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| **Analytical Report** | |
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| Title | **Bergamot Calabrian** Essential Oil Profile by GC-MS |
| Report No. | SE-37270-3 |
| Issue Date | August 31, 2015 |
| Notebook reference | III-29-75 |
| Contributors: | |
| Quote No. | |
| Requester | World Naturals LLC |

**Primary Aim**

To identify GC amendable volatile organic compounds present in submitted **Bergamot Calabrian** essential oil sample.

## Samples

The sample arrived as clear liquid with characteristic odor labeled as "Bergamot Calabrian lot 11009-a44".

## Experimental:

1. Oil was dissolved in methanol to concentration of ~0.1%, 1 ul injected into the GC injector port.

2. GC conditions:

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|---|---|
| Injector temperature: | 250 C |
| Initial oven temperature: | 80 C |
| Ramp | 10 C/min |
| Final temperature | 220 C |
| Final temperature hold | 5 min |

3. MS parameters

| | |
|---|---|
| Ionization and ion polarity | EI+ |
| Scan rate | 2 scans/sec |
| Mass range | 35-350 Da |
| Ion source temperature | 150C |
| Transfer line temperature | 280C |

4. GC-MS analysis. Waters/Micromass Quatro GC mass spectrometer interfaced to a ThermoElectron Trace gas chromatograph was utilized for the analysis. 30m 0.25 mm ID DB-5 column was used to separate components. Carrier gas was helium at 1.1 ml/min with split ratio of 50.

5. Data treatment.
For each sample, a set of target components was identified with the aid of the AMDIS software[1].The components were identified using the NIST mass spectral library[2].

## Deliverables

1. GC-MS chromatogram. GC-MS chromatogram is shown in Appendix I.

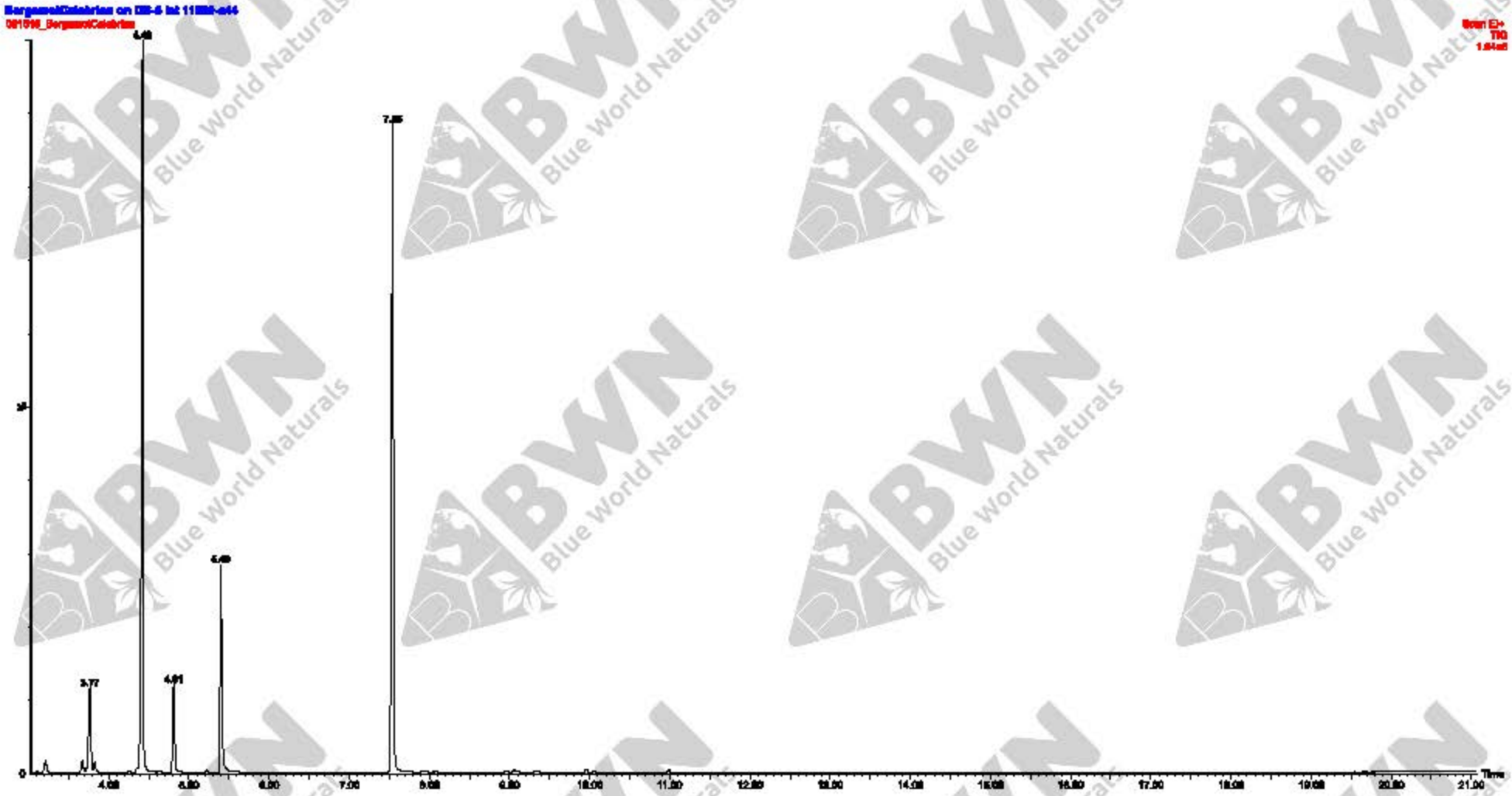
2. Appendix II lists library search results.

- RT Retention Time, time in minutes at which the compound elutes out of column
- CAS. CAS registry number or EPA number.
- Name. IUPAC or common name of identified compound.
- Area. Peak area of a component in %% to total ion count

1 http://chemdata.nist.gov/mass-spc/amdis/
2 http://www.nist.gov/srd/nistla.cfm

# APPENDIX I
## Bergamot Calabrian
## GC-MS Chromatogram

# Sample “Bergamot Calabrian”



# APPENDIX II
# Bergamot Calabrian
# Identified Compounds

Bergamot Calabrian

| CAS | Name | R.T. | Area |
|---|---|---|---|
| 80-56-8 | alpha-pinene | 3.082 | 0.1 |
| 2437958 | Bicyclo[3.1.1]hept-2-ene, 2,6,6-trimethyl-, (±)- | 3.19 | 0.8 |
| 3387415 | Bicyclo[3.1.0]hexane, 4-methylene-1-(1-methylethyl)- | 3.651 | 0.7 |
| 127913 | ß-Pinene | 3.742 | 5.9 |
| 123353 | ß-Myrcene | 3.803 | 0.6 |
| 99865 | 1,3-Cyclohexadiene, 1-methyl-4-(1-methylethyl)- | 4.229 | 0.1 |
| 527844 | Benzene, 1-methyl-2-(1-methylethyl)- | 4.335 | 0.2 |
| 138863 | Limonene | 4.399 | 36.0 |
| 99854 | 1,4-Cyclohexadiene, 1-methyl-4-(1-methylethyl)- | 4.789 | 5.3 |
| 586629 | Cyclohexene, 1-methyl-4-(1-methylethylidene)- | 5.201 | 0.1 |
| 78706 | 1,6-Octadien-3-ol, 3,7-dimethyl- | 5.38 | 11.3 |
| 5986389 | 5,7-Octadien-2-ol, 2,6-dimethyl- | 6.888 | 0.0 |
| 115-95-7 | Bergamiol | 7.521 | 37.7 |
| 691383 | 2-Pentene, 4-methyl-, (Z)- | 7.903 | 0.0 |
| 598038 | Propane, 1,1'-sulfonylbis- | 8.06 | 0.0 |
| 54845306 | Cyclohexanol, 2-methylene-3-(1-methylethyl)-, acetate, cis- | 8.06 | 0.0 |
| 20777495 | Cyclohexanol, 2-methyl-5-(1-methylethenyl)-, acetate, (1α,2ß,5α)- | 8.929 | 0.1 |
| 141128 | 2,6-Octadien-1-ol, 3,7-dimethyl-, acetate, (Z)- | 9.04 | 0.2 |
| 141128 | 2,6-Octadien-1-ol, 3,7-dimethyl-, acetate, (Z)- | 9.307 | 0.2 |
| 118650 | Bicyclo[7.2.0]undec-4-ene, 4,11,11-trimethyl-8-methylene-,[1R-(1R*,4Z,9S*)]- | 9.936 | 0.2 |
| 26560145 | 1,3,6,10-Dodecatetraene, 3,7,11-trimethyl-, (Z,E)- | 10.041 | 0.1 |
| 495614 | Cyclohexene, 1-methyl-4-(5-methyl-1-methylene-4-hexenyl)-, (S)- | 10.969 | 0.2 |