

True Honey Buzz

A Division of Authentic Food Solution Ltd.

10609 McGrath Rd

Rosedale, BC

VOX 1X2



Analysis Report Honey-Profiling

Customer Name: Peter Armitage

Customer Company (If Applicable): Four Cousins Honey

Customer Sample ID: BC HP 148

Customer Contact (Phone and Email): Armitage_peter@bellaliant.net

Sample Declaration

Method of Analysis: NMR

Assigned Sample ID: 1237

Type of Sample : Honey

Type of Honey: Undefined

Botanical Variety: Blossom

Geographical Origin: Newfoundland, Canada

Moisture Content: 15.2%

Sample date received: 2020-09-18

Sample date processed: 2020-09-22

Sample report generated: 2020-09-23

Results are dependent on the Sample as received and using data provided by customer. The data analysis is performed at Bruker BioSpin GmbH (Rheinstetten, Germany) according to testing method AA-72-03-02 (DIN EN ISO/IEC 17025:2018 Accreditation Certificate D-PL-19229-01-00).

All results solely refer to the tested sample as provided by the customer.

This report consists of 10 Pages.

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Approved by Cheyanne Schwab
Lab Director

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Analysis Report Honey-Profiling™

Sample ID: 1237-2020-09-22

Information/Declaration provided by customer:

Customer: **Peter Armitage**
 Customer Sample ID: 2020
 Type of Sample: Honey
 Type of Honey: Blossom
 Botanical Variety: undefined
 Geographical Origin: Canada
 Information: Not from BC but had an old BC label

Disclaimer: this information will affect the applicability and validity of analyses and results.

Measuring Date: 23-Sep-2020 13:16:57
 Reporting Date: 01-Oct-2020 23:24:54, 9 pages, Version 2.0.5

Results Summary

| Type of Analysis | Result | Status |
|--|------------------------|--------|
| Detection of Sugar Syrups | No | ● |
| Codex Alimentarius and EU-Directive 2001/110/EC | Compliant | ● |
| Quantitative Analysis | Typical concentrations | ● |
| Non-Targeted Analysis | | |
| Univariate Verification | Consistent | ● |
| Multivariate Verification | Consistent | ● |

The data analysis is performed at Bruker BioSpin GmbH (Rheinstetten, Germany) according to testing method AA-72-03-05 (Honey-Profiling 2.0.5), released on 18-Sep-2020 (DIN EN ISO/IEC 17025:2005 Accreditation Certificate D-PL-19229-01-00). All results solely refer to the tested sample as provided by the customer.

Detection of Sugar Syrups

(Analysis-ID: HO-2000-02/0167)

Following tests have been applied in order to detect sugar syrups:

| Nr | Type | Description | Result | Value | Limit | Out |
|----|-----------------|-------------------------------|--------|-----------|-----------------|-----|
| 1 | Intensity/Ratio | 3.263 (absolute quantitative) | passed | 721 | <1279 | - |
| 2 | Intensity/Ratio | 5.077 (absolute quantitative) | passed | 155 | >39 | - |
| 3 | Intensity/Ratio | 3.636 (absolute quantitative) | passed | 3014 | <4674 | - |
| 4 | Intensity/Ratio | 4.262 (absolute quantitative) | passed | 166 | >29 | - |
| 5 | Intensity/Ratio | 4.195 (absolute quantitative) | passed | 262 | <1200 | - |
| 6 | Intensity/Ratio | 5.271 (absolute quantitative) | passed | 32.9 | >5.6 | - |
| 7 | Intensity/Ratio | 4.280 (absolute quantitative) | passed | 136 | >20 | - |
| 8 | Intensity/Ratio | 5.113/(3.270-3.310) | passed | 0.004 | <0.036 | - |
| 9 | Intensity/Ratio | 4.496/(3.270-3.310) | passed | 0.028 | >0.012 | - |
| 10 | Intensity/Ratio | 5.334/(5.270-5.300) | passed | 0.06 | <0.13 | - |
| 11 | Intensity/Ratio | 3.546/(5.270-5.300) | passed | 1.26 | >0.62 | - |
| 12 | Intensity/Ratio | 3.740/(5.270-5.300) | passed | 2.3 | >1.2 | - |
| 13 | Intensity/Ratio | 3.857/(5.200-5.260) | passed | 0.0177 | >0.0037 | - |
| 14 | Intensity/Ratio | 4.150 (absolute quantitative) | passed | 250 | >115 | - |
| 15 | Intensity/Ratio | 5.181 (absolute quantitative) | passed | 65 | >24 | - |
| 16 | Intensity/Ratio | 4.055/(5.030-5.070) | passed | 4 | <46 | - |
| 17 | Intensity/Ratio | 1.809/(5.030-5.070) | passed | 0.1 | <1.0 | - |
| 18 | Intensity/Ratio | 3.708/(5.030-5.070) | passed | 259 | <872 | - |
| 19 | Intensity/Ratio | 6.765/(5.250-5.270) | passed | 0.009 | <0.046 | - |
| 20 | Intensity/Ratio | 2.200/(5.305-5.315) | passed | 0.106 | >0.019 | - |
| 21 | Intensity/Ratio | 3.326/(3.270-3.310) | passed | 0.139 | >0.034 | - |
| 22 | Intensity/Ratio | 4.037/(3.270-3.310) | passed | 1.61 | >0.73 | - |
| 23 | Intensity/Ratio | 4.006/(5.270-5.300) | passed | 1.03 | >0.70 | - |
| 24 | Intensity/Ratio | 3.564/(5.270-5.300) | passed | 16.4 | >10.0 | - |
| 25 | Intensity/Ratio | 5.388/(5.370-5.400) | passed | 0.23 | >0.13 | - |
| 26 | Intensity/Ratio | 3.524/(4.075-4.110) | passed | 0.060 | <0.070 | - |
| 27 | Intensity/Ratio | 3.182/(4.075-4.110) | passed | 0.0018 | <0.0045 | - |
| 28 | Intensity/Ratio | 3.785/(4.075-4.110) | passed | 0.098 | >0.036 | - |
| 29 | Intensity/Ratio | 3.857/(4.075-4.110) | passed | 0.0100 | >0.0021 | - |
| 30 | Intensity/Ratio | 4.267/(4.970-4.990) | passed | 0.6 | <4.7 | - |
| 31 | Intensity/Ratio | 4.276/(4.970-4.990) | passed | 0.1 | <5.4 | - |
| 32 | Intensity/Ratio | 4.204/(5.090-5.110) | passed | 2.5 | <5.7 | - |
| 33 | Intensity/Ratio | 4.249 (absolute quantitative) | passed | 97 | <380 | - |
| 34 | Intensity/Ratio | 4.460/(5.030-5.070) | passed | 0.05 | <0.77 | - |
| 35 | Intensity/Ratio | 3.524/(5.250-5.270) | passed | 32 | <97 | - |
| 36 | Intensity/Ratio | 5.113/(5.250-5.270) | passed | 0.03 | <0.19 | - |
| 37 | Intensity/Ratio | 5.091/(5.090-5.110) | passed | 0.41 | <0.48 | - |
| 49 | Quantification | Fructose/Glucose | passed | 1.31 | >0.85 and <1.95 | - |
| 50 | Quantification | Fructose+Glucose | passed | 71.2 | >40 | - |
| 51 | Quantification | Turanose | passed | 1.96 | >0.3 | - |
| 52 | Quantification | DHA(D) and Mannose(M) | passed | 2 / 0.000 | D<30 or M<0.05 | - |

| Nr | Type | Description | Result | Value | Limit | Out |
|----|----------------|-------------|--------|-------|-------|-----|
| 53 | Quantification | Sucrose | passed | 0.4 | <15 | - |

Result: There are no indications for the presence of sugar syrups.

Codex Alimentarius and EU-Directive 2001/110/EC:

Following parameters are required according to Codex Alimentarius and EU-Directive 2001/110/EC. The concentrations are obtained by direct quantification. Parameters labelled with * are calculated parameters.

| Compound | Value | Unit | LOQ | Official Reference | | |
|-------------------------------|-------|--------|------|--------------------|-----|------|
| | | | | min | max | Flag |
| glucose + fructose * | 71.2 | g/100g | 20.0 | 60 | - | ● |
| sucrose | <LOQ | g/100g | 0.5 | - | 15 | ● |
| 5-hydroxymethylfurfural (HMF) | <LOQ | mg/kg | 5 | - | 80 | ● |

Following flags are used according to Codex Alimentarius and EU-Directive 2001/110/EC:



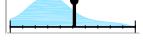







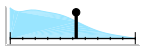

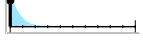

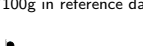








| Compound | Flag | Concentration | Declaration | Interpretation |
|--------------------|------|-----------------------------|--|--|
| glucose + fructose | ● | < 45 g/100g | All | Not compliant |
| | | < 60 g/100g | Blossom | Not compliant for blossom honey |
| | ● | ≥ 60 g/100g | All | Compliant |
| | ● | ≥ 45 g/100g | Honeydew | Compliant for honeydew honey |
| sucrose | ● | ≥ 45 g/100g, < 60 g/100g | Unknown | Compliant for honeydew honey and blends of honeydew honey with blossom honey. Not compliant for blossom honey. |
| | ● | > 15 g/100g | All | Not compliant |
| | ● | 10-15 g/100g | Acacia, Eucalyptus | Not compliant for false acacia (<i>Robinia pseudoacacia</i>), and red gum (<i>Eucalyptus camadulensis</i>) |
| sucrose | ● | ≤ 5 g/100g | All | Compliant |
| | | ≤ 10 g/100g | Acacia, Eucalyptus | Compliant for false acacia (<i>Robinia pseudoacacia</i>), and red gum (<i>Eucalyptus camadulensis</i>) |
| | ● | ≤ 15 g/100g | Lavender | Compliant for <i>Lavandula</i> spp. |
| HMF | ● | 5-10 g/100g | All, except Acacia, Eucalyptus, Lavender | If ≤ 15g/100g: compliant for lavender (<i>Lavandula</i> spp.) and borage (<i>Borago officinalis</i>). If ≤ 10g/100g: compliant for false acacia (<i>Robinia pseudoacacia</i>), alfalfa (<i>Medicago sativa</i>), Menzies Banksia (<i>Banksia menziesii</i>), French honeysuckle (<i>Hedysarum</i>), red gum (<i>Eucalyptus camadulensis</i>), leatherwood (<i>Eucryphia lucida</i> , <i>Eucryphia milliganii</i>) and <i>Citrus</i> spp |
| | ● | > 80 mg/kg | All, except Industrial honey | Not compliant, except for baker's honey |
| | ● | ≤ 40 mg/kg | All | Compliant |
| HMF | ● | > 80 mg/kg | Industrial honey | Compliant for baker's honey |
| | ● | 40-80 mg/kg | All | Not compliant, except for baker's honey and honeys of declared origin from regions with tropical climate and blends of these honeys |

Quantitative Analysis






(Analysis-ID: HO-Q/1363)

In the following table the results of the quantitative analysis are given. The concentrations are obtained by direct quantification. Parameters labelled with * are calculated parameters. The reference range is derived from the *Blossom* samples in the Honey-Profiling Database. The reference range bases on 13212 samples.

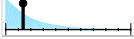



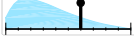



Sugars:

| Compound | Value | Unit | LOQ | Reference Range | Flag |
|----------------------|-------|--------|------|--|---|
| glucose + fructose * | 71.2 | g/100g | 20.0 | 60.9  83.5 |  |
| fructose / glucose * | 1.31 | - | - | 0.93  1.66 |  |
| fructose | 40.3 | g/100g | 10.0 | 33.5  47.6 |  |
| glucose | 30.8 | g/100g | 10.0 | 24.9  40.7 |  |
| sucrose | <LOQ | g/100g | 0.5 | <0.5  5.6 |  |
| turanose | 2.0 | g/100g | 0.2 | 0.4  2.9 |  |
| maltose | 2.2 | g/100g | 0.5 | <0.5  3.8 |  |
| melezitose | <LOQ | g/100g | 1.0 | <1.0  1.7 |  |
| maltotriose | <LOQ | g/100g | 1.0 | <1.0 g/100g in reference dataset |  |
| gentiobiose | <LOQ | g/100g | 0.3 | <0.3  0.4 |  |
| raffinose | 0.4 | g/100g | 0.1 | 0.1  0.6 |  |
| mannose | <LOQ | g/100g | 0.05 | <0.05  0.07 |  |









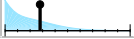

Acids:

| Compound | Value | Unit | LOQ | Reference Range | Flag |
|-------------|-------|-------|-----|--|---|
| citric acid | 243 | mg/kg | 50 | <50  579 |  |
| malic acid | <LOQ | mg/kg | 100 | <100  569 |  |
| quinic acid | <LOQ | mg/kg | 300 | <300 mg/kg in reference dataset |  |






Amino Acids:

| Compound | Value | Unit | LOQ | Reference Range | Flag |
|---------------|-------|-------|-----|---|------|
| alanine | 14 | mg/kg | 5 | <5  73 | ● |
| aspartic acid | <LOQ | mg/kg | 150 | <150  216 | ● |
| glutamine | <LOQ | mg/kg | 200 | <200  293 | ● |
| leucine | <LOQ | mg/kg | 40 | <40  132 | ● |
| proline | 712 | mg/kg | 150 | 192  1059 | ● |
| valine | <LOQ | mg/kg | 10 | <10  51 | ● |
| tyrosine | <LOQ | mg/kg | 50 | <50  841 | ● |
| phenylalanine | 141 | mg/kg | 100 | <100  1483 | ● |

Indicators for Fermentation, Processing and Origin:

| Compound | Value | Unit | LOQ | Reference Range | Flag |
|-------------------------------|-------|-------|-----|---|------|
| 2,3-butanediol | <LOQ | mg/kg | 20 | <20  122 | ● |
| 5-hydroxymethylfurfural (HMF) | <LOQ | mg/kg | 5 | <5  59 | ● |
| acetic acid | 14 | mg/kg | 10 | <10  86 | ● |
| acetoin | <LOQ | mg/kg | 20 | <20  68 | ● |
| ethanol | <LOQ | mg/kg | 5 | <5  295 | ● |
| lactic acid | 11 | mg/kg | 10 | <10  357 | ● |
| formic acid | 22 | mg/kg | 5 | <5  369 | ● |
| fumaric acid | <LOQ | mg/kg | 5 | <5  13 | ● |
| pyruvic acid | 18 | mg/kg | 10 | <10  38 | ● |
| succinic acid | 15 | mg/kg | 5 | <5  214 | ● |

Markers:

| Compound | Value | Unit | LOQ | Reference Range | Flag |
|------------------------|-------|-------|-----|--|------|
| 3-phenyllactic acid | <LOQ | mg/kg | 300 | <300  791 | ● |
| dihydroxyacetone (DHA) | <LOQ | mg/kg | 20 | <20  633 | ● |
| methylglyoxal (MGO) | <LOQ | mg/kg | 30 | <30  309 | ● |
| kynurenic acid | <LOQ | mg/kg | 60 | <60  122 | ● |
| shikimic acid | <LOQ | mg/kg | 80 | <80  261 | ● |

Guidelines for Interpretation

- Mannose is a mono saccharide not typical for honey but that is regularly found in industrial syrups. In rare cases, however, the presence of mannose cannot be excluded for certain geographic and/or botanical origins, e.g. for honey containing also honeydew. For blossom honey, a concentration of mannose exceeding 0.05 g/100g could indicate addition of syrup or types of industrial processing which are not suitable for honey. Expert interpretation is suggested in case the presence of mannose.
- Dihydroxyacetone and/or methylglyoxal are only typical for Manuka honeys from Ozeania. Occurrence exceeding 30 mg/kg in other types of honey is not typical and could indicate addition of syrup or types of industrial processing which are not suitable for honey; expert interpretation is needed in such cases.
- For monofloral Manuka honey, the concentration of 3-phenyllactic acid should exceed 400 mg/kg.
- Low concentration values of proline (less than 180 mg/kg) could indicate addition of syrup or usage of unripe honey.
- Concentration of ethanol exceeding 400 mg/kg indicates fermentation.
- The presence of kynurenic acid is common for chestnut honey.
- The presence of gentiobiose is common for Linden Tree honey.
- The presence of shikimic acid is common for honeydew.
- The presence of quinic acid is common for honeydew.

Non-Targeted Verification Analysis

Univariate Verification

(Analysis-ID: HO-2102-01/0031)

Applied Model: Blossom

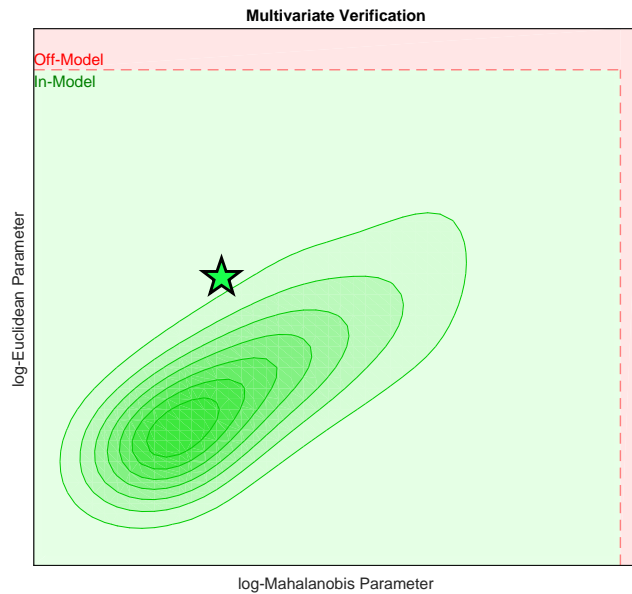
Result: No deviation was detected in univariate verification (In-Model).

Multivariate Verification

(Analysis-ID: HO-2102-01/0031)

Applied Model: Blossom

Result: No deviation was detected in multivariate verification (In-Model).



General Remarks

Analysis of declared Information

The test applied is a classification analysis with the aim to check the consistency of the declared meta-information of the sample (geographical origin or botanical variety). The consistency with a group is expressed as posterior probability in the range from 0% to 100%. A posterior probability exceeding 50% is being regarded as consistent with the respective group. The underlying statistical models are based on Linear Discriminant Analysis for dimension reduction followed by a Linear (or Quadratic) Discriminant Analysis for final classification.

Within the discrimination space figure, the ellipsoids are representing the modeling samples and the star represents the actual sample under investigation.

Expert interpretation is necessary before deducing any conclusions.

Quantitative Analysis

Quantitative values are compared to the reference honey database (visualised by distribution). Deviations to the reference distributions do not necessarily indicate an adulteration. Fermentation or specific botanical varieties can also create deviations. Therefore, expert interpretation is necessary before deducing any conclusions.

Non-Targeted Verification Analysis

Verification models are non-targeted analyses comparing the whole NMR-Profile of a specific sample with one corresponding group of reference spectra (database). All spectra data points are taken into account irrespective of whether the signals are caused by already identified molecules or not.

There are different possible reasons for any deviation from the group of reference spectra. If there are detected deviations, this does not automatically mean, that the sample is adulterated. Expert interpretation is necessary before deducing any conclusions.

In the univariate analysis, the NMR spectrum is checked for any unusual low or high signal intensities for a given sample, while taking into account the natural variability of a respective reference group. Multivariate models also take into account the relation between different signals in the NMR spectrum.