2006 (PIMPINELLA ANISUM)

Compound	Min. %	Max. %	Observed %	Complies?
Methylchavicol	0.5	3	2.7	Yes
(Z)-Anethole	0.1	0.4	0.1	Yes
para-Anisaldehyde	0.1	1.4	0.3	Yes
(E)-Anethole	87	94	90	Yes
γ-Himachalene	1	5	1	Yes
trans-Pseudoisoeugenyl 2-methylbutyrate	0.3	2	0.5	Yes
Refractive index	1.552	1.561	1.554	Yes

#### CONCLUSION

No adulterant, contaminant or diluent has been detected using this method. The oil complies with the ISO standard for *P. anisum* essential oil.

ANALYSIS SUMMARY

Identification	DB-5 (%)	DB-WAX (%)	Classe
Isobutyral	0.01		Aliphatic aldehyde
Isovaleral	0.08	0.08	Aliphatic aldehyde
2-Methylbutyral	0.06	0.06	Aliphatic aldehyde
2-Methylbutyric acid	0.05		Aliphatic acid
$\alpha$ -Pinene	0.01	0.01	Monoterpene
Sabinene	tr*		Monoterpene
$\beta$ -Pinene	[tr]*	tr	Monoterpene
Myrcene	0.01	tr	Monoterpene
para-Cymene	0.02	0.01	Monoterpene
Limonene	0.05	0.05	Monoterpene
$\gamma$ -Terpinene	0.02	0.01	Monoterpene
cis-Linalool oxide (fur.)	tr	tr	Monoterpenic alcohol
Fenchone	tr	tr	Aliphatic alcohol
trans-Linalool oxide (fur.)	0.01	0.01	Monoterpenic alcohol
Linalool	1.25	1.24	Monoterpenic alcohol
Geijerene	0.02		Terpene derivative
$\delta$ -Terpineol	0.01	0.01	Monoterpenic alcohol
$\alpha$ -Terpineol	1.21	1.32	Monoterpenic alcohol
Methylchavicol	2.72	2.74	Phenylpropanoid
Cuminal	0.02	0.05	Monoterpenic aldehyde
Carvone	0.03	0.02	Monoterpenic ketone
Carvacrol methyl ether	0.06	0.06	Monoterpenic ether
para-Anisaldehyde	0.34*	0.27	Simple phenolic
(Z)-Anethole	[0.34]*	0.15	Phenylpropanoid
(E)-Anethole	89.77	90.31	Phenylpropanoid
$\delta$ -Elemene	0.04	0.05	Sesquiterpene
$\alpha$ -Longipinene	0.02*	0.01	Sesquiterpene
Dehydro-ar-ionene	[0.02]*		Miscellaneous
6-Methoxy-3-methylbenzofuran	0.08		Furan
$\alpha$ -Ylangene	0.02	0.01	Sesquiterpene
para-Acetonylanisole	0.05	0.05	Phenylpropanoid
$\beta$ -Elemene	0.04	0.05*	Sesquiterpene
Isocaryophyllene	0.02	0.02	Sesquiterpene
$\beta$ -Caryophyllene	0.04	[0.05]*	Sesquiterpene
trans- $\alpha$ -Bergamotene	0.02	0.02	Sesquiterpene
$\alpha$ -Himachalene	0.10	0.09	Sesquiterpene
$\gamma$ -Himachalene	1.03	1.04	Sesquiterpene
ar-Curcumene	0.22	0.20	Sesquiterpene
$\alpha$ -Zingiberene	0.32*	0.25	Sesquiterpene
$\beta$ -Himachalene	[0.32]*	0.05	Sesquiterpene
$\beta$ -Bisabolene	0.18*	0.16	Sesquiterpene
$\gamma$ -Cadinene	[0.18]*	0.01	Sesquiterpene
$\delta$ -Cadinene	0.04	0.03	Sesquiterpene
Myristicin	0.06	0.04	Phenylpropanoid
$\alpha$ -Calacorene	0.01	0.01	Sesquiterpene
Spathulenol	0.02	0.01	Sesquiterpenic alcohol
Caryophyllene oxide	0.01	tr	Sesquiterpenic ether
Dill apiole	0.04	0.02	Phenylpropanoid

Isospathulenol	0.01	0.01	Sesquiterpenic alcohol
<i>trans</i> -Pseudoisoeugenyl 2-methylbutyrate	0.45	0.45	Phenolic ester
Eoxypseudoisoeugenyl 2-methylbutyrate	0.07	0.07	Phenolic ester
<b>Total identified</b>	<b>98.64%</b>	<b>99.07%</b>	

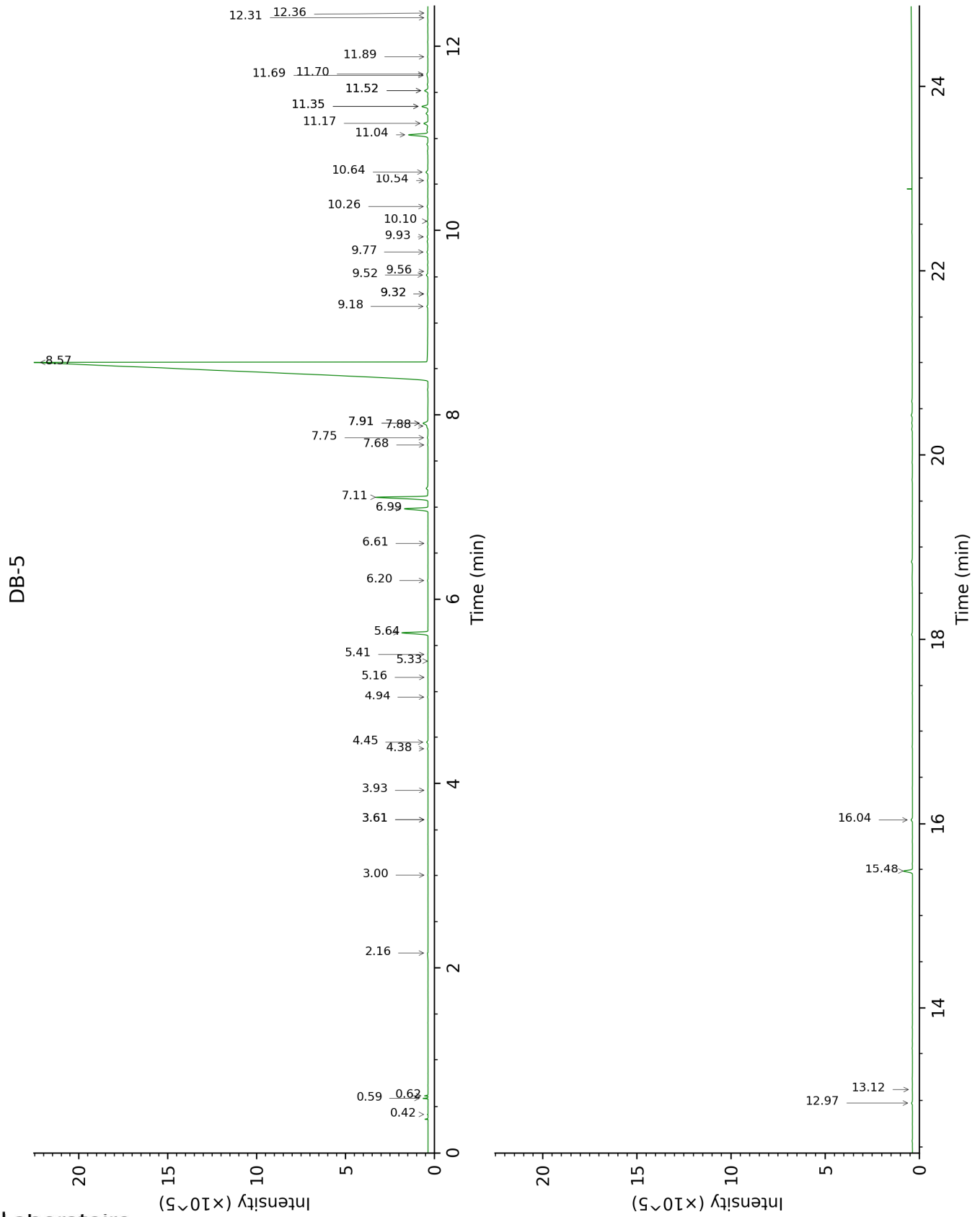
\*: Two or more compounds are coeluting on this column

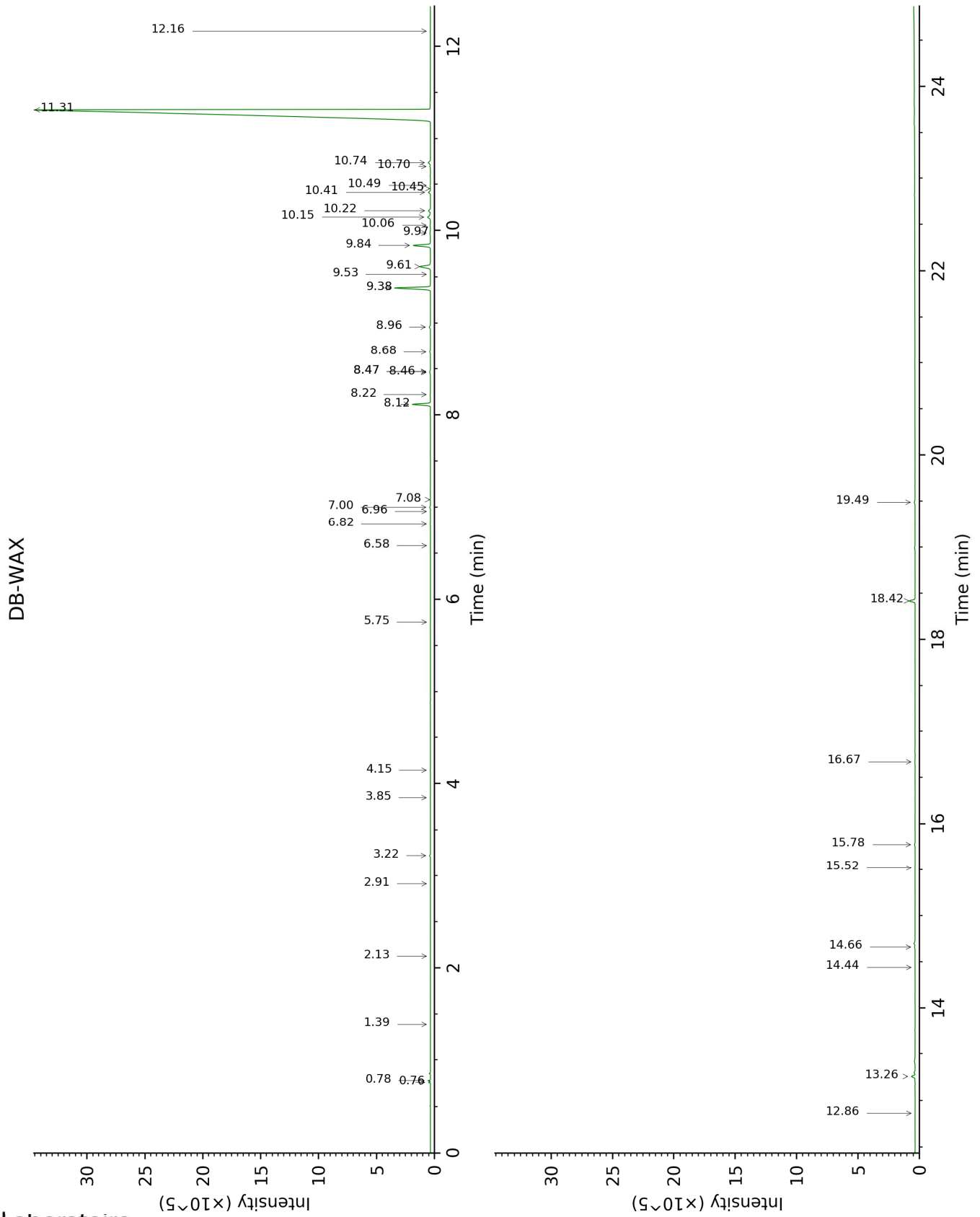
[xx]: Duplicate percentage due to coelutions, not taken account in the identified total

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	%
Isobutylal	0.42	542	0.01			
Isovaleral	0.59	639	0.08	0.78	887	0.08
2-Methylbutylal	0.62	649	0.06	0.76	879	0.06
2-Methylbutyric acid	2.16	863	0.05			
$\alpha$ -Pinene	3.00	928	0.01	1.39	996	0.01
Sabinene	3.61*	968	tr			
$\beta$ -Pinene	3.61*	968	[tr]	2.13	1070	tr
Myrcene	3.93	990	0.01	2.91	1136	tr
para-Cymene	4.38	1019	0.02	4.15	1224	0.01
Limonene	4.45	1024	0.05	3.22	1159	0.05
$\gamma$ -Terpinene	4.94	1054	0.02	3.85	1204	0.01
cis-Linalool oxide (fur.)	5.16	1068	tr	6.58	1403	tr
Fenchone	5.33	1080	tr	5.75	1344	tr
trans-Linalool oxide (fur.)	5.40	1084	0.01	6.96	1431	0.01
Linalool	5.64	1099	1.25	8.12	1517	1.24
Geijerene	6.20	1135	0.02			
$\delta$ -Terpineol	6.60	1161	0.01	9.53	1628	0.01
$\alpha$ -Terpineol	6.99	1186	1.21	9.84	1653	1.32
Methylchavicol	7.11	1194	2.72	9.38	1616	2.74
Cuminal	7.68	1231	0.02	10.70	1724	0.05
Carvone	7.76	1237	0.03	10.06	1671	0.02
Carvacrol methyl ether	7.88	1245	0.06	8.68	1561	0.06
para-Anisaldehyde	7.91*	1247	0.34	13.26	1949	0.27
(Z)-Anethole	7.91*	1247	[0.34]	10.41	1700	0.15
(E)-Anethole	8.57	1292	89.77	11.31	1776	90.31
$\delta$ -Elemene	9.18	1334	0.04	7.00	1434	0.05
$\alpha$ -Longipinene	9.32*	1344	0.02	6.82	1420	0.01
Dehydro-ar-ionene	9.32*	1344	[0.02]			
6-Methoxy-3-methylbenzofuran	9.52	1358	0.08			
$\alpha$ -Ylangene	9.56	1361	0.02	7.08	1440	0.01
para-Acetonylanisole	9.77	1376	0.05	14.66	2082	0.05
$\beta$ -Elemene	9.93	1388	0.04	8.47*	1545	0.05
Isocaryophyllene	10.10	1400	0.02	8.22	1525	0.02
$\beta$ -Caryophyllene	10.26	1412	0.04	8.47*	1545	[0.05]
trans- $\alpha$ -Bergamotene	10.54	1432	0.02	8.46	1544	0.02
$\alpha$ -Himachalene	10.64	1440	0.10	8.96	1582	0.09
$\gamma$ -Himachalene	11.04	1470	1.03	9.61	1635	1.04
ar-Curcumene	11.17	1479	0.22	10.74	1728	0.20
$\alpha$ -Zingiberene	11.35*	1493	0.32	10.15	1678	0.25
$\beta$ -Himachalene	11.35*	1493	[0.32]	9.98	1664	0.05
$\beta$ -Bisabolene	11.52*	1506	0.18	10.22	1683	0.16
$\gamma$ -Cadinene	11.52*	1506	[0.18]	10.45	1703	0.01
$\delta$ -Cadinene	11.69	1519	0.04	10.49	1706	0.03
Myristicin	11.70	1520	0.06	15.78	2193	0.04
$\alpha$ -Calacorene	11.89	1535	0.01	12.16	1850	0.01
Spathulenol	12.31	1568	0.02	14.44	2061	0.01



Caryophyllene oxide	12.36	1572	0.01	12.86	1913	tr
Dill apiole	12.97	1622	0.04	16.67	2286	0.02
Isospathulenol	13.12	1634	0.01	15.52	2168	0.01
<i>trans</i> -Pseudoisoeugenyl 2-methylbutyrate	15.48	1838	0.45	18.42	2478	0.45
Epoxypseudoisoeugenyl 2-methylbutyrate	16.04	1889	0.07	19.49	2602	0.07
<b>Total identified</b>	<b>98.64%</b>			<b>99.07%</b>		
<b>Total reported</b>	<b>98.64%</b>			<b>99.07%</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

R.T.: Retention time (minutes)

R.I.: Retention index