



Report

The Task To measure if the tea brewing kit from CoffeeBrewers Nordic gives a more intense and more complex aroma than conventional tea bags. The aroma compounds were identified from library databases and the amount of compounds are calculated from chloro-heptane as chloro-heptane equivalents.

Sampling CoffeeBrewers Nordic delivered 7 tea samples.

Sample description Four teas were delivered in a teabrewer (brewing kit) and three were delivered as tea bags. Sample names

Green Refreshment Organic
Cool Mint Organic
Cool Mint Green (tea bag)
Donna Camilla Organic
Organic Camomille (tea bag, named kamille on plastic bag)
Japanese Green Tea Organic
Supreme Matcha Green (tea bag)

All the teas were delivered from Coffeebrew Nordic and were stored at room temperature. The age and storage conditions of the teas were not provided.

Analysis program The analysis were carried out by a two-step program. First the headspace sampling onto Tenax TA tubes and the GC-MS of the mixtures were optimized and secondly, the GC-MS analysis of the teas were carried out.

Methods

Brewing conditions:
Tea bags:
A beaker is added 200 mL boiling water (approx. cup size) and a tea bag. After 3½ min 24 to 26 g tea brew is transferred to the cleaned sampling flask and chloro-heptane is added.

Tea brewing kit:
Boiling water (400 mL) is added the brewing bag. The kit was not shaken after addition of water. After 3½ min 24 to 26 g tea brew is transferred to the cleaned sampling flask flask and chloro-heptane is added.

The flasks were transferred to a water bath and after 10 min equilibration time at 50 °C the samples were collected on sorbent tubes Tenax TA and analysed on thermal desorption GC-MS equipped with a DB5-MS column. A cold trap with Carbograph 5TD and Tenax TA was used. The substances were gas chromatographically separated and the gas flow was split at the end of the GC column. The total amount of compounds, having an area corresponding to and above 5 ng chloro-heptane, were used to give a semi quantitative calculation of the amount of aroma compounds in the teas.

Climatic parameters Sampling conditions:

- Flask: 500 mL Erlenmeyer flask
- Temperature: 50 °C
- Air exchange rate: 50 mL/min for 10 min
- Flask loading: 24-26 g sample
- Sampling material: Tenax TA
- Cold trap: Carbograph 5TD, Tenax TA
- Analysis: GC-MS, Thermal desorption

Results

When the headspace analyses of the four tea brewers are compared to the tea bags, the brewing kits provides a more intense aroma profile (amount chloro-heptane eq), except for Japanese Green Tea Organic. The number of compounds extracted from the brewing kits are, in general, larger than those found in the tea bags. The results are given as mean values of duplicates.

The identification of the aroma components are based on library match with NIST05 and is made on the first sample set. A match of more than or equal to 80% is considered a positive match. Identification of isomers are not possible without a retention time from a pure reference standard and must therefore be used with caution. This also explains why some compounds are identified two or more times in one chromatogram, see annex.

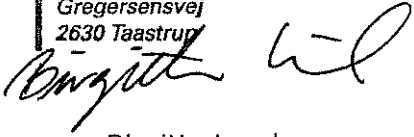
Tea	Average		
	Amount ISTD equivalents (ng)	No. of Compounds	No. of compounds ≥2% of total amount
Organic Camomille tea bag	525	24	21
Donna Camilla Organic	26462	84	7
Cool Mint Organic	65206	80	12
Cool Mint Green, tea bag	4150	37	8
Green Refreshment Organic	23095	57	8
Japanese Green Tea organic	814	26	18
Supreme Matcha, tea bag	230	13	13

Conclusion

In general, the tested tea brewers gives a more intense aroma profile than the compared tea bags and with a larger amount of compounds detectable. When comparing the amount of the individual compounds, the individual odour threshold should be taken into account, as small amounts of specific compounds can have great impact on the total perception of the tea.

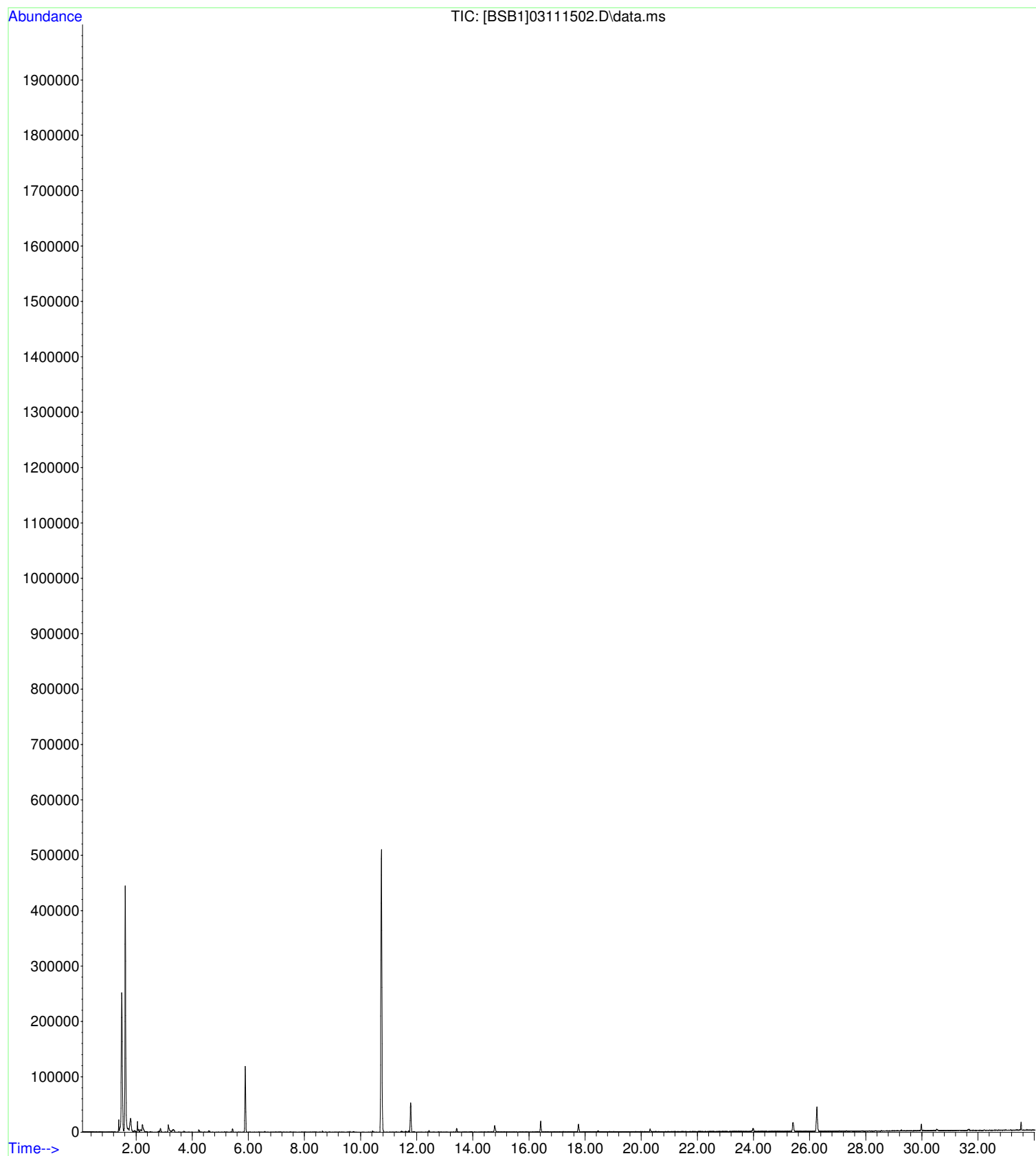
Teknologisk Institut, Taastrup

Teknologisk institut
Gregersensvej
2630 Taastrup

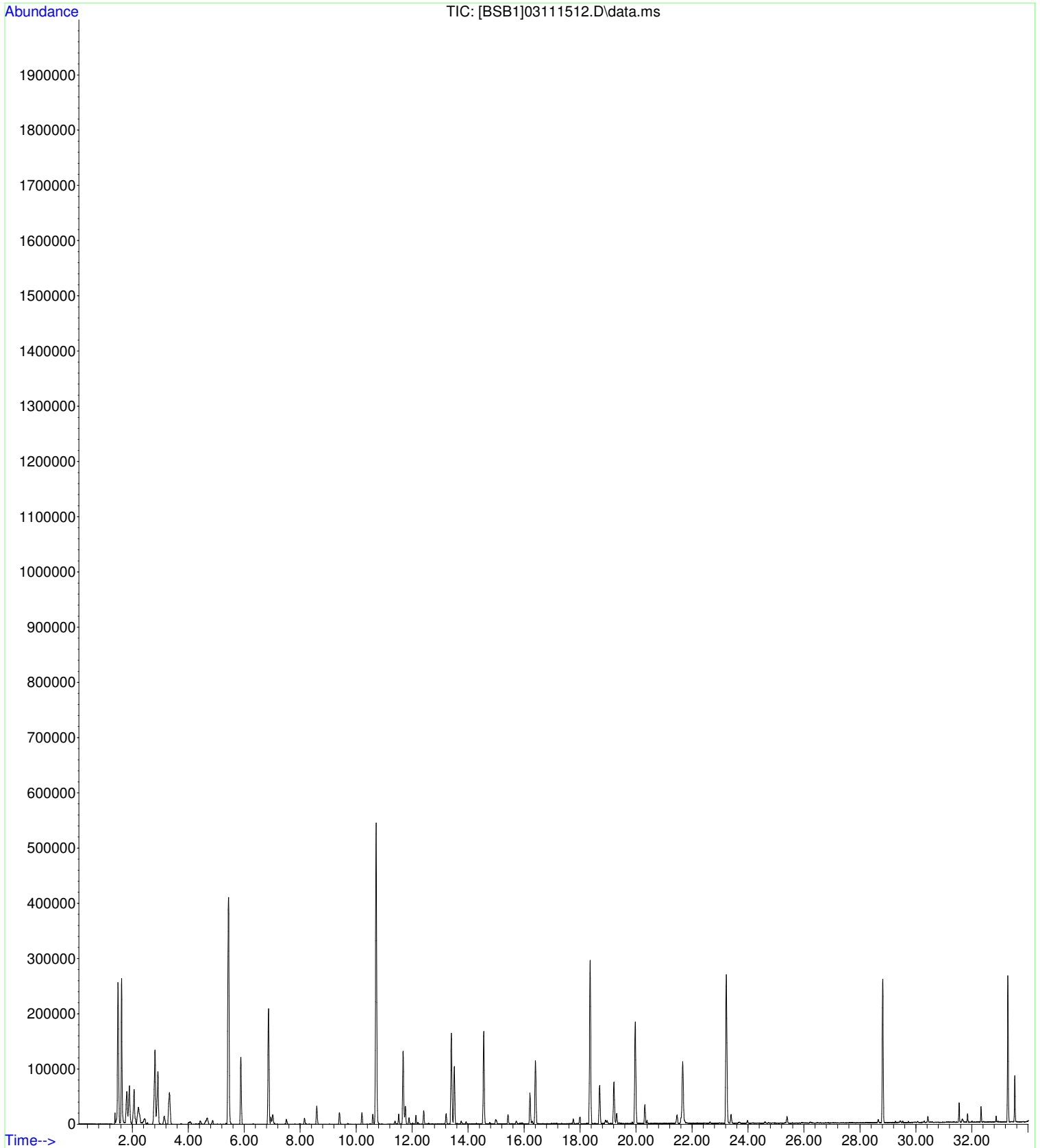


Birgitte Lund
Konsulent

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Instrument : GC-O-MS
Sample Name: Blind A132
Misc Info :
Vial Number: 2



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Acquired : 4 Nov 2015 16:28 using AcqMethod ATD-INLET-SNIFF-TE_AROMAER-291015.M
Instrument : GC-O-MS
Sample Name: Clipper Organic Camomille A0224
Misc Info :
Vial Number: 4



Sample Name :Clipper Organic Camomille A0224

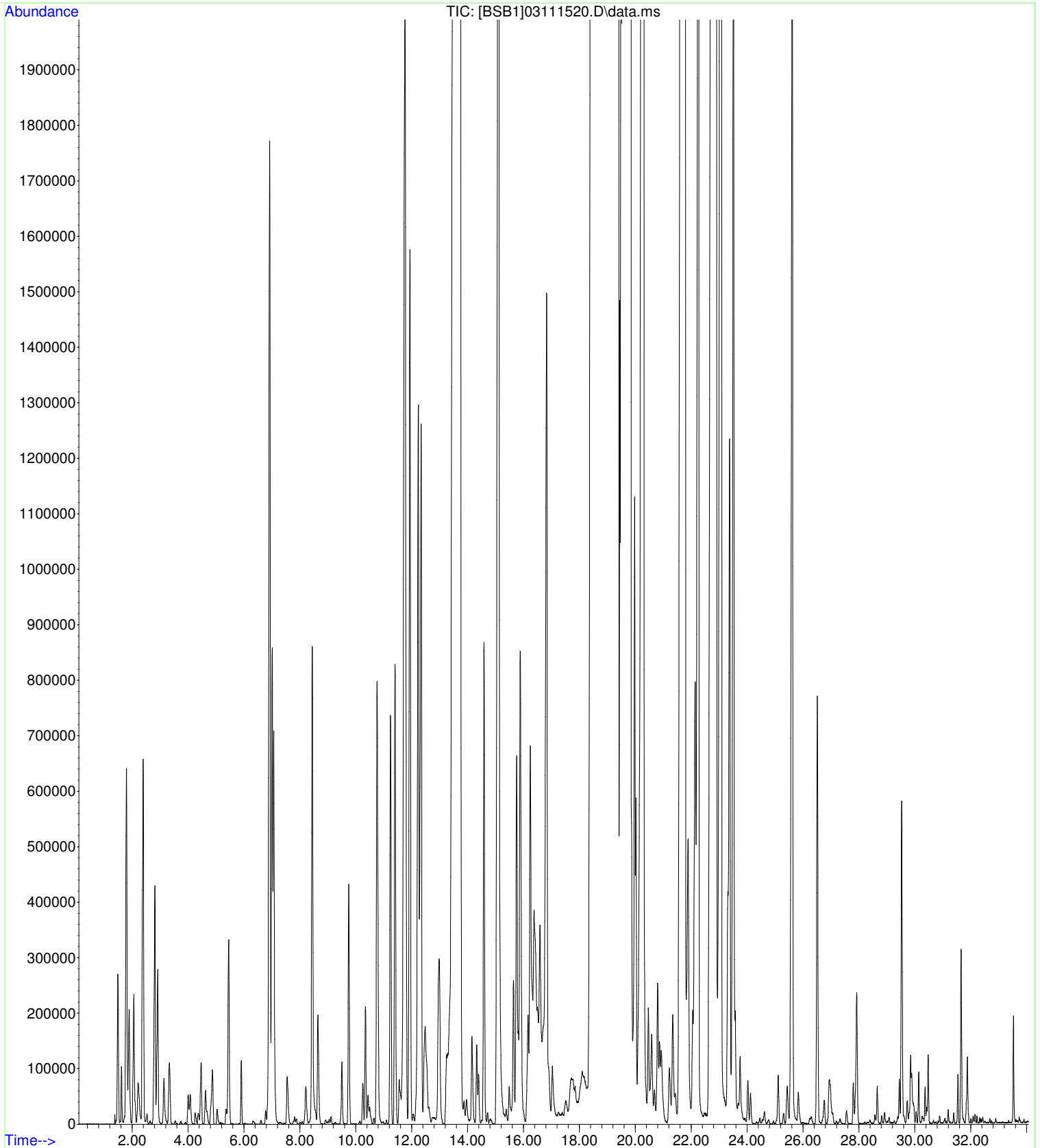
CAS Number	Hit Name	Match quality of identification (%)	% Area
000078-84-2	Propanal, 2-methyl-	86	2
000590-86-3	Butanal, 3-methyl-	97	5
000096-17-3	Butanal, 2-methyl-	91	4
000110-62-3	Pentanal	83	3
000066-25-1	Hexanal	91	16
007452-79-1	Butanoic acid, 2-methyl-, ethyl ester	93	1
000111-71-7	Heptanal	90	1
000110-93-0	6-Methyl-5-hepten-2-one	96	4
005989-27-5	D-Limonene	99	5
000470-82-6	1,8-Cineole	99	3
998239-46-3	Unknown	72	5
000586-62-9	alpha-terpinolene	91	2
000124-19-6	Nonanal	91	4
000089-80-5	Cyclohexanone, 5-methyl-2-(1-methylethyl)-, trans-	98	10
014073-97-3	l-Menthone	98	2
001490-04-6	Cyclohexanol, 5-methyl-2-(1-methylethyl)-	91	2
000140-67-0	Estragole	98	6
000112-31-2	Decanal	91	1
002244-16-8	D-Carvone	97	0
000104-46-1	Anethole	98	9
000502-60-3	trans-.beta.-Farnesene	97	7
122211-49-8	Unknown	49	1
058985-73-2	Bisabolone oxide	87	6
063321-70-0	Octanoic acid, 2-ethylhexyl ester \$\$ 2-Ethylhexyl octanoate #	91	2

Sample Name :Cool Mint Organic A0204

CAS Number	Hit Name	Match quality of identification (%)	% Area
000078-84-2	Propanal, 2-methyl-	90	0
000115-18-4	3-Buten-2-ol, 2-methyl-	91	0
000590-86-3	Butanal, 3-methyl-	95	0
000096-17-3	Butanal, 2-methyl-	91	0
000066-25-1	Hexanal	90	0
007452-79-1	Butanoic acid, 2-methyl-, ethyl ester	91	1
006728-26-3	2-Hexenal, (E)-	98	1
000108-64-5	butanoic acid, 3-methyl-, ethyl ester	94	0
041239-48-9	Furan, 2,5-diethyltetrahydro-	91	0
007785-26-4	(1S)-2,6,6-Trimethylbicyclo[3.1.1]hept-2-ene	97	0
003387-41-5	Sabinene	96	0
000127-91-3	2-.beta.-pinene	97	1
000110-93-0	6-methyl-5-hepten-2-one	95	0
000123-35-3	beta.-Myrcene	96	1
000589-98-0	3-Octanol	90	1
000589-98-0	3-Octanol	90	1
	Unknown	66	0
000099-86-5	alpha. Terpinene	98	0
000527-84-4	o-Cymene	97	0
005989-27-5	D-Limonene	99	0
000138-86-3	dl-Limonene	95	2
000470-82-6	1,8-Cineole	99	11
000099-85-4	gamma.-Terpinene	97	1
015826-82-1	cis-Sabinenehydrate	93	3
000586-62-9	alpha.-Terpinolene	98	0
000546-80-5	.alpha.-Thujone	95	0
	Unknown	46	1
000078-70-6	linalool L	96	1
	Unknown	49	1
000078-70-6	linalool L	97	2
000089-80-5	Cyclohexanone, 5-methyl-2-(1-methylethyl)-, trans-	98	13
014073-97-3	l-Menthone	98	2
000491-01-0	neo-Menthol	98	5
000507-70-0	endo-Borneol	93	0
029606-79-9	Isopulegone	98	1
015356-70-4	DL-Menthol	91	4
000491-02-1	Neoisomenthol	91	1
000119-36-8	Methyl salicylate	97	0
000140-67-0	Estragole	98	11
	Unknown	38	0
000104-55-2	2-Propenal, 3-phenyl-	97	0
000106-22-9	.beta.-Citronellol	98	0
000529-00-0	Cyclohexanone, 5-methyl-2-(1-methylethenyl)-	80	2
000106-26-3	2,6-Octadienal, 3,7-dimethyl-, (Z)-	93	0
002244-16-8	2-Cyclohexen-1-one, 2-methyl-5-(1-methylethenyl)-, (S)-	97	0
000106-24-1	Geraniol	94	1
000089-81-6	2-Cyclohexen-1-one, 3-methyl-6-(1-methylethyl)-	97	3
005392-40-5	Citral	96	17
000104-55-2	2-Propenal, 3-phenyl-	98	5
000104-46-1	Anethole	98	1
016409-45-3	Cyclohexanol, 5-methyl-2-(1-methylethyl)-, acetate	91	2
000097-53-0	Eugenol	98	2
000105-87-3	Geranyl acetate	91	0
000087-44-5	Caryophyllene	99	0

000644-30-4	Benzene, 1-(1,5-dimethyl-4-hexenyl)-4-methyl-	99	0
001139-30-6	Caryophyllene oxide	90	0
022567-17-5	7-Isopropenyl-1,4-dimethyl-1,2,3,3a,4,5,6,7-octahydroazulene	97	0
063321-70-0	2-Ethylhexyl octanoate	90	0

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Instrument : GC-O-MS
Sample Name: Cool Mint Organic A0204
Misc Info :
Vial Number: 1

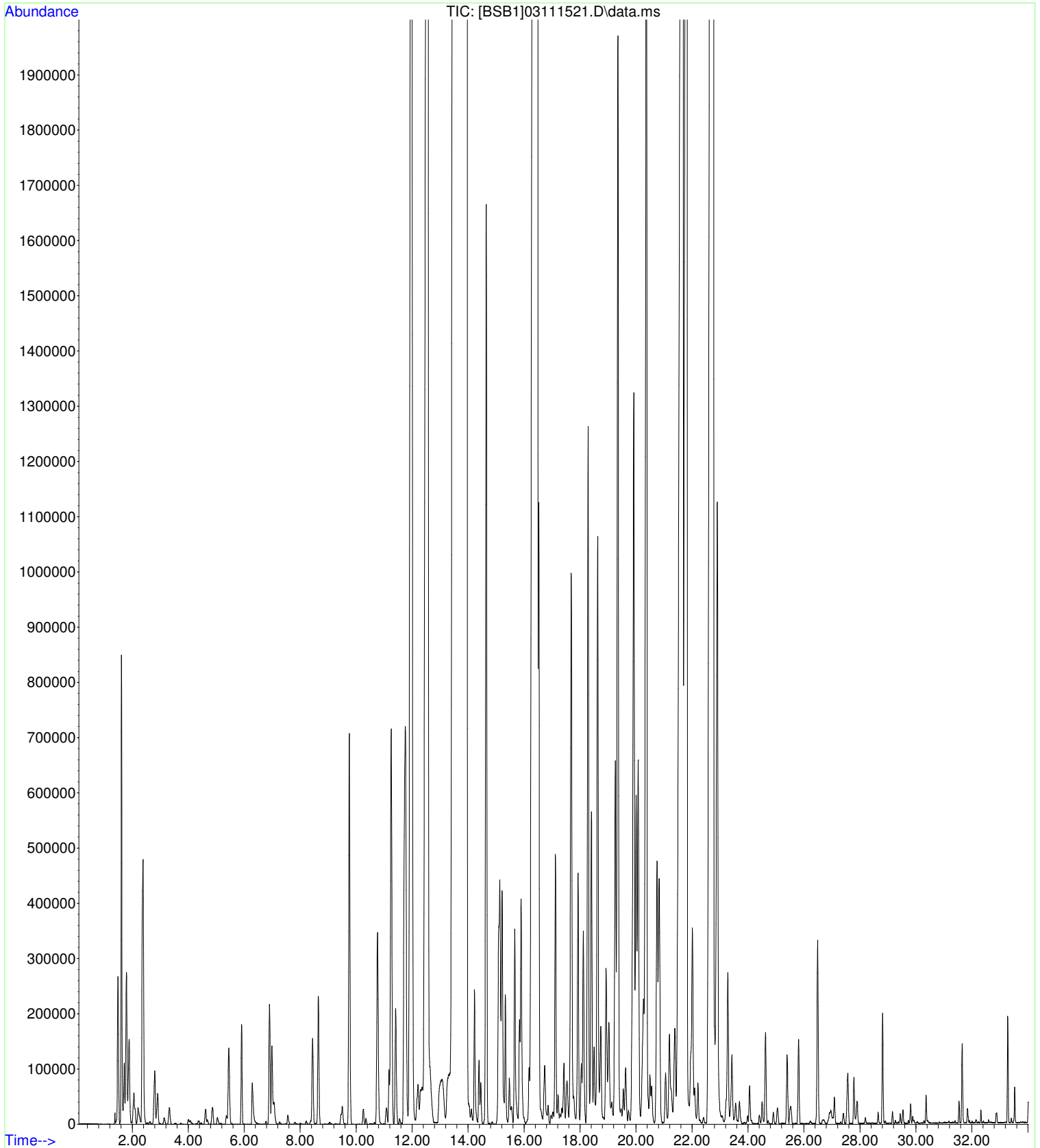


Sample Name :Dona Camomille OrganicA0134

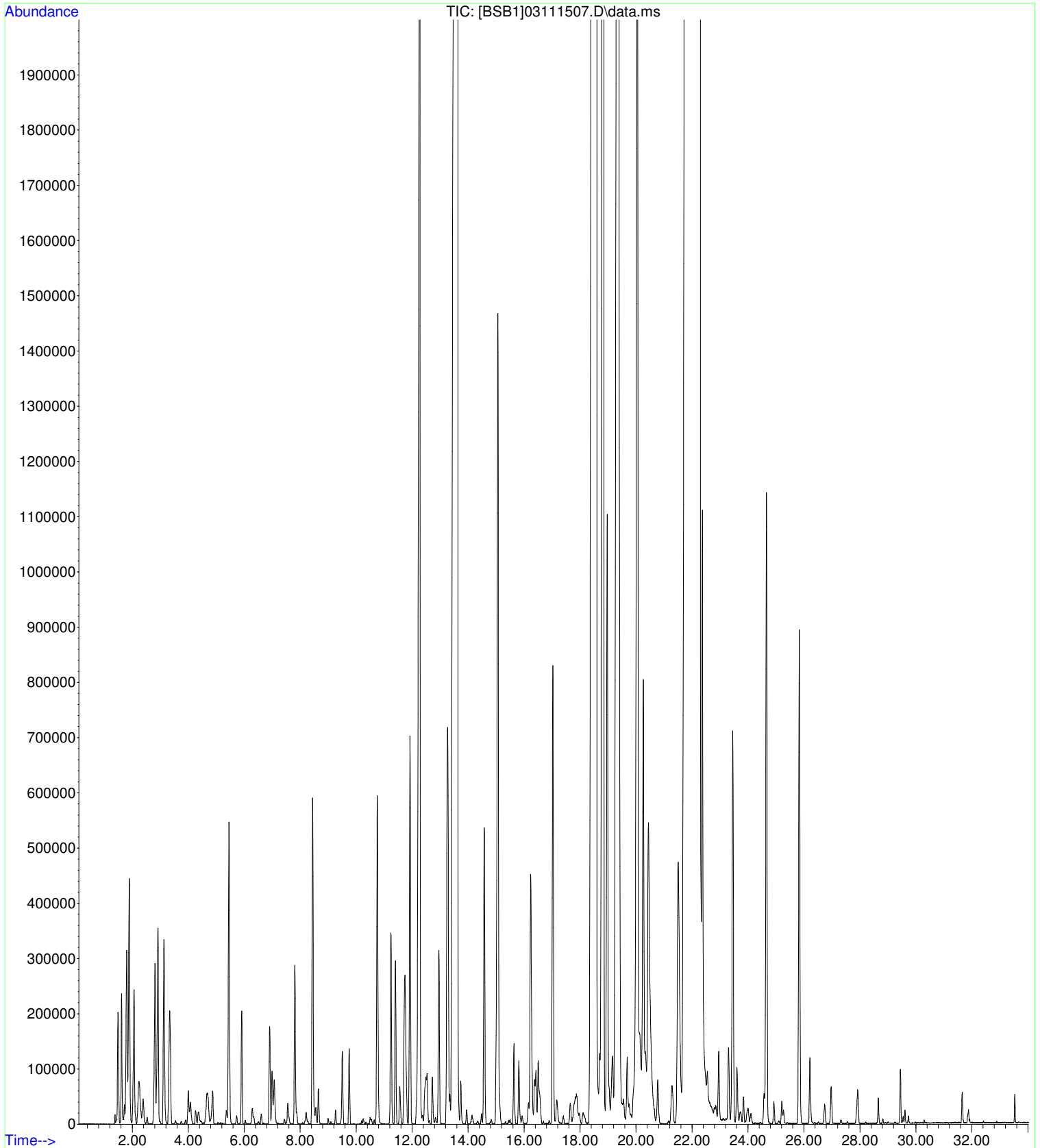
CAS Number	Hit Name	Match quality of identification (%)	%
	Unknown	64	0
000590-86-3	Butanal, 3-methyl-	91	0
000066-25-1	Hexanal	90	0
000098-01-1	2-Furancarboxaldehyde	91	0
007452-79-1	Butanoic acid, 2-methyl-, ethyl ester	94	0
006728-26-3	2-Hexenal, (E)-	98	0
041239-48-9	Furan, 2,5-diethyltetrahydro-	91	0
000111-71-7	Heptanal	91	0
000080-56-8	alpha.-Pinene	96	3
053535-33-4	Heptanol	90	0
003387-41-5	Sabinene	96	0
000127-91-3	2-beta.-Pinene	95	0
000110-93-0	6-Methyl-5-hepten-2-one	96	1
000123-35-3	beta.-Myrcene	96	2
	Unknown	72	0
000124-13-0	Octanal	98	3
000099-86-5	Alpha. terpinene	98	1
000138-86-3	dl-Limonene	99	54
003779-61-1	1,3,6-Octatriene, 3,7-dimethyl-, (E)-	98	0
	Unknown	59	0
000099-85-4	gamma.-Terpinene	96	1
015826-82-1	cis-Sabinenehydrate	93	0
000111-87-5	1-Octanol	91	0
000111-87-5	1-Octanol	91	0
005989-27-5	D-Limonene	99	0
057590-19-9	3,3,6-Trimethyl-1,5-heptadien-4-ol	83	0
000586-62-9	alpha-Terpinolene	98	0
001195-32-0	Benzene, 1-methyl-4-(1-methylethenyl)-	96	0
	Unknown	38	0
000078-70-6	Linalool L	97	10
000124-19-6	Nonanal	91	0
998041-98-1	3-Ethylidene-1-methyl-1,4-cycloheptadiene	94	0
007212-40-0	2-Cyclohexen-1-ol, 1-methyl-4-(1-methylethenyl)-, trans-	98	0
006090-09-1	4-Acetyl-1-methylcyclohexene	98	0
	Unknown	68	0
001195-92-2	Limonene oxide	86	0
	Unknown	53	0
055253-27-5	trans/trans-Photocitral	87	0
000106-23-0	Citronella	98	0
000089-80-5	Cyclohexanone, 5-methyl-2-(1-methylethyl)-, trans-	98	0
998076-90-1	(+)-Neo-isopulegol	98	0
	Unknown	49	0
014073-97-3	l-Menthone	98	0
092356-06-4	2-(2',3'-Epoxy-3'-methylbutyl)-3-methylfuran	91	0
	Unknown	55	0
002216-51-5	L-(-)-Menthol	81	0
	Unknown	60	1
000098-55-5	Alpha. Terpineol	91	1
005948-04-9	Cyclohexanone, 2-methyl-5-(1-methylethenyl)-, trans-	99	0
018675-33-7	Cyclohexanol, 2-methyl-5-(1-methylethenyl)-, (1.alpha.,2.alpha.	86	0
	Unknown	76	0
000112-31-2	Decanal	91	1
000138-86-3	dl-Limonene	81	0
001197-06-4	2-Cyclohexen-1-ol, 2-methyl-5-(1-methylethenyl)-, cis-	83	0

035719-26-7	Unknown	64	0
000106-22-9	.beta.-Citronellol	98	0
001197-06-4	cis-Carveol	91	0
000106-26-3	Z-Citral	97	5
000099-49-0	2-Cyclohexen-1-one, 2-methyl-5-(1-methylethynyl)-	97	2
	Unknown	72	0
000106-24-1	Geraniol	94	0
000141-27-5	2,6-Octadienal, 3,7-dimethyl-, (E)-	97	6
002111-75-3	1-Cyclohexene-1-carboxaldehyde, 4-(1-methylethenyl)-	98	1
000104-46-1	Anethole	98	0
	Unknown	53	0
000112-44-7	Undecanal	91	0
020777-49-5	Dihydrocarvyl acetate	91	0
000554-61-0	(+)-2-Carene	94	0
	Unknown	68	1
000105-87-3	2,6-Octadien-1-ol, 3,7-dimethyl-, acetate	91	1
	Unknown	76	1
000494-90-6	Benzofuran, 4,5,6,7-tetrahydro-3,6-dimethyl-	83	0
000502-60-3	trans-.beta.-Farnesene	96	0
	Unknown	78	0
058985-73-2	Bisabolone oxide	91	0

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Instrument : GC-O-MS
Sample Name: Dona Camomille Organica0134
Misc Info :
Vial Number: 2



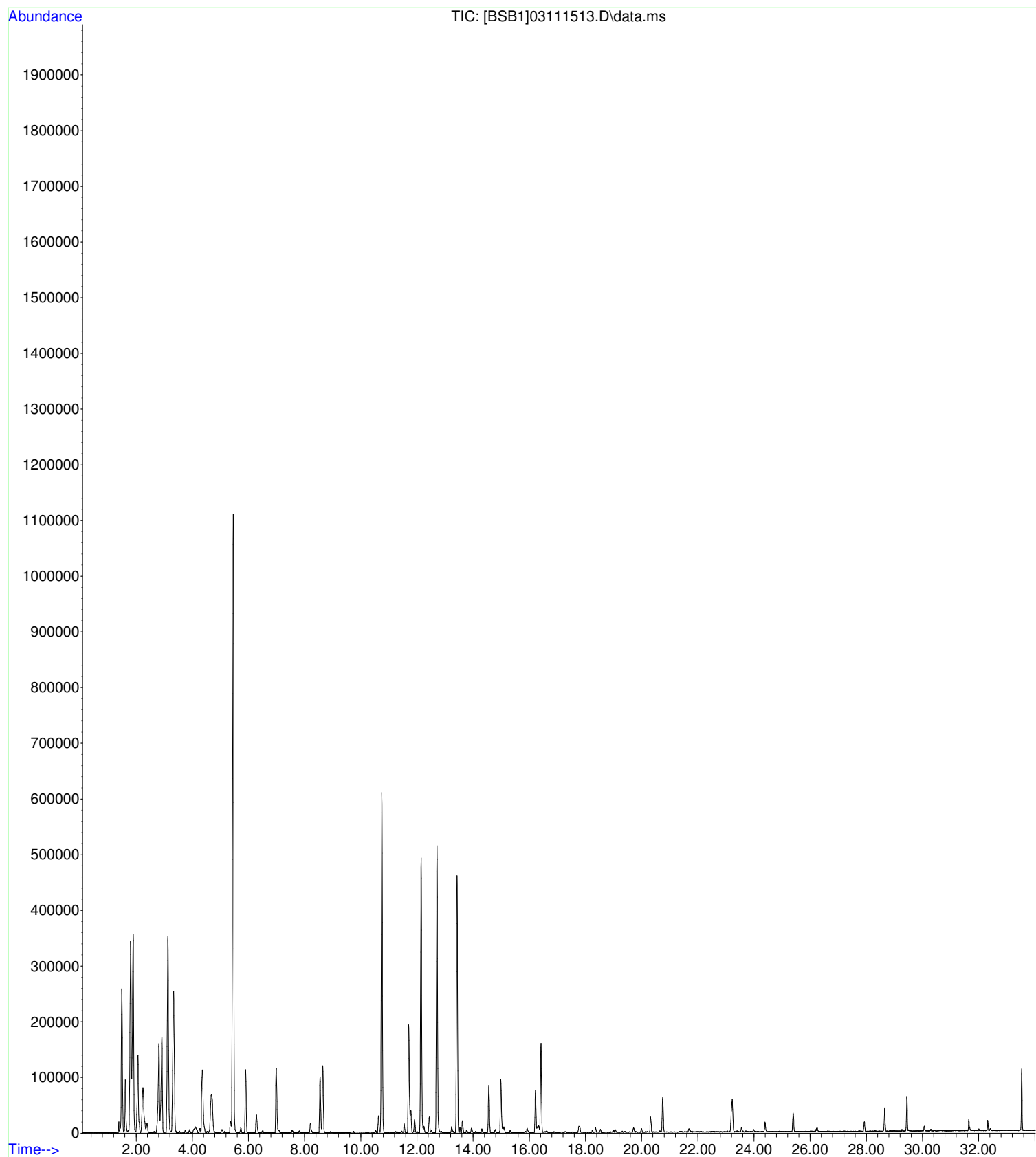
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Instrument : GC-O-MS
Sample Name: Green Refreshment Organic , A0147
Misc Info :
Vial Number: 6



Sample Name :Green Refreshment Organic , A0147

CAS Number	Hit Name	Match quality of identification (%)	% Area
000078-84-2	Propanal, 2-methyl-	91	0
000590-86-3	Butanal, 3-methyl-	95	0
000096-17-3	Butanal, 2-methyl-	91	1
000616-25-1	1-Penten-3-ol	86	1
	Unknown	46	0
000066-25-1	Hexanal	96	0
000123-92-2	1-Butanol, 3-methyl-, acetate	90	0
041239-48-9	Furan, 2,5-diethyltetrahydro-	91	0
002867-05-2	.alpha.-Thujene	93	0
000080-56-8	alpha-Pinene	97	0
003387-41-5	Sabinene	96	1
000127-91-3	2-beta-Pinene	97	0
	Unknown	64	1
000123-35-3	beta.-Myrcene	96	1
000589-98-0	3-Octanol	90	5
000099-86-5	alpha-Terpinene	98	0
000527-84-4	o-Cymene	97	0
005989-27-5	D-Limonene	99	1
000470-82-6	1,8-Cineole	98	2
000099-85-4	.gamma.-Terpinene	97	1
	Bicyclo[3.1.0]hexan-2-ol, 2-methyl-5-(1-methylethyl)-, (1.alpha.,2.alpha.,5.alpha)	94	3
017699-16-0		94	3
000586-62-9	alpha-Terpinolene	98	0
000586-62-9	alpha-Terpinolene	95	0
	Unknown	72	1
014073-97-3	5-methyl-2-(1-methylethyl)-cyclohexanone (isomer)	98	48
014073-97-3	5-methyl-2-(1-methylethyl)-cyclohexanone (isomer)	98	1
000491-01-0	neo-Menthol	98	2
002216-51-5	Levomenthol	91	2
005948-04-9	Dihydrocarvone	99	1
	Unknown	76	0
005948-04-9	Cyclohexanone, 2-methyl-5-(1-methylethenyl)-, trans-	98	2
070201-92-2	1-(O-dimethylaminophenyl)ethylidene	90	2
015932-80-6	Cyclohexanone, 5-methyl-2-(1-methylethylidene)-	98	1
006485-40-1	2-Cyclohexen-1-one, 2-methyl-5-(1-methylethenyl)-, (R)-	97	18
000089-81-6	2-Cyclohexen-1-one, 3-methyl-6-(1-methylethyl)-	97	0
	Unknown	72	0
000104-46-1	Anethole	98	0
000554-59-6	Bicyclo[4.1.0]heptane, 3,7,7-trimethyl-	94	1
020777-49-5	Dihydrocarvyl acetate	99	0
001134-95-8	trans-Carveyl acetate	95	1
006628-06-4	2-Allyl-4-methylphenol	90	0
000488-10-8	Jasmone	98	0
000079-92-5	Camphene	93	0
014901-07-6	beta.-Ionone	96	0

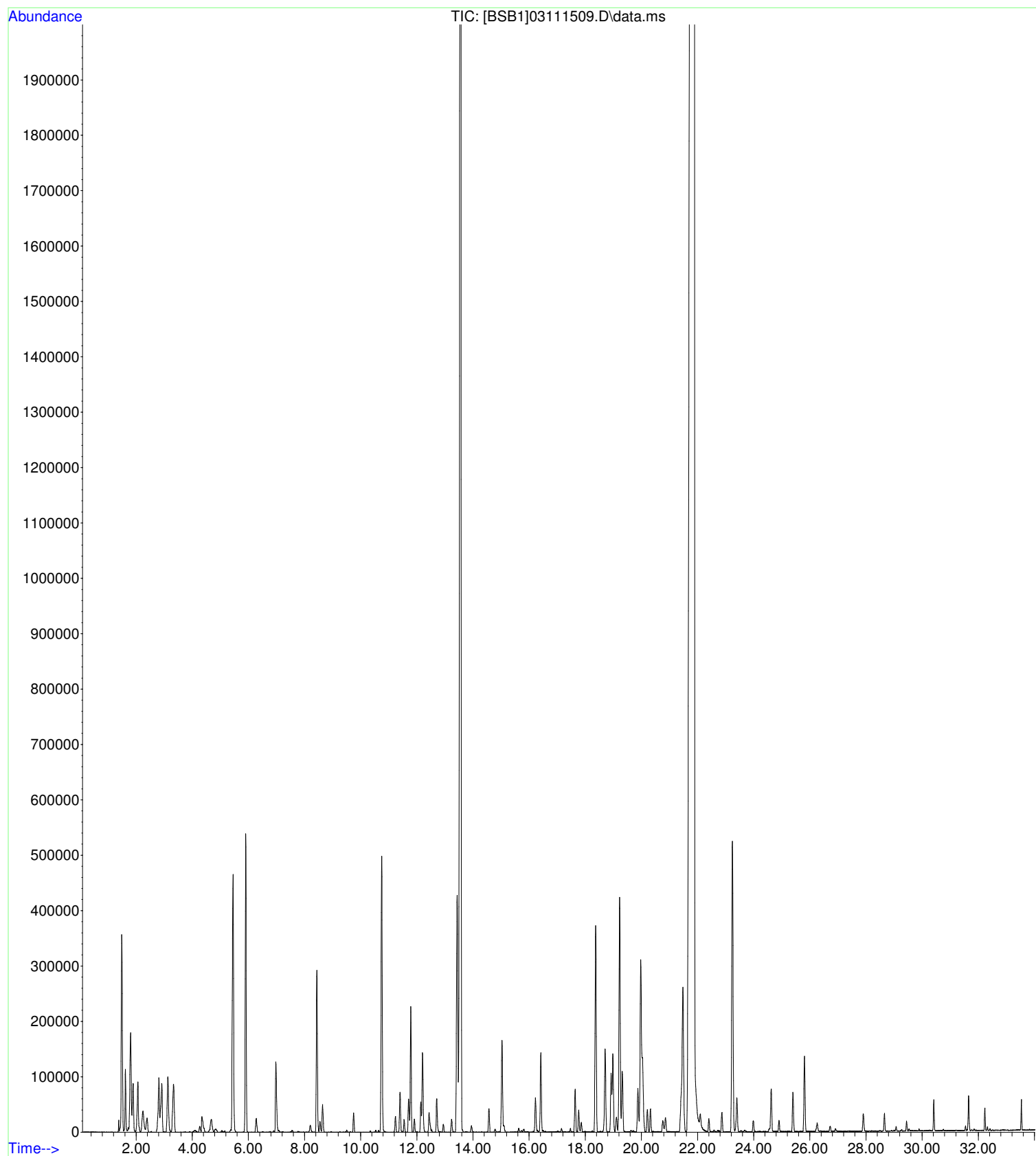
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Instrument : GC-O-MS
Sample Name: Japanese Green Tea Organic
Misc Info : Rette oan
Vial Number: 5



Sample Name :Japanese Green Tea Organic

CAS Number	Hit Name	Match quality of identification (%)	% Area
000590-86-3	Butanal, 3-methyl-	95	4
000096-17-3	Butanal, 2-methyl-	91	4
	Unkown	58	9
000110-62-3	Pentanal	87	8
000107-86-8	2-Butenal, 3-methyl-	87	3
	Unkown	60	3
000066-25-1	Hexanal	96	26
006728-26-3	2-Hexenal, (E)-	98	3
006728-31-0	4-Heptenal, (Z)-	91	2
000111-71-7	Heptanal	91	3
004313-03-5	2,4-Heptadienal, (E,E)-	95	1
004313-03-5	2,4-Heptadienal, (E,E)-	94	11
000138-86-3	dl-Limonene	99	10
	Unkown	47	2
030086-02-3	3,5-Octadien-2-one, (E,E)-	87	2
000078-70-6	Linalool	90	1
000124-19-6	Nonanal	91	3
000432-25-7	.beta.-Cyclocitral	94	1
000104-46-1	Benzene, 1-methoxy-4-(1-propenyl)-	97	2
000079-77-6	trans-.beta.-Ionone	98	1
063321-70-0	Octanoic acid, 2-ethylhexyl ester	91	1

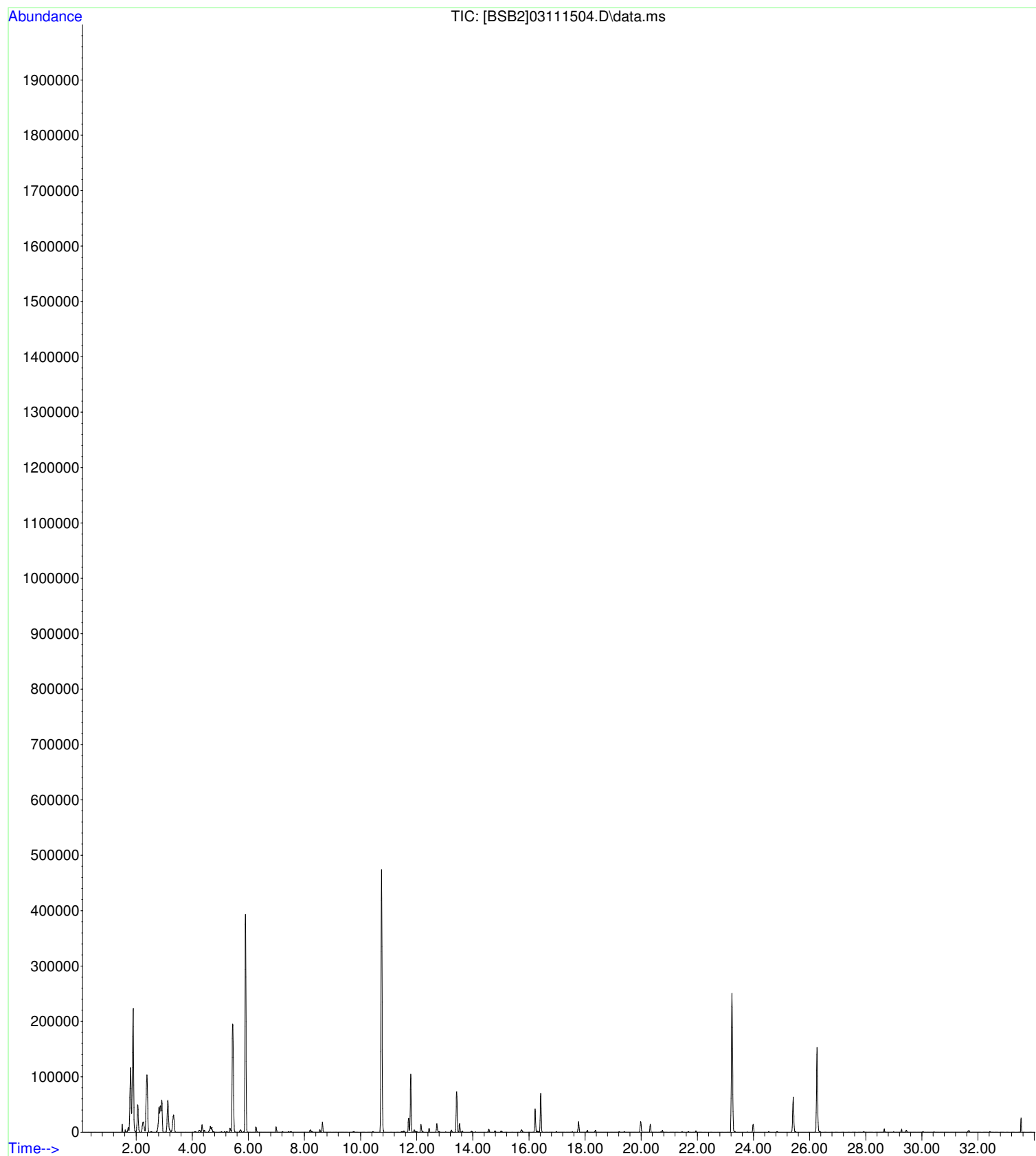
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Instrument : GC-O-MS
Sample Name: Pukka Coll Mint Green, A0205
Misc Info : Pukka Coll Mint Green, A0205
Vial Number: 1



Sample Name :Pukka Coll Mint Green, A0205

CAS Number	Hit Name	Match quality of identification (%)	% Area
000078-84-2	iso-Butyraldehyde	87	0
	Unknown	58	1
000066-25-1	Hexanal	96	5
006728-26-3	2-Hexenal, (E)-	98	1
041239-48-9	Furan, 2,5-diethyltetrahydro-	91	3
005989-27-5	D-Limonene	99	5
000470-82-6	1,8-Cineole	99	41
000099-85-4	1-methyl-4-(1-methylethyl) 1,4-cyclohexadiene	96	2
010458-14-7	l-Menthone	98	4
014073-97-3	l-Menthone	98	2
	Unknown	46	1
000464-45-9	Borneol L	90	2
001490-04-6	Cyclohexanol, 5-methyl-2-(1-methylethyl)-	91	4
000562-74-3	3-Cyclohexen-1-ol, 4-methyl-1-(1-methylethyl)-	96	1
005948-04-9	Dihydrocarvone	99	0
015932-80-6	Cyclohexanone, 5-methyl-2-(1-methylethylidene)-	98	4
002244-16-8	2-Cyclohexen-1-one, 2-methyl-5-(1-methylethenyl)-, (S)-	97	22
000104-46-1	Anethole	98	1
001134-95-8	trans-Carveyl acetate	94	1

File :L:\GCMS\Coffeebrewer\20151103\BSB\03111504.D
Operator : [BSB2]
Acquired : 3 Nov 2015 19:59 using AcqMethod ATD-INLET-SNIFF-TE_AROMAER-291015.M
Instrument : GC-O-MS
Sample Name: Pukka Supreame Matcha Green, A0116
Misc Info :
Vial Number: 4



Sample Name :Pukka Supreame Matcha Green, A0116

CAS Number	Hit Name	Match quality of identification (%)	%
	Unknown	58	4
	Unknown	68	11
	Unknown	33	4
	Unknown	38	4
000096-17-3	Butanal, 2-methyl-	90	5
	Unknown	59	6
000066-25-1	Hexanal	86	19
000138-86-3	dl-Limonene	98	5
000124-19-6	Nonanal	90	5
000104-46-1	Anethole	98	23
074367-34-3	Propanoic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester	83	13