

## Certificate of Analysis

### TSI USA LLC

135 W Main  
Missoula Montana 59802 United States

|                            |                          |                          |                                  |
|----------------------------|--------------------------|--------------------------|----------------------------------|
| <b>Sample Name:</b>        | <b>Glucosamine</b>       | <b>Eurofins Sample:</b>  | <b>10050621</b>                  |
| <b>Project ID</b>          | TSI_HEALTH-20201118-0003 | <b>Receipt Date</b>      | 23-Nov-2020                      |
| <b>PO Number</b>           | 20201117                 | <b>Receipt Condition</b> | Ambient temperature              |
| <b>Lot Number</b>          | GLH201804043             | <b>Login Date</b>        | 18-Nov-2020                      |
| <b>Sample Serving Size</b> |                          | <b>Date Started</b>      | 23-Nov-2020                      |
|                            |                          | <b>Sampled</b>           | Sample results apply as received |
|                            |                          | <b>Online Order</b>      | 16360-14754785                   |

#### Analysis

#### Result

#### Loss on Drying \*

Loss On Drying 0.1 %  
Method Name Glucosamine Hydrochloride

#### pH

pH 4.10  
Page Number 5045

#### Residue On Ignition \*

Page No. 5045  
Ash <0.1 % (on Dry Basis)

#### Aerobic Plate Count \*

Aerobic Plate Count <100 CFU/g

#### E. coli \*

Escherichia Coli Absent /25 g

#### Salmonella USP \*

Salmonella Absent /25 g

#### Yeast and Mold Count \*

Combined Yeast and Mold Count <10 CFU/g

#### Preparatory Testing of Nutritional and Dietary Supplements \*

Salmonella Suitability Result PASS  
Yeast and Mold Suitability PASS  
E. coli Suitability Result PASS  
Aerobic Plate Suitability Result Pass\*\*

#### Elements by ICP Mass Spectrometry

Arsenic <0.0100 ppm (on Dry Basis)  
Cadmium <5.01 ppb (on Dry Basis)  
Lead <5.01 ppb (on Dry Basis)  
Mercury <5.01 ppb (on Dry Basis)

#### Assay (Glucosamine HCl - USP/NF) \*

Result 99.2% Dried Basis

#### Identification A - Infrared Absorption (Glucosamine HCl - USP/NF) \*

Result Conforms

FT-IR Spectra

See Attachment 3091519-0\_0008944054.pdf

\* This analysis or component is not ISO accredited.

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| Analysis  | Result        |
|---|---------------|
| <b>Identification B - Chloride (Glucosamine HCl - USP/NF) *</b> |               |
| Identification  | Conforms      |
| <b>Identification C - HPLC (Glucosamine HCl - USP/NF) *</b>     |               |
| Result  | Conforms      |
| <b>Specific Rotation (Glucosamine HCl - USP/NF) *</b>           |               |
| Specific Rotation   | +72.3 Degrees |
| <b>Sulfate (Glucosamine HCl - USP/NF) *</b>                     |               |
| Sulfate   | <0.24 %       |

| Method References | Testing Location |
|-------------------|------------------|
|-------------------|------------------|

**Aerobic Plate Count (USPC2021)**

**Food Integ. Innovation-Madison NE**  
2102 Wright Street Madison, WI 53704 USA

USP Current revision, Chapter 2021.

To satisfy the requirements of the USP, the Preparatory Test must be completed on each matrix.

\*\*Based on the results of the preparatory test, the detection limit stipulated is adequate for the enumeration of the specified microorganisms.

**Assay (Glucosamine HCl - USP/NF) (M\_CHROM\_S)**

**Food Integrity Innovation-Madison**  
3301 Kinsman Blvd Madison, WI 53704 USA

United States Pharmacopeia, 43rd Revision - National Formulary 38th Edition. USP Convention. Rockville, MD (2019). (Modified).

## Certificate of Analysis

### TSI USA LLC

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#### Method References

#### Testing Location

##### E. coli (USPE2022)

##### Food Integ. Innovation-Madison NE

2102 Wright Street Madison, WI 53704 USA

USP Current revision, Chapter 2022.

To satisfy the requirements of the USP, the Preparatory Test must be completed on each matrix.

\*\*Based on the results of the preparatory test, conditions stipulated are adequate for detecting the presence of the specified microorganism.

##### Elements by ICP Mass Spectrometry (ICP\_MS\_S)

##### Food Integrity Innovation-Madison

3301 Kinsman Blvd Madison, WI 53704 USA

Official Methods of Analysis, Method 2011.19 and 993.14, AOAC INTERNATIONAL, (Modified).

Paquette, L.H., Szabo, A., Thompson, J.J., "Simultaneous Determination of Chromium, Selenium, and Molybdenum in Nutritional Products by Inductively Coupled Plasma/Mass Spectrometry: Single-Laboratory Validation," Journal of AOAC International, 94(4): 1240 - 1252 (2011).

##### Identification A - Infrared Absorption (Glucosamine HCl - USP/NF) (ID\_IR)

##### Food Integrity Innovation-Madison

3301 Kinsman Blvd Madison, WI 53704 USA

United States Pharmacopeia, 43rd Revision - National Formulary 38th Edition. USP Convention. Rockville, MD (2019). (Modified).

##### Identification B - Chloride (Glucosamine HCl - USP/NF) (M\_CHM\_ID\_S)

##### Food Integrity Innovation-Madison

3301 Kinsman Blvd Madison, WI 53704 USA

United States Pharmacopeia, 43rd Revision - National Formulary 38th Edition. USP Convention. Rockville, MD (2019). (Modified).

##### Identification C - HPLC (Glucosamine HCl - USP/NF) (M\_CHROM\_S)

##### Food Integrity Innovation-Madison

3301 Kinsman Blvd Madison, WI 53704 USA

United States Pharmacopeia, 43rd Revision - National Formulary 38th Edition. USP Convention. Rockville, MD (2019). (Modified).

##### Loss on Drying (LOD\_S)

##### Food Integrity Innovation-Madison

3301 Kinsman Blvd Madison, WI 53704 USA

United States Pharmacopeia, 43rd Revision - National Formulary 38th Edition. USP Convention. Rockville, MD (2019). (Modified).

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## Certificate of Analysis

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#### Method References

#### Testing Location

##### pH (PHAL\_S)

##### Food Integrity Innovation-Madison

3301 Kinsman Blvd Madison, WI 53704 USA

Official Methods of Analysis of AOAC INTERNATIONAL. 18th Ed., Method 981.12, AOAC INTERNATIONAL. Gaithersburg, MD.

Food Chemical Codex 7th Ed., The United States Pharmacopeia Convention (2010) Appendix II.

United States Pharmacopeia, 32nd Rev.-National Formulary 27th Ed., USP Convention, Inc., Rockville, MD (2009) General Chapter 791.

United States Pharmacopeia, 43rd Revision - National Formulary 38th Edition. USP Convention. Rockville, MD (2019). (Modified).

##### Preparatory Testing of Nutritional and Dietary Supplements (USPC\_PT)

##### Food Integ. Innovation-Madison NE

2102 Wright Street Madison, WI 53704 USA

##### Preparatory Testing of Nutritional and Dietary Supplements (USPE\_PT)

##### Food Integ. Innovation-Madison NE

2102 Wright Street Madison, WI 53704 USA

##### Preparatory Testing of Nutritional and Dietary Supplements (USPM\_PT)

##### Food Integ. Innovation-Madison NE

2102 Wright Street Madison, WI 53704 USA

##### Preparatory Testing of Nutritional and Dietary Supplements (USPS\_PT)

##### Food Integ. Innovation-Madison NE

2102 Wright Street Madison, WI 53704 USA

##### Residue On Ignition (ROI\_S)

##### Food Integrity Innovation-Madison

3301 Kinsman Blvd Madison, WI 53704 USA

United States Pharmacopeia, Twenty-ninth Revision, <281>, United States Pharmacopeial Convention, Inc.: Rockville, Maryland (2005).

United States Pharmacopeia, 43rd Revision - National Formulary 38th Edition. USP Convention. Rockville, MD (2019). (Modified).

##### Salmonella USP (USPS2022)

##### Food Integ. Innovation-Madison NE

2102 Wright Street Madison, WI 53704 USA

USP Current revision, Chapter 2022.

To satisfy the requirements of the USP, the Preparatory Test must be completed on each matrix.

\*\*Based on the results of the preparatory test, conditions stipulated are adequate for detecting the presence of the specified microorganism.

##### Specific Rotation (Glucosamine HCl - USP/NF) (SPEC\_ROT\_S)

##### Food Integrity Innovation-Madison

3301 Kinsman Blvd Madison, WI 53704 USA

United States Pharmacopeia, 43rd Revision - National Formulary 38th Edition. USP Convention. Rockville, MD (2019). (Modified).

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#### Method References

#### Testing Location

##### Sulfate (Glucosamine HCl - USP/NF) (M\_SO4LMT\_S)

##### Food Integrity Innovation-Madison

3301 Kinsman Blvd Madison, WI 53704 USA

United States Pharmacopeia, 43rd Revision - National Formulary 38th Edition. USP Convention. Rockville, MD (2019). (Modified).

##### Yeast and Mold Count (USPM2021)

##### Food Integ. Innovation-Madison NE

2102 Wright Street Madison, WI 53704 USA

USP Current revision, Chapter 2021.

To satisfy the requirements of the USP, the Preparatory Test must be completed on each matrix.

\*\*Based on the results of the preparatory test, the detection limit stipulated is adequate for the enumeration of the specified microorganisms.

#### Testing Location(s)

#### Released on Behalf of Eurofins by

##### Food Integrity Innovation-Madison

Eurofins Food Chemistry Testing Madison, Inc.  
3301 Kinsman Blvd  
Madison WI 53704  
800-675-8375

##### Edward Ladwig - President Eurofins Food Chemistry Testing Madison



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##### Food Integ. Innovation-Madison NE

Eurofins Food Chemistry Testing US, Inc.  
2102 Wright Street  
Madison WI 53704  
800-675-8375

##### Shannon Jacoby - Business Unit Manager

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