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February 7, 2019

ID 849

Richard Bonnette
Office of Food Additive Safety (HFS-200)
Center for Food Safety and Applied Nutrition
Food and Drug Administration
5100 Campus Drive
College Park, MD 20740-3835

Subject: GRAS Notification – Inulin from Jerusalem Artichoke

Dear Mr. Bonnette:

On behalf of Intrinsic Organics, LLC, ToxStrategies, Inc. (its agent) is submitting, for FDA review, a copy of the GRAS notification as required. The enclosed document provides notice of a claim that the food ingredient, inulin (from Jerusalem Artichoke), described in the enclosed notification is exempt from the premarket approval requirement of the Federal Food, Drug, and Cosmetic Act because it has been determined to be generally recognized as safe (GRAS), based on scientific procedures, for addition to food (except infant formula).

If you have any questions or require additional information, please do not hesitate to contact me at 630-352-0303, or dschmitt@toxstrategies.com.

Sincerely,

[redacted]

Donald F. Schmitt, M.P.H.
Senior Managing Scientist

GRAS Determination of Inulin from Jerusalem Artichoke for Use in Food

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GRAS Determination of Inulin from Jerusalem Artichoke for Use in Food

SUBMITTED BY:

Intrinsic Organics, LLC
1410 Organic Way
Weiser, Idaho 83672

SUBMITTED TO:

U.S. Food and Drug Administration
Center for Food Safety and Applied Nutrition
Office of Food Additive Safety
HFS-200
5100 Paint Branch Parkway
College Park MD 20740-3835

CONTACT FOR TECHNICAL OR OTHER INFORMATION

Donald F. Schmitt, MPH
ToxStrategies, Inc.
931 W. 75th St., Suite 137, PMB 255
Naperville, IL 60565

DECEMBER 21, 2018

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List of Acronyms

ACF	aberrant crypt foci
ADME	absorption, distribution, metabolism and excretion
AIL	acceptable intake level
AOM	azoxymethane
CAS	Chemical Abstracts Service
CFR	Code of Federal Regulations
cfu	colony forming unit
cGMP	current Good Manufacturing Practice
CVM	Center for Veterinary Medicine
DP	degree of polymerization
EC	European Commission
EFSA	European Food Safety Authority
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FDA	Food and Drug Administration
FOS	fructooligosaccharides
FSANZ	Food Standards Australia New Zealand
FSIS	Food Safety and Inspection Service
GFR	glomerular filtration rate
GI	gastrointestinal
GMP	Good Manufacturing Practice
GRAS	Generally Recognized as Safe
GRN	GRAS Notification
IgA	immunoglobulin A
IgAN	immunoglobulin A nephropathy
InuL	long-chain inulin
InuS	short-chain inulin
IOF	Intrinsic Organics Full-spectrum inulin
JA	Jerusalem Artichoke
JECFA	Joint FAO/WHA Expert Committee on Food Additives
OAS	oral allergy syndrome
ppm	parts per million
U.S.C	United States Code
USDA	United States Department of Agriculture
VLCI	very long-chain inulin
WHO	World Health Organization

§ 170.225 Part 1, GRAS Notice: Signed Statements and Certification

(1) GRAS Notice Submission

Intrinsic Organics, LLC (Intrinsic Organics), through its agent, ToxStrategies, Inc., hereby notifies the U.S. Food and Drug Administration (FDA) of the submission of a Generally Recognized as Safe (GRAS) notice for the use of inulin from Jerusalem Artichoke in human food.

(2) Name and Address

Intrinsic Organics, LLC
1410 Organic Way
Weiser, Idaho 83672

(3) Name of Notified Substance

The name of the substance that is the subject of this Generally Recognized as Safe (GRAS) notification is "inulin (from Jerusalem Artichoke)". The proposed inulin product is derived from Jerusalem Artichoke (*Helianthus tuberosus*), a member of the *Asteraceae* family.

(4) Intended Use in Food

Inulin is intended for use as a bulking agent in food for human consumption (except for infant formula), in which it serves as a source of a reduced-energy carbohydrate, for use as a sugar replacer, humectant, fat-replacer, and/or texture modifier as well as a source of non-digestible dietary fiber. The inulin ingredient that is the subject of this GRAS determination is proposed only as an alternative to other inulin ingredients, and the daily consumption of inulin is not expected to increase as a result of its introduction.

(5) Statutory Basis for GRAS Determination

Intrinsic Organics, through its agent ToxStrategies, Inc., confirms that its inulin ingredient, meeting the specifications described herein, has been determined to be GRAS through scientific procedures in accordance with 21 CFR § 170.30(a) and (b).

(6) Premarket Approval Statement

Intrinsic Organics further asserts that the use of inulin in foods, as described below, is exempt from the pre-market approval requirements of the Federal Food, Drug, and Cosmetic Act, based on a conclusion that the notified substance is GRAS under the conditions of its intended use.

(7) Availability of Information

The data and information that serve as the basis for this GRAS determination, as well as any information that has become available since the GRAS determination, will be sent to the U.S. Food and Drug Administration (FDA) on request, or are available for the FDA's review and copying during customary business hours from ToxStrategies, Inc., Naperville, Illinois.

(8) Data and Information Confidentiality Statement

None of the data and information items in the GRAS notice are exempt from disclosure under the Freedom of Information Act, 5 U.S.C. 552.

(9) GRAS Notice Certification

To the best of our knowledge, this GRAS determination is a complete, representative, and balanced document. Intrinsic Organics is not aware of any information that would be inconsistent with a finding that the proposed uses and use levels (see Table 9) for inulin in food, meeting the appropriate specifications described herein, and used according to current Good Manufacturing Practices (cGMP), is GRAS. Recent reviews of the scientific literature revealed no potential adverse health concerns.

(10) Name/Position of Notifier

[redacted]

02/07/2019
Date

Donald F. Schmitt, M.P.H.
Senior Managing Scientist
ToxStrategies, Inc.
Agent for Intrinsic Organics

(11) FSIS Statement

Intrinsic Organics recognizes that with intended meat and poultry uses, FDA will likely share this GRAS notice with FSIS for their agreement and has no objections to that action.

§ 170.230 Part 2, Identity, Method of Manufacture, Specifications, and Physical or Technical Effect

Identity

The inulin product is sourced from Jerusalem Artichoke (*Helianthus tuberosus*), as distinguished from the globe artichoke. Two forms of inulin are produced by Intrinsic Organics and include an inulin powder (IOF-POWDER) and inulin syrup (IOF-SYRUP). Inulin ($C_{6n}H_{10n+2}O_{5n+1}$) consists primarily of a mixture of linear β-(1-2)-linked fructose chains with a terminal glycopyranose unit at the reducing end (Kays and Nottingham, 2007; Mensink et al, 2015). Of the various naturally occurring chain-length species of polysaccharides, the most common fractions are referred to as inulin, oligofructose, and fructooligosaccharides (FOS). The IOF products contain the whole fructo-oligo/polysaccharide with a chain length ranging from DP-3 to over DP-60.

The IOF inulin products are a brown liquid or tan powder that have a neutral taste, an average pH at 10° Brix of approximately 5.7, and an average density of 1.2 kg/L (syrup) or 0.6 kg/L (powder).

The Jerusalem Artichoke (*Helianthus tuberosus*) is a member of the sunflower (*Asteraceae*) family. The Jerusalem Artichoke stores carbohydrates as fiber, not starch like other related plants, and the fiber component is called inulin. Intrinsic Organics does not subdivide the inulin product into different chain lengths or cut the larger chains to get more uniform short chains. The inulin is rendered from the tuber, giving a variety of chain-length compositions reflecting agriculture, harvest, and storage conditions, as opposed to synthetic methods that use sucrose and enzymes that are only effective at creating 8–10 monomer chains, a product referred to as oligofructose inulin.

Chemical Structure and Empirical Formula

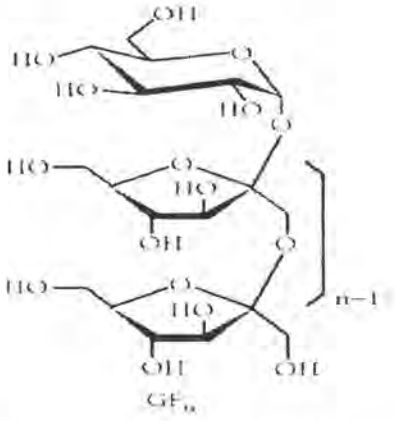


Figure 1. Structure of inulin containing a terminal glucopyranose unit (GFn)

Common or Chemical Names

Inulin

Chemical Abstracts service (CAS Number)

Inulin has a CAS number of 9005-80-5.

Manufacturing Process

Inulin is manufactured from Jerusalem Artichoke in accordance with current Good Manufacturing Practice (cGMP) (21 CFR Title 21 Part 117 Subpart B). Hot water is employed to extract the fiber from raw tubers, which is subsequently filtered in several steps to clarify and remove suspended solids and reduce protein, simple carbohydrates, and minerals. The filtration steps also remove excess water to concentrate the product prior to a heat treatment kill step. After the kill step, the concentrated liquid is directed to one of two final processing steps. For inulin powder (IOF-POWDER), the concentrated liquid is spray-dried and bagged. For inulin syrup (IOF-SYRUP) production, the concentrated liquid is evaporated for further concentration before packing in intermediate bulk containers. Figure 2 provides a flow diagram of the inulin manufacturing process.

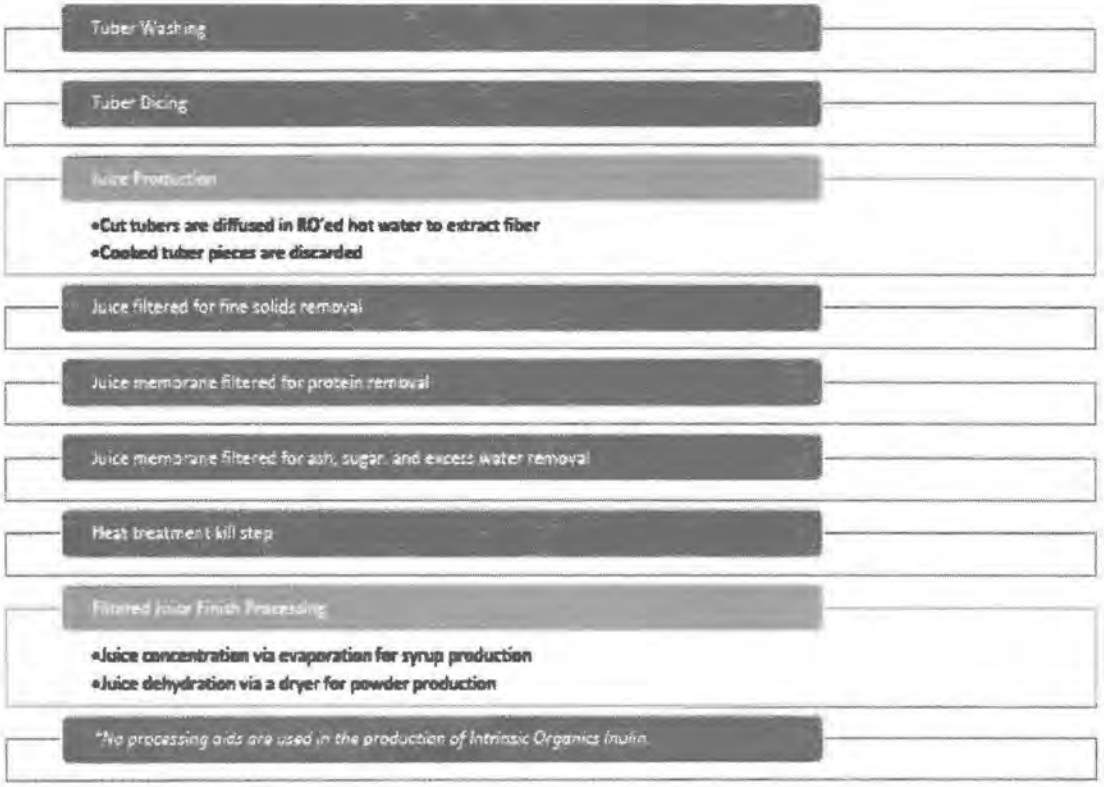


Figure 2. Inulin manufacturing process

Product Specifications

The proposed food-grade specifications for Intrinsic Organics' inulin syrup and powder are presented in Tables 1 and 2. Analytical results for three non-consecutive batches of the proposed inulin products are found in Tables 3–6 and Appendix A. It should be noted that other analyses (e.g., mycotoxins, individual heavy metals) of the proposed inulin products have been conducted but are not included in the certificates of analysis. Results of the additional analyses are found in Appendix A.

Table 1. Specifications for IOF-SYRUP

Parameter	Specification
Composition	
Total solids (%)	Min. 65
Inulin (DP-3 to DP-60+) (%)	Min. 65
Total glucose, fructose, sucrose (%)	Max. 20
Protein (%)	Max. 10
Ash (%)	Max. 10
Contaminants	
Arsenic (ppm)	<0.05
Lead (ppm)	<0.05
Mercury (ppm)	<0.05
Cadmium (ppm)	<0.05
Pesticides	Absent
Mycotoxins	Absent
Microbiological Specifications	
Aerobic plate count (cfu/g)	≤1,000
Molds (cfu/g)	≤20
Yeasts (cfu/g)	≤20
Bacillus cereus (cfu/g)	≤100
Enterobacteriaceae (in 1g)	Absent
Coliforms (in 1g)	Absent
E. coli (in 1g)	Absent
Staphylococcus aureus (in 1g)	Absent
Salmonella (in 25g)	Absent

Table 2. Specifications for IOF-POWDER

Parameter	Specification
Composition	
Total solids (%)	Min. 90
Inulin (DP-3 to DP-60+) (%)	Min. 65
Total glucose, fructose, sucrose (%)	Max. 20
Protein (%)	Max. 10
Ash (%)	Max. 10
Contaminants	
Arsenic (ppm)	<0.05
Lead (ppm)	<0.05
Mercury (ppm)	<0.05
Cadmium (ppm)	<0.05
Pesticides	Absent
Mycotoxins	Absent
Microbiological Specifications	
Aerobic plate count (cfu/g)	≤1,000
Molds (cfu/g)	≤20
Yeasts (cfu/g)	≤20
Bacillus cereus (cfu/g)	≤100
Enterobacteriaceae (in 1g)	Absent
Coliforms (in 1g)	Absent
E. coli (in 1g)	Absent
Staphylococcus aureus (in 1g)	Absent
Salmonella (in 25g)	Absent

At present, Intrinsic Organics harvests Jerusalem Artichoke tubers semi-annually, in late fall and late spring. The tuber supply chain is tightly controlled, and tubers are stored on site under refrigerated conditions. The Jerusalem Artichoke is a hardy plant with no natural pests allowing it to be grown without pesticides. Furthermore, because the inulin ingredient is sourced from tubers and is not a grain product, mycotoxins are not present. Intrinsic Organics routinely tests for heavy metals, pesticides, and mycotoxins. Therefore, Tables 3 and 5 present the analytical results for individual batches of inulin syrup and inulin powder, as well as the individual heavy metals data for representative batches of inulin syrup and powder (Tables 4 and 6).

Table 3. Analytical results for three non-consecutive batches of IOF-SYRUP

Parameter	Specifications	[redacted]	[redacted]	[redacted]
Total solids (by Brix) (%)	Min. 65	71.4	69.03	66.8
Carbohydrates (%)	Min. 80	87.93	86.25	84.78
Inulin (DP-3 to DP-60+) (%)	Min. 65	77.05	68.90	66.84
Glucose, fructose, sucrose (%)	Max. 20	10.88	17.35	17.94
Protein (%)	Max. 10	5.94	6.30	7.99
Ash (%)	Max. 10	6.13	7.45	7.22
Pesticides (ppm)*	Absent	NT	Undetected**	Undetected
Mycotoxins (ppm)***	Absent	NT	Undetected****	Undetected
Aerobic plate count (cfu/g)	≤1,000	Undetected	10	404
Molds (cfu/g)	≤20	Undetected	Undetected	Undetected
Yeasts (cfu/g)	≤20	Undetected	Undetected	17
Bacillus cereus (cfu/g)	≤100	Undetected	Undetected	23
Enterobacteriaceae (in 1g)	Absent	Undetected	Undetected	Undetected
Coliforms (in 1g)	Absent	Undetected	Undetected	Undetected
E. coli (in 1g)	Absent	Undetected	Undetected	Undetected
Staphylococcus aureus (in 1g)	Absent	Undetected	Undetected	Undetected

Parameter	Specifications	[redacted]	[redacted]	[redacted]
Salmonella (in 25g)	Absent	Undetected	Undetected	Undetected

NT – not tested
*LOD for pesticides of ≤0.25ppm.
**Batch no. [redacted]
*** Aflatoxin (LOD, 0.005 ppm), deoxynivalenol (DON) (LOD, 0.05 ppm), ochratoxin (LOD, 0.002 ppm), zearalenone (LOD, 0.025 ppm), fumonisin, (LOD, 0.50 ppm).
**** Batch no. [redacted]

Table 4. Individual heavy metals analytical results for a representative batch of IOF-SYRUP

Parameter	Batch [redacted]	Batch [redacted]	Batch [redacted]
Arsenic (ppm)	<0.02	<0.02	<0.02
Cadmium (ppm)	<0.02	<0.02	<0.02
Mercury (ppm)	<0.01	<0.02	<0.01
Lead (ppm)	<0.02	<0.02	<0.02

Table 5. Analytical results for three non-consecutive batches of IOF-POWDER

Parameter	**Specifications**	[redacted]	[redacted]	[redacted]
Total solids (%)	Min. 90	99	95.27	94.64
Carbohydrates (%)	Min. 80	85.93	88.05	89.70
Inulin (DP-3 to DP-60+) (%)	Min. 65	81.06	82.14	83.36
Glucose, fructose, sucrose (%)	Max. 20	4.78	5.88	6.34
Protein (%)	Max. 10	6.57	6.15	6.48
Ash (%)	Max. 10	7.32	5.80	3.83
Pesticides (ppm)*	Absent	Undetected	Undetected	Undetected
Mycotoxins (ppm)**	Absent	Undetected***	Undetected	Undetected
Aerobic plate count (cfu/g)	≤1,000	220	500	200
Molds (cfu/g)	≤20	Undetected	Undetected	Undetected
Yeasts (cfu/g)	≤20	3	Undetected	Undetected
Bacillus cereus (cfu/g)	≤100	43	93	43
Enterobacteriaceae (in 1g)	Absent	Undetected	Undetected	Undetected
Coliforms (in 1g)	Absent	Undetected	Undetected	Undetected
E. coli (in 1g)	Absent	Undetected	Undetected	Undetected
Staphylococcus aureus (in 1g)	Absent	Undetected	Undetected	Undetected

Parameter	Specifications	[redacted]	[redacted]	[redacted]
Salmonella (in 25g)	Absent	Undetected	Undetected	Undetected

*LOD for pesticides of ≤0.25ppm.
**Aflatoxin (LOD, 0.005 ppm), deoxynivalenol (DON) (LOD, 0.05 ppm), ochratoxin (LOD, 0.002 ppm), zearalenone (LOD, 0.025 ppm), fumonisin, (LOD, 0.50 ppm).
*** Batch no. [redacted]

Table 6. Heavy metals analytical results for a representative batch of IOF-POWDER

Parameter	Batch [redacted]	Batch [redacted]
Arsenic (ppm)	<0.02	<0.02
Cadmium (ppm)	<0.02	<0.02
Mercury (ppm)	<0.01	<0.01
Lead (ppm)	<0.02	<0.02

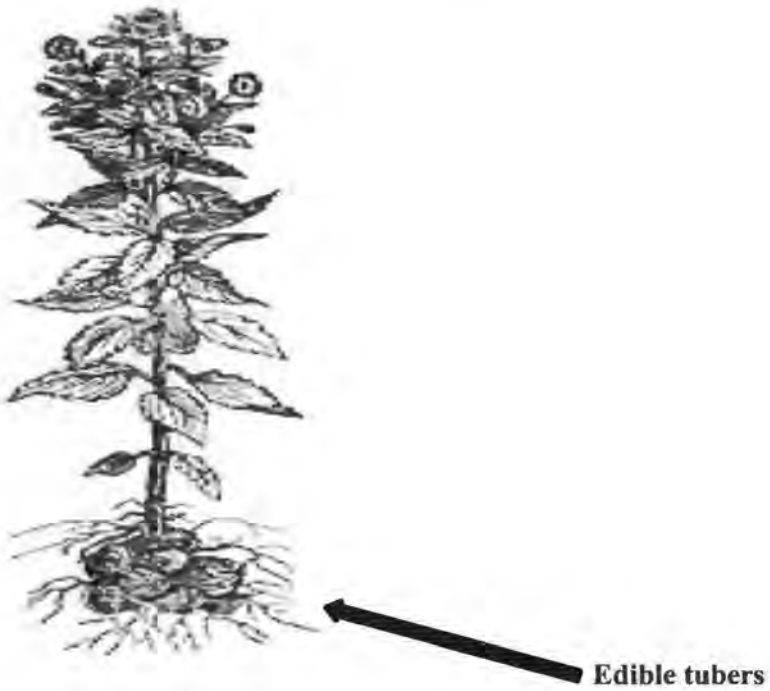
In summary, the analytical results confirm that the proposed inulin ingredients meet the analytical specifications and confirm that impurities/contaminants are not present at levels of toxicological concern.

Stability Data

Intrinsic Organics currently recommends that the product be stored in a dry place in its original container and tightly sealed until use. Once opened, the inulin product should be handled using cGMPs. Stability testing of unopened containers of the syrup and powder inulin forms is in progress. Currently 2-month (syrup) and 3-month (powder) stability data indicate that the products are stable. Additional data will be available at 6 months and beyond. The stability testing data can be found in Appendix A. Similar to other currently marketed inulin products, Intrinsic Organics considers the finished product to also be stable when kept in an unopened, sealed container under ambient conditions for a minimum of 1 year for IOF-SYRUP, and 5 years for IOF-POWDER.

§ 170.235 Part 3, Dietary Exposure

Inulin is found naturally in the roots, stems, leaves, and seeds of many edible plants and fruits (Table 7). A botanical image of the Jerusalem Artichoke is found below.



Inulin is a found in many plants, including the *Liliaceae*, *Graminae* (grass), and *Compositae* (sunflower/daisy) families. There are many examples of plants consumed as foodstuffs that contain inulin and a fraction of inulin defined as oligofructose. Inulin-containing foods, especially chicory, dahlia, Jerusalem Artichoke, murnong, and yacon, have been used as either dietary staples or sustenance crops. Many inulin-containing crops make up a significant portion of animal and human diets (FDA, 2003; Raffinerie Tirlemontoise, 1993; Meijer et al., 1993). The natural occurrence of and exposure to inulin have been extensively summarized and reviewed as part of GRN nos. 118, 477, and 576 (FDA, 2003, 2014, 2015), and oligofructose/fructooligosaccharides as part of GRN nos. 44, 576, and 623 (FDA, 2000, 2015, 2016).

The Jerusalem Artichoke tuber was introduced from North America into parts of Europe in 1607 and was cultivated as a food crop primarily in the Netherlands, France, Italy, England, and Germany. It was superseded by the potato as a major food crop in the middle of the 18th century (Wyse and Wilfahrt, 1982; Kosaric et al., 1985). The Jerusalem Artichoke's historical use in the diet as an adequate potato substitute has caused it to be referred to as wild potato, horse potato, and diabetic potato.

Table 7. Inulin and oligofructose found in food sources eaten by Americans[1]

Food Source[2]	Inulin Content Range (g/100g)	Oligofructose Content Range (g/100g)
Banana	0.3-0.7	0.3-0.7
Asparagus	2.0-3.0	2.0-3.0
Chicory Root	35.7-47.6	19.6-26.2
Dandelion greens	12.0-15.0	9.6-12.0
Garlic	9.0-16.0	3.6-6.4
Globe artichoke	2.0-6.8	0.2-0.7
Jerusalem Artichoke	16.0-20.0	12.0-15.0
Leeks	3.0-10.0	2.4-8.0
Onions	1.1-7.5	1.1-7.5
Wheat	1.0-4.0	1.0-4.0
Barley	0.5-1.0	0.5-1.0

[1] Adapted from Moshfegh et al., 1999.
[2] Food sources are raw, uncooked.

The mean daily intake of inulin and oligofructose in the U.S. diet has been estimated (Moshfegh et al., 1999; FDA, 2003) and is summarized in Table 8. American diets provide an average of 2.6 g/day of inulin and 2.5 g/day of oligofructose. Intakes vary by sex and age, ranging from 1.3 g/day for young children to 3.5 g/day for teenage boys and adult males (Moshfegh et al., 1999).

Table 8. Mean daily intakes of inulin and oligofructose in American diets[1,2]

Age Group (years)	Inulin		Oligofructose	
	Range (g)	Midpoint (g)	Range (g)	Midpoint (g)
Children				
≤5	0.55-2.13	1.34	0.54-2.10	1.32
6-11	0.90-3.52	2.21	0.87-3.47	2.17
Males				
12-19	1.34-5.41	3.36	1.30-5.34	3.32
20-49	1.36-5.59	3.47	1.31-5.49	3.40
50+	1.20-4.70	2.95	1.15-4.62	2.88
Females				
12-19	0.91-3.69	2.30	0.87-3.62	2.25
20-49	0.94-3.80	2.36	0.90-3.73	2.31
50+	0.88-3.47	2.17	0.85-3.41	2.13
All individuals	1.04-4.16	2.60	1.00-4.19	2.54

[1] Adapted from Moshfegh et al., 1999.
[2] Weighted population estimates from 1994-1996 CSFII.

GRN 118 (FDA, 2003) included proposed food use categories and related use levels (see Table 9) and estimated the inulin intake of the U.S. population ages 2+ and reported 2-day average mean intakes of Frutafit® (i.e., inulin from the root of the chicory plant) and inulin from all their proposed use categories of 11.3 and 10.1 grams per user per day, respectively. The estimated 90th percentile intakes of Frutafit® and inulin from the proposed uses were 21.3 and 19.2 g per user per day, respectively. It should be noted that the estimates of inulin consumption in GRN 118 were extremely conservative and likely were overestimates, because the reported intakes assume that all foods are supplemented with the maximum proposed use levels, and that individuals consume all the proposed inulin-containing foods on a daily basis. GRN 118 also estimated that the dietary intake of inulin for infants at the 90th percentile level would be approximately 6 g per day for those younger than 1 year and approximately 15 g per day for those 1 year of age. Intrinsic Organics' inulin ingredient is intended to be used as an alternative source of inulin in the same food categories and at the same equivalent food use levels as stated in GRN 118 and Table 9.

IOF-POWDER and IOF-SYRUP contains the whole fructo-oligo/polysaccharide with chain length ranging from DP-3 to over DP-60 and has application in a wide range of foods, including nutrition and energy bars, yogurt, ice cream, dressings and spreads, baked goods, cereals, and beverages. Intrinsic Organics' inulin ingredients are intended for use as an alternative source of inulin and will be used in a similar fashion in all current food categories in which it is employed (FDA, 2003). Therefore, the proposed use of the inulin products will not increase the overall consumption of inulin, but simply will provide an alternative source of well-characterized inulin from Jerusalem Artichoke for use in food. Therefore, cumulative intake analysis is not considered necessary.

Table 9. Proposed food use categories and use levels of inulin

Food Category	GRN 118 maximum use level of Frutafit inulin (g/100g food)	Equivalent maximum use level of IOF-SYRUP (g/100g food)	Equivalent maximum use level of IOF-POWDER (g/100g food)
Baby foods: all types of baby foods and beverages, including ready-to-serve and dry baby foods (excluding infant formula)	1 g/serving[1]	0.35 g/serving[1]	0.25 g/serving[1]
Baked goods, lite cakes: fat-free and reduced fat/sugar/calorie baked goods including cakes, brownies, and pastries	5	7	5
Baked goods, lite cookies: fat-free and reduced fat/sugar/calorie cookies	8	11.2	8
Bars: all types, including breakfast bars, granola bars, energy bars, and diet/meal replacement bars	10	14	10
Beverages, fermented milks: kefir, buttermilk, yogurt drinks	2	2.8	2

[1] Serving sizes correspond to Reference Amounts Commonly Consumed Per Eating Occasion: 21 CFR 101.12 (GRN 118, 2003)

Beverages, functional: meal replacement beverages and meal supplement beverages, including ready-to-drink beverages and dry beverage mixes[2]	5	7	5
Beverages, juices and juice drinks: fruit juices and drinks, including ades, cocktails, cider, nectar, and smoothies, vegetable juices, flavored waters, soy drinks, gelatin drinks, and lightly carbonated beverages, including ready-to-drink beverages and dry beverage mixes (excluding citrus juices and highly carbonated beverages)[2]	1.5	2.1	1.5
Beverages, milk-based: dairy-based beverages, including ready-to-drink beverages and dry beverage mixes[2]	1	1.4	1
Biscuits, reduced fat: fat-free and reduced fat biscuits	6	8.4	6
Breads, conventional: conventional yeast breads, rolls, and buns	0.5	0.7	0.5
Breads, specialty: specialty types such as breads reduced in calories or fat and/or containing added fiber or added calcium	6	8.4	6
Candy, hard dietetic	15	21	15
Candy, soft dietetic	5	7	5
Condiments: catsup and mustard	5	7	5
Cream cheese, reduced fat: fat-free and reduced fat cream cheese	5	7	5
French fry coatings: coatings on French fries[3]	1.7	2.4	1.7
Frozen dairy desserts, lite: fat-free and reduced fat/sugar/calorie ice creams and dairy-based frozen desserts, including novelties and frozen yogurt	8	11.2	8
Icings/glazes, lite: fat-free and reduced fat/sugar icings and glazes	5	7	5
Jams and jellies, lite: reduced sugar/calorie jams and jellies	2	2.8	2
Meat products: processed meats, including frankfurters, sausages, bratwurst, beef patties, chicken patties, loaves, pates, and deli meats	4	5.6	4
Mousse, reduced fat	3	4.2	3
Pancake syrup, lite	2	2.8	2
Pasta fillings: fillings used in pasta, such as tortellini, ravioli and manicotti fillings	5	7	5

[2] Maximum use levels correspond to g Frutafit per 100 g prepared beverage or sauce (GRN 118, 2003)
[3] Maximum use level per 100 g coated French fry (as consumed) (GRN 118, 2003)

Pasta, fresh: fresh pasta, such as spaghetti, fettuccini, linguini, tortellini, ravioli, or lasagna (excluding noodles)	4	5.6	4
Pasta, precooked macaroni	4	5.6	4
Pizza cmst	5	7	5
Potatoes, mashed: prepared or in frozen meals (excluding dry mix types)	3	4.2	3
Pretzels, soft	5	7	5
Processed cheese, reduced fat: fat-free and reduced fat processed cheese and cheese products	5	7	5
Pudding mix: regular and reduced sugar/calorie pudding mix	7	9.8	7
RTE breakfast cereals, all types of ready-to-eat (RTE) breakfast cereals	5 g/serving[4]	7 g/serving[4]	5 g/serving[4]
Salad dressings, lite: fat-free and reduced fat/calorie dressings, including mayonnaise, salad dressings and mayonnaise-type dressings	5	7	5
Sauces and gravies: entree, dipping and condiment sauces such as Alfredo, BBQ, cheese, clam, Hollandaise, pasta, pizza, soy, sweet & sour and white sauces, salsa, and gravies, including prepared sauces and dry sauce mixes (excluding tomato sauce and paste)[4]	2	2.8	2
Snack chips, reduced fat: fat-free and reduced fat snacks, including chips and extruded snacks	3	4.2	3
Snack crackers: savory snack, sandwich, and whole grain crackers (excluding plain crackers such as saltines, matzo crackers, or oyster crackers)	4	5.6	4
Soups, dry	3	4.2	3
Spreads. reduced fat: fat-free and reduced fat margarines and margarine-like spreads	10	14	10
Surimi, imitation crab, and reconstructed seafood	3	4.2	3
Toppings, dessert: toppings used on desserts (excluding whipped toppings)	2	2.8	2
Tortillas, reduced fat	3	4.2	3
Vegetarian patties/crumbles	2	2.8	2

[4] Serving sizes correspond to Reference Amounts Commonly Consumed Per Eating Occasion; 21 CFR 101.12 (GRN 118, 2003)

Whipped toppings, lite: fat-free and reduced fat/sugar non-dairy whipped cream toppings	6	8.4	6
Yogurt, reduced fat: fat-free and reduced fat refrigerator-type yogurts	3	4.2	3

NOTE: Unless indicated otherwise, all food categories include both regular and lite versions of all food products.

§ 170.240 Part 4, Self-Limiting Levels of Use

The use of inulin in foods is considered to be self-limiting for technological reasons, such as product texture and/or flavor profile as well as potential laxation, any of which could affect consumer acceptance.

§ 170.245 Part 5, Experience Based on Common Use in Food

While inulin is found naturally in various foods and has commonly been added to food for human consumption, the statutory basis for our conclusion of its GRAS status in the notice is based on scientific procedures and not common use in food.

§ 170.250 Part 6, GRAS Narrative

History of Use and Regulatory Approval of Inulin and Fructooligosaccharides (FOS)

Inulin and inulin/oligofructose products from chicory root are considered GRAS for use in food for human consumption, including infant formula (FDA, 2003, 2014, 2015; Table 10). Extensive published information and data have been submitted to and reviewed by FDA as part of the various GRNs for inulin-related products. In addition to the FDA, USDA's FSIS, and the FDA Center for Veterinary Medicine (CVM) reviewed the safety of inulin and oligofructose as part of several regulatory submissions for the use of inulin as a binder, emulsifier, stabilizer, and texturizer in processed meat products and for inclusion by the Association of Feed Control Officials as an additive to the food of poultry, ruminants, non-ruminants, and companion animals. Furthermore, fructooligosaccharides, a shorter chain-length fructan, was determined to be GRAS without questions from the FDA (GRN 44, FDA, 2000; GRN 623, FDA, 2016).

Table 10. Regulatory approvals for use of inulin and FOS in human food

Year Approved	Country	Submission
2003	USA	GRN 118; Inulin from the root of the chicory plant
2014	USA	GRN 477; Long-chain inulin from chicory roots for use in infant and toddler formulas and medical foods
2015	USA	GRN 576; Oligofructose and inulin from chicory roots for use in infant formulas
2016	USA	GRN 623; fructooligosaccharide from sucrose
2000	USA	GRN 044; fructooligosaccharide from sucrose syrup
2006*	Canada	Inulin from chicory root*, **Jerusalem Artichoke tuber**, or blue agave head; by hot water extraction or conventional separation processes

*Beneo ORAFTI inulin from chicory root

Canada has also approved the classification of inulin as a dietary fiber. The Canadian Food Inspection Agency (2011) lists "chicory root inulin" and "Inulin from Jerusalem Artichoke tuber" as traditional fiber sources. The Health Canada approval is for suggested doses of ≤15 g/day for adults. Inulin is classified as an allowable food ingredient under the European Directive 95/002 on Food Additives (EC, 1995). The European Food Safety Authority (EFSA) Panel on Dietetic Products, Nutrition, and Allergies reported no adverse events in clinical studies following consumption of chicory inulin (ORAFTI inulin) ranging from 12 to 40 g/day (EFSA, 2015).

Similarly, inulin has been added to food in Australia and New Zealand for approximately 20 years and is also labeled as a dietary fiber (FSANZ, 2008).

Safety

Introduction

For the present GRAS determination of inulin sourced from Jerusalem Artichoke, comprehensive literature searches were performed pertinent to its safe use. Because inulin is a common component of the human diet, very few traditional toxicology studies of inulin were identified in the public domain. Literature searches have been performed to identify available safety data on inulin and Jerusalem Artichoke through August 2018. This included searching sources of information such as publicly available assessments, databases, or reviews from organizations that include the European Food Safety Authority (EFSA), Joint FAO/WHO Expert Committee on Food Additives (JECFA), U.S. FDA, and the World Health Organization (WHO), general internet searching, and searching databases such as Embase, Medline, Toxline, and PubMed.

As soluble, fermentable, dietary fibers, inulin, as well as oligofructose and fructooligosaccharides, have been added to food as a source of dietary fiber. Multiple GRAS "no questions" letters have been issued (GRNs 118, 477, 576) that support the safe use of inulin as a bulking agent in foods in which it serves as a source of reduced-energy carbohydrate, for use as a sugar replacer, humectant, binder, fat-replacer, and/or texture modifier (FDA, 2003, 2014, 2015). Studies with inulin, oligofructose, and FOS have been conducted to examine their effect on mineral absorption, glycemic control, constipation, intestinal flora (bifidobacteria), colon cancer, and lipid metabolism (Carabin and Flamm, 1999; FDA, 2003). The study results demonstrated that inulin-type fructans do not adversely affect any of the above endpoints. In addition, more recent studies have demonstrated that prebiotics such as inulin can have positive health-related effects on mineral absorption, lipid metabolism, and anti-inflammatory and immune effects (Macfarlane et al., 2008; Cantero et al., 2015; Kelly et al., 2009; Schaafsma and Slavin, 2015).

The long history of safe use of inulin-containing foods is reflected by the fact that very little formal toxicity testing in laboratory animals has been reported on inulin or its oligosaccharide hydrolysis products, oligofructose or fructooligosaccharides (maximum degree of polymerization [DP] of less than 10; a DP of 10 or above generally has been referred to as inulin). However, a number of animal toxicity studies with Neosugar (FOS) have been published. Neosugar has the same chemical structure as inulin but has a shorter chain length (up to four fructose units) and is produced by enzymatic synthesis from sucrose. No specific safety issues were raised in these studies (Carabin and Flamm, 1999; Clevenger et al.,1988; Sleet and Brightwell, 1990, as cited in Carabin and Flamm, 1999; Takeda and Niizato, 1982).

Safety Data

Absorption, Distribution, Metabolism, and Excretion (ADME)

Inulin and oligofructose are not digested in the upper gastrointestinal (GI) tract but, rather, are fermented in the lower GI tract. Inulin reaches the colon almost intact and is then fermented by the colonic microflora, producing short-chain organic acids such as lactic, acetic, propionic, and butyric acids. The fermentation process has been described as complete, as they are not detected in the feces following consumption (Norwegian Scientific Committee on food Safety (VKM), 2016).

Given that inulin, oligofructose, and FOS are chemically and physiologically similar, the results of the aforementioned toxicity studies with FOS were considered predictive of the toxicological effects of inulin and oligofructose (Carabin and Flamm, 1999; FDA, 2003). Carabin and Flamm (1999) evaluated the safety of inulin and oligofructose and concluded that results from toxicology tests on the inulin-type fructans (i.e., FOS and oligofructose) have not shown evidence of mortality, morbidity, target-organ toxicity, reproductive or developmental toxicity, mutagenicity, or carcinogenicity. The authors concluded that FOS and oligofructose are safe for human consumption under their intended conditions of use in food and that up to 20 g/day of inulin and/or oligofructose was well tolerated. A brief summary of the animal and human studies follows.

Acute Oral Toxicity

The median lethal dose (LD_{50}) in mice and rats administered a single dose FOS was determined to be greater than 9 g/kg (Takeda and Nizato, 1982; Carabin and Flamm, 1999; FDA, 2003).

Repeat-Dose Oral Toxicity

Male Wistar rats were administered FOS by oral gavage at doses of 0, 1.5, 3, and 4.5 g/kg for 6 weeks. No treatment-related adverse effects were reported at doses up to 4.5 g/kg, and the no-observed-adverse-effect level (NOAEL) was considered to be the highest dose administered of 4.5 g/kg (Takeda and Nizato, 1982; Carabin and Flamm, 1999; FDA, 2003).

Male Wistar rats were also administered FOS in the diet at concentration of 5% and 10% FOS, also for 6 weeks. Sucrose, glucose, and sorbitol served as control articles. No treatment-related abnormalities or deaths were reported. Diarrhea was observed on the third day for the sorbitol group and on the tenth day for FOS. Sorbitol and FOS groups showed a lower body weight in weeks 1–5, but the growth trends near completion of the study were the same as those of the control groups. A treatment-related reduction in cholesterol was observed in the FOS groups. A few hepatic specimens, from all groups including controls, exhibited slight necrosis and infiltration of round cells. Renal changes and cases of degeneration of the proximal tubular epithelial cells were seen in all sucrose-, glucose-, sorbitol-, and FOS-treated groups. The changes were greatest with sorbitol and sucrose. Cases in the FOS and glucose groups also demonstrated dilatation of

the proximal renal tubules. Calcium deposits were found in some cases in the FOS, sorbitol, and control groups (Takeda and Nizato, 1982; Carabin and Flamm, 1999; FDA, 2003).

In summary, feeding diets with added FOS resulted in a decrease in body weight, a reduction in cholesterol, and swelling of the appendix while, in few cases, pathological changes in the kidneys and liver were observed. The authors noted that the changes were similar to those in the control groups. The changes seen in the proximal renal tubules were less severe in the FOS group than in the sucrose group, while the calcium deposits observed in the cortex were also identified in the control groups. The authors concluded that FOS showed no toxicity compared with existing sugars commonly used in the food supply, and that that the reduction in body weight was due to the low caloric content of FOS.

Reproductive and Developmental Toxicity

Henquin (1988, as cited in Carabin and Flamm, 1999; FDA, 2000) reported a lack of developmental toxicity of FOS in rats fed FOS at dietary levels of 20%. Two groups of twelve female Wistar rats were administered a diet containing either 0 or 20% FOS from gestation day 1 to 21. Six hours after birth, the litters were numbered, sexed, and weighed. Thirty-six hours after delivery, nine newborns were distributed equally between the lactating mothers, which were continued on their gestational diet containing FOS. There was no effect on the number of pregnancies in the FOS group; however, a reduction in body-weight gain of the pregnant rats was identified. The authors believed that the body-weight-gain reduction could have been due to the combination of a lower caloric value for FOS, decreased intake of food in the treated group, and/or diarrhea observed in the first week and softer stools in the second and third weeks. However, the fetuses and newborn weights were not affected by the reduction in body-weight gain of the mothers. However, a subsequent growth delay was observed in the pups (males) in the test group during the nursing period and was considered possibly indicative of the restricted nutritional status of the lactating mothers. The authors concluded that the diet containing 20% FOS had no significant adverse effects on the course of pregnancy in rats and on the development of their fetuses and newborns.

Sleet and Brightwell (1990, as cited in Carabin and Flamm, 1999; FDA, 2000) also evaluated the maternal and developmental toxicity in rats (Crl CD [SD] BR) following administration of FOS during gestation. Four groups of 24 to 27 pregnant females were pretreated with FOS at a dietary level of 4.75%, from day 0 to 6 postcoitum. The pretreatment was an attempt to avoid the occurrence of diarrhea observed in earlier studies. A fifth group received a FOS-free diet throughout the entire study. On postcoital day 6, the FOS pretreatment diet was replaced with diets containing 0, 5%, 10%, or 20% FOS. The new diet was continued until day 15, when all pregnant females were then fed a FOS-free diet. No treatment-related effects were observed during pretreatment (days 0 to 6 postcoitum) and treatment (days 6 to 15 postcoitum) with FOS at dietary levels up to 20%. Diarrhea was not observed in any of the test animals, and no deaths were recorded. There was no effect of FOS administration during the pretreatment period on body weight or body-weight change in any of the groups. Two days after the start of the treatment (postcoital day 8), body weights were reduced in all FOS groups relative to

controls and in a dose-related manner. From day 11 to the end of the study, body weights and body-weight changes were similar among groups, with the exception that the 20% FOS group remained below controls. Necropsy findings in dams were unremarkable. The number of pups/litter, the sex ratio, and the viability of both the embryo and the fetus were not affected by treatment with FOS. Litter and fetal weights were not reduced, while the fetal weight of the 20% group was statistically greater than that of the controls. No structural changes were noted in the fetuses. The authors concluded that dietary supplementation with FOS, at concentrations up to 20%, did not cause adverse effects (e.g., diarrhea), nor did it negatively affect the pregnancy outcome or *in utero* development of the rat. The only treatment-related effect was the moderate reduction in the body weight of the dams in the 20% FOS group.

Mutagenicity and Genotoxicity

FOS was tested in (1) the Ames assay with *Salmonella typhimurium* strains TA1535, TA1537, TA1538, TA98, and TA 100, and *Escherichia coli* WP2 uvr A; (2) the L5178Y mouse lymphoma TK^+ mammalian cell mutation assay; and (3) the unscheduled DNA synthesis assay in human epithelioid cells at a wide range of doses. No evidence of genotoxicity was noted in any of the assays (Clevenger et al., 1988).

Carcinogenicity

A long-term/carcinogenicity study was conducted with 50 male and 50 female Fischer 344 rats for 104 weeks (Clevenger et al., 1988). The animals received FOS (average DP 3.5) in the diet at concentrations of 0, 8000, 20,000, and 50,000 ppm (0, 0.8, 2, and 5% in the diet). All animals were observed twice daily, and body weights were determined weekly in the first 26 weeks and biweekly thereafter. Food consumption for all animals was recorded weekly. Food efficiency and FOS intake were determined from body weights and food consumption data. At the conclusion of the study, blood samples were obtained from all rats prior to sacrifice. Brain, adrenal gland, heart, lung, spleen, liver, kidney, testis, and ovary weights were recorded. Tissues were fixed in formalin, sectioned, and stained with hematoxylin and eosin per protocol.

Survival of both sexes of rats was unaffected by treatment. Body-weight gain, food intake, and organ weights for both sexes were unaffected by FOS supplementation. Overall, food efficiencies by FOS-treated male and female groups were comparable to their control groups. FOS intake by the 8000-, 20,000-, and 50,000-ppm groups was equivalent to 341, 854, and 2170 mg/kg/day for male rats and 419, 1045, and 2664 mg/kg/day for female rats. Hematology parameters were not affected by FOS supplementation. Blood chemistry results demonstrated a slight, but significant elevation of sodium (Na^+) and chloride (Cl^-) in male rats. Male rats in the mid-dose FOS group had slightly elevated levels of blood glucose and creatinine, non-significant toxicological or clinical changes. A decrease in creatinine levels was observed in high-dose males. In females, all blood chemistry parameters were similar to those of controls, except for slight elevation of uric acid in the low- and mid-dose groups. No treatment-related macro- or microscopic changes were found in either males or females. The only non-neoplastic lesions observed were common to aging rats of the strain by comparison to the historical control incidence.

In the male rats, the incidences of pituitary adenomas in the control group was 20% and in the treatment groups were 26%, 38%, and 44%. The historical incidence of pituitary adenomas in the control F-344 male rats from the test laboratory was reported to range from 1% to 49%. However, the incidence of this tumor in the two highest dose groups (20,000 and 50,000 ppm) was significantly greater than the incidence in controls. Therefore, the authors conducted additional statistical analyses employing two trend tests. The Cochran-Armitage chi-square test indicated a dose–response trend ($P = 0.007$), while the logistic regression analysis showed no such trend ($P = 0.51$), resulting in an overall equivocal result. In female rats, a negative trend in the incidence of pituitary adenomas was recorded. Based on these analyses, it was concluded that the higher incidence of pituitary adenomas in males was not treatment-related. The authors concluded that FOS was without carcinogenic potential.

Other Studies

Pattananandecha et al., 2016) assessed the effect of hydrolyzed inulin of differing degrees of polymerization on the intestinal microbiota of rats with preneoplastic aberrant crypt foci (ACF) induced by azoxymethane (AOM). While not a standard toxicology study of inulin, the study is included because the rats were administered the inulin test article for 17 weeks. Seventy-two male Sprague Dawley rats were randomly divided into six groups (three control and three AOM-treated groups), and the animals were fed either a normal diet or a diet containing 10% of long-chain inulin (InuL) or short-chain inulin (InuS) for 17 weeks. Colon cancer was induced in rats by injecting AOM subcutaneously during the 8th and 9th weeks of the study. At the end of the experiment, cecal contents of rats were examined for selected microbiota, organic acids, putrefactive compounds, and microbial enzymes. ACF formation was microscopically examined. The study demonstrated that the dietary administration of inulin reduced the formation of preneoplastic lesions in the colon that were induced by AOM.

Human Tolerance

As in the previously cited inulin and fructan-related GRNs, human data were proposed as being more useful than animal data for establishing an intake threshold for GI disruption. Studies with inulin, oligofructose, and FOS have also been conducted to examine their effect on mineral absorption, glycemic control, constipation, intestinal flora (*bifidobacteria*), colon cancer, and lipid metabolism (Carabin and Flamm, 1999; FDA, 2003). The study results demonstrated that inulin-type fructans do not adversely affect any of the above endpoints. More recent studies have demonstrated that prebiotics such as inulin can have positive health-related effects on mineral absorption, lipid metabolism, and anti-inflammatory and immune effects (Macfarlane et al., 2008; Cantero et al., 2015; Kelly et al., 2009; Schaafsma and Slavin, 2015).

The human tolerance of inulin has been studied extensively in historical and contemporary diets and in clinical studies in adults and infants. GRN 118 (FDA, 2003; Carabin and Flamm, 1999) summarized numerous human tolerance studies as did GRNs 477 and 576 (FDA, 2014; FDA, 2015). GRN 118 concluded that regular consumption of up to 40 grams of inulin (i.e., Frutafit®) per day by healthy adults appeared to result in no

significant adverse effects when consumed in divided doses over the course of a day. Flatulence and loose stools are the most common adverse effects at high doses (>40 g/day). An acceptable intake level (AIL) for inulin of 40 grams when consumed in divided doses over the course of a day was proposed for Frutafit® and was considered a conservative estimate as some studies with Frutafit® suggested that up to 70 grams of inulin per day as part of the daily diet may be tolerated (FDA, 2003).

VKM (2016) conducted a recent risk assessment on inulin and concluded that no serious adverse health effects have been identified at human study doses of 5 to 20 grams/day. Only mild GI symptoms like those above were noted.

Relevant to inulin from Jerusalem Artichoke (JA), Ramnani et al. (2010) conducted a three-arm, parallel, placebo-controlled, double-blind study with healthy human volunteers (thirty-three men and thirty-three women, age range: 18–50 years). Subjects were randomized into three groups assigned to consume either the test shots, pear-carrot-sea buckthorn (PCS) or plum-pear-beetroot (PPB), containing JA inulin (5 grams/day) or a placebo. Fluorescent *in situ* hybridization was employed to monitor populations of total bacteria, bacteroides, bifidobacteria, *Clostridium perfringens/histolyticum* subgroup, *Eubacterium rectale/Clostridium coccoides* group, *Lactobacillus/Enterococcus* spp., *Atopobium* spp., *Faecalibacterium prausnitzii* and propionibacteria. Bifidobacteria levels were significantly higher on consumption of both the PCS and PPB shots compared with placebo. A small but significant increase in *Lactobacillus/Enterococ*cus group was also observed for both the PCS and PPB shots compared with placebo. Other bacterial groups and fecal short chain fatty acid (SCFA) concentrations remained unaffected. No adverse events, or changes in medication or bowel habits were observed. A slight but significant increase in flatulence was reported in the subjects consuming the PCS and PPB shots compared with placebo, but overall flatulence levels remained mild. The authors concluded that the study confirmed the prebiotic efficacy of fruit and vegetable shots containing Jerusalem Artichoke-sourced inulin.

Costabile et al. (2010) conducted a double-blind, cross-over study using healthy adults randomized into two groups that received either 10 grams/day of very long-chain inulin from the globe artichoke (VLCI; average DP between 50 and 103) or maltodextrin, for two 3-week study periods, separated by a 3-week washout period. Numbers of fecal *bifidobacteria* and *lactobacilli* were significantly higher upon VLCI ingestion compared with the placebo. Additionally, levels of *Atopobium* group significantly increased, while *Bacteroides–Prevotella* numbers were significantly reduced. No significant changes in fecal SCFA concentrations were observed. There were no adverse gastrointestinal symptoms apart from a significant increase in mild and moderate bloating upon VLCI ingestion. The authors concluded that daily consumption of VLCI extracted from globe artichokes exerted a pronounced prebiotic effect on the human fecal microbiota composition and was well tolerated. It should be noted that the globe artichoke is not related to the Jerusalem Artichoke.

Slavin and Feirtag (2011) examined the effects of supplementation of the diet with 20 grams/day of chicory inulin on stool weight, intestinal transit time, stool frequency and consistency, selected intestinal microorganisms and enzymes, fecal pH, short chain fatty acids and ammonia produced as by-products of bacterial fermentation. Twelve healthy

male subjects consumed a well-controlled diet with and without 20 grams/day of chicory inulin (DP 2–60). The randomized, double-blind, crossover trial consisted of dietary treatments for 3-week periods. Inulin was consumed in a low-fat ice cream. Inulin consumption resulted in a significant increase in total anaerobes and *Lactobacillus* species and a significant decrease in ammonia levels and beta-glucuronidase activity. Flatulence increased significantly with the inulin treatment. No other significant differences were found in bowel function. Inulin had no negative effects on food acceptability and 20 grams/day of inulin was well tolerated and had minimal effects on measures of laxation in healthy, human subjects.

In addition, EFSA (2015) provided an opinion on the scientific substantiation of a health claim related to "native chicory inulin" and maintenance of normal defecation by increasing stool frequency. They reviewed six studies involving 86 subjects that consistently showed that consumption of "native chicory inulin" at an amount of at least 12 g/day increases stool frequency. The EFSA panel concluded that a cause and effect relationship had been established between the consumption of "native chicory inulin" and maintenance of normal defecation by increasing stool frequency and that 12 g of chicory inulin consumed daily was sufficient for normal defecation by increasing stool volume.

Allergy

The Jerusalem Artichoke is not listed as one of eight major allergen groups by the FDA under the Food Allergen Labeling and Consumer Protection Act of 2004 (Public Law 108-282, Title II). However, as noted earlier, Jerusalem Artichoke *(Helianthus tuberosus)* is a member of the sunflower *(Asteraceae)* family and there are rare reported cases of allergic responses to inulin and/or the Jerusalem Artichoke in the literature.

In 2000, Gay-Crosier et al. reported one of the first cases of an allergic reaction to inulin from vegetables or processed food. A 39-year-old butcher who had four episodes of anaphylaxis (generalized wheal-and-flare reaction, laryngeal edema, nasal itching, cough, and breathing difficulties) a few minutes following ingestion of salsify, artichoke leaves (NOTE: most likely globe artichoke leaves as the leaves of Jerusalem Artichoke are not the edible part), a margarine containing inulin extracted from chicory (Raftiline HP, Orafti), and a candy (Actilife Toffee orange–carrot) containing inulin (Raftiline HP) or oligofructose (Raftilose P95). He also presented with local wheal-and-flare reactions after touching artichokes (type of artichoke was not identified). All four episodes occurred within a two-year period. Skin-prick testing produced a very strong reaction to inulin (Raftiline HP) and strong reactions to salsify, artichoke, the margarine containing inulin, candy (Actilife Toffee), and oligofructose (Raftilose P95). A double-blind, placebo-controlled food challenge produced generalized urticaria, rhinoconjunctivitis, and a 20% drop in the peak expiratory flow rate within 10 minutes of the ingestion of 10g of inulin (Raftiline HP) in mint syrup containing rice flour, but not after the ingestion of mint syrup containing rice flour alone. An open oral challenge with 40g of oligofructose (Raftilose P95) was negative.

Gutierrez-Gomez et al. (2005) reported two cases of allergy to inulin from vegetables and diet foods. A 52-year-old woman had 2 episodes of anaphylaxis (generalized wheal and flare reaction, laryngeal edema, vomiting, and breathing difficulties) a few minutes after

the ingestion of artichokes (type of artichoke was not identified) and two kinds of cakes with chocolate and soup. Both the cake and soup's labels indicated the presence of inulin as an ingredient. The second patient was a 59-year-old woman on a high-protein diet (inulin fiber appeared among the ingredients) who presented with a generalized urticaria a few minutes after eating the processed meal. She also described cutaneous reactions with pruritis after consuming artichokes and different kind of vegetables.

A woman with a past history of allergy to artichoke (type of artichoke was not identified) presented with two episodes of immediate allergic reactions, one of which was a severe anaphylactic shock after eating two types of health foods containing inulin from chicory (Franck et al., 2005). The patient had no past history of atopic diseases. Dot blot assay techniques identified specific IgEs to artichoke, to yogurt F, and to a heated bovine serum albumin (BSA) + inulin product. Dot blot inhibition techniques confirmed the anti-inulin specificity of specific IgE. The authors reported that the absence of a positive reaction to an unheated milk-inulin mixture indicated the probability of protein-inulin binding.

Streeks et al. (2017) reported a recent case of a young child (age not stated) with anaphylaxis to inulin following multiple exposures. The inulin allergy was confirmed by a percutaneous skin test with a powdered form of inulin and to the artichoke, which also contained the oligosaccharide.

In addition, Bachetta et al. (2008) previously reported a case of allergy and hypersensitivity after inulin infusion. An 11-year-old boy suffering from severe immunoglobulin (Ig)A nephropathy (IgAN) experienced both anaphylactic reaction and concomitant relapse of his nephropathy following inulin infusion, used for measuring glomerular filtration rate (GFR) 2 years after the appearance of his initial symptoms (pruritis, wheezing, and cough). While the underlying mechanism of inulin hypersensitivity was not known, the authors hypothesized that inulin had activated the innate immune system.

Doyen et al. (2011) reported a case of IgE-mediated food allergy to the Jerusalem Artichoke due to a Bet v1–like allergen. A 40-year-old woman presented with springtime rhinitis for the preceding 4 years. She reported an oral allergy syndrome (OAS) to apples, cherries, peaches, hazelnuts, and raw Jerusalem Artichoke tubers. Reactions to raw Jerusalem Artichoke tubers were more severe than with other fruits (i.e., laryngeal edema and face swelling). Cooked Jerusalem Artichoke was tolerated.

In summary, reports of allergic reactions are very rare, the potential to cause allergy is very low at the levels of intended use. However, any potential concern for an allergic reaction in already sensitive individuals to inulin and/or Jerusalem Artichoke would be addressed, as the food product ingredients list would clearly state the presence of inulin as an ingredient and its source, and individuals who wish to avoid consumption for any reason would be able to easily identify the presence of inulin as an ingredient and its source.

Basis for the GRAS Determination

Introduction

The regulatory framework for determining whether a substance can be considered GRAS in accordance with section 201(s) (21 U.S.C. § 321(s)) of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. § 301 et. Seq.) ("the Act"), is set forth at 21 CFR 170.30, which states:

> General recognition of safety may be based only on the view of experts qualified by scientific training and experience to evaluate the safety of substances directly or indirectly added to food. The basis of such views may be either (1) scientific procedures or (2) in the case of a substance used in food prior to January 1, 1958, through experience based on common use in food. General recognition of safety requires common knowledge about the substance throughout the scientific community knowledgeable about the safety of substances directly or indirectly added to food.
>
> General recognition of safety based upon scientific procedures shall require the same quantity and quality of scientific evidence as is required to obtain approval of a food additive regulation for the ingredient. General recognition of safety through scientific procedures shall ordinarily be based upon published studies, which may be corroborated by unpublished studies and other data and information.

These criteria are applied in the analysis below to determine whether the use of the inulin ingredients sourced from Jerusalem Artichoke in human food that are the subject of this GRAS determination is GRAS based upon scientific procedures. All data relied upon in this GRAS determination are publicly available and generally known, and therefore meet the "general recognition" standard under the Federal Food, Drug, and Cosmetics Act.

Safety Determination

The Intrinsic Organics inulin ingredient (sourced from Jerusalem Artichoke) that is the subject of the current GRAS determination is proposed for use as an alternative source of inulin and will be used in a similar fashion in all current food categories in which other inulin products are employed (FDA, 2003), with the exception of infant formula (see Table 9). The IOF product forms (syrup and powder) contain the whole fructo-oligo/polysaccharide with chain length ranging from DP-3 to over DP-60 and have application in a wide range of foods including nutrition and energy bars, yogurt, ice cream, dressings and spreads, baked goods, cereals and beverages. Therefore, the proposed use of the inulin products will not increase the overall consumption of inulin, but simply will provide an alternative source of well-characterized inulin from Jerusalem Artichoke for use in food.

The Jerusalem Artichoke (*Helianthus tuberosus*) is a member of the sunflower (*Asteraceae*) family. The Jerusalem Artichoke stores carbohydrates as fiber, not starch

like other related plants and the fiber component is called inulin. Intrinsic Organics does not subdivide the inulin product into different chain lengths or cut the larger chains to get more uniform short chains. The inulin is rendered from the tuber, giving a variety of chain length compositions reflecting agriculture, harvest, and storage conditions, as opposed to synthetic methods that use sucrose and enzymes that are only effective at creating 8-10 monomer chains, a product referred to as oligofructose inulin.

Inulin and inulin/oligofructose products from chicory root are considered GRAS for use in food for human consumption, including infant formula (FDA, 2003; FDA, 2014; FDA, 2015; Table 10). Extensive published information and data have been submitted to and reviewed by FDA as part of the various GRNs for inulin-related products. In addition to the FDA, both the USDA Food Safety and Inspection Service, and the FDA Center for Veterinary Medicine (CVM) have also reviewed the safety of inulin and oligofructose as part of several regulatory submissions for the use of inulin as a binder, emulsifier, stabilizer and texturizer in processed meat products and for inclusion by the Association of Feed Control Officials as an additive to the food of poultry, ruminants, non-ruminants, and companion animals. Furthermore, fructooligosaccharides, a shorter chain length fructan, was determined to be GRAS without questions from the FDA in two separate notifications (GRN 44, FDA 2000; GRN 623, FDA 2016).

As soluble, fermentable, dietary fibers, inulin as well as oligofructose and fructooligosaccharides have been added to food as a source of dietary fiber. Multiple GRAS "no questions" letters have been issued (GRNs 118, 477, 576) that support the safe use of inulin as a bulking agent in foods in which it serves as a source of reduced-energy carbohydrate, for use as a sugar replacer, humectant, binder, fat-replacer, and/or texture modifier (FDA, 2003, 2014, 2015).

There is a long history of safe use of inulin-containing foods. While few animal toxicology studies have been conducted, a number of animal toxicity studies with Neosugar (FOS) have been published and used as supportive data for the safety and GRAS status of inulin in past GRNs (FDA, 2003, FDA, 2014; FDA, 2015). Neosugar has the same chemical structure as inulin but has a shorter chain length (up to four fructose units) and is produced by enzymatic synthesis from sucrose. No specific safety issues were raised in any of the studies which included acute toxicity, short-term and subchronic toxicity, reproductive and developmental toxicity, genotoxicity, and carcinogenicity studies (Carabin and Flamm, 1999; Clevenger et al. 1988; Takeda and Nizato 1982).

The human tolerance of inulin has been extensively studied in historical and contemporary diets and in clinical studies in adults as well as infants. GRN 118 (FDA, 2003; Carabin and Flamm, 1999) summarized numerous human tolerance studies, as did GRNs 477 and 576 (FDA, 2014; FDA,2015). GRN 118 concluded that regular consumption of up to 40 g of inulin (i.e., Frutafit®) per day by healthy adults appeared to result in no significant adverse effects when consumed in divided doses over the course of a day. Flatulence and loose stools are the most common adverse effects at high doses (>40 g/day). An acceptable intake level (AIL) for inulin of 40 g when consumed in divided doses over the course of a day was proposed for Frutafit® as part of GRN 118, which received a "no questions" letter from FDA.

American diets provide an average of 2.6 g/day of inulin and 2.5 g/day of oligofructose. Intakes varied by gender and age, ranging from 1.3 g/day for young children to 3.5 g/day for teenage boys and adult males (Moshfegh et al., 1999). GRN 118 (FDA, 2003) estimated the inulin intake of the U.S. population ages 2 years and older and reported 2-day average mean intakes of Frutafit® and inulin from all their proposed use categories of 11.3 and 10.1 g per user per day, respectively, and the estimated 90th percentile intakes of Frutafit® and inulin from the proposed uses of 21.3 and 19.2 g per user per day, respectively. It should be noted that the estimates of inulin consumption in GRN 118 were extremely conservative and likely were overestimates, because the reported intakes assume that all foods are supplemented with the maximum proposed use levels, and individuals consume all the proposed inulin-containing foods on a daily basis.

Similarly, the proposed use of Jerusalem Artichoke–sourced inulin as an alternative source of inulin to chicory-root inulin is well below the AIL (GRN 118) of 40 g/day when consumed in divided doses over the course of a day and is safe and GRAS for the proposed use.

General Recognition of the Safety of Inulin Sourced from Jerusalem Artichoke

The intended use of inulin sourced from Jerusalem Artichoke has been determined to be safe through scientific procedures as set forth in 21 CFR § 170.3(b), thus satisfying the so-called "technical" element of the GRAS determination, and this determination is based on the following:

- The Intrinsic Organics inulin ingredient that is the subject of the current GRAS determination is derived from Jerusalem Artichoke (*Helianthus tuberosus*), a member of the *Asteraceae* family.

- Two forms of inulin are produced by Intrinsic Organics and include an inulin powder (IOF-POWDER) and inulin syrup (IOF-SYRUP) and consists primarily of a mixture of linear β-(1-2)-linked fructose chains with a terminal glycopyranose unit at the reducing end. The IOF inulin products are a brown liquid or tan powder that have a neutral taste, an average pH at 10° Brix of approximately 5.7, and an average density of 1.2 kg/L (syrup) or 0.6 kg/L (powder).

- The IOF products contain the whole fructo-oligo/polysaccharide with a chain length ranging from DP-3 to over DP-60.

- The inulin products are manufactured from organically grown Jerusalem Artichoke in accordance with cGMP (21 CFR Title 21 Part 117 Subpart B). Hot water is employed to extract the fiber, which is subsequently filtered mechanically in several steps to remove suspended solids and reduce protein, simple carbohydrates, and minerals.

- IOF POWDER and IOF-SYRUP have application in a wide range of foods, including nutrition and energy bars, yogurt, ice cream, dressings and spreads, baked goods, cereals, and beverages. Intrinsic Organics' inulin products are intended for use as an alternative source of inulin and will be used in a similar fashion in all current food categories in which it is employed (as previously submitted in GRN 118 (FDA, 2003). Therefore, the proposed use of the inulin products will not increase the overall consumption of inulin, but simply will provide an alternative source of well-characterized inulin from Jerusalem Artichoke for use in food.

- GRN 118 (FDA, 2003) estimated the inulin intake of the U.S. population ages 2+ and reported 2-day average mean intakes of Frutafit® and inulin from all their proposed use categories of 11.3 and 10.1 g per user per day, respectively, and the estimated 90th percentile intakes of Frutafit® and inulin from the proposed uses of 21.3 and 19.2 g per user per day, respectively. The estimates of inulin consumption in GRN 118 were extremely conservative and likely were overestimates, because the reported intakes assume that all foods are supplemented with the maximum proposed use levels, and that individuals consume all the proposed inulin-containing foods on a daily basis. GRN 118 also estimated that the dietary intake of inulin at the 90th percentile level would be approximately 6 g per day for infants younger than 1 year and approximately 15 g per day for infants 1 year of age.

- Multiple GRAS "no questions" letters have been issued (GRNs 118, 477, 576) that support the safe use of inulin as a bulking agent in foods in which it serves as a source of reduced-energy carbohydrate, for use as a sugar replacer, humectant, binder, fat-replacer, and/or texture modifier (FDA, 2003, 2014, 2015).

- There exists a long history of safe use of inulin-containing foods. While few toxicological studies of inulin have been conducted in animals, numerous safety studies of oligofructose and FOS have been conducted. No specific safety issues were raised in any of the studies, which include acute toxicity, short-term and subchronic toxicity, reproductive and developmental toxicity, genotoxicity, and carcinogenicity studies.

- The human tolerance of inulin has been studied extensively in historical and contemporary diets and in clinical studies in adults and infants. GRNs 118, 477, and 576 summarized numerous human tolerance studies. GRN 118 concluded that regular consumption of up to 40 g of inulin (i.e., Frutafit®) per day by healthy adults appeared to result in no significant adverse effects when consumed in divided doses over the course of a day. Flatulence and loose stools were the most common adverse effects reported at high doses (>40 g/day). An acceptable intake level (AIL) for inulin of 40 g when consumed in divided doses over the course of a day was established for Frutafit®. The proposed use of Jerusalem Artichoke-sourced inulin as an alternative source to chicory-root inulin (approximately 20 g/day at the 90th percentile intake) is well below the AIL of 40 g.

- The potential of Jerusalem Artichoke-sourced inulin to cause allergy is very low

at the levels of intended use. However, any potential concern for an allergic reaction in already sensitive individuals would be addressed, as the food product ingredients list would clearly state the presence of inulin as an ingredient and its source, and individuals who wish to avoid consumption for any reason would be able to easily identify the presence of inulin as an ingredient and its source

- The body of publicly available scientific literature on the consumption and safety of inulin and the closely related ingredients oligofructose and FOS is sufficient to support the safety and GRAS status of the proposed inulin ingredient.

Because this safety evaluation was based on generally available and widely accepted data and information, it also satisfies the so-called "common knowledge" element of a GRAS determination.

Determination of the safety and GRAS status of inulin from Jerusalem Artichoke that is the subject of this self-determination has been made through the deliberations of an Expert Panel convened by Intrinsic Organics and composed of Michael Carakostas, DVM, Ph.D.; Stanley M. Tarka, Jr., Ph.D., F.A.T.S; and Thomas Vollmuth, Ph.D. These individuals are qualified by scientific training and experience to evaluate the safety of substances intended to be added to food. They have critically reviewed and evaluated the publicly available information summarized in this document and have individually and collectively concluded that the inulin ingredient, produced consistent with cGMP and meeting the specifications described herein, is safe under its intended conditions of use. The Panel further unanimously concluded that use of the inulin ingredient in human food is GRAS based on scientific procedures, and that other experts qualified to assess the safety of food and food ingredients for human consumption would concur with these conclusions. The Panel's GRAS opinion is included as Exhibit 1 to this document.

It is also Intrinsic Organics' opinion that other qualified scientists reviewing the same publicly available toxicological and safety information would reach the same conclusion. Intrinsic Organics has concluded that the inulin ingredients are GRAS under the intended conditions of use on the basis of scientific procedures; and therefore, it is excluded from the definition of a food additive and may be marketed and sold for its intended purpose in the U.S. without the promulgation of a food additive regulation under Title 21 of the CFR.

Intrinsic Organics is not aware of any information that would be inconsistent with a finding that the proposed use of the inulin ingredients in food for human consumption, meeting appropriate specifications, and used according to GMP, is GRAS. Recent reviews of the scientific literature revealed no potential adverse health concerns.

§ 170.250 Part 7, Supporting Data and Information

The following references are all generally available, unless otherwise noted. Appendix A and Exhibit 1 (analytical Certificates of Analysis for inulin, additional analytical data, and signed Expert Panel report) are not generally available but are attached for reference.

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APPENDIX A

Certificates of Analysis and Analytical Results

PRODUCT DESCRIPTION

Intrinsic ***Organics™ Full-spectrum Inulin Syrup (IOF SYRUP)*** is a soluble pre-biotic fiber extracted from our proprietary Jerusalem Artichoke tuber, SunSpuds™.

IOF SYRUP contains the whole fructo-oligo/polysaccharide with ***chain length ranging from DP-3 to over DP-60*** and has application in a wide range of foods including nutrition and energy bars, yogurt, ice cream, dressings and spreads, baked goods, cereals and beverages.

TYPICAL ANALYSIS

COMPOSITION (on a dry basis)

Total Solids (By Brix)	65% min
Inulin (DP-3 to DP-60+)	65% min
Glucose, Fructose, Sucrose	20% max
Protein	10% max
Ash	10% max

PHYSICAL CHARACTERISTICS

Appearance	Brown Liquid
Density	1.2 kg/L avg
Dispersibility	Excellent (with stirring)
Taste	Neutral
pH (at 10° Brix)	5.7 avg

MICROBIAL SPECIFICATIONS

Aerobic plate count	≤ 1000 CFU/g
Molds	≤ 20 CFU/g
Yeasts	≤ 20 CFU/g
Bacillus cereus	≤100 CFU/g
Enterobacteriaceae	absent in 1 g
Coliform	absent in 1 g
E coli	absent in 1 g
Staphylococcus aureus	absent in 1 g
Salmonella	absent in 25 g

CONTAMINANT ANALYSIS

Heavy Metals (As, Pb, Hg, Cd)	<0.05 ppm
Pesticides	Absent
Mycotoxins	Absent

OTHER INFORMATION

Labeling	Organic Inulin (from organic Jerusalem Artichoke)
Storage	Product should be stored under dry conditions in the original unopened container.
Shelf Life	Minimum 1 year from production date, in unopened containers under ambient conditions.
Allergens	Neither the raw Jerusalem Artichoke nor the process used to produce ***IOF SYRUP*** contain or introduce dairy, eggs, seafood, shellfish, tree nuts, peanuts, grains, or soy.
USDA Organic	Idaho State Department of Agriculture certified
Kosher	Orthodox Union certified
Non-GMO	Food Chain ID certified
Vegan	Vegan Action certified
Gluten Free	Gluten Free Certification Organization certified
Halal	Islamic Food and Nutritional Council of America

PACKAGING

IOF SYRUP is packaged in 275-gallon, 55-gallon, and 5-gallon FDA approved HDPE containers.

PRODUCT DESCRIPTION

Intrinsic Organics™ Full-spectrum Inulin Powder (IOF POWDER) is a soluble pre-biotic fiber extracted from our proprietary Jerusalem Artichoke tuber, SunSpuds™.

IOF POWDER contains the whole fructo-oligo/polysaccharide with ***chain length ranging from DP-3 to over DP-60*** and has application in a wide range of foods including nutrition and energy bars, yogurt, ice cream, dressings and spreads, baked goods, cereals and beverages.

TYPICAL ANALYSIS

COMPOSITION (on a dry basis)

Total Solids	90% min
Inulin (DP-3 to DP-60+)	65% min
Glucose, Fructose, Sucrose	20% max
Protein	10% max
Ash	10% max

PHYSICAL CHARACTERISTICS

Appearance	Tan Powder
Density	0.60 kg/L avg
Dispersibility	Excellent (with stirring)
Taste	Neutral
pH (at 10° Brix)	5.7 avg

MICROBIAL SPECIFICATIONS

Aerobic plate count	≤ 1000 CFU/g
Molds	≤ 20 CFU/g
Yeasts	≤ 20 CFU/g
Bacillus cereus	≤100 CFU/g
Enterobacteriaceae	absent in 1 g
Coliform	absent in 1 g
E coli	absent in 1 g
Staphylococcus aureus	absent in 1 g
Salmonella	absent in 25 g

CONTAMINANT ANALYSIS

Heavy Metals (As, Pb, Hg, Cd)	<0.05 ppm
Pesticides	Absent
Mycotoxins	Absent

OTHER INFORMATION

Labeling	Organic Inulin (from organic Jerusalem Artichoke)
Storage	Product should be stored under dry conditions in the original unopened container.
Shelf Life	Minimum 5 years from production date, in unopened containers under ambient conditions.
Allergens	Neither the raw Jerusalem Artichoke nor the process used to produce ***IOF POWDER*** contain or introduce dairy, eggs, seafood, shellfish, tree nuts, peanuts, grains, or soy.
USDA Organic	Idaho State Department of Agriculture certified
Kosher	Orthodox Union certified
Non-GMO	Food Chain ID certified
Vegan	Vegan Action certified
Gluten Free	Gluten Free Certification Organization certified
Halal	Islamic Food and Nutritional Council of America

PACKAGING

IOF POWDER is packaged in 20 kg multi-layer poly-lined paper bags (50 bags per pallet).

CERTIFICATE OF ANALYSIS

ORGANIC IOF SYRUP
Batch Number : [redacted]
Date: 4/17/2018

PARAMETER	SPECIFICATION	TESTED VALUES[1]	UNIT	METHOD
PHYSICAL ASPECTS				
Total Solids	>65	71.4	%	AOAC 925.45
COMPOSITION (on a dry basis)				
Carbohydrates	>80	87.93	%	AOAC 950.46
Inulin (DP-3 to DP-60+)	>65	77.05	%	Calculated
Fructose, Glucose, Sucrose, Maltose	<20	10.88	%	AOAC 980.13
Chain Length (Monomers)	>3	3-46	-	OP-8014[2]
Protein	<10	5.94	%	AOAC 992.23
Ash	<10	6.13	%	AOAC 900.02
MICROBIOLOGY				
Total Aerobic Plate Count	1000	Undetected	CFU/gram	AOAC 2015.13
Bacillus cereus	100	Undetected	CFU/gram	FDA/BAM
Mold	20	Undetected	CFU/gram	AOAC 2014.05
Yeast	20	Undetected	CFU/gram	AOAC 2014.05
Enterobacteriaceae	Absent	Undetected	/gram	AOAC 2003.01
Coliform	Absent	Undetected	/gram	AOAC 991.14
E. coli	Absent	Undetected	/gram	AOAC 991.14
Staphlococcus aureus	Absent	Undetected	/gram	FDA/BAM
Salmonella	Absent	Undetected	/25 grams	AOAC 100201
OTHER INFORMATION				
Manufacture Date			04/10/2018	
Expiration Date			04/10/2019	

VERIFIED

AMY R HALL
Laboratory Manager
1410 Organic Way
Weiser, ID 83672

All batches comply with FDA regulations for foodstuffs regarding microbial criteria, pesticides and heavy metals.

[1] Tested **values** are mean values for the **batch**

CERTIFICATE OF ANALYSIS

ORGANIC IOF SYRUP

Batch Number : [redacted]
Date: 7/09/2018

INTRINSIC ORGANICS

PARAMETER	SPECIFICATION	TESTED VALUES[1]	UNIT	METHOD
PHYSICAL ASPECTS				
Total Solids	>65	69.03	%	AOAC 932.14
COMPOSITION (on a dry basis)				
Carbohydrates	>80	86.25	%	AOAC 950.46
Inulin (DP-3 to DP-70+)	>65	68.90	%	Calculated
Fructose, Glucose, Sucrose, Maltose	<20	17.35	%	AOAC 980.13
Chain Length (Monomers)	>3	3-60	-	OP-8014[2]
Protein	<10	6.30	%	AOAC 992.23
Ash	<10	7.45	%	AOAC 900.02
MICROBIOLOGY				
Total Aerobic Plate Count	1000	10	CFU/gram	AOAC 2015.13
Bacillus cereus	100	Undetected	CFU/gram	FDA/BAM
Mold	20	Undetected	CFU/gram	AOAC 2014.05
Yeast	20	Undetected	CFU/gram	AOAC 2014.05
Enterobacteriaceae	Absent	Undetected	/gram	AOAC 2003.01
Coliform	Absent	Undetected	/gram	AOAC 991.14
E. coli	Absent	Undetected	/gram	AOAC 991.14
Staphlococcus aureus	Absent	Undetected	/gram	FDA/BAM
Salmonella	Absent	Undetected	/25 grams	AOAC 100201
OTHER INFORMATION				
Manufacture Date			06/27/2018	
Expiration Date			06/27/2019	

VERIFIED

AMY R HALL
Laboratory Manager
1410 Organic Way
Weiser, ID 83672

All batches comply with FDA regulations for foodstuffs regarding microbial criteria, pesticides and heavy metals.

[1] Printed Values are representative for this batch
[2] Method verified in accordance with standard validation

CERTIFICATE OF ANALYSIS

ORGANIC IOF SYRUP

Batch Number : [redacted]
Date: 8/27/2018

PARAMETER	SPECIFICATION	TESTED VALUES[1]	UNIT	METHOD
PHYSICAL ASPECTS				
Total Solids	>65	66.8	%	AOAC 925.45
COMPOSITION (on a dry basis)				
Carbohydrates	>80	84.78	%	AOAC 950.46
Inulin (DP-3 to DP-60+)	>65	66.84	%	Calculated
Fructose, Glucose, Sucrose, Maltose	<20	17.94	%	AOAC 980.13
Chain Length (Monomers)	>3	3-68	-	OP-8014[2]
Protein	<10	7.99	%	AOAC 992.23
Ash	<10	7.22	%	AOAC 900.02
MICROBIOLOGY				
Total Aerobic Plate Count	1000	404	CFU/gram	AOAC 2015.13
Bacillus cereus	100	23	CFU/gram	FDA/BAM
Mold	20	Undetected	CFU/gram	AOAC 2014.05
Yeast	20	17	CFU/gram	AOAC 2014.05
Enterobacteriaceae	Absent	Undetected	/gram	AOAC 2003.01
Coliform	Absent	Undetected	/gram	AOAC 991.14
E. coli	Absent	Undetected	/gram	AOAC 991.14
Staphlococcus aureus	Absent	Undetected	/gram	AOAC 975.55
Salmonella	Absent	Undetected	/25 grams	AOAC 2004.03
OTHER INFORMATION				
Manufacture Date			07/28/2018	
Expiration Date			07/28/2019	

VERIFIED

AMY R HALL
Laboratory Manager
1410 Organic Way
Weiser, ID 83672

All batches comply with FDA regulations for foodstuffs regarding microbial criteria, pesticides and heavy metals.

[1] Printed Values are mean values for this batch
[2] Internal method, no international standard available

CERTIFICATE OF ANALYSIS

ORGANIC IOF POWDER

Batch Number : [redacted]
Date: 8/14/2018

PARAMETER	SPECIFICATION	TESTED VALUES[1]	UNIT	METHOD
PHYSICAL ASPECTS				
Total Solids	>90	99.00	%	AOAC 931.04
COMPOSITION (on a dry basis)				
Carbohydrates	>80	85.93	%	AOAC 950.46
Inulin (DP-3 to DP-60+)	>65	81.06	%	Calculated
Fructose, Glucose, Sucrose, Maltose	<20	4.78	%	AOAC 980.13
Chain Length (Monomers)	>3	3-61	-	OP-8014[2]
Protein	<10	6.57	%	AOAC 992.23
Ash	<10	7.32	%	AOAC 923.03
MICROBIOLOGY				
Total Aerobic Plate Count	1000	220	CFU/gram	AOAC 2015.13
Bacillus cereus	100	43	CFU/gram	FDA/BAM
Mold	20	Undetected	CFU/gram	AOAC 2014.05
Yeast	20	3	CFU/gram	AOAC 2014.05
Enterobacteriaceae	Absent	Undetected	/gram	AOAC 2003.01
Coliform	Absent	Undetected	/gram	AOAC 991.14
E. coli	Absent	Undetected	/gram	AOAC 991.14
Staphlococcus aureus	Absent	Undetected	/gram	AOAC 975.55
Salmonella	Absent	Undetected	/25 grams	AOAC 2004.03
OTHER INFORMATION				
Manufacture Date			03/26/2018	
Expiration Date			03/26/2023	

VERIFIED

AMY R HALL
Laboratory Manager
1410 Organic Way
Weiser, ID 83672

All batches comply with FDA regulations for foodstuffs regarding microbial criteria, pesticides and heavy metals.

Printed [illegible]

[illegible]

CERTIFICATE OF ANALYSIS

ORGANIC IOF POWDER

Batch Number : [redacted]
Date: 10/24/2018

PARAMETER	SPECIFICATION	TESTED VALUES[1]	UNIT	METHOD
PHYSICAL ASPECTS				
Total Solids	>90	95.27	%	AOAC 931.04
COMPOSITION (on a dry basis)				
Carbohydrates	>80	88.05	%	AOAC 950.46
Inulin (DP-3 to DP-60+)	>65	82.14	%	Calculated
Fructose, Glucose, Sucrose, Maltose	<20	5.88	%	AOAC 980.13
Chain Length (Monomers)	>3	3-80	-	OP-8014[2]
Protein	<10	6.15	%	AOAC 992.23
Ash	<10	5.80	%	AOAC 923.03
MICROBIOLOGY				
Total Aerobic Plate Count	1000	500	CFU/gram	AOAC 2015.13
Bacillus cereus	100	93	CFU/gram	FDA/BAM
Mold	20	Undetected	CFU/gram	AOAC 2014.05
Yeast	20	Undetected	CFU/gram	AOAC 2014.05
Enterobacteriaceae	Absent	Undetected	/gram	AOAC 2003.01
Coliform	Absent	Undetected	/gram	AOAC 991.14
E. coli	Absent	Undetected	/gram	AOAC 991.14
Staphlococcus aureus	Absent	Undetected	/gram	AOAC 975.55
Salmonella	Absent	Undetected	/25 grams	AOAC 2004.03
OTHER INFORMATION				
Manufacture Date			10/12/2018	
Expiration Date			10/12/2023	

VERIFIED

AMY R HALL
Laboratory Manager
1410 Organic Way
Weiser, ID 83672

All batches comply with FDA regulations for foodstuffs regarding microbial criteria, pesticides and heavy metals.

[1] Printed values are mean values for this batch
[2] Internal method, no international standard available

CERTIFICATE OF ANALYSIS

ORGANIC IOF POWDER

Batch Number : [redacted]
Date: 11/02/2018

PARAMETER	SPECIFICATION	TESTED VALUES[1]	UNIT	METHOD
PHYSICAL ASPECTS				
Total Solids	>90	94.64	%	AOAC 931.04
COMPOSITION (on a dry basis)				
Carbohydrates	>80	89.70	%	AOAC 950.46
Inulin (DP-3 to DP-60+)	>65	83.36	%	Calculated
Fructose, Glucose, Sucrose, Maltose	<20	6.34	%	AOAC 980.13
Chain Length (Monomers)	>3	3-82	-	OP-8014[2]
Protein	<10	6.48	%	AOAC 992.23
Ash	<10	3.83	%	AOAC 923.03
MICROBIOLOGY				
Total Aerobic Plate Count	1000	200	CFU/gram	AOAC 2015.13
Bacillus cereus	100	43	CFU/gram	FDA/BAM
Mold	20	Undetected	CFU/gram	AOAC 2014.05
Yeast	20	Undetected	CFU/gram	AOAC 2014.05
Enterobacteriaceae	Absent	Undetected	/gram	AOAC 2003.01
Coliform	Absent	Undetected	/gram	AOAC 991.14
E. coli	Absent	Undetected	/gram	AOAC 991.14
Staphlococcus aureus	Absent	Undetected	/gram	AOAC 975.55
Salmonella	Absent	Undetected	/25 grams	AOAC 2004.03
OTHER INFORMATION				
Manufacture Date			10/23/2018	
Expiration Date			10/23/2023	

VERIFIED

AMY R HALL
Laboratory Manager
1410 Organic Way
Weiser, ID 83672

All batches comply with FDA regulations for foodstuffs regarding microbial criteria, pesticides and heavy metals.

[1] Printed values are mean values for this batch
[2] Internal method, no international standard available

FSNS
Food Safety Net Services

Analytical Results

Report Number : 19-026678
Report Date : 01/28/2019

258 W. Turbo, San Antonio, TX, 78216 Phone:210-308-0675 Fax:210-308-8730

Customer : Intrinsic Organics LLC
Contact : Amy Hall
1410 Organic Way

Weiser, ID, 83672
Phone : 208-417-4470
Fax :

Samples Received : 01/22/2019
Start of Testing : 01/23/2019
PO Number : 2017-207

Billing Code	Sample Date	Sample Number	Sample Description	Analysis - FSNS Method Number	Result	Units
HMS28	12/04/2018	001	201812041S Inulin Syrup Composite: None	Heavy Metal Screen 4 - ICPMS: Pb, Hg, As, Cd	Complete	
NC	12/04/2018	001		Arsenic (ICP-MS) #C55	<0.020	ppm
				Test Note: Arsenic = Undetected		
NC	12/04/2018	001		Cadmium (ICP-MS) #C55	<0.020	ppm
				Test Note: Cadmium = Undetected		
NC	12/04/2018	001		Mercury (ICP-MS) #C55	<0.010	ppm
				Test Note: Mercury = Undetected		
NC	12/04/2018	001		Lead (ICP-MS) #C55	<0.020	ppm
				Test Note: Lead= Undetected		

Sample Temperature Upon Receipt : 13.6 deg C

Remarks :

All results contained in the above report relate only to the items tested.All Samples Received in Satisfactory Condition Unless Noted Otherwise.

For Questions or Comments Contact :
Josh Collins
210-308-0675 or joshua.collins@fsns.com

First Approval By : Maria Carranco
Signature : [redacted]

Second Approval By : Hillary Jacques
Signature : [redacted]

FSNS
Food Safety Net Services

Analytical Results

Report Number : 18-234886
Report Date : 08/24/2018

351 N Mitchell St Suite 300, Boise, ID, 83704 Phone:208-513-2020 Fax:208-513-2055

Customer : Intrinsic Organics LLC
Contact : Amy Hall
1410 Organic Way

Weiser, ID, 83672
Phone : 208-417-4470
Fax :

Samples Received : 08/06/2018
Start of Testing : 08/06/2018
PO Number :

Billing Code	Sample Date	Sample Number	Sample Description	Analysis - FSNS Method Number	Result	Units
PRO02	07/28/2018	001	201807281S Inulin Syrup **Composite:** None	Percent Protein- Combustion #C1565 (AOAC)	5.34	%
HMS28	07/28/2018	001		Heavy Metal Screen 4 - ICPMS: Pb, Hg, As, Cd	Complete	
SAL49	07/28/2018	001		Salmonella FSNS #32.2 (ELFA-AOAC) 25g	Negative	25 gram
SPEPRO	07/28/2018	001		Special Chemistry Project Test Note: Veratox Aflatoxin Total Final Result: Undetected Veratox DON 2/3 Final Result: 0.7 ppm Veratox Ochratoxin Final Result: Undetected	Complete	
SPEPRO	07/28/2018	001		Special Chemistry Project Test Note: HPLC Zearalenone final result: Undetected Veratox Fumonisin 5/10 final result: Undetected	Complete	
SPEPRO	07/28/2018	001		Special Chemistry Project Test Note: See Attached Results	Complete	
STA01	07/28/2018	001		Staphylococcus aureus FSNS # 11.1 (FDA-BAM)	Undetected	CFU/g
NC	07/28/2018	001		Arsenic (ICP-MS) #C55 Test Note: Arsenic = Undetected	<0.020	ppm
NC	07/28/2018	001		Cadmium (ICP-MS) #C55 Test Note: Cadmium = Undetected	<0.020	ppm
NC	07/28/2018	001		Mercury (ICP-MS) #C55 Test Note: Mercury = Undetected	<0.020	ppm
NC	07/28/2018	001		Lead (ICP-MS) #C55 Test Note: Lead = Undetected	<0.020	ppm
SAL49	07/28/2018	002	20180326XP Inulin Powder	Salmonella FSNS #32.2 (ELFA-AOAC) 25g	Negative	25 gram

Customer : Intrinsic Organics LLC Report Number : 18-234886 Report Date : 08/24/2018

Billing Code	Sample Date	Sample Number	Sample Description	Analysis - FSNS Method Number	Result	Units
			Composite: None			
STA01	07/28/2018	002		Staphylococcus aureus FSNS # 11.1 (FDA-BAM)	Undetected	CFU/g

Sample Temperature Upon Receipt : 17.1 deg C

Remarks :

All results contained in the above report relate only to the items tested.All Samples Received in Satisfactory Condition Unless Noted Otherwise.

For Questions or Comments Contact :
Sarah Shay
208-513-2020 or Sarah.Shay@fsns.com

First Approval By : Kathleen Dunn

Signature : [redacted]

Second Approval By : Joel Hiatt

Signature : [redacted]

FSNS
Food Safety Net Services

Analytical Results

Report Number : 18-318029
Report Date : 10/23/2018

351 N Mitchell St Suite 300, Boise, ID, 83704 Phone:208-513-2020 Fax:208-513-2055

Customer : Intrinsic Organics LLC
Contact : Amy Hall
1410 Organic Way

Weiser, ID, 83672
Phone : 208-417-4470
Fax :

Samples Received : 10/19/2018
Start of Testing : 10/19/2018
PO Number : 2017-170

Billing Code	Sample Date	Sample Number	Sample Description	Analysis - FSNS Method Number	Result	Units
HMS28	07/28/2018	001	201810101P Inulin Powder Composite: None	Heavy Metal Screen 4 - ICPMS: Pb, Hg, As, Cd	Complete	
NC	07/28/2018	001		Arsenic (ICP-MS) #C55 Test Note: Undetected	<0.020	ppm
NC	07/28/2018	001		Cadmium (ICP-MS) #C55 Test Note: Undetected	<0.020	ppm
NC	07/28/2018	001		Mercury (ICP-MS) #C55 Test Note: Undetected	<0.010	ppm
NC	07/28/2018	001		Lead (ICP-MS) #C55 Test Note: Undetected	<0.020	ppm
PRO02	07/28/2018	002	201810121P Inulin Powder Composite: None	Percent Protein- Combustion #C1565 (AOAC)	6.15	%
SAL49	07/28/2018	002		Salmonella FSNS #32.2 (ELFA-AOAC) 25g Test Note: Undetected	Negative	25 gram
STA01	07/28/2018	002		Staphylococcus aureus FSNS # 11.1 (FDA-BAM) Test Note: Undetected	<10	CFU/g

Customer : Intrinsic Organics LLC Report Number : 18-318029 Report Date : 10/23/2018

Billing Code	Sample Date	Sample Number	Sample Description	Analysis - FSNS Method Number	Result	Units

Sample Temperature Upon Receipt : 16.3 deg C

Remarks : Sampled By: JC/MSB AH

All results contained in the above report relate only to the items tested.All Samples Received in Satisfactory Condition Unless Noted Otherwise.

For Questions or Comments Contact :
Sarah Shay
208-513-2020 or Sarah.Shay@fsns.com

First Approval By : Melanie Rutherford

Signature :

Second Approval By : Zachary Harder

Signature :

FSNS
Food Safety Net Services

Analytical Results

Report Number : 18-509196
Report Date : 12/17/2018

258 W. Turbo, San Antonio, TX, 78216 Phone:210-308-0675 Fax:210-308-8730

Customer : Intrinsic Organics LLC
Contact : Amy Hall
1410 Organic Way

Weiser, ID, 83672
Phone : 208-417-4470
Fax :

Samples Received : 12/11/2018
Start of Testing : 12/12/2018
PO Number : 2017-202

Billing Code	Sample Date	Sample Number	Sample Description	Analysis - FSNS Method Number	Result	Units
HMS28	07/28/2018	001	201811151P inulin powder Composite: None	Heavy Metal Screen 4 - ICPMS: Pb, Hg, As, Cd	Complete	
NC	07/28/2018	001		Arsenic (ICP-MS) #C55	<0.020	ppm
NC	07/28/2018	001		Cadmium (ICP-MS) #C55	<0.020	ppm
NC	07/28/2018	001		Mercury (ICP-MS) #C55	<0.010	ppm
NC	07/28/2018	001		Lead (ICP-MS) #C55	<0.020	ppm
HMS28	07/28/2018	002	201811281S inulin syrup Composite: None	Heavy Metal Screen 4 - ICPMS: Pb, Hg, As, Cd	Complete	
NC	07/28/2018	002		Arsenic (ICP-MS) #C55	<0.020	ppm
NC	07/28/2018	002		Cadmium (ICP-MS) #C55	<0.020	ppm
NC	07/28/2018	002		Mercury (ICP-MS) #C55	<0.010	ppm
NC	07/28/2018	002		Lead (ICP-MS) #C55	<0.020	ppm

Sample Temperature Upon Receipt : 19.8 deg C

Remarks :

All results contained in the above report relate only to the items tested.All Samples Received in Satisfactory Condition Unless Noted Otherwise.

For Questions or Comments Contact :
Josh Collins
210-308-0675 or joshua.collins@fsns.com

First Approval By : Maria Carranco
Signature :

Second Approval By : Hillary Jacques
Signature :

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Eurofins Scientific Inc.
Nutrition Analysis Center
2200 Rittenhouse Street, Suite 150
Des Moines, IA 50321
Tel:+1 515 265 1461
Fax:+1 515 266 5453

Eurofins Sample Code: [redacted]
Sample Description: Inulin Powder
Client Sample Code: [redacted]
PO Number: [redacted]
Client Code: [redacted]

Entry Date: 12/22/2018
Reporting Date: 01/04/2019

Cargill CTS R&D
attn: Breann Rasmussen
14800 28th Ave N.
Plymouth, MN 55447

Cargill CTS R&D
Attn: Varathan Vamadevan
14800 28th Ave N.
Plymouth, MN 55447

CERTIFICATE OF ANALYSIS

AR-19-QD-001779-01

Test	Result	Theoretical Level
QA101 - Aflatoxin B1 B2 G1 G2 (LC-MSMS)		**Completed: 01/04/2019**
AOAC 999.07 Modified		
Aflatoxin B1	<5 µg/kg	
Adjusted LOQ for this matrix.		
Aflatoxin B2	<5 µg/kg	
Aflatoxin G1	<5 µg/kg	
Aflatoxin G2	<5 µg/kg	
Aflatoxins total	<5 µg/kg	
QA299 - Fumonisin, total (LC-MSMS)		**Completed: 01/04/2019**
J AOAC, 92 (2), 496.		
Fumonisin, total	<30 µg/kg	
QAA07 - Vomitoxin (Deoxynivalenol, DON) LC-MSMS		**Completed: 01/04/2019**
Internal Method		
Vomitoxin (Deoxynivalenol)	<50 µg/kg	
Adjusted LOQ for this matrix.		
QAA19 - Zearalenone (LC-MSMS)		**Completed: 01/04/2019**
Internal Method		
Zearalenone	<25 µg/kg	
Adjusted LOQ for this matrix.		
QA404 - Ochratoxin A (LC-MSMS)		**Completed: 01/04/2019**
AOAC 999.07 Modified		
Ochratoxin A	<5 µg/kg	
Adjusted LOQ for this matrix.		

Eurofins Sample Code: (b) (4)
Client Sample Code: (b) (4)

Respectfully Submitted,
Eurofins Scientific Inc.

David Gross

Support Services Manager

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Eurofins Scientific Inc.
Nutrition Analysis Center
2200 Rittenhouse Street, Suite 150
Des Moines, IA 50321
Tel:+1 515 265 1461
Fax:+1 515 266 5453

Eurofins Sample Code: (b) (6)
Sample Description: Inulin Powder
Client Sample Code: (b) (6)
PO Number:
Client Code:

Entry Date: 12/22/2018
Reporting Date: 01/04/2019

Cargill CTS R&D
attn: Breann Rasmussen
14800 28th Ave N.
Plymouth, MN 55447

Cargill CTS R&D
Attn: Varathan Vamadevan
14800 28th Ave N.
Plymouth, MN 55447

CERTIFICATE OF ANALYSIS

AR-19-QD-001780-01

Test	Result	Theoretical Level
QA101 - Aflatoxin B1 B2 G1 G2 (LC-MSMS)		**Completed: 01/04/2019**
AOAC 999.07 Modified		
Aflatoxin B1	<5 µg/kg	
Adjusted LOQ for this matrix.		
Aflatoxin B2	<5 µg/kg	
Aflatoxin G1	<5 µg/kg	
Aflatoxin G2	<5 µg/kg	
Aflatoxins total	<5 µg/kg	
QA299 - Fumonisin, total (LC-MSMS)		**Completed: 01/04/2019**
J AOAC, 92 (2), 496.		
Fumonisin, total	<30 µg/kg	
QAA07 - Vomitoxin (Deoxynivalenol, DON) LC-MSMS		**Completed: 01/04/2019**
Internal Method		
Vomitoxin (Deoxynivalenol)	<50 µg/kg	
Adjusted LOQ for this matrix.		
QAA19 - Zearalenone (LC-MSMS)		**Completed: 01/04/2019**
Internal Method		
Zearalenone	<25 µg/kg	
Adjusted LOQ for this matrix.		
QA204 - Ochratoxin A (LC-MSMS)		**Completed: 01/04/2019**
AOAC 999.07 Modified		
Ochratoxin A	<5 µg/kg	
Adjusted LOQ for this matrix.		

Eurofins Sample Code: (b) (4)
Client Sample Code: (b) (4)

Respectfully Submitted,
Eurofins Scientific Inc.

David Gross

Support Services Manager

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Eurofins Scientific Inc.
Nutrition Analysis Center
2200 Rittenhouse Street, Suite 150
Des Moines, IA 50321
Tel:+1 515 265 1461
Fax:+1 515 266 5453

Eurofins Sample Code: [redacted]
Sample Description: Inulin Powder
Client Sample Code: (b) (4)
PO Number: (b) (4)
Client Code: [redacted]

Entry Date: 12/22/2018
Reporting Date: 01/04/2019

Cargill CTS R&D
attn: Breann Rasmussen
14800 28th Ave N.
Plymouth, MN 55447

Cargill CTS R&D
Attn: Varathan Vamadevan
14800 28th Ave N.
Plymouth, MN 55447

CERTIFICATE OF ANALYSIS

AR-19-QD-001781-01

Test	Result	Theoretical Level
QA101 - Aflatoxin B1 B2 G1 G2 (LC-MSMS)		**Completed: 01/04/2019**
AOAC 999.07 Modified		
Aflatoxin B1	<5 µg/kg	
Adjusted LOQ for this matrix.		
Aflatoxin B2	<5 µg/kg	
Aflatoxin G1	<5 µg/kg	
Aflatoxin G2	<5 µg/kg	
Aflatoxins total	<5 µg/kg	
QA200 - Fumonisin, total (LC-MSMS)		**Completed: 01/04/2019**
J AOAC, 92 (2), 496.		
Fumonisin, total	<30 µg/kg	
QAA07 - Vomitoxin (Deoxynivalenol, DON) LC-MSMS		**Completed: 01/04/2019**
Internal Method		
Vomitoxin (Deoxynivalenol)	<50 µg/kg	
Adjusted LOQ for this matrix.		
QAA19 - Zearalenone (LC-MSMS)		**Completed: 01/04/2019**
Internal Method		
Zearalenone	<25 µg/kg	
Adjusted LOQ for this matrix.		
QA404 - Ochratoxin A (LC-MSMS)		**Completed: 01/04/2019**
AOAC 999.07 Modified		
Ochratoxin A	<5 µg/kg	
Adjusted LOQ for this matrix.		

Eurofins Sample Code: (b) (4)
Client Sample Code: (b) (4)

Respectfully Submitted,
Eurofins Scientific Inc.

David Gross
Support Services Manager

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Eurofins Scientific Inc.
Nutrition Analysis Center
2200 Rittenhouse Street, Suite 150
Des Moines, IA 50321
Tel:+1 515 265 1461
Fax:+1 515 266 5453

Eurofins Sample Code: [redacted]
Sample Description: Inulin Syrup
Client Sample Code: (b) (4)
PO Number: (b) (4)
Client Code: [redacted]

Entry Date: 12/22/2018
Reporting Date: 01/04/2019

Cargill CTS R&D
attn: Breann Rasmussen
14800 28th Ave N.
Plymouth, MN 55447

Cargill CTS R&D
Attn: Varathan Vamadevan
14800 28th Ave N.
Plymouth, MN 55447

CERTIFICATE OF ANALYSIS

AR-19-QD-001782-01

Test	Result	Theoretical Level
QA101 - Aflatoxin B1 B2 G1 G2 (LC-MSMS)		**Completed: 01/04/2019**
AOAC 999.07 Modified		
Aflatoxin B1	<5 µg/kg	
Adjusted LOQ for this matrix.		
Aflatoxin B2	<5 µg/kg	
Aflatoxin G1	<5 µg/kg	
Aflatoxin G2	<5 µg/kg	
Aflatoxins total	<5 µg/kg	
QA220 - Fumonisin, total (LC-MSMS)		**Completed: 01/04/2019**
J AOAC, 92 (2), 496.		
Fumonisin, total	<30 µg/kg	
QA207 - Vomitoxin (Deoxynivalenol, DON) LC-MSMS		**Completed: 01/04/2019**
Internal Method		
Vomitoxin (Deoxynivalenol)	<50 µg/kg	
Adjusted LOQ for this matrix.		
QA219 - Zearalenone (LC-MSMS)		**Completed: 01/04/2019**
Internal Method		
Zearalenone	<25 µg/kg	
Adjusted LOQ for this matrix.		
QA105 - Ochratoxin A (LC-MSMS)		**Completed: 01/04/2019**
AOAC 999.07 Modified		
Ochratoxin A	<5 µg/kg	
Adjusted LOQ for this matrix.		

Eurofins Sample Code: (b) (4)
Client Sample Code: (b) (4)

Respectfully Submitted,
Eurofins Scientific Inc.

David Gross

Support Services Manager

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Eurofins Scientific Inc.
Nutrition Analysis Center
2200 Rittenhouse Street, Suite 150
Des Moines, IA 50321
Tel:+1 515 265 1461
Fax:+1 515 266 5453

Eurofins Sample Code: (b) (4)
Sample Description: Inulin Syrup
Client Sample Code: (b) (4)
PO Number:
Client Code: (b) (4)

Entry Date: 09/10/2018
Reporting Date: 09/19/2018

Cargill
Attn: Erik Eliason
14800 28th Ave N.
MS #117
Plymouth, MN 55447

CERTIFICATE OF ANALYSIS

AR-18-QD-140673-01

Test	Result	Theoretical Level
QAA07 - Vomitoxin (Deoxynivalenol, DON) LC-MSMS		Completed: 09/19/2018
Internal Method		
Vomitoxin (Deoxynivalenol)	<50 µg/kg	

Respectfully Submitted,
Eurofins Scientific Inc.

David Gross
Support Services Manager

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Eurofins Scientific Inc.
Nutrition Analysis Center
2200 Rittenhouse Street, Suite 150
Des Moines, IA 50321
Tel:+1 515 265 1461
Fax:+1 515 266 5453

Eurofins Sample Code: [redacted]
Sample Description: Inulin Syrup
Client Sample Code: (b) (4)
PO Number:
Client Code: (b) (4)

Entry Date: 09/10/2018
Reporting Date: 09/19/2018

Cargill
Attn: Erik Eliason
14800 28th Ave N.
MS #117
Plymouth, MN 55447

CERTIFICATE OF ANALYSIS

AR-18-QD-140674-01

Test	Result	Theoretical Level
QAA07 - Vomitoxin (Deoxynivalenol, DON) LC-MSMS		**Completed: 09/19/2018**
Internal Method		
Vomitoxin (Deoxynivalenol)	<50 µg/kg	

Respectfully Submitted,
Eurofins Scientific Inc.

David Gross
Support Services Manager

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FSNS®
Food Safety Net Services
258 W. Turbo, San Antonio, TX 78216 Ph 210-384-3426 Fax 210-308-8730

Analytical Results

Contact: Amy Hall

Customer: **Intrinsic Oganics**

Ph: 208-417-4470
Fax:

Report Number: 18-234886

Report Date: 8/24/18

Samples Received: 8/6/18
Start of Testing: 8/6/18
PO#

Sample Date	Sample Number	Sample Description	Analysis	Results	Units	Detection Limit
			OC Screen			
			a, b, d-BHC	ND	ppm	0.01
			Alachlor	ND	ppm	0.02
			Aldrin	ND	ppm	0.01
			Benfluralin	ND	ppm	0.02
			Bifenox	ND	ppm	0.05
			Boscalid	ND	ppm	0.02
			Bromacil	ND	ppm	0.04
			Captafol	ND	ppm	0.04
			Captan	ND	ppm	0.02
			Chlordane (sum of Isomers)	ND	ppm	0.02
			Chlorfenapyr	ND	ppm	0.04
			Chlorobenzilate	ND	ppm	0.04
			Chloroneb	ND	ppm	0.04
			Chlorothalonil	ND	ppm	0.01
			Cyanazine	ND	ppm	0.10
			Dacthal	ND	ppm	0.02
			DDD	ND	ppm	0.02
			DDE	ND	ppm	0.02
			DDT	ND	ppm	0.02
			Dichlobenil	ND	ppm	0.03
			Dichlone	ND	ppm	0.05
			Dicloran	ND	ppm	0.02
			Dicofol	ND	ppm	0.05
			Dieldrin	ND	ppm	0.01
			Endosulfan alpha	ND	ppm	0.01
			Endosulfan beta	ND	ppm	0.01
			Endosulfan sulfate	ND	ppm	0.01
			Endosulfans (Total)	ND	ppm	0.01
			Endrin	ND	ppm	0.01
			Ethafluralin	ND	ppm	0.03
			Fenhexamid	ND	ppm	0.03
			Folpet	ND	ppm	0.05
			Heptachlor	ND	ppm	0.01
			Heptachlor epoxide	ND	ppm	0.02
			Hexachlorobenzene	ND	ppm	0.01
			Indoxacarb	ND	ppm	0.03
			Iprodione	ND	ppm	0.05
			Lindane (gamma-BHC)	ND	ppm	0.01
			Linuron	ND	ppm	0.15
			Methoxychlor	ND	ppm	0.05
			Metribuzin	ND	ppm	0.02
			Mirex	ND	ppm	0.02
			Myclobutanil	ND	ppm	0.05
			Oxadiazon	ND	ppm	0.05
			Oxyfluorfen	ND	ppm	0.04
			Pendimethalin	ND	ppm	0.05
			Pentachloronitrobenzene (PCNB)	ND	ppm	0.02
			Pentachloroanaline (PCA)	ND	ppm	0.01

Sample Date	Sample Number	Sample Description	Analysis	Results	Units	Detection Limit
			OC Screen (cont'd)			
			Permethane	ND	ppm	0.10
			Polychlorinated Biphenyls	ND	ppm	0.25
			Procymidone	ND	ppm	0.02
			Profluralin	ND	ppm	0.02
			Pronamide	ND	ppm	0.05
			Propanil	ND	ppm	0.05
			Tetradifon	ND	ppm	0.02
			Toxaphene	ND	ppm	0.25
			Triadimefon	ND	ppm	0.02
			Trifloxystrobin	ND	ppm	0.03
			Triflumazole	ND	ppm	0.05
			Trifluralin	ND	ppm	0.02
			Vegadex (Diethyldithiocarbamic Acid)	ND	ppm	0.05
			Vinclozolin	ND	ppm	0.02
			Pyrethroid Screen			
			Bifenthrin	ND	ppm	0.02
			Cyfluthrin	ND	ppm	0.04
			Cypermethrin	ND	ppm	0.04
			Deltamethrin	ND	ppm	0.02
			Esfenvalerate	ND	ppm	0.03
			Fenpropathrin	ND	ppm	0.01
			Fluvalinate	ND	ppm	0.04
			lambda Cyhalothrin	ND	ppm	0.01
			Permethrin	ND	ppm	0.10
			Tralomethrin	ND	ppm	0.02
			Pyrethrins (Total)	ND	ppm	0.05
			ON Screen			
			Acetamiprid	ND	ppm	0.05
			Atrazine	ND	ppm	0.03
			Azoxystrobin	ND	ppm	0.03
			Benthiocarb	ND	ppm	0.05
			Cyanazine	ND	ppm	0.05
			Cyromazine	ND	ppm	0.05
			Cyprodinil	ND	ppm	0.05
			Dimethomorph	ND	ppm	0.05
			Diphenyl Amine	ND	ppm	0.05
			Fenamidone	ND	ppm	0.05
			Fenbuconazole	ND	ppm	0.05
			Fipronil	ND	ppm	0.05
			Fludioxinil	ND	ppm	0.05
			Hexazinone	ND	ppm	0.05
			Imazalil	ND	ppm	0.05
			Kresoxim Methyl	ND	ppm	0.05
			Metalaxyl	ND	ppm	0.05
			Metolachlor	ND	ppm	0.05
			Metribuzin	ND	ppm	0.05
			Molinate	ND	ppm	0.05
			Myclobutanil	ND	ppm	0.05
			Prometon	ND	ppm	0.05
			Prometryne	ND	ppm	0.05
			Propamocarb	ND	ppm	0.05
			Propiconazole	ND	ppm	0.05
			Pymetrozine	ND	ppm	0.05
			Pyraclostrobin	ND	ppm	0.05
			Pyriproxifen	ND	ppm	0.05
			Sethoxydim	ND	ppm	0.05
			Simazine	ND	ppm	0.05
			Tebuconazole	ND	ppm	0.05
			Terbacil	ND	ppm	0.05
			Thiabendazole	ND	ppm	0.05

Report Number: 18-254886 Report Date:

Sample Date	Sample Number	Sample Description	Analysis	Results	Units	
			OP Screen			
			Acephate	ND	ppm	0.02
			Azinphos-methyl	ND	ppm	0.05
			Bolstar	ND	ppm	0.03
			Bensulide	ND	ppm	0.05
			Carbofenothion	ND	ppm	0.02
			Chlorfenvinphos	ND	ppm	0.03
			Chlorpyrifos	ND	ppm	0.02
			Chlorpyrifos-methyl	ND	ppm	0.03
			Ciodrin	ND	ppm	0.05
			Coumaphos	ND	ppm	0.05
			DEF	ND	ppm	0.05
			Demeton (Systox) O S Analogues	ND	ppm	0.04
			Diazinon	ND	ppm	0.03
			Dibrom	ND	ppm	0.05
			Dichlorvos	ND	ppm	0.03
			Dicrotophos	ND	ppm	0.02
			Dimethoate	ND	ppm	0.02
			Disulfoton	ND	ppm	0.02
			EPN	ND	ppm	0.02
			Ethion	ND	ppm	0.03
			Ethoprop	ND	ppm	0.05
			Fenamiphos	ND	ppm	0.02
			Fenitrothion	ND	ppm	0.03
			Fenthion	ND	ppm	0.02
			Fonofos	ND	ppm	0.04
			Isofenphos	ND	ppm	0.03
			Malathion	ND	ppm	0.02
			Metasystox-R	ND	ppm	0.05
			Methamidophos	ND	ppm	0.03
			Methidathion	ND	ppm	0.03
			Methyl Parathion	ND	ppm	0.03
			Mevinphos	ND	ppm	0.05
			O-methoate	ND	ppm	0.05
			Parathion	ND	ppm	0.04
			Phorate	ND	ppm	0.05
			Phosalone	ND	ppm	0.05
			Phosmet	ND	ppm	0.03
			Phosphamidon	ND	ppm	0.02
			Pyrimiphos-methyl	ND	ppm	0.05
			Profenofos	ND	ppm	0.02
			Propetamphos	ND	ppm	0.02
			Ronnel	ND	ppm	0.03
			Tetrachlorvinphos	ND	ppm	0.02
			Thionazin	ND	ppm	0.02

Note:
ND = None Detected at or below the detection limit.

Supervisory Approval by:

EXHIBIT 1

Report of the Expert Panel

OPINION OF AN EXPERT PANEL ON THE SAFETY AND GENERALLY RECOGNIZED AS SAFE (GRAS) STATUS OF INULIN FROM JERUSALEM ARTICHOKE FOR USE IN FOOD

Introduction

An independent panel of experts (Expert Panel), qualified by scientific training and experience to evaluate the safety of food and food ingredients, was requested by Intrinsic Organics, LLC to determine the safety and Generally Recognized as Safe (GRAS) status of the use of inulin from Jerusalem Artichoke for use in food for human consumption. Inulin is intended for use as a bulking agent in food for human consumption (except for infant formula), in which it will serve as a source of a reduced-energy carbohydrate, and for use as a sugar replacer, humectant, fat-replacer, and/or texture modifier as well as a source of non-digestible dietary fiber. The inulin ingredient is manufactured in accordance with current Good Manufacturing Practice (cGMP) and meets the proposed specifications.

A detailed review based on the existing scientific literature (through September 2018) on the safety of inulin and Jerusalem Artichoke was conducted by ToxStrategies, Inc. (ToxStrategies) and is summarized in the attached dossier. The Expert Panel members reviewed the dossier prepared by ToxStrategies and other pertinent information and convened on January 14, 2019 via teleconference. Based on their independent, critical evaluation of all of the available information and subsequent discussions during the January 14, 2019 teleconference, the Expert Panel unanimously concluded that the intended uses and use levels described herein for Intrinsic Organics' inulin ingredient, meeting appropriate food-grade specifications as described in the supporting dossier (**GRAS Determination of Inulin from Jerusalem Artichoke for Use in Food**) and manufactured according to cGMP, are safe, suitable, and GRAS based on scientific procedures. A summary of the basis for the Expert Panel's conclusion is provided below.

Summary and Basis for GRAS Determination

Description

The inulin product is sourced from Jerusalem Artichoke (*Helianthus tuberosus*), as distinguished from the globe artichoke. Two forms of inulin are produced by Intrinsic Organics and include an inulin powder (IOF-POWDER) and inulin syrup (IOF-SYRUP). Inulin ($C_{6n}H_{10n+2}O_{5n+1}$) consists primarily of a mixture of linear β-(1-2)-linked fructose chains with a terminal glycopyranose unit at the reducing end (Kays and Nottingham, 2007; Mensink et al, 2015). Of the various naturally occurring chain-length species of polysaccharides, the most common fractions are referred to as inulin, oligofructose, and fructooligosaccharides (FOS). The IOF products contain the whole fructo-oligo/polysaccharide with a chain length ranging from DP-3 to over DP-60.

The IOF inulin products are either in a brown liquid or tan powder form that have a neutral taste, an average pH at 10° Brix of approximately 5.7, and an average density of 1.2 kg/L (syrup) or 0.6 kg/L (powder).

Manufacturing Process

Inulin is manufactured from Jerusalem Artichoke in accordance with current Good Manufacturing Practice (cGMP) (21 CFR Title 21 Part 117 Subpart B). Hot water is employed to extract the fiber from raw tubers, which is subsequently filtered in several steps to clarify and remove suspended solids and reduce protein, simple carbohydrates, and minerals. The filtration steps also remove excess water to concentrate the product prior to a heat treatment kill step. After the kill step, the concentrated liquid is directed to one of two final processing steps. For inulin powder (IOF-POWDER), the concentrated liquid is spray-dried and bagged. For inulin syrup (IOF-SYRUP) production, the concentrated liquid is evaporated for further concentration before packing in intermediate bulk containers.

Analytical (physical, chemical and microbiological) results for the inulin product confirm that the finished product meets the proposed specifications as demonstrated by the consistency of production, the lack of impurities and contaminants (e.g., heavy metals-lead, arsenic, mercury, and cadmium; microbiological contaminants-yeast, mold, coliforms; mycotoxins-aflatoxins, fumonisin, vomitoxin, zearalenone, Ochratoxin A).

Intrinsic Organics currently recommends that the product be stored in a dry place in its original container and tightly sealed until use. Once opened, the inulin product should be handled using cGMPs. Stability testing of unopened containers of the syrup and powder inulin forms is in progress. Currently 2-month (syrup) and 3-month (powder) stability data indicate that the products are stable. Additional data will be available at 6 months and beyond. Similar to other currently marketed inulin products, Intrinsic Organics considers the finished product to also be stable when kept in an unopened, sealed container under ambient conditions for a minimum for 1 year for IOF-SYRUP, and 5 years for IOF-POWDER.

History of Use

Inulin and inulin/oligofructose products from chicory root are considered GRAS for use in food for human consumption, including infant formula (FDA, 2003, 2014, 2015; see Table below). Extensive published information and data have been submitted to and reviewed by FDA as part of the various GRNs for inulin-related products. In addition to the FDA, USDA's FSIS, and the FDA Center for Veterinary Medicine (CVM) reviewed the safety of inulin and oligofructose as part of several regulatory submissions for the use of inulin as a binder, emulsifier, stabilizer, and texturizer in processed meat products and for inclusion by the Association of Feed Control Officials as an additive to the food of poultry, ruminants, non-ruminants, and companion animals. Furthermore, fructooligosaccharides, a shorter chain-length fructan, was determined to be GRAS without questions from the FDA (GRN 44, FDA, 2000; GRN 623, FDA, 2016).

Year Approved	Country	Submission
2003	USA	GRN 118; Inulin from the root of the chicory plant

2014	USA	GRN 477; Long-chain inulin from chicory roots for use in infant and toddler formulas and medical foods
2015	USA	GRN 576; Oligofructose and inulin from chicory roots for use in infant formulas
2016	USA	GRN 623; fructooligosaccharide from sucrose
2000	USA	GRN 044; fructooligosaccharide from sucrose syrup
2006*	Canada	Inulin from chicory root*, **Jerusalem Artichoke tuber**, or blue agave head; by hot water extraction or conventional separation processes

*Beneo ORAFTI inulin from chicory root

Canada has also approved the classification of inulin as a dietary fiber. The Canadian Food Inspection Agency (2011) lists "chicory root inulin" and "Inulin from Jerusalem Artichoke tuber" as traditional fiber sources. The Health Canada approval is for suggested doses of ≤15 g/day for adults. Inulin is classified as an allowable food ingredient under the European Directive 95/002 on Food Additives (EC, 1995). The European Food Safety Authority (EFSA) Panel on Dietetic Products, Nutrition, and Allergies reported no adverse events in clinical studies following consumption of chicory inulin (ORAFTI inulin) ranging from 12 to 40 g/day (EFSA, 2015). Similarly, inulin has been added to food in Australia and New Zealand for approximately 20 years and is also labeled as a dietary fiber (FSANZ, 2008).

Intended Use and Intake Assessment

Inulin is found naturally in the roots, stems, leaves, and seeds of many edible plants and fruits (see Table below). Inulin is a found in many plants, including the *Liliaceae*, *Graminae* (grass), and *Compositae* (sunflower/daisy) families. There are many examples of plants consumed as foodstuffs that contain inulin and a fraction of inulin defined as oligofructose. Inulin-containing foods, especially chicory, dahlia, Jerusalem Artichoke, murnong, and yacon, have been used as either dietary staples or sustenance crops. Many inulin-containing crops make up a significant portion of animal and human diets (FDA, 2003; Raffinerie Tirlemontoise, 1993; Meijer et al., 1993). The natural occurrence of and exposure to inulin have been extensively summarized and reviewed as part of GRN nos. 118, 477, and 576 (FDA, 2003, 2014, 2015), and oligofructose/fructooligosaccharides as part of GRN nos. 44, 576, and 623 (FDA, 2000, 2015, 2016).

The Jerusalem Artichoke tuber was introduced from North America into parts of Europe in 1607 and was cultivated as a food crop primarily in the Netherlands, France, Italy, England, and Germany. It was superseded by the potato as a major food crop in the middle of the 18th century (Wyse and Wilfahrt, 1982; Kosaric et al., 1985). The Jerusalem Artichoke's historical use in the diet as an adequate potato substitute has caused it to be referred to as wild potato, horse potato, and diabetic potato.

Food Source[2]	Inulin Content Range (g/100g)	Oligofructose Content Range (g/100g)
Banana	0.3-0.7	0.3-0.7
Asparagus	2.0-3.0	2.0-3.0
Chicory Root	35.7-47.6	19.6-26.2
Dandelion greens	12.0-15.0	9.6-12.0
Garlic	9.0-16.0	3.6-6.4
Globe artichoke	2.0-6.8	0.2-0.7
Jerusalem Artichoke	16.0-20.0	12.0-15.0
Leeks	3.0-10.0	2.4-8.0
Onions	1.1-7.5	1.1-7.5
Wheat	1.0-4.0	1.0-4.0
Barley	0.5-1.0	0.5-1.0

[1] Adapted from Moshfegh et al., 1999.
[2] Food sources are raw, uncooked.

Both IOF-POWDER and IOF-SYRUP contain the whole fructo-oligo/polysaccharide with chain length ranging from DP-3 to over DP-60 and have application in a wide range of foods, including nutrition and energy bars, yogurt, ice cream, dressings and spreads, baked goods, cereals, and beverages. Intrinsic Organics' inulin ingredients are intended for use as an alternative source of inulin and will be used in a similar fashion in all current food categories in which it is employed (FDA, 2003; see above Table). Therefore, the proposed use of the inulin products will not increase the overall consumption of inulin, but simply will provide an alternative source of well-characterized inulin from Jerusalem Artichoke for use in food.

GRN 118 (FDA, 2003) included proposed food use categories and related use levels (see Table below) and estimated the inulin intake of the U.S. population ages 2+ and reported 2-day average mean intakes of Frutafit® (i.e., inulin from the root of the chicory plant) and inulin from all their proposed use categories of 11.3 and 10.1 grams per user per day, respectively. The estimated 90th percentile intakes of Frutafit® and inulin from the proposed uses were 21.3 and 19.2 g per user per day, respectively. It should be noted that the estimates of inulin consumption in GRN 118 were extremely conservative and likely were overestimates, because the reported intakes assume that all foods are supplemented with the maximum proposed use levels, and that individuals consume all the proposed inulin-containing foods on a daily basis. GRN 118 also estimated that the dietary intake of inulin for infants at the 90th percentile level would be approximately 6 g per day for those younger than 1 year and approximately 15 g per day for those 1 year of age. Intrinsic Organics' inulin ingredient is intended to be used as an alternative source of inulin in the same food categories and at the same equivalent food use levels as stated in GRN 118.

Food Category	GRN 118 maximum use level of Frutafit inulin (g/100g food)	Equivalent maximum use level of IOF-SYRUP (g/100g food)	Equivalent maximum use level of IOF-POWDER (g/100g food)
Baby foods: all types of baby foods and beverages, including ready-to-serve and dry baby foods (excluding infant formula)	1 g/serving[1]	0.35 g/serving[1]	0.25 g/serving[1]
Baked goods, lite cakes: fat-free and reduced fat/sugar/calorie baked goods including cakes, brownies, and pastries	5	7	5
Baked goods, lite cookies: fat-free and reduced fat/sugar/calorie cookies	8	11.2	8
Bars: all types, including breakfast bars, granola bars, energy bars, and diet/meal replacement bars	10	14	10
Beverages, fermented milks: kefir, buttermilk, yogurt drinks	2	2.8	2
Beverages, functional: meal replacement beverages and meal supplement beverages, including ready-to-drink beverages and dry beverage mixes[2]	5	7	5
Beverages, juices and juice drinks: fruit juices and drinks, including ades, cocktails, cider, nectar, and smoothies, vegetable juices, flavored waters, soy drinks, gelatin drinks, and lightly carbonated beverages, including ready-to-drink beverages and dry beverage mixes (excluding citrus juices and highly carbonated beverages)[2]	1.5	2.1	1.5
Beverages, milk-based: dairy-based beverages, including ready-to-drink beverages and dry beverage mixes[2]	1	1.4	1
Biscuits, reduced fat: fat-free and reduced fat biscuits	6	8.4	6
Breads, conventional: conventional yeast breads, rolls, and buns	0.5	0.7	0.5
Breads, specialty: specialty types such as breads reduced in calories or fat and/or containing added fiber or added calcium	6	8.4	6
Candy, hard dietetic	15	21	15
Candy, soft dietetic	5	7	5
Condiments: catsup and mustard	5	7	5
Cream cheese, reduced fat: fat-free and reduced fat cream cheese	5	7	5

[1] Serving sizes correspond to Reference Amounts Commonly Consumed Per Eating Occasion; 21 CFR 101.12 (GRN 118, 2003)

[2] Maximum use levels correspond to g Frutafit per 100 g prepared beverage or sauce (GRN 118, 2003).

French fry coatings: coatings on French fries[3]	1.7	2.4	1.7
Frozen dairy desserts, lite: fat-free and reduced fat/sugar/calorie ice creams and dairy-based frozen desserts, including novelties and frozen yogurt	8	11.2	8
Icings/glazes, lite: fat-free and reduced fat/sugar icings and glazes	5	7	5
Jams and jellies, lite: reduced sugar/calorie jams and jellies	2	2.8	2
Meat products: processed meats, including frankfurters, sausages, bratwurst, beef patties, chicken patties, loaves, pates, and deli meats	4	5.6	4
Mousse, reduced fat	3	4.2	3
Pancake syrup, lite	2	2.8	2
Pasta fillings: fillings used in pasta, such as tortellini, ravioli and manicotti fillings	5	7	5
Pasta, fresh: fresh pasta, such as spaghetti, fettuccini, linguini, tortellini, ravioli, or lasagna (excluding noodles)	4	5.6	4
Pasta, precooked macaroni	4	5.6	4
Pizza cmst	5	7	5
Potatoes, mashed: prepared or in frozen meals (excluding dry mix types)	3	4.2	3
Pretzels, soft	5	7	5
Processed cheese, reduced fat: fat-free and reduced fat processed cheese and cheese products	5	7	5
Pudding mix: regular and reduced sugar/calorie pudding mix	7	9.8	7
RTE breakfast cereals, all types of ready-to-eat (RTE) breakfast cereals	5 g/serving[4]	7 g/serving[4]	5 g/serving[4]
Salad dressings, lite: fat-free and reduced fat/calorie dressings, including mayonnaise, salad dressings and mayonnaise-type dressings	5	7	5
Sauces and gravies: entree, dipping and condiment sauces such as Alfredo, BBQ, cheese, clam, Hollandaise, pasta, pizza, soy, sweet & sour and white sauces, salsa, and gravies, including prepared sauces and dry sauce mixes (excluding tomato sauce and paste)[4]	2	2.8	2

[3] Maximum use level per 100 g coated French fry (as consumed) (GRN 118, 2003)

[4] Serving sizes correspond to Reference Amounts Commonly Consumed Per Eating Occasion; 21 CFR 101.12 (GRN 118, 2003)

Snack chips, reduced fat: fat-free and reduced fat snacks, including chips and extruded snacks	3	4.2	3
Snack crackers: savory snack, sandwich, and whole grain crackers (excluding plain crackers such as saltines, matzo crackers, or oyster crackers)	4	5.6	4
Soups, dry	3	4.2	3
Spreads. reduced fat: fat-free and reduced fat margarines and margarine-like spreads	10	14	10
Surimi, imitation crab, and reconstructed seafood	3	4.2	3
Toppings, dessert: toppings used on desserts (excluding whipped toppings)	2	2.8	2
Tortillas, reduced fat	3	4.2	3
Vegetarian patties/crumbles	2	2.8	2
Whipped toppings, lite: fat-free and reduced fat/sugar non-dairy whipped cream toppings	6	8.4	6
Yogurt, reduced fat: fat-free and reduced fat refrigerator-type yogurts	3	4.2	3

NOTE: Unless indicated otherwise, all food categories include both regular and lite versions of all food products

Safety Data

The Intrinsic Organics inulin ingredient (sourced from Jerusalem Artichoke) that is the subject of the current GRAS determination is proposed for use as an alternative source of inulin and will be used in a similar fashion in all current food categories in which other inulin products are employed (FDA, 2003), with the exception of infant formula. The IOF product forms (syrup and powder) contain the whole fructo-oligo/polysaccharide with chain length ranging from DP-3 to over DP-60 and have application in a wide range of foods including nutrition and energy bars, yogurt, ice cream, dressings and spreads, baked goods, cereals and beverages. The proposed use of the inulin products will not increase the overall consumption of inulin, but simply will provide an alternative source of well-characterized inulin from Jerusalem Artichoke for use in food.

The Jerusalem Artichoke (*Helianthus tuberosus*) is a member of the sunflower (*Asteraceae*) family. The Jerusalem Artichoke stores carbohydrates as fiber, not starch like other related plants and the fiber component is called inulin. Intrinsic Organics does not subdivide the inulin product into different chain lengths or cut the larger chains to get more uniform short chains. The inulin is rendered from the tuber, giving a variety of chain length compositions reflecting agriculture, harvest, and storage conditions, as opposed to synthetic methods that use sucrose and enzymes that are only effective at creating 8-10 monomer chains, a product referred to as oligofructose inulin.

Inulin and inulin/oligofructose products from chicory root are considered GRAS for use in food for human consumption, including infant formula (FDA, 2003; FDA, 2014; FDA, 2015). Extensive published information and data have been submitted to and reviewed by FDA as part of the various GRNs for inulin-related products. In addition to the FDA, both the USDA Food Safety and Inspection Service, and the FDA Center for Veterinary Medicine (CVM) have also reviewed the safety of inulin and oligofructose as part of several regulatory submissions for the use of inulin as a binder, emulsifier, stabilizer and texturizer in processed meat products and for inclusion by the Association of Feed Control Officials as an additive to the food of poultry, ruminants, non-ruminants, and companion animals. Furthermore, fructooligosaccharides, a shorter chain length fructan, was determined to be GRAS without questions from the FDA in two separate notifications (GRN 44, FDA 2000; GRN 623, FDA 2016).

As soluble, fermentable, dietary fibers, inulin as well as oligofructose and fructooligosaccharides have all been added to food as a source of dietary fiber. Multiple GRAS "no questions" letters have been issued (GRNs 118, 477, 576) that support the safe use of inulin as a bulking agent in foods in which it serves as a source of reduced-energy carbohydrate, and for use as a sugar replacer, humectant, binder, fat-replacer, and/or texture modifier (FDA, 2003, 2014, 2015).

There is a long history of safe use of inulin-containing foods. While few animal toxicology studies have been conducted, a number of animal toxicity studies with Neosugar (FOS) have been published and used as supportive data for the safety and GRAS status of inulin in past GRNs (FDA, 2003, FDA, 2014; FDA, 2015). Neosugar has the same chemical structure as inulin but has a shorter chain length (up to four fructose units) and is produced by enzymatic synthesis from sucrose. No specific safety issues were raised in any of the studies which included acute toxicity, short-term and subchronic toxicity, reproductive and developmental toxicity, genotoxicity, and carcinogenicity studies (Carabin and Flamm, 1999; Clevenger et al. 1988; Takeda and Nizato 1982).

The human tolerance of inulin has been extensively studied in historical and contemporary diets and in clinical studies in adults as well as infants. GRN 118 (FDA, 2003; Carabin and Flamm, 1999) summarized numerous human tolerance studies, as did GRNs 477 and 576 (FDA, 2014; FDA,2015). GRN 118 concluded that regular consumption of up to 40 g of inulin (i.e., Frutafit®) per day by healthy adults appeared to result in no significant adverse effects when consumed in divided doses over the course of a day. Flatulence and loose stools are the most common adverse effects at high doses (>40 g/day). An acceptable intake level (AIL) for inulin of 40 g when consumed in divided doses over the course of a day was proposed for Frutafit® as part of GRN 118, which received a "no questions" letter from FDA.

American diets provide an average of 2.6 g/day of inulin and 2.5 g/day of oligofructose. Intakes varied by gender and age, ranging from 1.3 g/day for young children to 3.5 g/day for teenage boys and adult males (Moshfegh et al., 1999). GRN 118 (FDA, 2003) estimated the inulin intake of the U.S. population ages 2 years and older and reported 2-day average mean intakes of Frutafit® and inulin from all their proposed use categories of 11.3 and 10.1 g per user per day, respectively, and the estimated 90th percentile intakes of Frutafit® and inulin from the proposed uses of 21.3 and 19.2 g per user per day,

respectively. It should be noted that the estimates of inulin consumption in GRN 118 were extremely conservative and likely were overestimates, because the reported intakes assume that all foods are supplemented with the maximum proposed use levels, and individuals consume all the proposed inulin-containing foods on a daily basis.

Similarly, the proposed use of Jerusalem Artichoke–sourced inulin as an alternative source of inulin to chicory-root inulin is well below the AIL (GRN 118) of 40 g/day when consumed in divided doses over the course of a day and is considered by the Panel to be safe and GRAS for the proposed use.

General Recognition of the Safety of Inulin Sourced from Jerusalem Artichoke

The intended use of inulin sourced from Jerusalem Artichoke has been determined to be safe through scientific procedures as set forth in 21 CFR § 170.3(b), thus satisfying the so-called "technical" element of the GRAS determination, and this determination is based on the following:

- The Intrinsic Organics inulin ingredient that is the subject of the current GRAS determination is derived from Jerusalem Artichoke (*Helianthus tuberosus*), a member of the *Asteraceae* family.

- Two forms of inulin are produced by Intrinsic Organics and include an inulin powder (IOF-POWDER) and inulin syrup (IOF-SYRUP) and each consists primarily of a mixture of linear β-(1-2)-linked fructose chains with a terminal glycopyranose unit at the reducing end. The IOF inulin products are in either a brown liquid or tan powder form that have a neutral taste, an average pH at 10° Brix of approximately 5.7, and an average density of 1.2 kg/L (syrup) or 0.6 kg/L (powder).

- The IOF products contain the whole fructo-oligo/polysaccharide with a chain length ranging from DP-3 to over DP-60.

- The inulin products are manufactured from organically grown Jerusalem Artichoke in accordance with cGMP (21 CFR Title 21 Part 117 Subpart B). Hot water is employed to extract the fiber, which is subsequently filtered mechanically in several steps to remove suspended solids and reduce protein, simple carbohydrates, and minerals.

- IOF POWDER and IOF-SYRUP have application in a wide range of foods, including nutrition and energy bars, yogurt, ice cream, dressings and spreads, baked goods, cereals, and beverages. Intrinsic Organics' inulin products are intended for use as an alternative source of inulin and will be used in a similar fashion in all current food categories in which it is employed (as previously submitted in GRN 118 (FDA, 2003). Therefore, the proposed use of the inulin products will not increase the overall consumption of inulin, but simply will provide an alternative source of well-characterized inulin from Jerusalem Artichoke for use in food.

- GRN 118 (FDA, 2003) estimated the inulin intake of the U.S. population ages 2+ and reported 2-day average mean intakes of Frutafit® and inulin from all their proposed use categories of 11.3 and 10.1 g per user per day, respectively, and the estimated 90th percentile intakes of Frutafit® and inulin from the proposed uses of 21.3 and 19.2 g per user per day, respectively. The estimates of inulin consumption in GRN 118 were extremely conservative and likely were overestimates, because the reported intakes assume that all foods are supplemented with the maximum proposed use levels, and that individuals consume all the proposed inulin-containing foods on a daily basis. GRN 118 also estimated that the dietary intake of inulin at the 90th percentile level would be approximately 6 g per day for infants younger than 1 year and approximately 15 g per day for infants 1 year of age.

- Multiple GRAS "no questions" letters have been issued by the U.S. FDA (GRNs 118, 477, 576) that support the safe use of inulin as a bulking agent in foods in which it serves as a source of reduced-energy carbohydrate, and for use as a sugar replacer, humectant, binder, fat-replacer, and/or texture modifier (FDA, 2003, 2014, 2015).

- There exists a long history of safe use of inulin-containing foods. While few toxicological studies of inulin have been conducted in animals, numerous safety studies of oligofructose and FOS have been conducted. No specific safety issues were raised in any of the studies which included acute toxicity, short-term and subchronic toxicity, reproductive and developmental toxicity, genotoxicity, and carcinogenicity studies.

- The human tolerance of inulin has been studied extensively in historical and contemporary diets and in clinical studies in adults and infants. GRNs 118, 477, and 576 summarized numerous human tolerance studies. GRN 118 concluded that regular consumption of up to 40 g of inulin (i.e., Frutafit®) per day by healthy adults appeared to result in no significant adverse effects when consumed in divided doses over the course of a day. Flatulence and loose stools were the most common adverse effects reported at high doses (>40 g/day). An acceptable intake level (AIL) for inulin of 40 g when consumed in divided doses over the course of a day was established for Frutafit®. The proposed use of Jerusalem Artichoke-sourced inulin as an alternative source to chicory-root inulin (approximately 20 g/day at the 90th percentile intake) is well below the AIL of 40 g.

- The potential of Jerusalem Artichoke-sourced inulin to cause allergy is very low at the levels of intended use. However, any potential concern for an allergic reaction in already sensitive individuals would be addressed, as the food product ingredients list would clearly state the presence of inulin as an ingredient and its source, and individuals who wish to avoid consumption for any reason would be able to easily identify the presence of inulin as an ingredient and its source.

- The body of publicly available scientific literature on the consumption and safety of inulin and the closely related ingredients oligofructose and FOS is sufficient to support the safety and GRAS status of the proposed inulin ingredient.

Because this safety evaluation was based on generally available and widely accepted data and information, it also satisfies the so-called "common knowledge" element of a GRAS determination.

Conclusions of the Expert Panel

We, the undersigned members of the Expert Panel, have individually and collectively critically reviewed the published and ancillary information pertinent to the identification, use, and safety of Intrinsic Organics' inulin products. We conclude that the inulin ingredients sourced from Jerusalem Artichoke, produced under the conditions described in the attached dossier, and meeting the proposed specifications are safe.

We further unanimously conclude that the intended uses and use levels of the inulin products in specified foods for human consumption, meeting the specifications described above, are Generally Recognized as Safe (GRAS) based on scientific procedures and that other experts qualified to assess the safety of foods and food additives, and critically evaluating the same information, would concur with these conclusions.

_____ _____

Michael Carakostas, D.V.M., Ph.D. Date
Consultant
MC Scientific Consulting LLC

_____ _____

Stanley M. Tarka, Jr., Ph.D., F.A.T.S. Date
Consultant
Tarka Group, Inc.

_____ _____

Thomas Vollmuth, Ph.D. Date
Consultant
Vollmuth and Associates, LLC

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[redacted]

2/6/19

Michael Carakostas, D.V.M., Ph.D.
Consultant
MC Scientific Consulting LLC

Date

Stanley M. Tarka, Jr., Ph.D., F.A.T.S.
Consultant
Tarka Group, Inc.

Date

Thomas Vollmuth, Ph.D.
Consultant
Vollmuth and Associates, LLC

Date

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Michael Carakostas, D.V.M., Ph.D.
Consultant
MC Scientific Consulting LLC

Date

[redacted]

Stanley M. Tarka, Jr., Ph.D., F.A.T.S.
Consultant
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Consultant
Tarka Group, Inc.

Date

Thomas Vollmuth, Ph.D.
Consultant
Vollmuth and Associates, LLC

2/7/2019
Date

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From:	Don Schmitt
To:	Kolanos, Renata
Cc:	Amy Hall
Subject:	Re: REGARDING: GRN 849
Date:	Wednesday, July 10, 2019 8:46:11 PM
Attachments:	Intrinsic Organics FDA Repsonses 071019.pdf

Dear Dr. Kolanos,

Please find attached answers to FDA's questions regarding GRN 849.

Don

Donald F. Schmitt, M.P.H.
Senior Managing Scientist

ToxStrategies, Inc.
739 Thornapple Drive
Naperville, IL 60540
phone: 630.352.0303
email: dschmitt@toxstrategies.com

ToxStrategies

Innovative solutions
Sound science

July 10, 2019

Renata Kolanos, Ph.D.
Consumer Safety Officer
U.S. Food and Drug Administration
Center for Food Safety and Applied Nutrition
Office of Food Additive Safety
Division of Food Ingredients

Subject: Clarification Letter Questions (dated June 25, 2019)

Dear Dr. Kolanos,

The following letter contains Intrinsic Organic's responses to the questions raised in FDA's letter of June 25, 2019. We believe it addresses all of the issues raised and provides clarification of all nine items.

Please let me know if you have any further questions/needs.

Sincerely,

Donald F. Schmitt, M.P.H.
Senior Managing Scientist

(1) According to 21 CFR 170.255(c)(1), Part 1 of a GRAS notice must contain a statement that the notifier is submitting the notice in accordance with 21 CFR Part 170 Subpart E. This statement is missing in the notice. Please provide this statement.

- Intrinsic Organics, LLC, through its agent ToxStrategies, Inc., hereby notifies the U.S. Food and Drug Administration (FDA) of the submission of a Generally Recognized as Safe (GRAS) notice for the use of inulin from Jerusalem Artichoke in human food in accordance with Subpart E of 21 CFR § 170.

(2) On p. 8, the notifier states that inulin contains fructooligo/polysaccharides with a chain length (degree of polymerization or DP) ranging from 3 to over 60. Please provide the molecular weight range, an average DP, and chain length distribution.

The following tables provide the molecular weight range, an average DP, and chain length distribution for the inulin ingredient.

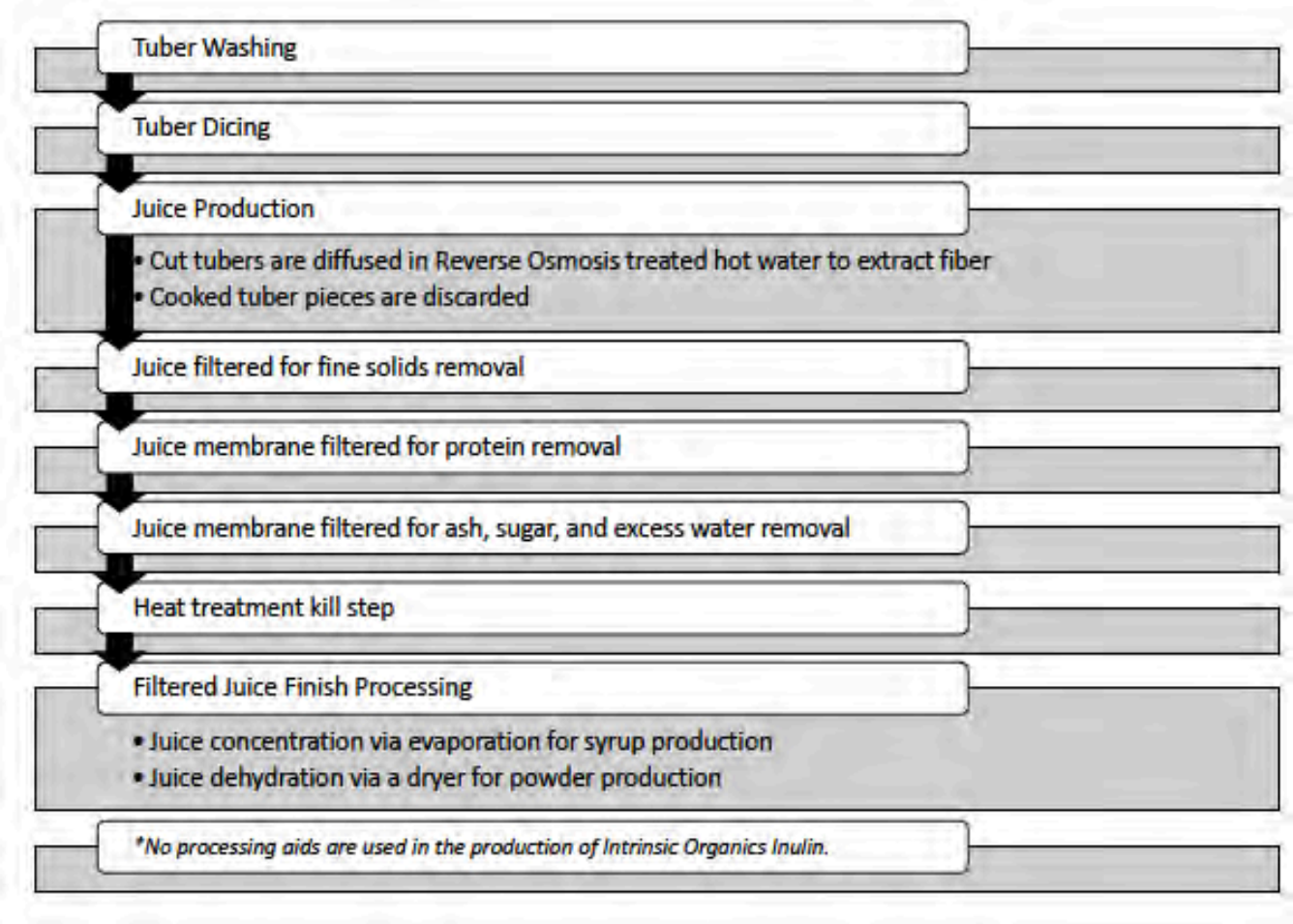
Lot	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
DP Range	3 to 80	3 to 82	3 to 60	3 to 59	3 to 60	3 to 60
MW Range	504 to 12994	504 to 13318	504 to 9750	504 to 9588	504 to 9750	504 to 9750
Avg DP	10	11	6	6	9	8

		[redacted]	[redacted]	2[redacted]	[redacted]	[redacted]	[redacted]
DP Level	MW	% Dry Mass	% Dry Mass	% Dry Mass	% Dry Mass	% Dry Mass	% Dry Mass
DP3	504.4	5.14	3.94	11.21	10.29	1.42	6.80
DP4	666.6	6.11	5.70	12.04	9.02	10.46	8.94
DP5	828.8	5.40	5.79	10.99	8.57	8.52	8.53
DP6	991	5.46	5.53	9.48	8.65	7.70	6.04
DP7	1153.2	5.76	5.58	7.96	7.42	6.76	5.32
DP8	1315.4	5.98	5.83	6.87	8.26	6.53	5.14
DP9	1477.6	5.78	5.94	6.01	6.49	6.05	4.19
DP10	1639.8	5.76	5.60	5.37	5.26	5.30	4.26
DP11	1802	5.51	5.42	4.59	3.04	5.04	3.89
DP12	1964.2	6.20	5.14	3.54	2.58	4.28	3.26
DP13	2126.4	5.01	4.83	2.62	1.90	4.16	2.92
DP14	2288.6	4.70	4.41	1.96	0.76	3.82	2.32
DP15	2450.8	4.25	4.01	1.71	0.42	3.00	2.05
DP16	2613	3.72	3.72	1.20	0.39	2.81	1.79
DP17	2775.2	3.60	3.29	0.82	0.39	2.33	1.61
DP18	2937.4	3.13	2.97	0.31	0.38	1.94	1.41
DP19	3099.6	2.81	2.55	trace	0.36	1.56	1.30
DP20	3261.8	2.31	2.24	trace	0.35	1.34	1.05
DP21	3424	1.88	1.90	trace	0.33	1.30	0.89

DP22	3586.2	1.52	1.55	trace	0.31	1.21	0.81
DP23	3748.4	1.21	1.23	trace	0.28	1.10	0.67
DP24	3910.6	0.92	0.92	trace	0.25	0.97	0.59
DP25	4072.8	0.63	0.62	trace	0.22	0.85	0.52
DP26	4235	0.32	0.46	trace	0.18	0.75	0.46
DP27	4397.2	trace	0.21	trace	0.17	0.79	0.39
DP28	4559.4	trace	trace	trace	0.14	0.58	0.33
DP29	4721.6	trace	trace	trace	trace	0.48	0.30
DP30	4883.8	trace	trace	trace	trace	0.42	0.23
DP31	5046	trace	trace	trace	trace	0.34	0.17
DP32	5208.2	trace	trace	trace	trace	0.29	0.13
DP33	5370.4	trace	trace	trace	trace	0.24	0.11
DP34	5532.6	trace	trace	trace	trace	0.15	trace
DP35	5694.8	trace	trace	trace	trace	0.17	trace
DP36	5857	trace	trace	trace	trace	0.14	trace
DP37	6019.2	trace	trace	trace	trace	0.13	trace
DP38	6181.4	trace	trace	trace	trace	0.12	trace
DP39	6343.6	trace	trace	trace	trace	0.10	trace
DP40	6505.8	trace	trace	trace	trace	trace	trace
DP41	6668	trace	trace	trace	trace	trace	trace
DP42	6830.2	trace	trace	trace	trace	trace	trace
DP43	6992.4	trace	trace	trace	trace	trace	trace
DP44	7154.6	trace	trace	trace	trace	trace	trace
DP45	7316.8	trace	trace	trace	trace	trace	trace
DP46	7479	trace	trace	trace	trace	trace	trace
DP47	7641.2	trace	trace	trace	trace	trace	trace
DP48	7803.4	trace	trace	trace	trace	trace	trace
DP49	7965.6	trace	trace	trace	trace	trace	trace
DP50	8127.8	trace	trace	trace	trace	trace	trace
DP51	8290	trace	trace	trace	trace	trace	trace
DP52	8452.2	trace	trace	trace	trace	trace	trace
DP53	8614.4	trace	trace	trace	trace	trace	trace
DP54	8776.6	trace	trace	trace	trace	trace	trace
DP55	8938.8	trace	trace	trace	trace	trace	trace
DP56	9101	trace	trace	trace	trace	trace	trace
DP57	9263.2	trace	trace	trace	trace	trace	trace
DP58	9425.4	trace	trace	trace	trace	trace	trace
DP59	9587.6	trace	trace	trace	trace	trace	trace
DP60	9749.8	trace	trace	trace		trace	trace
DP61	9912	trace	trace				
DP62	10074.2	trace	trace				

DP63	10236.4	trace	trace				
DP64	10398.6	trace	trace				
DP65	10560.8	trace	trace				
DP66	10723	trace	trace				
DP67	10885.2	trace	trace				
DP68	11047.4	trace	trace				
DP69	11209.6	trace	trace				
DP70	11371.8	trace	trace				
DP71	11534	trace	trace				
DP72	11696.2	trace	trace				
DP73	11858.4	trace	trace				
DP74	12020.6	trace	trace				
DP75	12182.8	trace	trace				
DP76	12345	trace	trace				
DP77	12507.2	trace	trace				
DP78	12669.4	trace	trace				
DP79	12831.6	trace	trace				
DP80	12993.8	trace	trace				
DP81	13156		trace				
DP82	13318.2		trace				

(3) On p. 9, the notifier included a flow diagram of the inulin manufacturing process (Figure 2). The diagram is not easily readable. Please provide a readable copy of Figure 2 and define the abbreviations used.



(4) On p. 9 (Figure 2), the notifier states that no processing aids are used in the manufacture of inulin. However, based on Figure 2, the aqueous extract is filtered/membrane filtered. Please provide a statement whether the filters/membranes used are permitted for use in the manufacture of food.

- All filters and membranes (ultrafiltration (UF) and nanofiltration (NF)) used in the manufacturing process are permitted for use in the manufacture of food.

(5) In Appendix A, the notifier provides results of batch analyses along with the analytical methods. We noted that in some cases different methods were used to test for the same specification parameters. For example, inulin syrup batches were tested using the methods listed below for the following specification parameters:

- total solids: AOAC 925.45 or AOAC 932.14,

- *S. aureus*: FDA/BAM or AOAC 975.55
- *Salmonella*: AOAC 100201 or AOAC 2004.03

Please explain the reason for using different methods for testing the same specification parameters, and for each specification parameter listed in Tables 1 and 2, provide a corresponding method that will be routinely used to monitor inulin batches for consistent quality and compliance with the specification provided in the notice. In addition, for each method (except for standard methods such as AOAC methods), please provide a statement indicating whether the method was validated.

- At the time of the batch analysis, two different contract laboratories were employed that used different AOAC or FDA/BAM methods for some parameters.
- The following tables provide a corresponding method that will be routinely used to monitor inulin batches for consistent quality and compliance with the specification provided in the notice.

Table 1. Specifications for IOF-SYRUP

Parameter	**Specification**	**Method**
Composition		
Total solids (%)	Min. 65	AOAC 932.14
Inulin (DP-3 to DP-60+) (%)	Min. 65	Calculated
Total glucose, fructose, sucrose (%)	Max. 20	AOAC 980.13
Protein (%)	Max. 10	AOAC 992.23
Ash (%)	Max. 10	AOAC 900.02
Contaminants		
Arsenic (ppm)	<0.05	AOAC 985.01
Lead (ppm)	<0.05	AOAC 999.10
Mercury (ppm)	<0.05	AOAC 985.01
Cadmium (ppm)	<0.05	AOAC 999.10
Pesticides	Absent	AOAC 2007.01
Mycotoxins	Absent	Aflatoxin and Ochratoxin, AOAC 999.07 modified; Fumonisin JAOAC 92(2):496; Vomitoxin and Zearalenone, internal method, validated
Microbiological Specifications		
Aerobic plate count (cfu/g)	≤1,000	AOAC 2015.13

Molds (cfu/g)	≤20	AOAC 2014.05
Yeasts (cfu/g)	≤20	AOAC 2014.05
Bacillus cereus (cfu/g)	≤100	FDA/BAM
Enterobacteriaceae (in 1g)	Absent	AOAC 2003.01
Coliforms (in 1g)	Absent	AOAC 991.14
E. coli (in 1g)	Absent	AOAC 991.14
Staphylococcus aureus (in 1g)	Absent	FDA/BAM
Salmonella (in 25g)	Absent	AOAC 2004.03

Table 2. Specifications for IOF-POWDER

Parameter	**Specification**	**Method**
Composition		
Total solids (%)	Min. 90	AOAC 925.10
Inulin (DP-3 to DP-60+) (%)	Min. 65	Calculated
Total glucose, fructose, sucrose (%)	Max. 20	AOAC 980.13
Protein (%)	Max. 10	AOAC 992.23
Ash (%)	Max. 10	AOAC 923.03
Contaminants		
Arsenic (ppm)	<0.05	AOAC 985.01
Lead (ppm)	<0.05	AOAC 999.10
Mercury (ppm)	<0.05	AOAC 985.01
Cadmium (ppm)	<0.05	AOAC 999.10
Pesticides	Absent	AOAC 2007.01
Mycotoxins	Absent	Aflatoxin and Ochratoxin, AOAC 999.07 modified; Fumonisin JAOAC 92(2):496; Vomitoxin and Zearalenone, internal method, validated
Microbiological Specifications		
Aerobic plate count (cfu/g)	≤1,000	AOAC 2015.13
Molds (cfu/g)	≤20	AOAC 2014.05
Yeasts (cfu/g)	≤20	AOAC 2014.05
Bacillus cereus (cfu/g)	≤100	FDA/BAM

Enterobacteriaceae (in 1g)	Absent	AOAC 2003.01
Coliforms (in 1g)	Absent	AOAC 991.14
E. coli (in 1g)	Absent	AOAC 991.14
Staphylococcus aureus (in 1g)	Absent	AOAC 975.55
Salmonella (in 25g)	Absent	AOAC 2004.03

(6) In Appendix A, footnotes 1 and 2 in the certificates of analyses are not readable. Please provide this information in a readable form.

- Footnote 1 reads "Printed values are mean values for this batch
- Footnote 2 reads "Internal method, no international standard available"

(7) On p. 16, the notifier states that stability testing data for inulin can be found in Appendix A. However, Appendix A does not contain stability data. Please provide these data.

- The statement concerning stability testing data to be found in Appendix A was in error and should be removed. Analyses are in progress and stability data will be provided to the FDA late July/August as an amendment to the GRAS notification.
- Paragraph on page 16 should now read; "Intrinsic Organics currently recommends that the product be stored in a dry place in its original container and tightly sealed until use. Once opened, the inulin product should be handled using cGMPs. Stability testing of unopened containers of the syrup and powder inulin forms is in progress. Similar to other currently marketed inulin products, Intrinsic Organics considers the finished product to also be stable when kept in an unopened, sealed container under ambient conditions for a minimum of 1 year for IOF-SYRUP, and 5 years for IOF-POWDER."

(8) On p. 19, the notifier states that the inulin is intended to be used as an alternative source of chicory inulin in the same food categories and at the equivalent use levels as specified in GRN 118. The notifier calculated the equivalent use levels for two inulin formulations, powder and syrup, in Table 9. Please confirm that the notifier calculated use levels assuming that the powder contains 90% inulin (the same as the chicory inulin that was the subject of GRN 118), and that the syrup contains 65% inulin. If this assumption is not correct, please provide sample calculations of the use levels for your inulin powder and syrup.

- The notifier confirms that the calculated use levels assumed that the powder contains 90% inulin (the same as the chicory inulin that was the subject of GRN 118), and that the syrup contains 65% inulin

(9) In Table 1, the notifier includes the use level of inulin syrup and powder in baby foods (0.35 g/serving and 0.25 g/serving, respectively). If the notifier calculated these levels based on the use level of chicory inulin (1 g/serving) as provided in Table 1, we note that these use levels were calculated incorrectly. We also note that the use level of chicory inulin specified in GRN 118

was 0.25 g/serving and was increased to 1 g/serving upon a successful supplement to GRN 118. Please clarify which use level of chicory inulin was used to calculate the use levels of the notifier's inulin in baby foods and provide the correct intended use levels for both inulin syrup and inulin powder.

- Given the 1 g/serving for chicory inulin in baby foods that was approved in the supplement to GRN 118, the calculated use levels for the syrup and powder in Table 9 were incorrectly calculated and presented. The maximum use levels for IOF syrup and powder for use in baby foods should read 1.4 g/serving and 1 g/serving, respectively.

From:	Don Schmitt
To:	Kolanos, Renata
Subject:	Re: Regarding GRN 849
Date:	Wednesday, September 11, 2019 11:57:16 AM
Attachments:	Shelf Life Test 201811271S 9 Month Comparison[16].pdf Shelf Life Test 201810231P 10 Month Comparison[10].pdf

Hi Dr. Kolanos,

Here is the promised stability testing data from Intrinsic Organics. There are data for the syrup (9-month stability data) and powder (10-month stability data) forms of the inulin ingredient. FYI, [redacted]

Best regards,

Don

Donald F. Schmitt, M.P.H.
Senior Managing Scientist

ToxStrategies, Inc.
739 Thornapple Drive
Naperville, IL 60540
phone: 630.352.0303
email: dschmitt@toxstrategies.com

Analytical Report

Mfg Date: 10/23/18 Batch ID:

Parameter	Original	1/24/2019 3 Month	8/28/2019 10 Month	12 month	18 Month
Solids (%)	94.64	97.52	94.05		
A_w	0.24	0.22	0.34		
Glucose (%)	0.43	0.23	0.00		
Fructose (%)	0.79	0.57	0.50		
Sucrose (%)	4.49	3.75	6.21		
DP3 (%)	3.82	3.27	9.71		
Maltose (%)	0.63	0.93	0.00		
DP4 (%)	5.61	3.60	8.11		
Sugar Content (%)	6.34	5.48	6.71		
DP Range (3 to X)	82	84	89		

Microbe (Allowable Limit)

Aerobic Plate Count (1000 CFU)	200	56	ND		
Enterrobacterecea (0 CFU)	ND	ND	ND		
Coliform (0 CFU)	ND	ND	ND		
E. coli (0 CFU)	ND	ND	ND		
Yeast (20 CFU)	ND	ND	ND		
Mold (20 CFU)	ND	ND	ND		
B. cereus (100 CFU)	43	38	ND		

AMY R HALL
Laboratory Manager
1410 Organic Way
Weiser, ID 83672

Analytical Report

Date: 11/27/18 Batch ID:

Parameter	Original	1/24/2019 2 Month	8/28/2019 9month	12 month	18 Month
Solids (%)	65.56	65.87	66.03		
A_W	0.86	0.87	0.88		
Glucose (%)	0.15	0.15	0.00		
Fructose (%)	0.30	0.32	0.00		
Sucrose (%)	9.92	4.82	4.86		
DP3 (%)	8.94	3.96	10.22		
Maltose (%)	0.88	0.74	0.00		
DP4 (%)	8.95	4.41	9.24		
Sugar Content (%)	11.26	6.02	4.86		
DP Range (3 to X)	68	57	65		

Microbe (Allowable Limit)

Aerobic Plate Count (1000 CFU)	894	637	500		
Enterrobacterecea (0 CFU)	ND	ND	ND		
Coliform (0 CFU)	ND	ND	ND		
E. coli (0 CFU)	ND	ND	ND		
Yeast (20 CFU)	ND	ND	ND		
Mold (20 CFU)	ND	ND	ND		
B. cereus (100 CFU)	93	93	94		

AMY R HALL
Laboratory Manager
1410 Organic Way
Weiser, ID 83672

From:	Amy Hall
To:	Kolanos, Renata
Cc:	Don Schmitt; Wanda Coulombe
Subject:	RE: Regarding GRN 849
Date:	Friday, September 13, 2019 12:55:29 PM

Dr. Kolanos,

The values to which you are inquiring are indeed below the LOD. They are listed as 0.00% so they don't present problems for formulas within our analysis software.

Kindest regards,

Amy Hall
Laboratory Manager

From: Don Schmitt <dschmitt@toxstrategies.com>
Sent: Friday, September 13, 2019 6:23 AM
To: Wanda Coulombe <wanda@intrinsicorganics.com>; Amy Hall <amy@intrinsicorganics.com>
Subject: FW: Regarding GRN 849

Hi Amy/Wanda,

Just received the following email from FDA this morning. Can you respond to their question? Feel free to send it to them directly (cc me) or send to me and I will forward it to Dr. Kolanos.

Thanks.

Don

Donald F. Schmitt, M.P.H.
Senior Managing Scientist

ToxStrategies, Inc.
739 Thornapple Drive
Naperville, IL 60540
phone: 630.352.0303
email: dschmitt@toxstrategies.com

From: "Kolanos, Renata" <Renata.Kolanos@fda.hhs.gov>
Date: Friday, September 13, 2019 at 6:40 AM
To: "Donald Schmitt, MPH" <dschmitt@toxstrategies.com>
Subject: RE: Regarding GRN 849

Dear Mr. Schmitt,

We reviewed the stability data for the syrup and powder form of inulin and we noted that the concentration of glucose, fructose, and/or maltose at the end of the testing period (9 or 10 months) are reported as zero percent (0.00 %). Please confirm that the concentrations are reported as 0.00% because they are below the limit of detection (LOD) of the analytical method. If this is not the case, please provide an explanation for these analytical results.

Regards,
Renata

Renata Kolanos, Ph.D.
Regulatory Review Scientist/Chemistry Reviewer

U.S. Food and Drug Administration
Center for Food Safety and Applied Nutrition
Office of Food Additive Safety
Division of Food Ingredients

From:	Don Schmitt
To:	Kolanos, Renata
Subject:	Re: REGARDING GRN 000849
Date:	Monday, October 14, 2019 9:23:36 AM

Hi Dr. Kolanos,

My apologies for the delay in responding, [redacted]
While the GRAS notification as submitted indicated August 2018, we also searched in September 2018 and again at the end of the year (December 2018). We submitted the GRAS notification the first week of February 2019.

Don

Donald F. Schmitt, M.P.H.
Senior Managing Scientist

ToxStrategies, Inc.
739 Thornapple Drive
Naperville, IL 60540
phone: 630.352.0303
email: dschmitt@toxstrategies.com

From: "Kolanos, Renata" <Renata.Kolanos@fda.hhs.gov>
Date: Friday, October 11, 2019 at 8:23 AM
To: "Donald Schmitt, MPH" <dschmitt@toxstrategies.com>
Subject: REGARDING GRN 000849

Dear Mr. Schmitt,

We need one more information. Please provide the end date (the month and year) for the literature search performed prior to the submission of GRN 000849.

Regards,
Renata

Renata Kolanos, Ph.D.
Regulatory Review Scientist/Chemistry Reviewer

U.S. Food and Drug Administration
Center for Food Safety and Applied Nutrition
Office of Food Additive Safety
Division of Food Ingredients