ORIGINAL SUBMISSION

#683

DSM
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Dr. Antonia Mattia
Division of Biotechnology and GRAS Notice Review
Office of Food Additive Safety (HFS-200)
Center for Food Safety and Applied Nutrition
Food and Drug Administration
5100 Paint Branch Parkway
College Park, MD 20740-3835

16 December 2016

GRAS Notification: the use of Canola/Rapeseed protein isolate as a nutritive and function ingredient in human food

Dear Dr. Mattia

On behalf of DSM Food Specialties ("DSM"), I am submitting under cover of this letter one digital version of DSM's generally recognized as safe ("GRAS") notice for its Canola/Rapeseed protein isolate. The digital copy is provided on a virus-free CD, scanned using McAfee Virus Scan Enterprise version 8.8, and is an exact copy of the original DSM file. DSM has determined through scientific procedures that its rapeseed protein isolate is GRAS for use as a nutritional and functional ingredient in commercial food products such as beverages, baked goods, confections and dairy products at levels not to exceed the amounts reasonably required to accomplish its intended effect in foods as required by FDA regulation,21 CFR 182.1 (b)(1).

Pursuant to the regulatory and scientific procedures established by the regulation at 21 C.F.R.§ 170.225 (c)(5), this use of rapeseed protein isolate is exempt from premarket approval requirements of the Federal Food, Drug and Cosmetic Act, because the notifier has determined that such use is GRAS.

If you have any questions regarding this notification, or require any additional information to aid in the review of DSM's conclusion, please do not hesitate to contact me via email at james.lamarta@dsm.com or by telephone, (973)257-8347.

Sincerely

(b) (6)
[redacted]

James La Marta, Ph.D, CFS
Sr. Manager Regulatory Affairs

RECEIVED
DEC 19 2016
OFFICE OF
FOOD ADDITIVE SAFETY

THE SAFETY AND THE GENERALLY RECOGNIZED AS SAFE (GRAS) STATUS OF THE PROPOSED USES OF CANOLA /RAPESEED PROTEIN ISOLATE IN HUMAN FOOD

By

DSM Innovation Center

Delft, The Netherlands

Anneke Boot

Delft, The Netherlands

James La Marta

Parsippany, NJ

Table of Contents

List of Tables

List of Figures

1. Statements and Certification

1.1 Compliance with 21 CFR 170.255 part 1

DSM is hereby submitting a GRAS notice in accordance with 21 CFR 170.255 part1.

1.2 Name and address of Notifier

DSM Innovation Company 45 Waterview Blvd. Parsippany, New Jersey, 07054, USA Tel:973-257-8500	**Person responsible for the dossier:** James La-Marta 45 Waterview Boulevard Parsippany, New Jersey 07054 Tel: 973-257-8325

1.3 Name and Address of Manufacturer

DSM New Business Development B.V.
Poststraat 1
6135 KR Sittard
Netherlands

1.4 Name and Address of the Exclusive Distributor

DSM Nutritional Products
45 Waterview Blvd.
Parsippany, New Jersey, 07054, USA
Tel: 973-257-8500

1.5 Name of the notified substance

The name of the notified substance is Rapeseed Protein Isolate, also identified as RPI90 in this notice and to be marketed as CanolaPro.

1.6 Intended conditions of use and technical effects of the notified substance

Rapeseed Protein Isolate will be used as a protein source, thickener, water binder, emulsifier, gelling agent, foaming agent, or texturizer in human food products.

Table 1 Application levels for the general population (age 4 and above)

Food Category	Maximum use level [% rapeseed protein isolate in final food]	gram RPI/serving	% RPI of total protein
Prepared food (e.g. ready-to-eat meals, soups, pasta, snacks)	10	20	40
Meat analogues	30	20	90
Bakery products (e.g. bread, rolls, doughnut, cookies, cakes, pies, batters, muffins, pasta, and cereal bars, cereals)	5	5	30
Protein enriched bakery products (eg. bars, cookies)	30	10	70
Sports nutrition (e.g. protein drinks , energy bars)	10	20	90
Weight management (e.g. meal replacement, nutritional bars)	30	20	90
Beverages (e.g. fruit juices, soft drinks, juice blends)	5	10	100
Dairy products (e.g. desserts, ice cream, cheese, yogurt)	5	5	75
Medical nutrition (e.g. protein fortified drinks, ready-to-drink)	10	20	100
Elderly nutrition (e.g. foods specifically meant for the needs of elderly people)	10	10	75

It is anticipated that RPI90 will be used in food and beverage products for consumption by adults and children 4 years of age and older. For products designed specifically for the toddler group, 1 – 3 years of age, the use levels for the following product categories would be lower than that of adults; 5% for prepared foods, 3% for bakery products, 5 % for beverages and 4% for dairy products.

1.7 Basis for GRAS determination

DSM Innovation is hereby notifying the FDA that it has concluded that the intended use of Rapeseed Protein Isolate as an ingredient in human food products is generally recognized as safe (GRAS) based on scientific procedures as described under 21 CFR § 170.30 (a) and (b).

1.8 Exemption from Premarket Approval

DSM Innovation believes that the notified substance, rape seed protein isolate, is not subject to the premarket approval requirements of the Federal Food, Drug, and Cosmetic Act based on our conclusion that the notified substance is GRAS under the conditions of its intended use.

1.9 Availability of information for FDA review

1.9.1 Availability

The data and information that are the basis for DSM's GRAS conclusion are available to the FDA.

1.9.2 Copying

The FDA can review and copy the data and information that were used to conclude that rapeseed protein isolate is GRAS during customary business hours at:

DSM Innovation Company

45 Waterview Blvd

Parsippany, NJ 07054

Tel: 973-257-8500

1.9.3 Accessibility to raw data

DSM Innovation will provide FDA with a complete copy of the data and information used as a basis for the GRAS conclusion either in an electronic format that is accessible for FDA's evaluation or on paper.

1.9.4 Exemption from disclosure

The data and information in Parts 2 through 7 of this GRAS notice are not exempt from disclosure under the Freedom of Information Act, 5 U.S.C. 552.

1.9.5 Certification

The undersigned certifies that to the best of their knowledge, this GRAS notice is a complete, representative, and balanced submission that includes unfavorable information, as well as favorable information, known to DSM Innovation and pertinent to the evaluation of the safety and GRAS status of the use of the Rapeseed Protein Isolate.

(b) (6)

James La Marta, Ph.D., CFS

Sr. Manager Regulatory Affairs

16 December 2016

Date

2. Identity, method of manufacture, specifications and physical/technical effect

2.1 Common or usual name of the notified substance

Rapeseed Protein Isolate (RPI) is the common name of the substance that is the subject of this GRAS notification. RPI90 is the DSM internal name of the material. Rapeseed is also known as Canola and DSM intends to market the substance as CanolaPro.

Formulations of RPI90 produced with other approved or GRAS, human food grade ingredients may be produced in the future to meet customer needs. In no case will its use and the use levels be beyond those specified in this dossier.

2.2 Characterization of the Rapeseed Protein

2.2.1 Description of the product

This GRAS notification concerns a rapeseed protein isolate obtained from rapeseed presscake that is a byproduct of rapeseed oil production. Rapeseed oil is produced by pressing the seeds of the rape plant from one or both varieties, *Brassica napus* and/or *Brassica juncea*. The presscake is composed of the crushed seeds. The rapeseed protein isolate contains two major protein fractions: cruciferins and napins. Cruciferins are globulins and are the major storage protein in the seed. Cruciferins are composed of 6 subunits and has a total molecular weight of approximately 300 kDa.

Napins are albumins and are a low molecular weight storage protein (14 kDa) composed of two disulfide-linked polypeptides (Tan et al. 2011). RPI90 contains approximately 40-65% cruciferins and 35-60% napins[1].

2.2.2 Presence of known toxicants

The seeds of the rape plant are known to contain a number of anti-nutritional factors. Until the advent of the low erucic acid varieties in the 1970's, branded as Canola, the rape plant was utilized for the production of industrial lipids and animal feed. Rape plants are known to contain erucic acid in the oil and glucoscinolates, polyphenolics and phytic acid and protease inhibitors in the seeds. The potential for adverse impacts from consuming these compounds is addressed in **section 3.2** of this notice.

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[1] As analyzed by HP-SEC analysis: Samples were dissolved in a 500 mM NaCl solution and analyzed by HP-SEC using the same solution as mobile phase. Detection was done by measuring UV absorbance at 280 nm. The relative contribution of cruciferin and napin (%) was calculated as the ratio of the peak area of each protein with respect to the sum of both peak areas.

2.3 Production process

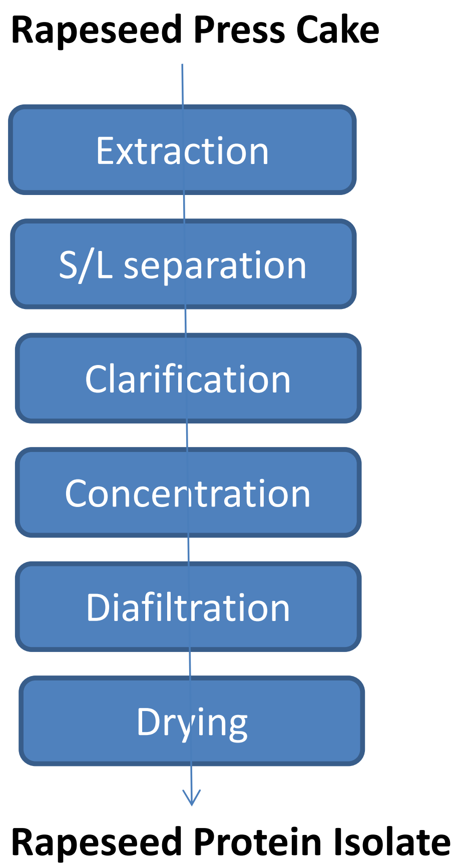
Figure 1 presents a block flow diagram depicting the steps involved in the production process of the rapeseed protein isolate product (RPI90). The rapeseed protein isolates are produced from rapeseed press cake/meal, the by-product of rapeseed oil production. The facility follows ISO 9001 and GMP, see **Appendix 1**.

The process starts with an extraction step, in which rapeseed cake/meal is mixed with an aqueous salt solution (cake/meal to water ratio: 1:5 to 1:20) (0-5% NaCl) at a temperature between 40 - 75ºC). After 5 min to 2 hours the protein rich solution is separated from the insoluble material. The protein rich solution is hereafter referred to as the extract. The pH of the extract is adjusted and the extract is further processed to clarify the material and remove non-protein substances. Citric acid and/or ascorbic acid may be used as buffers. The residual fat and formed precipitates are removed via a solid/liquid separation step (e.g. a membrane filter press or centrifugation). The extract is then concentrated and washed in an ultrafiltration/diafiltration (UF/DF) step. The UF-DF step concentrates the protein and removes anti-nutritional factors (e.g. polyphenols, residual phytate, glucosinolates). Sodium bisulfite may be used to whiten the product if necessary. If sulfite is used the finished product will contain < 10 ppm.

Finally, the washed concentrate can be dried in a suitable dryer, like a spray drier (single or multistage) at an inlet temperature of 150-200 ^{0}C and an outlet temperature of 50-100^{0}C. The produced powder is the canola/rapeseed protein isolate that is the subject of this dossier.

All processing aids used in the manufacturing of rapeseed protein isolate, including sodium chloride, pH adjustment titrants such as ascorbic acid, citric acid, hydrochloric acid and sodium hydroxide and divalent cations such as calcium chloride, are food grade. Maltodextrin or any other human food grade carbohydrates might be used to formulate the end-product depending on customer needs.

Figure 1 Block flow diagram of the process to produce protein isolate from canola/rapeseed cake/meal. S/L: Solid liquid separation (e.g. filtration, centrifugation



2.3.1 Product specification

Table 2 Product Manufacturing Specification for RPI90

Parameter	Unit	Value	Method
Appearance	-	tan	Visual
Composition			
Total Protein (% via N*6.25)	% w/w	≥ 90	AOCS Ba 4e-93
Carbohydrates 7	% w/w	≤	By difference*
Fat (direct)	% w/w	≤ 2	ISO 1444:1996
Ash	% w/w	≤ 4	FCC v10 appendix II c
Moisture	% w/w	≤ 7	FCC v7, 1133 [100%- dm]
Fibre	% w/w	≤ 0.6	ISO 6865-M; EC Method 152/2009 app. III-M
Purity			
Glucosinolates	µmol/g	≤ 1	EEC 1864/90
Phytates	% w/w	≤ 1.5	Ellis et al., 1977
Lead	mg/kg	≤ 0.5	ICP-AES of UPS 233
Microbiological criteria			
Total plate count	cfu/g	≤ 10^4	ISO 4833:part 2 2013
E. Coli	cfu in	absent	ISO 21528
Salmonella spp.	cfu in	absent	ISO 6579:2002
Yeast and Molds	cfu/g	< 100	ISO 21527-2

*Carbohydrates are calculated by difference as follows: 100 % - [protein (as is) % + moisture % + fat % + ash % + fiber %]

2.4 Batch Data

In table 3 the result of 5 separate and representative batches of the product RPI90 are presented. The results show compliance with the specifications and consistency of the production process. Certificate of Analysis for three batches are provided in **Appendix 2.**

Table 3 Results of analysis of 5 production batches of RPI90

Parameter	Unit 7	Specification	RPI-1536 -01-G	RPI-1543 -02-P	RPI-1543 -03-P	RPI-1549 -01-P	RPI-1549 -02-P
Appearance		Tan powder	Tan powder	Tan powder	Tan powder	Tan powder	Tan powder
Total Protein (% via N*6.25)	% w/w	≥ 90	96.3	98.1	98.8	98.8	98.8
Carbohydrates	% w/w	≤	0	0	0	0	0
Fat (direct)	% w/w	≤ 2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ash	% w/w	≤ 4	0.71	0.08	0.08	0.08	0.06
Moisture	% w/w	≤ 7	4.3	3.3	3.6	2.3	3
Fibre	% w/w	≤ 0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Glucosinolates	μmol/g	≤ 1	<0.1	<0.1	<0.1	<0.1	<0.1
Purity							
Phytates	% w/w	≤ 1.5	< 0.14	< 0.14	<0.14	<0.14	<0.14
Lead	mg/kg	≤ 0.5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Microbiological criteria							
Total plate count	cfu/g	≤ 10^4	110	270	110	70	20
E. Coli	Absent in 10 g	absent	absent	absent	absent	absent	absent
Salmonella spp.	Absent in 25 g	absent	absent	absent	absent	absent	absent
Moulds	cfu/g	< 100	30	20	30	<10	<10
Yeasts	cfu/g	< 100	<10	<10	<10	<10	<10

2.5 Mycotoxin analysis of RPI90

The following table contains the extensive mycotoxin analysis for four lots of RPI90.

Table 4 Mycotoxins in RPI90 (Appendix 3)

	Lot Number	**RPI-1536-01-G**	**RPI-1543-02-P**	**RPI-1549-01-P**	**RPI-1615-01-G**
Test Method	**Toxin**	Result µg/Kg	Result µg/Kg	Result µg/Kg	Result µg/Kg
BA-TM-03	Deoxynivalenol (DON)	<10	<10	<10	<10
BA-TM-03	Diacetoxyscirpenol (DAS)	<10	<10	<10	<10
BA-TM-03	3-Acetyldeoxynivalenol (3AcDON)	<10	<10	<10	<10
BA-TM-03	15-Acetyldeoxynivalenol (15AcDON)	<10	<10	<10	<10
BA-TM-03	Fusarenone X (Fus X)	<10	<10	<10	<10
BA-TM-03	Nivalenol (NIV)	<10	<10	<10	<10
BA-TM-03	Neosolaniol (NEO)	<10	<10	<10	<10
BA-TM-03	T2 Toxin (T2)	<10	<10	<10	<10
BA-TM-03	HT2 Toxin (HT2)	<10	<10	<10	<10
BA-TM-10	Aflatoxin B1	<0.1	<0.1	<0.1	<0.1
BA-TM-10	Aflatoxin B2	<0.1	<0.1	<0.1	<0.1
BA-TM-10	Aflatoxin G1	<0.1	<0.1	<0.1	<0.1
BA-TM-10	Aflatoxin G2	<0.1	<0.1	<0.1	<0.1
BA-TM-31	Fumonisin B1	<10	<10	<10	<10
BA-TM-31	Fumonisin B2	<10	<10	<10	<10
BA-TM-31	Fumonisin B3	<10	<10	<10	<10

2.6 Pesticide analysis

Three lots of the rapeseed protein isolate were sent to a third party laboratory for analysis. The material was screen for residues of over 600 pesticides using GC-MS and LC-MS. No residues were found to be at a level of concern. See **Appendix 4**.

2.7 Acrylamide formation

Acrylamide is produced when certain free amino acids (such as asparagine and glutamine) are heated in the presence of reducing sugars (such as glucose or fructose) to temperatures above 200 ºC. Since the DSM process and the seed pressing process do not exceed 100 ºC acrylamide is highly unlikely to be produced. Out of an abundance of caution, DSM confirmed this understanding by having three lots of RPI90 analyzed by a third party laboratory. Each lot had an acrylamide concentration <5 µg/Kg, below the limit of quantification for the method, see **Appendix 5**. The FDA has not set a maximum concentration for acrylamide in any food or food ingredient at this time (FDA 2016).

Table 5 Typical amino acid content in representative batches of rapeseed protein

Amino acid	Unit	RPI-1536-01-G	RPI-1543-02-P	RPI-1543-03-P	RPI-1549-01-P	RPI-1549-02-P	Average	% of amino acid total (w/w)
Alanine	g/100g	4.09	4.13	4.19	4.22	4.21	4.17	4.4%
Arginine	g/100g	6.24	6.27	6.23	6.47	6.41	6.32	6.7%
Asparagine	g/100g	6.44	5.35	5.26	5.62	5.71	5.68	6.0%
Glutamine	g/100g	20.9	22.3	22.8	23.2	22.8	22.4	23.7%
Glycine	g/100g	4.81	4.76	4.79	4.90	4.88	4.83	5.1%
Histidine*	g/100g	2.84	3.08	3.06	3.17	3.12	3.05	3.2%
Hydroxyproline	g/100g	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	n/a
Isoleucine*	g/100g	3.58	3.45	3.44	3.55	3.56	3.52	3.7%
Leucine*	g/100g	6.84	6.68	6.69	7.02	6.96	6.84	7.2%
Lysine*	g/100g	5.62	6.22	6.15	6.24	6.18	6.08	6.4%
Ornithine	g/100g	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	n/a
Phenylalanine*	g/100g	3.74	3.53	3.54	3.72	3.73	3.65	3.9%
Proline	g/100g	6.30	6.92	6.07	6.85	6.71	6.57	7.0%
Serine	g/100g	4.17	3.71	3.57	4.07	4.04	3.91	4.1%
Threonine*	g/100g	3.91	3.66	3.53	3.77	3.80	3.73	4.0%
Tyrosine	g/100g	2.03	1.95	1.83	1.98	2.01	1.96	2.1%
Valine*	g/100g	4.68	4.64	4.59	4.79	4.74	4.69	5.0%
Cysteine	g/100g	3.00	3.78	3.81	3.50	3.46	3.51	3.7%
Methionine*	g/100g	1.98	2.05	2.13	2.09	2.04	2.06	2.2%
Tryptophan*	g/100g	1.35	1.34	1.34	1.39	1.40	1.36	1.4%

*Essential amino acids

2.8 Product stability

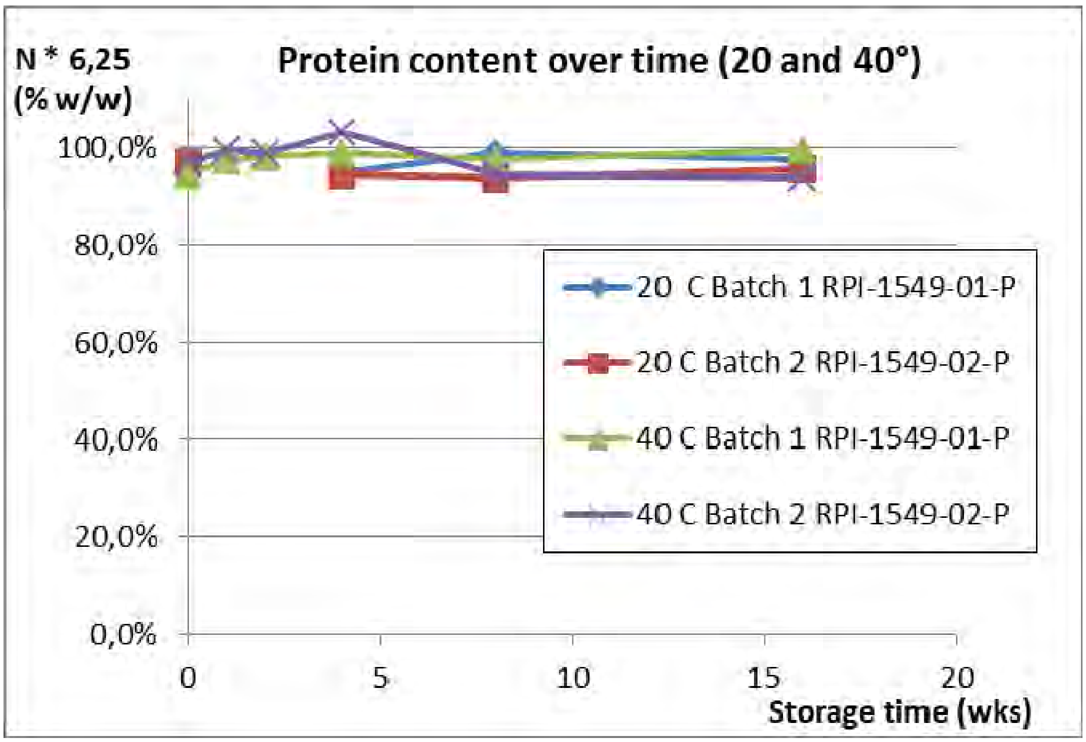
Dry protein isolate powder is usually very stable during shelf life as long as it is kept under dry storage conditions at moderate temperature, < 25º C.

Two representative batches of rapeseed protein isolate were sampled during 16 weeks storage at 20 and 40ºC[2]. Both batches were analyzed on protein content (Kjeldal, N*6.25) and protein solubility, which is indicative for the functional performance of the protein in food applications. Solubility was determined at pH 6.8 and both 0 and 150 mM NaCl.

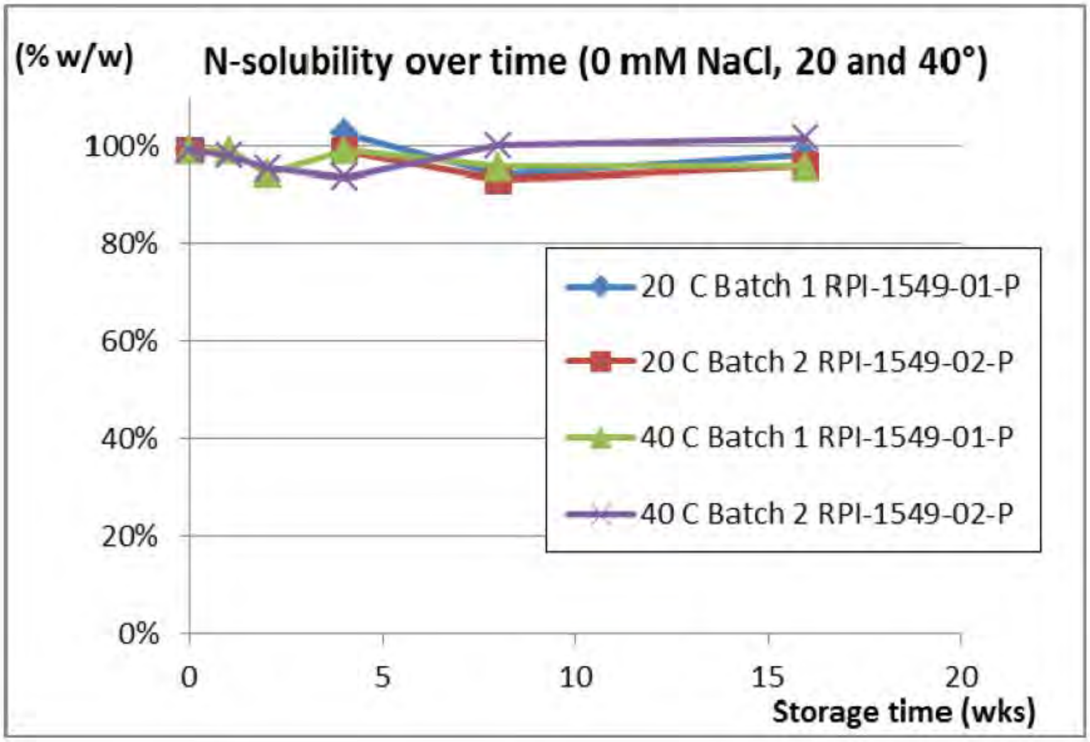
The results shown in Figure 2 demonstrate that both protein content and protein solubility remain constant at the tested time and temperatures. The data are shown in **Appendix 6**.

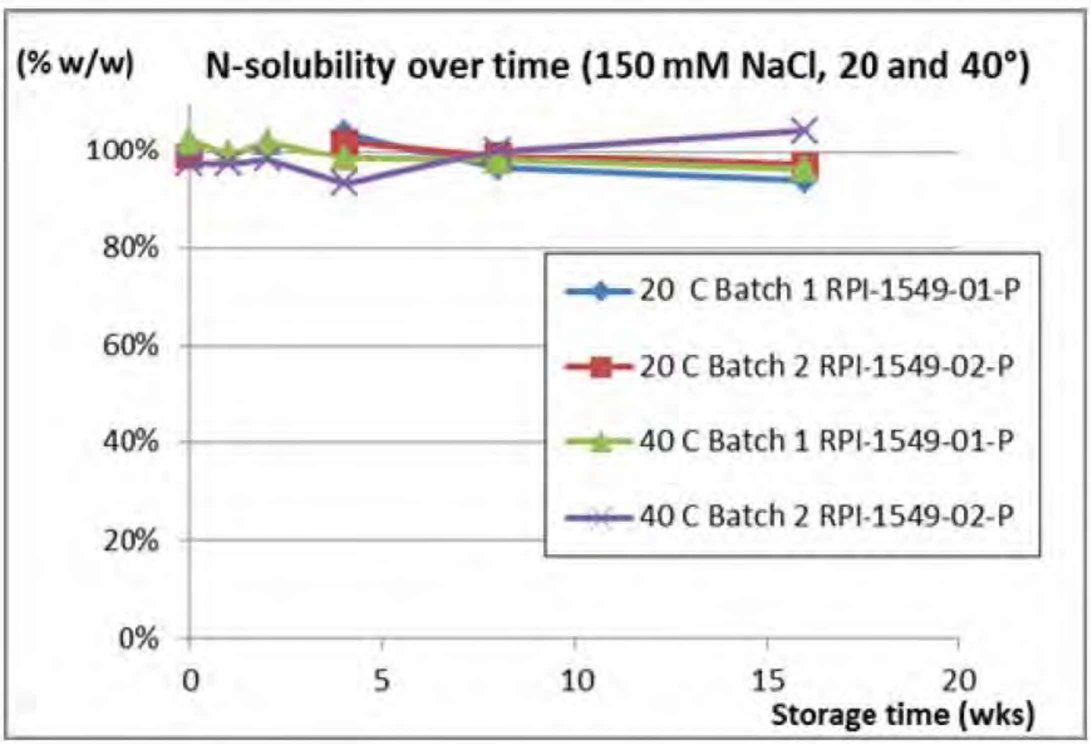
With no apparent degradation after 15 weeks at 40º C, it can be concluded that RPI90 would be stable at 25º C for 15 months.

Figure 2 a, b and c Effect of Temperature on protein content (Kjeldahl N*6.25 in %w/w) an N-solubility (% w/w, pH 6.8 at 0 and 150 mM NaCl in 2 batches of RPI90 during 16 weeks storage at 20 and 40ºC



[2] In general, industry practice indicates that 1 week of shelf life at 40ºC represents 4 weeks of shelf life at 20ºC.


(% w/w)
N-solubility over time (0 mM NaCl, 20 and 40°)
100%
80%
60%
40%
20%
0%
0
5
10
15
20
Storage time (wks)
20 C Batch 1 RPI-1549-01-P
20 C Batch 2 RPI-1549-02-P
40 C Batch 1 RPI-1549-01-P
40 C Batch 2 RPI-1549-02-P


(% w/w)
N-solubility over time (150 mM NaCl, 20 and 40°)
100%
80%
60%
40%
20%
0%
0
5
10
15
20
Storage time (wks)
20 C Batch 1 RPI-1549-01-P
20 C Batch 2 RPI-1549-02-P
40 C Batch 1 RPI-1549-01-P
40 C Batch 2 RPI-1549-02-P

2.9 Raw materials

The main raw material for the production of the rapeseed protein isolate is rapeseed press cake. Rapeseed cake is a byproduct of rapeseed oil production and the material used by DSM is from the first press which does not use solvent extraction. The rapeseed used for this purpose is from the varieties *Brassica napus* and *Brassica juncea.* These varieties contain only low levels of erucic acid and glucosinolates, and are also known as Canola or Rapeseed-00 (OECD 2011). They are used today to produce rapeseed oil for human consumption. The press cake is produced under Good Manufacturing Practices (GMP) and is suitable for use in food. See the GMP+ certificate of one of the rapeseed press cake suppliers in **Appendix 7**, other suppliers who follow cGMP could be used provided that they are able to meet the raw material specifications.

Risks of potential contaminants from the rapeseed cake are:

- Heavy metals

  The heavy metals content of the rapeseed press cake was analyzed using ICP-MS in three different batches (Table 6). Additionally, heavy metals have also been measured in the end product RPI90 (see Table 7).

  The heavy metals content in both the raw material and the product RPI90 is within safe limits.

Table 6 Heavy metal content in three batches of the raw material rapeseed press cake

Rapeseed press cake Batch no.	Arsenic	Cadmium	Lead	Mercury
Limit of Detection	0.5 ppm	0.1 ppm	0.5 ppm	0.05 ppm
T - 94345	< 0.01	0.06	<0.1	< 0.02
L - 98285	<LOD	<LOD	<LOD	<LOD
R - 95423	<LOD	<LOD	<LOD	<LOD

Table 7 Heavy metal concentration in three batches of the product rapeseed protein isolate

RPI90 Batch no.	Arsenic	Cadmium	Lead	Mercury
	[ppm]			
RPI-1536-01-G	0.081	0.053	< 0.2	<0.02
RPI-1543-02-P	0.096	< 0.01	< 0.2	< 0.02
RPI-1543-03-P	0.080	< 0.01	< 0.2	< 0.02
RPI-1549-01-P	0.12	0.021	< 0.2	< 0.02
RPI-1549-02-P	0.098	0.020	< 0.2	< 0.02

Arsenic is a toxic and carcinogenic metalloid that occurs in different organic and inorganic forms. FDA focus is on inorganic arsenic, because it is the primary toxic form of arsenic, in contrast to organic arsenic.

Background concentrations of arsenic in ambient air generally range from 1 to 3 ng/m^3, but concentrations in an urban area may range up to 100 ng/m^3. Seawater typically contains 1.5 – 1.7 ppb total arsenic. Arsenic concentrations in natural surface and groundwater of the United States are generally less than the EPA Maximum Contaminant Level (MCL) of 10 ppb[3].

FDA has performed a risk assessment where a major contributor to the dietary burden of inorganic arsenic (rice grain and rice products) is addressed. FDA proposed an action level of 100 ppb for inorganic arsenic in infant rice cereal in 2016[4].

Total arsenic was measured in the RPI90 batches. When total arsenic is considered as inorganic arsenic, the content of the rapeseed protein isolate described in Table 7 (average of 0.095 ppm) is within the maximum limit recommended by FDA. Since rapeseed protein isolate is intended to be used as a protein replacer, the intake of protein in the U.S. population is considered. The protein intake data in the U.S. population available from the NHANES database (NHANES, What we eat in America, 2011-2012)[5] indicates that the average protein intakes of adults is 98.8 g/day for men and 68.1 g/day for women. Considering a body weight of 60 kg for adults, this would result in an average intake of 1.6 g proteins/kg bw/day for men and 1.1 g proteins/kg bw/day for women, and at the 90th percentile intake would correspond to 3.2 g proteins/kg bw/day for men and 2.2 g

[3] http://www.fda.gov/downloads/Food/FoodScienceResearch/RiskSafetyAssessment/UCM486543.pdf

[4] http://www.fda.gov/Food/FoodborneIllnessContaminants/Metals/ucm319870.htm

[5] http://www.ars.usda.gov/SP2UserFiles/Place/80400530/pdf/1112/Table_1_NIN_GEN_11.pdf

proteins/kg bw/day for women[6], respectively. According to the same database, the age group 2-5 years old is estimated to have the highest protein intake with an average protein of 57.8 g/day for boys and 53.3 g/day for girls, which means 4.8 g proteins/kg bw/day for boys and 4.4 g/kg bw/day for girls considering a body weight of 12 kg for children. This corresponds to a 90th percentile intake of 9.6 g proteins/kg bw/day for boys and 8.8 g proteins/kg bw/day for girls. In practice, in the adult population, approximately 50% of protein intake comes from poultry, beef, cheese, milk, and yeast bread/rolls (O'Neil et al. 2012). Another 25% originates from fish and seafood, eggs, bakery products and nuts or seeds (O'Neil et al. 2012). Therefore, considering the proposed intake values for rapeseed protein isolate (Table 10), the mean exposure levels will be at 0.4 g proteins/kg bw/day for men, 0.28 g proteins/kg bw/day for women, 1.2 g/kg bw/day for boys and 1.1 g/kg bw/day for girls, while the 90th percentiles will be not more than 0.8 g proteins/kg bw/day for men, 0.55 g proteins/kg bw/day for women, 2.4 g/kg bw/day for boys and 2.2 g/kg bw/day for girls could be expected to come from rapeseed protein products.

Taken into account the arsenic level in the rapeseed protein isolate (95 ppb) and intake exposure levels at the 90th percentile of 0.8 g proteins/kg bw/day for an adult and 2.4 g/kg bw/day for a child this will lead to an intake of 0.08 µg/kg bw/day for adults and 0.23 µg/kg bw/day for children. These level do not pose an additional cancer risk when compared to the levels of exposure due to consumed water with a Maximum Contaminant Level (MCL) of 10 ppb as set by EPA[7].

- Pesticides

  DSM utilized two suppliers of rapeseed press cake during the development of RPI90. Both suppliers follow GMP and therefore must be in compliance with relevant regulations on use of pesticides and maximum residue levels of pesticides in food.

  A pesticide residue analysis for a typical batch can be found in **Appendix 8**.

- Microbiological contamination

  The press cake used as raw material in the rapeseed protein production must be of sufficient microbial quality. The rapeseed oil crushing is done without water and the water content of the rapeseed is so low that no microbial growth will take place during or after processing.

  The microbiological contamination level is monitored for all rapeseed press cake used to produce RPI90. Data of three independent and representative batches of rapeseed press cake are presented in **Appendix 9**.

[6] 90th percentile is approximately 2 times the average intake and 95th percentile approximately 4 times the average intake (US Food and Drug Administration, 2006).

[7] https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants

The manufacturing process for rapeseed protein isolate contains several filtration steps to control the microbiological load. Additionally the contamination levels are monitored during the manufacturing process and the end product, RPI90 is controlled for contamination (see results in table 3).

- Mycotoxins

The levels of mycotoxins in rapeseed press cake are monitored. As presented in Table 8, reported concentrations are below maximum limits established by US regulations. See **Appendix 10**.

Table 8 Mycotoxins concentration in two different and representative batches of rapeseed press cake

Mycotoxins	Unit	LOD	Rapeseed press cake batches RPC-95423	R 18-8-2015	Specification according to FDA mycotoxin Regulatory Guidance
Aflatoxin B1[1]	ppb	2	< 0.1	< 2[2]	< 20
Ochratoxin A	ppb	48	< LOD		Not established
Zearalenone	ppb	50	< LOD		Not established
Deoxynivalenol[3]	ppm	0.36	< 10	< 0.362[2]	< 1
Fumonisins (sum)[4]	ppm	1.54	< LOD	< 1.54[2]	< 2
T-2 & HT-2 (sum)	ppb	30	< LOD		Not established

[1] Analyzed by DIN EN ISO 17375:2006 method
[2] LOQ = Limit of Quantification
[3] Analyzed by DIN EN ISO 15791:2009 method
[4] Analyzed by DIN EN ISO 16006 method

3. Dietary Exposure

Dietary exposure was determined utilizing the application rate provided in section 1.6 of this dossier.

3.1 Exposure to rapeseed protein isolate

DSM rapeseed protein products are expected to be used for diverse applications such as a protein source, thickener, water binder, emulsifier, gelling agent, foaming agent, or texturizer. RPI90 will therefore be used in a number of food products. The maximum level of rapeseed protein expected in any final food product is 30%, see Table 9. In order to estimate the intake of DSM rapeseed protein isolate via the diet, the traditional toxicological assumption of a worst-case scenario was taken. DSM assumed that RPI90 would replace soy protein isolates in the diverse applications where these isolates are currently incorporated, as well as the unrealistic scenario where RPI90 would replace all the possible protein in the diet. DSM rapeseed protein isolate is not intended to be used as an ingredient in infant food or infant formulae

Intake of DSM rapeseed protein isolate can therefore be estimated based on protein consumption by American people using an approach similar to what was used by Burcon in GRN000327 and BioExx in GRN000386. The 2015-2020 Dietary Guidelines Recommendations[8] are based on data from the Institute of Medicine (IOM)[9], where Dietary Reference Intakes are provided considering the essential guide to nutrient requirements. The IOM has set a Recommended Dietary Allowance (RDA) of 13 g/day for children 1-3 years old, 19 g/day for children 4-8 years old, 56 g/day for adult males and 46 g/day for adult females. In terms of exposure on a g/kg bw/day basis, utilizing the mean body weights from the CDC 2012 anthropomorphic data report yields an average of 0.95 g/Kg BW/day for children 1-3 years old (mean BW of 13.73 Kg), 0.82 g/Kg BW/day for children 4-8 years old (mean BW of 23.14 Kg) and 0.74g /Kg BW/day for adult males and 0.73 g /Kg BW/day for adult females (mean BW of 75.56 and 62.82 Kg respectively).

Protein intake data in the U.S. population is available from the NHANES database (NHANES, What we eat in America, 2011-2012). In the U.S., the average protein intakes among adults range from 80.0 to 110 g/day for men and from 58.8 to 75.5 g/day for women, with average values of 98.8 g/day for men and 68.1 g/day for women. The age group 2-11 years old is estimated to have the highest protein intake on a per Kg BW basis,

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[8] http://health.gov/dietaryguidelines/2015/guidelines/appendix-7/

[9] https://iom.nationalacademies.org/~/media/Files/Activity%20Files/Nutrition/DRIs/DRI_Macronutrients.pdf

with an average protein of 2.35 g proteins/Kg BW/day for boys and 2.16 g/Kg BW/day for girls considering a body weight of 27.54 Kg for boys and 27.43 Kg for girls (CDC 2012). Utilizing this data set and multiplying by 2 results in a 90th percentile intake (FDA 2006) of 9.6 g proteins/Kg BW/day for boys and 8.8 g proteins/Kg BW/day for girls.

Annual disappearance figures for a food commodity can be divided by the national population and by 365 days to obtain a 'per capita' estimate of the food that is available for consumption per day expressed as grams per person per day. The Soybean Board reported in 2014 that 2% of soybean production was used for human consumption (United Soybean Board, 2014), and considering that soybeans contain 36.5% of protein (USDA report 16108, 2016), with the assumptions of a US population of 320 million and soybean production of 75 million metric tonnes, consumer exposure can be estimated by the 'per capita times 10' method of 0.55 million metric tonnes[10] x 10[11] / 365[12] x 320 million people[13] = 47 g soy protein/person/day. Considering an average body weight values of 75.56 kg for an adult male, 62.82 Kg for an adult female and 18.8 Kg for a child between ages 2-8 (CDC 2012), this would be equivalent to an exposure level of 0.62 g proteins/Kg BW/day for men, 0.75 g /Kg BW/day for women and 2.5 g/ Kg BW/ day for a child. This would lead to a 90th percentile intake of 1.24 g proteins/ Kg BW /day for an adult male, 1.5 / Kg BW/ day for an adult female and 5.0 g proteins/ Kg BW /day for a child. The estimated exposure by the 'per capita times 10' method is within the range of the estimated exposure based on the protein intake data in the U.S. population available from the NHANES database (NHANES, What we eat in America, 2011-2012).

A more thorough analysis of protein intake from the NHANES survey of 2003-2004 was published in 2008 (Fulgoni, 2008). This analysis revealed that for children, female and male combined, the 90th percentile of protein consumption was 72.5 g/day for 2-3 year olds and 84.1 g/day for 4-8 year olds. The 90th percentile for adult males was between 143.1 and 97.3 g/day with protein consumption falling as the participants aged. Adult women had a range of 104.6 to 77.5 g/day.

The analysis of O'Neil et al. (2012) indicates that total protein from foods that could not contain RPI90, such as muscle meats, fish, eggs and nuts accounts for 59.8% of total protein intake, leaving 40.2% for possible applications of RPI90, not too different from the value in the two prior GRAS Notices. Philips et al. performed a similar analysis in 2015 (Philips et al. 2015). Combining this information with the CDC body weight data of 2012 allows for the conservative estimation of protein intake per Kg BW/day as well as potential exposure to RPI90. The estimate is conservative because we used the 90th percentile intake divided by the 50th percentile body weight, see table 9.

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[10] Weight disappearance of the soybean protein production for human consumption

[11] Exaggeration factor = 10. This a maximization factor added to take into account the uneven distribution of consumption through the population.

[12] Days per year

[13] Population in US

Table 9 Exposure to RPI90

Age	Protein Consumption 90th percentile g/day[a]	Body Weight 50th percentile Kg[b]	Protein Consumption g/Kg BW/day	Exposure to RPI90 if replacing all possible (40.2%) dietary protein g/Kg BW/day
2-3	72.5	14.6	4.97	2.00
4-8	84.1	22.94	3.67	1.47
Males				
9-13	103.9	43.8	2.37	0.95
14-18	129.5	69.28	1.87	0.75
19-30	143.1	83.1	1.72	0.69
31-50	135.3	87.3	1.55	0.62
51-70	117.1	88.55	1.32	0.53
71+	97.3	81.3	1.20	0.48
Females				
9-13	87.7	43.58	2.01	0.81
14-18	90.8	59.32	1.53	0.62
19-30	95.8	59.75	1.60	0.64
31-50	90.2	72.15	1.25	0.50
51-70	91.2	74.2	1.23	0.49
71+	77.5	67.9	1.14	0.46

a – data from Fulgoni, 2008

b – data from CDC 2012

The estimated exposure to RPI90 ranges from 2.00 g/Kg BW/day for young children to 0.46 g/Kg BW/day for adults. These conservative exposure values are much lower than the NOAEL of 11.24 g/kg bw/day for male rats reported by Mejia et al. for the cruciferin-rich protein isolate and of 12.46 g/kg bw/day for male rats for the napin-rich protein isolate (Mejia et al. 2009a, Mejia et al. 2009b). The exposures are also lower than those reported in two prior GRAS notices which ranged from 3.1 to 0.75 g/Kg BW/day.

DSM rapeseed protein isolate is not be expected to have 100% of the market share for protein isolate products. Additionally, food intake databases from which the estimated exposures are derived usually overestimate consumption, since they do not reflect the exposures are derived usually overestimate consumption, since they do not reflect the true chronic exposure conditions. These factors will typically overestimate the exposure of a macronutrient by a factor of 2- to 10-fold (Munro et al. 1996).

Taking into consideration all the aspects for evaluating safe exposure, there is every indication that RPI90 intakes will be well below levels of any possible concern.

3.2 Exposure to other substances

3.2.1 Erucic acid

Erucic acid is a fatty acid present in the oil of cruciferous plants, including rapeseed and canola. While no negative health effects have ever been documented in humans, rapeseed oil high in erucic acid has been associated with lipid and histological changes in the heart of experimental animals (OECD 2011). However, similar myocardial lipidosis has also been observed in rats exposed to vegetable fatty acids (Neat, Thomassen & Osmundsen 1981), which has been suggested to be due to the fact that rats are less able to digest vegetable fats (containing erucic acid or not) than other animals (Chien et al. 1983). In addition, the toxicity of erucic acid has been studied in sub-chronic and short-term feeding studies. Most animal studies did not show any negative effect despite the high concentrations or unnatural scenarios of exposure. In one case, neonate piglets that have a limited ability to absorb these fats had their normal sow's milk replaced solely with rapeseed oil for one hundred percent of their caloric needs (Food Standards Australia and New Zealand (Australia NZ 2003)). Lipidosis occurred in piglets very shortly after the beginning of feeding oil and increased in its severity in a dose–dependent manner. The severity of the lipidosis appeared to decline with time regardless of whether or not the feeding of erucic acid continued, suggesting that the animal liver responds by increasing enzyme levels to cope with the unusual diet. Myocardial lipidosis in animals can therefore be regarded as a short–term, reversible effect. Food Standards Australia and New Zealand (Australia NZ 2003)).

Although a number of epidemiological studies on the human consumption of oils containing high levels of erucic acid exist, they do not indicate any association between erucic acid and the occurrence of heart disease (Food Standards Australia and New Zealand (Australia NZ 2003)). Nevertheless, Food Standards Australia New Zealand has defined a tolerable intake of erucic acid for humans of 7.5 mg erucic acid/kg bw/day (Food Standards Australia and New Zealand 2003). This tolerable intake was based on the level that was associated with increased myocardial lipidosis in nursling pigs.

Canola is, by design, low in erucic acid. FDA has defined a maximum level of 2% erucic acid for low erucic acid rapeseed oil to be used in food (21 CFR §184.1555). As can be seen in Table 14 the erucic acid content of the protein isolates described in this dossier (<0. 005%) is well below the 2% maximum limit set by FDA. Additionally, taking into account a maximum use level of RPI90 of 30% in final food (see **section 4**), a worst-case scenario of total protein replacement, where 90th percentile intake levels of 3.2 g RPI90/kg bw/day for an adult of 60 kg body weight and 9.6 g RPI90/ kg bw/day for a child of 12 kg body weight are considered (see **section 6.8**), the content of 0.005% erucic acid will lead to a worst-case intake of 0.048 mg erucic acid/kg bw/day for adults and 0.144 mg erucic acid/kg bw/day for children. This level is well below the tolerable intake of 7.5 mg erucic acid/kg bw/day defined by Food Standards Australia New Zealand and therefore does not represent any toxicological concern.

As shown below, only traces of erucic acid are found in DSM isolate.

Table 9 Concentration of anti-nutritional factors in five independent and representative batches of rapeseed protein isolate

Batch	Erucic acid	Total phenolics (expressed as sinapic acid)	Phytic acid	Glucosinolates
	%	ppm	%	µmol/g
RPI-1536-01-G	< 0.005	605	< 0.14	< 0.1
RPI-1543-02-P	< 0.005	703	< 0.14	< 0.1
RPI-1543-03-P	< 0.005	881	< 0.14	< 0.1
RPI-1549-01-P	< 0.005	670	< 0.14	< 0.1
RPI-1549-02-P	< 0.005	600	< 0.14	< 0.1

3.2.2 Total phenolics (expressed as sinapic acid)

The total phenolics concentration in the rapeseed protein isolates described in this dossier is presented in Table 14. These concentrations of 600-900 ppm are very low and within the levels the same range as the rapeseed protein isolates that were reviewed by FDA in GRN 000327 and GRN 000386.

Phenolic acids are common in all kinds of plants and are therefore present in a considerable part of the human diet. Rich sources of phenolic acids are blueberry (1,881-2,112 mg/Kg), cherry (290-1,280 mg/Kg), pear (44-1,270 mg/Kg), apple (2-258 mg/Kg), orange (21-182 mg/Kg, potato (100-190 mg/Kg) and coffee (56 g/Kg/Dry weight) (GRN 000327). Phenolic substances are also present in soybeans (2.1-3.4 g/kg), and consequently in soy protein isolates (Tepavčević et al. 2010). They are in general considered as safe and also have antioxidant effects. The main concern for their natural presence in rapeseed products is not their potential toxicity, but their negative impact on animal nutrition, notably for the pig and poultry industries. Phenolic acids are associated with poor palatability due to bitterness or astringency, thus affecting the feed intake of animals. In addition, they interfere with nutrient uptake in the digestive system.

In canola, sinapine – the choline ester of sinapic acid – is the most abundant of all small phenolics. Sinapine is converted into trimethylamine by the intestinal microflora and is then absorbed. Most animals have the ability to convert trimethylamine to trimethylamine oxide, a compound that is easily excreted. However, some animals cannot fully metabolize trimethylamine. This is notably the case for laying hens that started to produce eggs smelling 'fishy' or 'crabby'. The problem was traced back to the sinapine content of canola meal and to the leaching of trimethylamine into the eggs, giving them a fishy odor (Bonnardeaux 2007, OECD 2011).

3.2.3 Phytic acid

The levels of phytate found in rapeseed protein isolates is <0.14% (see Table 14) and, as discussed in this dossier, are lower than the levels found in commonly consumed foods. Moreover, phytate levels on RPI90 are much lower than the phytate levels reported to cause adverse effects in male or female rats fed rapeseed proteins (Jones, 1979; Shah et al., 1979). The antinutritional actions of phytate are shown in the following by are only seen at high levels in foods.

Phytic acid is the principal storage form of phosphorous in many seeds. It is a strong chelator of important minerals, such as calcium, zinc and iron and could therefore contribute to mineral deficiencies by reducing their bioavailability. Phytate can also chelate the vitamin niacin (B3) which could contribute to vitamin B3 deficiency (Reddy 2002). Phytate is a common component of many food products such as cereals approximating up to 2.2%. It is present in wheat and is known to cause zinc deficiency in humans in regions of the world where unleavened bread makes up a large proportion of the diet (Jones 1979). In several studies of rats fed protein concentrates containing between 5 and 7.5% of the diet adverse effect have been reported. When fed to pregnant rats, loss of appetite, wasting, apathy, reduced litter size and an increase in numbers of still-born pups was found (Eklund 1973, Eklund 1975, Jones 1979). These adverse effects were attributed to a chelation of zinc by phytate, causing a zinc deficiency in the animals. Serum analyses obtained from the treated-rats revealed low zinc values but normal levels of calcium, magnesium, iron and copper (Jones 1979). Similarly, in a group of female rats fed rapeseed proteins containing a high level of phytate salts (1.61% of the total rat diet) for two weeks before breeding, levels of zinc in maternal serum, liver, femur and in the pups were significantly lower than the comparable levels in the other two groups. In addition, the rat body weights were reduced (Shah et al. 1979). On the other hand, a group of female rats fed with rapeseed proteins and supplemented with zinc did not show anorexia, and there was neither a significant difference between reproductive performances of the supplemented group and the control group nor was there any significant difference between the zinc levels determined between these two groups. A similar experiment was performed on male rats (Jones 1979). The group of male rats fed rapeseed protein concentrates showed marked reductions of serum and femur zinc content compared to the control group, while these zinc levels were normal in the group of male rats receiving rapeseed protein concentrates as well as zinc supplementation. No visible abnormalities could be seen in the zinc deficient animals, but these rats gained weight at a slower rate than those receiving zinc supplementation or than the control rats. It therefore seems that male rats are not subjected to as much stress as the pregnant rats when experiencing a zinc deficiency.

Phytic acid is ingested with many plant-derived foods. Soy protein isolate is reported to contain 1.6-2.0 % phytic acid (Honig, Wolf & Rackis 1984). Lower values (0.49-0.84 %) were reported more recently (Hurrell et al. 1992). In tofu, 1.46-2.90 % phytic acid was found (on a dry matter basis). Phytic acid/phytate is present in cereals such as maize 0.72-2.22 %, wheat 0.39-1.35 %, rice 0.06-1.08%, barley 0.38-1.16%, sorghum 0.57-3.35 %, oat 0.42-1.16%, rye 0.54-1.46 %, millet 0.18-1.67 %, triticale 0.50-1.89 % and wild rice 2.20% (on dry matter basis). The level of phytic acid/phytate has also been identified in several legumes such as kidney beans 0.61-2.3 %, broad beans 0.51-1.77 %, peas 0.22-1.22 % dry cowpeas 0.37-2.90 %, chickpeas 0.28-1.60 % and lentils 0.27-1.51 % (on dry matter basis). Several type of nuts contain Phytic acid/phytate ranging from 0.17-9.42 % (on dry matter basis) (Schlemmer, Frølich, Prieto & Grasesn 2009).

In addition, 90-day toxicology studies performed with napin-rich protein isolate containing 3.35% phytate fed orally to rats at up to 20% of their diet did not affect the plasma concentration of zinc (Mejia et al. 2009b). These results strongly suggest that the very low level of phytate present in RPI90 (< 0.14%) is not of toxicological concern.

It has been demonstrated that technological processes to manufacture rapeseed products further eliminate significant amounts of anti-nutritional factors. For example, isolation of canola proteins has been shown to eliminate up to 95% of glucosinolates, 92% of phytic acid and 100% of tannic acid (Mansour et al. 1993).

3.2.4 Glucosinolates

This level of glucosinolates in DSM rapeseed protein isolates consumed in the proposed food uses would be below the acceptable daily intake (ADI) derived by European Food Safety Authority (EFSA) for Allyl isothiocyanates (AITC) of 20 µg/kg bw/day (EFSA panel on food additives and nutrient sources added to food (ANS) 2010) and therefore does not represent any toxicological concern (Table 14). The raw material used for the production of the rapeseed proteins is the canola or rapeseed bred for low glucosinolate, is low in glucosinolate (i.e. less than 30 µmol glucosinolates/g meal). In addition, by optimizing the extraction process of the rapeseed protein it is possible to reduce the glucosinolate levels to insignificant levels. The very low typical values <0.1 µmol glucosinolates/g in the rapeseed protein isolates described in this dossier are shown in Table 14. In addition, AITC levels were below the detection limit (< 3 ppm). Thus, taking into account a maximum use level of RPI 90 of 30% in final food (see **section 4)** a worst-case scenario of total protein replacement, where 90th percentile intake levels of 3.2 g/kg bw/day for an adult of 60 kg body weight and 9.6 g/ kg bw/day for a child of 12 kg body weight are considered (see **section 6.8**) and the content of 3 ppm AITC will lead to an intake of 2.88 µg AITC/kg bw/day for adults and 8.64 µg AITC/kg bw/day for children.

Glucosinolates are a class of water soluble, sulfur or nitrogen-containing glucosides that occur as secondary metabolites in virtually all species of *Brassica*. On their own, glucosinolates are innocuous, but when cells of the seed are ruptured, glucosinolates come in contact with the enzyme myrosinase. This enzyme, present in *Brassica* species, hydrolyzes the glucosinolates by cleaving off the glucose group. The remaining unstable molecules are then quickly converted into a wide range of glucosinolate derivatives including isothiocyanates, nitriles, thiocyanates and 5-vinyloxazolidine-2-thione (VOT), with the release of sulphur. Heating during the production process inactivates the myrosinase, though this does not completely eliminate the effects of glucosinolates because intestinal microflora also produces myrosinase (Tripathi, Mishra 2007).

In human, isothiocyanates, thiocyanates and VOT are described as goitrogenic, reducing the ability of the thyroid to absorb iodine (Downey 2005).

Nitriles on the other hand can affect animal performance and can be toxic to the liver and kidneys (Tripathi, Mishra 2007). Nitriles lead to hypertrophy of the target organs, disruption of the normal lobular structure of the liver and irregular proliferation of the bile duct. They can also produce rapid kidney lesions, along with elevated plasma levels of nitrogen, urea and creatinine. Experiments performed in animals suggest that they interact with reduced glutathione, thus leading to substantial alterations in tissue glutathione levels in the liver, kidney, adrenals and lungs.

Due to their derivatives, glucosinolate levels of 18 to 30 µmol/g canola meal have been shown to have antinutritional or toxic effects in animal studies. On the other hand, a lower level of glucosinolates content has been reported to have a positive effect on health (Tan et al. 2011) and notably on cancer prevention (Lampe, Peterson 2002). Rapeseed proteins containing high levels of glucosinolates fed to rats have directly contributed to anti-thyroidal effects and reduction of the animal body weight (Tripathi, Mishra 2007). However, it has been shown that the purification of rapeseed proteins to remove glucosinolates eliminates the negative effects on the thyroid (Loew et al. 1976, Jones 1979, Kroll, Przybilski 1991). While feeding rats 20 or 40% protein isolates containing 930 ppm glucosinolates led to slight anti-thyroid effects, purification of the proteins to 30 ppm glucosinolates abolished the adverse thyroid effects in the rats fed rapeseed protein isolates at 20 or 40% of the total dietary protein (Loew et al. 1976). Similarly, beagle dogs and rats were fed for 90 days a 20% protein diet containing 20 or 40% rapeseed protein concentrate (with 290 ppm goitrin and 900 ppm isothiocyanates) (Jones 1979). While no effects were observed on the dogs, the higher concentration of rapeseed proteins led to anti-thyroid effects in rats. Repeating this toxicity study with rapeseed protein concentrates containing lower levels of residual glucosinolates (20 ppm goitrin and 30 ppm isothiocyanates) did not lead to any adverse effects on treated rats. In order to further investigate the toxicological effects of rapeseed proteins and their components on the thyroid gland, rats were fed a diet containing 10% of one of three rapeseed protein products – industrial rapeseed meal, rapeseed protein isolate prepared from the meal by extraction, ultra- and diafiltration, or rapeseed extraction residue obtained by protein extraction of the meal (Kroll, Przybilski 1991). The toxicological effect on the thyroid of the three diets was tested with a thyroid stimulation test. While the industrial rapeseed meal – containing high levels of glucosinolates – led to a clear impairment of rat thyroid function, thyrotoxic effects were considerably reduced with both rapeseed protein isolate and rapeseed extraction residue. These results strongly suggest that the anti-thyroidal effects observed with rapeseed proteins can be attributed to the presence of a high level of glucosinolates.

3.2.5 Protease inhibitors

The presence of protease inhibitors in plants has been known for almost 100 years '*Ever since Osborne and Mendel (1917) observed that soybeans would not support the growth of rats unless the beans were cooked for 3 h on a steam bath….'*.(Rackis & Gumbmann, 1981). Soybean based products have been the primary concern as a source of protease inhibitors but anti-nutritional compounds are also present in other legumes (Kadam & Smithard, 1987 and Carvalho, 1997), wheat and potatoes; (Habeeb & Khalid, 2007). As was indicated by Osborne and Mendel heat processing tends to inactivate the protein digestion inhibitors. In the market survey performed by Doell et al. they reported that raw soy beans contained 49.6 mg trypsin inhibitor per gram of protein but raw and cooked tofu contained 9.2 and 5.5 mg/g respectively, (Doell et al., 1982). Yuan et al., 2008 compared the residual trypsin inhibitor concentration of Ultra high Temperature (UHT) processed soy milk following standard commercial time temperature programs. They reported that in general, higher temperature and longer time resulted in lower residual trypsin inhibitor in the UHT samples ranging from a low of 10.9% for an experimental processing program to a high of 37.7% for one of the commercial processes. A survey of commercial soy-based infant formulae in Canada revealed a trypsin inhibitor concentration ranging from 0.75 to 1.59 mg/g protein in ready to eat liquid formula and from 0.34 to 0.91 mg/g in powder formulae (Xiao et al., 2012).

The *Brassica* genus of plants, like many other plants, contains protease inhibitors, (Ceciliani et al., 1994). Consequently, RPI90 also contains a protease inhibitor. Analysis of 22 samples collected during product development revealed an average protease inhibitor concentration of 21.1 mg/g of protein. See **Appendix14**. Napin is the primary source of protease inhibitors in rape seed (Tuija et al., 2006).

Many of the proposed food categories in which RPI90 is anticipated to be utilized are heat processed to varying degrees which will lead to some level of degradation of the protease inhibitor. But even if no degradation were to occur, if the highest use level, 30% for protein enriched baked goods, is used as a model for exposure to the protease inhibitor, the average concentration would be 21 mg/g protein. This concentration is not unusual and is in line with other food products such as cow's milk, cabbage and tofu (Doell et al., 1982) or soy milk, (Xiao et al., 2012). Since heat processing decreases the presence of protease inhibitors the concentration in products containing RPI90 will be very low and not likely to be a concern.

3.2.6 Comparison of anti-nutrients in RPI90 to prior notified rapeseed protein isolates

The concentrations of anti-nutrients in RPI90 are similar to that of other rapeseed protein isolates notified to the FDA.

Table 10 Anti-nutrients in RPI90 and other rapeseed protein isolates

Anti-nutrient	RPI90	Napin Rich RPI Mejia et al. 2009a	Cruciferin Rich RPI Mejia et al. 2009b	Isolexx GRN000386	Vitalexx GRN000386
Total glucosinolates (µmol/g)	<0.1	0.80	1.22	0.09	0.21
Erucic Acid %	<0.005	<0.0025	<0.0025	0.002	0.003
Phytic Acid %	<0.14	3.34	0.32	0.85	0.5
Total Phenolics %	0.07	0.25	0.37	0.14	0.39

4. Self-limiting levels of use

Protein is a macro component or ingredient in food. At high levels of protein, food products become bitter and unpalatable. Additionally, because of the water binding properties of protein ingredients, excessive levels can make the food product dry, gummy and difficult to manufacture. Levels in excess of those provided in section 1.6 of this dossier (maximum of 30%) are not anticipated due to the potential for unpalatability or the technological impracticality of higher use levels.

The belief that the projected use levels are representative is supported by the protein levels in current market products with high protein claims and published literature.

Table 11 Examples of Commercial High Protein Products

Product Type	Brand Name	Protein Source(s)	Protein / serving	% Protein
Bread	See: Mizrahi et. al. 1967	Soy		2-10
Dairy alternative	SoDelicious-Vanilla Frozen Dessert[1]	Soy protein	2 g	2.5
Dairy alternative	Stonyfield-O'Soy vanilla yogurt[2]	Soy protein	7 g	4.1
Dairy alternative	Silk – vanilla yogurt[3]	Soy protein	6 g	4
Donuts	See: Singh et. al. 2008	Soy		3 – 3.5
High Protein Cookie	Nashua – ProteiDiet[4]	Gelatine, soy, whey, egg	15 g	35.7
Meat Analogues	See: Asgar et. al. 2010	Soy, whey, egg, legume		4-20
Nutritional Beverage	Power Bar – Protein Shake[5]	Casein, Whey	30 g	6
Nutritional Beverage	Boost- High Protein[6]	Soy, Casein	15 g	6
Pasta	Barilla-Protein Plus Spaghetti[7]	Bean flour, egg	10 g	17.8

Product Type	Brand Name	Protein Source(s)	Protein / serving	% Protein
Sport Nutrition	Power Bar-Clean Whey[8]	Whey	20 g	30
Sport Nutrition	Power Bar-Protein Plus[9]	Soy, Casein, Whey	20 g	30
Sport Nutrition	Gatorade – Whey Protein Bar[10]	Whey	20 g	25
Weight Management	Nashua-Health Smart Protein Bar[11]	Soy, Whey, Casein	14 g	35
Weight management - Cereal	NutriWise Cinnamon diet Protein Cereal[12]	Soy protein Isolate	15 g	51.7 (reduced to 5.6 when eaten with skim milk)
Weight management - Soup	NutriWise – Instant Cream of Chicken[13]	Whey protein	15 g	5.6

1- http://sodeliciousdairyfree.com/products/soy-milk-frozen-desserts/creamy-vanilla
2- http://www.stonyfield.com/products/yogurt/osoy/vanilla
3- https://silk.com/products/vanilla-dairy-free-yogurt-alternative
4- http://www.nashuanutrition.com/store/snacks-and-treats/protidiet-cookies-cranberry-lemon-7-box.html
5- https://www.powerbar.com/protein/protein-shake
6- https://www.boost.com/products/high-protein
7- https://www.barilla.com/en-us/products/pasta/proteinplus/proteinplus-spaghetti
8- https://www.powerbar.com/chocolate-chip-cookie-dough
9- https://www.powerbar.com/protein/20-30g-proteinplus%E2%84%A2
10- https://shop.gatorade.com/sports-fuel/whey-protein-bar
11- http://www.nashuanutrition.com/store/protein-bars/healthsmart-protein-bar-chocolate-mint-7-box.html
12- https://www.bariatriclifestylediet.com/product/nutriwise-bariatric-cinnamon-protein-cereal/
13- https://www.bariatriclifestylediet.com/product/nutriwise-bariatric-cream-of-chicken-soup/

5. Experience Based on common use in food before 1958

DSM Innovation is unaware of any use of rapeseed protein isolate prior to 1958. As mentioned in section 2.2.2, the rape plant was not used for the production of human food ingredients until the 1970's.

6. Narrative

6.1 Current safe use

Oilseed rape species are derived from the *Brassica* genus of the *Brassicaceae* or *Cruciferae* family, also known as the mustard or cabbage family. *Brassica* species are one of the most widely cultivated species of plants used for human food. As sources of common vegetables in the diet, *Brassica* species, such as broccoli, cabbage, cauliflower, radish and turnip, have been in use for centuries. Some of them are now recognized as having desirable health benefits.

Several species of the *Brassicaceae* or *Cruciferae* family have become important agricultural crops around the world. The seeds of these Crucifers are rich in oil and contain considerable amounts of protein that accounts for 20 to 35% of seed dry weight. The predominant storage proteins of these Crucifers are cruciferin (11 or 12S) and napin. These proteins are expressed during seed development as precursors, undergo co- and post-translational modifications, before being transported to membranous organelles (protein bodies) where they accumulate in large quantities and become a considerable fraction of seed biomass. The structural protein oleosin is associated with the oil fraction.

Among the *Brassicaceae*, rapeseed (*Brassica napus* and *Brassica rapa*, formerly *Brassica campestris*, also known as turnip rape or sarson), oriental and brown mustard (*Brassica juncea*, also known as Indian mustard), black mustard (*Brassica nigra*), and yellow mustard (*Sinapis alba* syn. *Brassica hirta,* also known as white mustard) are important in the global oilseed economy. See USDA 2016 for taxonomic information. Oilseed rape was first cultivated in India about 4,000 years ago. It was then introduced to China about 2,000 years later. The large-scale production of oilseed rape was first reported in Europe in the thirteen century, but its consumption in the Western World is more recent and was first limited to the use of canola meal in the livestock industry and the use of the oil for cooking and salads. Interest in rapeseed breeding intensified in Canada soon after the crop was introduced from Europe in the 1940s. The first efforts were concentrated on improving the agronomic characteristics and the oil content. Studies conducted in the late 1940s correlated a high consumption of rapeseed oil containing a large amount of erucic acid with heart lesions in experimental animals. These studies stimulated plant breeders to develop rapeseed varieties low in erucic acid. In the late 1970s, the name canola (**Can**adian **o**il, **l**ow **a**cid) was adopted in North America to distinguish the plant low in erucic acid from other types of rapeseed. Later on, rapeseed varieties low in glucosinolates were developed, notably for livestock consumption, when it appeared that glucosinolates contained in rapeseed had toxic effects on the animals and were responsible for the bitter taste of the rapeseed meal. Further breeding programs led to the development of varieties low both in erucic acid and glucosinolates. The term canola has since then been adopted to designate a cultivar of *Brassica napus*, *Brassica juncea* or *Brassica rapa*. Canola must contain less than 2% erucic acid in the oil and less than 30 μmol/g glucosinolates in the air-dried, oil-free meal. Today it is also known that technological processes to manufacture rapeseed products further eliminate significant amounts of anti-nutritional factors. For example, isolation of canola proteins has been found to eliminate up to 95% of glucosinolates, 92% of phytic acid and 100% of tannic acid (Mansour et al. 1993).

Rapeseed oil, low in erucic acid, was recognized as GRAS in 1985 by the U.S. FDA (21 CFR § 184.1555(c), which is the edible oil obtained from *Brassica napus* or *Brassica campestris*). This GRAS status was then extended to canola oil from *Brassica juncea*.

Rapeseed protein isolate is a relatively new food ingredient and was the subject of two prior GRAS Notices, GRN000327 in 2010 and GRN000386 in 2011. Both Notices received no questions letters from the FDA Center for Food Safety and Nutrition.

It needs to be remembered that other members of the *Brassicae* family contain the same anti-nutritional factors as rape, namely, phytic acid and glucosinolates. Glucosinolate concentrations have been reported for broccoli (47-121 mg GSL/100g), cauliflower (14-208 mg GSL/100g), cabbage (39-70 mg GSL/100g), turnip (99-230 mg GSL/100g) and radish (44-252 mg GSL/100g) (GRN 000327).

Because the raw material used to manufacture RPI90 is well known and has been in use as a source of a human food ingredient, Canola oil, for several decades, there is a low probability that the seeds of the plant would negatively impact the safety of the protein isolate; provided that the material meets the specifications presented in section 2.8.

6.2 DSM rapeseed protein isolate

RPI90 is manufactured following cGMP by a multistep process starting with rapeseed press cake, the by-product of rapeseed oil production. Rapeseed varieties used for the production of human edible vegetable oil are low in the anti-nutrition factors erucic acid and glucosinolates. The protein is extracted from the press cake by aqueous saline precipitation followed by several purification steps, filtration, washing and ultrafiltration. The washed concentrate is dried in a suitable dryer, like a spray drier (single or multistage) at an inlet temperature of 150-200 ^{0}C and an outlet temperature of 50-100^{0}C. The purified final product is a brownish powder that is stable at room and elevated temperatures (20 and 40^o C respectively) for a minimum of 18 months. See Sections 2.3 through 2.8 of the dossier. Because the manufacturing process does not introduce any solvents or other potentially harmful substances and follows cGMP, there is no reason to believe that the process could adversely impact the safety of the product.

Results of literature searches for information on the toxicological properties of rapeseed proteins were evaluated. Studies reviewed addressed the different fields of toxicological risk assessment included metabolism and pharmacokinetics (single administration) and toxicokinetics, short-term acute and repeated dose toxicity and genotoxicity studies (Ames test and Chromosomal Aberration in Vitro). See section 7.1 of the dossier.

Rapeseed protein isolates from low erucic acid varieties of the plant have been reported to be not clastogenic, not mutagenic and to have an NOAEL of between 11.24 and 14.95 g/Kg BW/ day in a 13 week rat study. See Mejia et al. 2009a and 2009b.

Because RPI90 is manufactured in a similar manner to that of previously notified rapeseed protein isolates (see GRN000327 and GRN000386) and is manufactured from the same commercial varieties of low erucic acid as other commercial rapeseed oil crops, it was determined that the published information was sufficient to support the safety of RPI90.

Analysis of RPI90 for the presence of anti-nutrition factors and contaminants revealed that the protein isolate has impurity and contaminant levels well below contemporary levels of concern and are similar to or below the levels reported in the two GRAS Notices (GRN 000327 and GRN000386) for similar rapeseed protein isolates. Because rapeseed is a member of the mustard family, cross-reactivity for individuals allergic to mustard is possible and this will be noted in product literature. No cross-reactivity with the eight major allergens was discovered. See section 7.3.6.

In summary, RPI90 is manufactured following cGMP to produce a rapeseed protein isolate with compositional and nutritional properties that are similar to rapeseed protein isolates currently marketed for human consumption. Published toxicological studies support the safety of rapeseed protein isolates (Mejia et al. 2009a and 2009b). The anticipated uses of RPI90 are well below the published NOAEL, section 3.1 of this dossier.

6.3 Contradictory information

DSM reviewed the available literature and has presented the findings from that literature in sections 7.1 through 7.3.6. All the information supports the safety of RPI90 provided that the necessary precautions are taken to minimize introduction of toxicants via the raw material, heavy metals and mycotoxins, which is accomplished by adhering to the specifications for the press cake as provided in section 2.8.

Rapeseed is a member of the mustard family and consequently can be considered an allergen is some regions of the world. DSM contract the Food Allergy and Anaphylaxis Research Program for an analysis of the proteins present in RPI90 to ensure that there were no other allergenic proteins present. The results were negative, see section 7.3.6 and **Appendix 11**.

The anticipated maximum use levels for RPI90 in a diverse range of consumer products has been evaluated. An analysis of the products in the market that contain high levels of protein support the projected maximum exposure, see section 4 of this dossier. The worst case exposure for all age groups is well below the NOAEL, see section 7.4.

6.4 Confidentiality

DSM does not view any of the information contained in this GRAS Notice to be confidential.

6.5 Toxicology

Consistent with the expectations that a sponsor of a GRAS Notice would investigate the published literature addressing the safety of the substance under review and other similar materials DSM provides the following information.

Rapeseed is a potential protein source for humans and many studies have been conducted to address the safety of rapeseed protein products. The first records of safety studies with rapeseed were obtained from exposure of livestock animals to rapeseed press cake. Table 12 below summarizes the outcomes of toxicological studies performed rapeseed meals and protein concentrates. The table lists the performed studies in an ascending chronological fashion.

Table 12 Summary table of available safety data on rapeseed protein products

Type of study	Protein preparation	Results	Remarks	Reference
Feeding, rats	Industrial rapeseed press cake	"satisfactory protein source"	Toxic glucosides removed	(Matet, Montagne & Buchy 1949)
Feeding, dairy calves	Mustard oil meal	As good as soybean meal	No toxic effect	(Huang 1956)
Feeding, rats	Mustard and rapeseed meals	As good as soybean meal	Toxic factors removed	(Goering et al. 1960)
Tox test, laying hens	Extracted Algerian rapeseed meal and French rapeseed meal. 1.6%, 3.2%, 4.8%, 6.4% and 8% protein of Algerian rapeseed meal diet with crude protein 39.6%. 1.7%, 3.4%, 5.2%, 6.9% and 8.6% protein of French rapeseed meal diet with crude protein 37.6%	Thyrotoxic	Weight increase of the thyroid gland	(Jackson 1970)
Tox test, rats	Rapeseed lipid-protein concentrate	Similar to control	Higher incidence of renal calculi	(Agren, Eklund 1972)
Reproduction, rats	Detoxified rapeseed protein Casein 23% in Control diet (CM), Rapeseed protein concentrate 37% in rapeseed protein	Delivery and litter size strongly reduced	Toxic components remain after detoxification	(Eklund 1973)

Type of study	Protein preparation	Results	Remarks	Reference
	concentrate diet (RP), and casein 11.5% and RP 18.5% in mix diet (CMRP). Crude protein 20%			
Tox & teratological test, rats and mice	Rapeseed protein	Complex, slightly abnormal behavior and effects	0.2 mg glucosinolates/g protein	(Sharpe, Larsson & Liedén 1975)
Reproduction, rats	Rapeseed protein concentrate 20% RPC content in diet with 20% protein level	Reduced weight gain in mothers, reduced number of fetuses	Decrease in serum tocopherol	(Eklund 1975)
Feeding, rats & dogs	Rapeseed protein concentrates 20% and 40% of the protein was rapeseed flour (RSF)	No abnormalities	No antithyroid effects	(Loew et al. 1976)
Feeding, rats	Rapeseed protein concentrate	Lower serum Zn and tocopherol	No reduction in food intake, weight gain or growth	(Eklund, Ågren 1978, Eklund, Rask 1979)
Reproduction, rats	Rapeseed protein concentrate + Zn 20% of rapeseed protein concentrate content in diet; Diets with 60-66% RPC	Zn supplement alleviate anorexia caused by protein concentrate	Zn deficiency caused by phytates?	(Shah et al. 1979, Jones 1979)
Feeding, dairy cows	Fines from rapeseed protein concentrates	Normal health, slightly lower conception rate	Decreased blood urea, increased thiocyanate	(Ahlstroem 1979)
Feeding, rats	Rapeseed protein concentrates + Zn Diet with 20% protein, replacement of total of half of protein with RSC. RSC protein content of 68.4% or 64.9%	Slightly lower body weight	Some kidney calcification	(Shah et al. 1980)
Feeding, rats	Rapeseed meal, washed. Diet with 10% protein. RM content of 26.4%, 30% or 32.9% protein	Slightly enlarged liver and kidneys	Slightly lower Zn in femur	(Thompson et al. 1982)
Feeding, Salmon	Canola meal and rapeseed protein	Usefull at 13-16% dietary protein	Increase in thyroid activity	(Higgs et al. 1982)

Type of study	Protein preparation	Results	Remarks	Reference
	concentrate			
4-week growth and biochemical parameters, rats	Rapeseed meal, 5% and 10% of RM fed to animals	Increase in liver glycogen content; decrease of various blood, liver and muscle parameters. Decrease in growth rate.	Rapeseed meal disturbs the metabolic homeostasis and cannot be recommended as such for animal consumption	(Garg et al. 1982)
Thyroid Stimulating Test, rats	1.Industrial rapeseed meal, 2. rapeseed protein isolate (purified from 1. 3. rapeseed extraction residue from 1. Diets with standard mixture and 10% RSM, 10% RPI and 10% RER	1. Strong thyreotoxic effect 2. Slight impairment of thyroid function 3. No negative effects	Improvement upon purification	(Kroll, Przybilski 1991)
4-weeks feeding, rats	1. rapeseed protein isolate (RPI) 2. rapeseed extraction residue (RER) RPI and RER were fed at levels of 2.5%, 5%, and 10%. RPI was between 85.9-88.2% protein, whereas the RER was only 26.3% protein with approximately 74% uncharacterized material	Abnormalities in liver and kidneys.	Feeding RPI up to 5% and RER for 2.5% for 4-weeks produce no changes of toxicological significance	(Plass et al. 1992)
Feeding, Rainbow Trout	Rapeseed protein concentrate 43% protein in diet. The protein in control diet was replaced by RPC 19%, 39% and 59%	No depression in food intake; Significant reduction in growth rate, feed efficiency and protein and energy utilization	No full replacement for whole herring meal	(Teskeredžić et al. 1995)
Feeding, poultry	Canola meal	Reduced bird performance	Due to high sulphur level	(Summers 1995)
Feeding ruminants, pigs, poultry	Rapeseed cakes	Changes in meat quality in pigs; changes in organs in poultry	Only to be used after treatment and in carefully chosen combinations	(Koodziej 1995)

Type of study	Protein preparation	Results	Remarks	Reference
Feeding, rats	Rapeseed flours and rapeseed concentrates	Changes in biochemical parameters and organ characteristics	Lower impact upon treatment	(Allam et al. 1997)
Feeding, rats	Mustard meal and protein isolates thereof	Changes in biochemical parameters and organ characteristics	Usable till 25% if glucosinolates and phytates are removed	(Talati et al. 2005)
The following studies were with rapeseed protein concentrates similar to DSM RPI90				
13-week dietary tox, rats	Napin-rich canola protein isolate (Supertein™). 5%, 10% or 20% rapeseed protein isolate	Lower body weight gain and lower food consumption at 10 and 20%, attributed to low palatability of the test material.	NOEL considered as 5%; NOAEL considered as highest dose: 20%, or 12.46 g/kw bw (males) and 14.95 g/kg bw (females)	(Mejia et al. 2009b, Mejia et al. 2010-abstract)
13-week sub-chronic dietary tox, rats	Cruciferin-rich canola protein isolate (Puratein®) 5%, 10% or 20% rapeseed protein isolate	A slightly higher thyroid/parathyroid weight at 20%	NOEL considered as 10%; NOAEL considered as highest dose tested: 20%, or 11.24 g/kw bw (males) and 14.11 g/kg bw (females)	(Mejia et al. 2009a, Mejia et al. 2010-abstract)
Reverse mutation assay	Cruciferin-rich protein isolate.	Cruciferin-rich protein isolate is not mutagenic		ADM internal report, reported in GRAS Notice No 327
Reverse mutation assay	Napin-rich protein isolate.	Napin-rich protein isolate is not mutagenic		ADM internal report, reported in GRAS Notice No 327
Micronucleus test in bone marrow, in mice	Cruciferin-rich protein isolate.	Cruciferin-rich protein isolate is not clastogenic		ADM internal report, reported in GRAS Notice No 327
Micronucleus test in bone marrow, in mice	Napin-rich protein isolate.	Napin-rich protein isolate is not clastogenic		ADM internal report, reported in GRAS Notice No 327
Gene mutation test with mouse lymphoma cells, *in vitro*	Cruciferin-rich protein isolate.	Cruciferin-rich protein isolate is not mutagenic		ADM internal report, reported in GRAS Notice No 327
Gene mutation test with mouse lymphoma cells, *in vitro*	Napin-rich protein isolate.	Napin-rich protein isolate is not mutagenic		ADM internal report, reported in GRAS Notice No 327
Theoretical	Rapeseed protein	Prevention of onset of	Beneficial effect	(Hermier et al.

Type of study	Protein preparation	Results	Remarks	Reference
evaluation in preventing metabolic syndrome; rats, humans		insulin resistance; alleviating the postprandial vascular endothelial dysfunction	probably due to high Cys and Arg	2010)
Metabolic fate, rats	Rapeseed protein isolate	Normal protein fractional synthesis rate and dietary N-losses. Dietary N incorporation higher in intestinal mucosa and liver, lower in skin	Differential modulation of proteolysis is suggested	(Boutry et al. 2011)

From this overview of studies, it appears that several toxicity endpoints have been found.

Since the analytical composition of the different rapeseed protein products and flours tested in these studies is not always available, it is not possible to judge if contaminants play a role in adverse observations or whether very pure protein preparations have been studied. However, as already suggested in **section 7.3**, the main toxic effects reported in these studies are attributed to the anti-nutritional factors present in rapeseed meal, and concentrates rather than to the proteins themselves when isolated. . Most likely, the adverse effects encountered in these studies could be attributed to a high presence of glucosinolate derivatives and phytic acids in rapeseed protein concentrates.

Some studies have reported a thyrotoxic effect for rapeseed proteins on the animals, i.e. on laying hens (Jackson 1970) and on rats (Kroll, Przybilski 1991). Several studies have linked an exposure of pregnant rats to rapeseed protein concentrates to a reduced weight gain in mothers and to reduced litter size (Eklund 1973, Eklund 1975, Shah et al. 1979, Jones 1979). A slightly lower body weight has been reported in non-pregnant rats fed rapeseed proteins (Shah et al. 1980, Mejia et al. 2009b) and in rainbow trout (Teskeredžić et al. 1995). Finally, changes in biochemical parameters and organ characteristics, notably in liver and kidneys, have been observed on several occasions in rats fed rapeseed protein meal (Thompson et al. 1982, Garg et al. 1982) and rapeseed proteins (Plass et al. 1992).

By causing zinc deficiency, the presence of phytic acid in rapeseed protein meal and concentrate has been linked to loss of appetite, wasting, apathy, reduced litter size and an increase in numbers of still-born pups after feeding of pregnant rats with rapeseed proteins (Eklund 1973, Eklund 1975, Jones 1979). These adverse effects were probably caused by zinc chelation by phytate, leading to a zinc deficiency in the animals. Pregnant rats fed with rapeseed proteins and supplemented with zinc did not show any anorexia or reproductive toxicity (Shah et al. 1979). On the other hand, the slightly lower body weight and lower food consumption that have been reported in non-pregnant rats fed with napin-rich canola isolates (0.32% phytic acid) as described by Meija et al. was shown to be due to its low palatability (Mejia et al. 2009b).

Indeed, glucosinolates and glucosinolate derivatives present in rapeseed proteins preparation have been linked to anti-thyroidal effects and reduction of the animal body weight (Tripathi, Mishra 2007), while it has been shown that the purification of rapeseed proteins to remove glucosinolates abolishes the negative effects on the thyroid (Loew et al. 1976, Jones 1979, Kroll, Przybilski 1991).

Several glucosinolate derivatives have been linked to toxic effects on the liver and kidneys of treated animals. This is notably the case of nitriles. The mechanism that underlies their toxicity seems to be their ability to interact with reduced glutathione, thus leading to substantial alterations in tissue glutathione levels as observed in the liver, kidneys, adrenals and lungs of rats after chronic ingestion or a single injection of acrylonitrile (Nugon-Baudon, Rabot 1994). The toxic effect of nitriles manifests itself as hypertrophy of the target organs, disruption of the normal lobular structure of the liver and irregular proliferation of the bile duct. Nitriles have also been attributed to enlarged nuclei of the epithelial cells lining the convoluted tubules of the kidneys as well as a rapid production of kidney lesions, along with elevated plasma levels of nitrogen, urea and creatinine, which could suggest functional alterations of the kidneys (Nugon-Baudon, Rabot 1994). Another glucosinolate derivative, progoitrin, has also been shown to induce enlargement of the liver and kidneys in experimental animals, next to its effect on thyroid (Nugon-Baudon, Rabot 1994). Therefore, the presence of glucosinolates and glucosinolate derivatives most probably explains the adverse effects observed in animals fed rapeseed protein meal (Thompson et al. 1982, Garg et al. 1982). It is difficult to conclude on the slight absolute liver weight changes and reduced relative kidney weight observed in the case of rats fed rapeseed protein isolates and rapeseed extraction residue (Plass et al. 1992). In this case, although the reported levels of glucosinolate derivatives (progoitrin, VOT, butenyl, pentenyl and phenyl-ethyl isothiocyanate) are very low in the rapeseed products, their nitrile content was not measured. The glucosinolate concetration of RPI90 is below that of previously notified rapeseed protein isolates, see section 3.2.4 of this dossier

The safety of protein isolates has been shown in 13 week toxicity studies were performed with rats fed either a cruciferin-rich protein isolate (Puratein® from ADM/Burcon) or a napin-rich protein isolate (Supertein™ from ADM/Burcon) with low content of anti-nutritional factors (Mejia et al. 2009a and 2009b). These published and peer-reviewed safety studies can be used to bridge the toxicological assessment of RPI90 and to support its safety. DSM products contain the same major rapeseed storage proteins cruciferin and napin as the protein isolates used by Meija et al. The composition of DSM and ADM/Burcon products is very comparable, with protein contents of at least 90%, and levels of moisture, ash, carbohydrates, fats and fibres in the same range for these products. In addition, DSM and ADM/Burcon amino acid profiles are comparable (see Table 13). Finally, similarly to ADM/Burcon protein isolates, DSM rapeseed protein isolate has a low content of potentially toxic anti-nutritional factors, phytate levels being even lower in DSM rapeseed protein isolates. The 13-week toxicity studies reported by Meija et al. (2009a and b) are described in the next paragraph.

Table 13 Typical amino acid profile in g/100g of RPI90 compared to Puratein® and Supertein® as reported in GRN000327

Amino acids (g/100 g)	Average in RPI90	Cruciferin-rich Puratein®	Napin-rich Supertein®
Alanine	4.17	4.2	4.0
Arginine	6.32	7.2	5.8
Asparagine	5.68	9.3	2.6
Glutamine	22.4	19.8	24.6
Glycine	4.83	5.4	4.3
Histidine	3.05	2.5	3.6
Hydroxyproline	<0.05		
Isoleucine	3.52	4.4	3.0
Leucine	6.84	8.2	6.0
Lysine	6.08	4.0	7.4
Ornithine	<0.05		
Phenylalanine	3.65	4.9	2.6
Proline	6.57	5.8	9.2
Serine	3.91	4.1	3.3
Threonine	3.73	3.7	3.2
Tyrosine	1.96	4.1	1.4
Valine	4.69	5.5	4.3
Cysteine	3.51	1.6	4.5
Methionine	2.06	1.9	2.4
Tryptophan	1.36	2.0	1.4

Both ADM/Burcon studies were conducted according to FDA Redbook guidelines. In both studies, Sprague Dawley rats consisting of 20 animals/sex/group were fed ad libitum with an AIN-93G based protein-free diet supplemented with either 5%, 10% or 20% rapeseed protein isolate for 13 weeks. It was reported that the control group received 20% vitamin free casein as control (Meija et al. 2009a and 2009b).

Rats were observed for mortality, clinical signs, physical abnormalities, eye abnormalities, changes in body weights and food consumption. Functional observational battery and locomotor activity tests were also performed on 10 animals/sex/group. Clinical pathology investigations (haematology, coagulation, clinical chemistry and urinanalysis) were also performed on 10 animals/sex/group. All rats were subjected to detailed necropsy at terminal sacrifice and specified organs were weighed. Histopathological examination was carried out on the preserved organs and tissues of the high dose and control groups respectively, and on gross lesions from all rats in the study (Mejia et al. 2009a and 2009b).

In both studies, no treatment-related changes were observed in the functional observation tests, haematology, clinical chemistry and urinalysis. Gross and histopathological examination did not reveal any treatment-related changes (Mejia et al. 2009a and 2009b).

In rats fed cruciferin-rich protein isolates up to 20%, no effects on body weight gains and food consumption were observed (Mejia et al. 2009b). A slightly higher thyroid/parathyroid ratio was observed in the 20% cruciferin-rich protein isolate group. However, there were no correlating histopathologic changes and the values of the ratios in all groups were within the laboratorie's historical normal control range. In addition, statistical significance was not consistent between absolute and relative values in males vs. females, suggesting a random outcome. Therefore, this observation was considered of no toxicological relevance and was not considered an adverse effect (Mejia et al. 2009a). Taking into account these observations, the No-Observed-Effect-Level (NOEL) of the study was reported as 10% w/w, while the No-Observed-Adverse-Effect-Level (NOAEL) was concluded as being 20% w/w, which provided 12.46 g/kg bw/day for males and 14.95 g/kg bw/day for females (Mejia et al. 2009a).

These toxicity studies are the most relevant ones to assess the safety of DSM products. Indeed, DSM products contain the same major rapeseed storage proteins cruciferin and napin as the protein isolates used by Meija et al. The composition of DSM and ADM/Burcon products is very comparable, with protein contents of at least 90%, and levels of moisture, ash, carbohydrates, fats and fibres in the same range for these products. In addition, DSM and ADM/Burcon amino acid profiles are comparable (see Table 13). Finally, similarly to ADM/Burcon protein isolates, DSM rapeseed proteins have a low content of potentially toxic anti-nutritional factors, phytate levels being even lower in DSM protein isolates. (As noted previously, a table of comparison of these is needed) The 13-week toxicity studies reported by Meija et al. (2009a and b) are described in the next paragraph.

In rats fed the ADM napin-rich protein isolates, lower body weights and body weight gains were reported with the 10% diet in the male group and the 20% diet in male and female groups. Llower food consumption was found in all groups of protein isolate-treated males and in the 10% and 20% female groups (Meija et al. (2009a). The authors attributed these lower body weights, body weight gains and food consumption to a low palatability of the napin-rich protein isolates. Based on these observations, the NOEL for dietary administration of the napin-rich protein isolate was concluded to be 5% w/w, and the NOAEL 20% w/w, equivalent to 12.46 g/kg bw/day for males and 14.95 g/kg bw/day for females (Meija et al. (2009a).

6.6 Absorption, Distribution, Metabolism, and Excretion

The amino acids of rapeseed protein isolate are relatively well absorbed (Galibois et al. 1989) and utilized (Bos et al. 2007). Both cruciferin and napin are proteins, and like any other protein they will be digested by normal metabolic processes. Therefore, there is no need for ADME-studies. Proteins are an essential part of the daily diet as an integral part of many food products. fter ingestion, proteins are hydrolyzed in the gastrointestinal tract by proteolytic enzymes derived from the pancreas resulting in the release of dipeptides, tripeptides and free amino acids (Grimble 1994). Carrier systems specific for the transport of either the amino acids or the di- and tripeptides are responsible for the efficient transport across the intestine wall. The amino acids resulting from the digestion of foods are used as building blocks for formation and maintenance of body proteins.

The digestibility of DSM rapeseed protein isolate is moderate, 87%, based on a human study by Bos et al. (Bos et al. 2007, Deglaire et al. 2009). DSM rapeseed protein isolate contains relatively high levels of all indispensable amino acids (see **Appendix 12**). Based on a scoring pattern for a 0.5-3 year-old child, the Digestible Indispensable Amino Acid Score (DIAAS) of DSM rapeseed protein isolate was calculated to be 95%, which is comparable to estimated DIAAS for soy protein isolate. A protein with a DIAAS between 75%-99% is considered a good source of protein according to FAO recommendations (FAO 2013).

The Protein Digestibility Corrected Amino Acid ratios for individual amino acids and PDCAAS for total protein based on requirements for children 2-5 years of age was calculated to be 87%. The DSM calculations are in **Appendix 13**.

6.7 Potential Anti Nutritional Factors

6.7.1 Erucic acid

Erucic acid is a fatty acid present in the oil of cruciferous plants, including rapeseed and canola. While no negative health effects have ever been documented in humans, rapeseed oil high in erucic acid has been associated with lipid and histological changes in the heart of experimental animals (OECD 2011). However, similar myocardial lipidosis has also been observed in rats exposed to vegetable fatty acids (Neat, Thomassen & Osmundsen 1981), which has been suggested to be due to the fact that rats are less able to digest vegetable fats (containing erucic acid or not) than other animals. In addition, the toxicity of erucic acid has been studied in sub-chronic and short-term feeding studies. Most animal studies did not show any negative effect despite the high concentrations or unnatural scenarios of exposure. In one case, neonate piglets that have a limited ability to absorb these fats had their normal sow's milk replaced solely with rapeseed oil for one hundred percent of their caloric needs (Food Standards Australia and New Zealand (Australia NZ 2003)). Lipidosis occurred in piglets very shortly after the beginning of feeding oil and increased in its severity in a dose-dependent manner. The severity of the lipidosis appeared to decline with time regardless of whether or not the feeding of erucic acid continued, suggesting that the animal liver responds by increasing enzyme levels to cope with the unusual diet. Myocardial lipidosis in animals can therefore be regarded as a short-term, reversible effect (Food Standards Australia and New Zealand (Australia NZ 2003)).

Although a number of epidemiological studies on the human consumption of oils containing high levels of erucic acid exist, they do not indicate any association between erucic acid and the occurrence of heart disease (Food Standards Australia and New Zealand (Australia NZ 2003)). Nevertheless, Food Standards Australia New Zealand has defined a tolerable intake of erucic acid for humans of 7.5 mg erucic acid/kg bw/day (Food Standards Australia and New Zealand 2003). This tolerable intake was based on the level that was associated with increased myocardial lipidosis in nursling pigs.

Canola is, by design, low in erucic acid. FDA has defined a maximum level of 2% erucic acid for low erucic acid rapeseed oil to be used in food (21 CFR §184.1555). As can be seen in Table 14 the erucic acid content of the protein isolates described in this dossier (<0. 005%) is well below the 2% maximum limit set by FDA. Additionally, taking into account a maximum use level of RPI90 of 30% in final food (see Table 1, a exaggerated exposure scenario of total protein replacement, where 90th percentile intake levels of 3.2 g

RPI90/kg bw/day for an adult of 60 kg body weight and 9.6 g RPI90/ kg bw/day for a child of 12 kg body weight are considered (see **section 6.8**), the content of 0.005% erucic acid will lead to an exaggerated exposure scenario of 0.048 mg erucic acid/kg bw/day for adults and 0.144 mg erucic acid/kg bw/day for children. This level is well below the tolerable intake of 7.5 mg erucic acid/kg bw/day defined by Food Standards Australia New Zealand and therefore does not represent any toxicological concern.

As shown below, only traces of erucic acid are found in DSM isolate.

Table 14 Concentration of anti-nutritional factors in five independent and representative batches of rapeseed protein isolate

Batch	Erucic acid	Total phenolics (expressed as sinapic acid)	Phytic acid	Glucosinolates
	%	ppm	%	µmol/g
RPI-1536-01-G	< 0.005	605	< 0.14	< 0.1
RPI-1543-02-P	< 0.005	703	< 0.14	< 0.1
RPI-1543-03-P	< 0.005	881	< 0.14	< 0.1
RPI-1549-01-P	< 0.005	670	< 0.14	< 0.1
RPI-1549-02-P	< 0.005	600	< 0.14	< 0.1

6.7.2 Total phenolics (expressed as sinapic acid)

The total phenolics concentration in the rapeseed protein isolates described in this dossier is presented in Table 14. These concentrations of 600-900 ppm are very low and within the same range as found in rapeseed protein isolates that were reviewed by FDA in GRN 000327 and GRN 000386.

Phenolic acids are common in all kinds of plants and are therefore present in a considerable part of the human diet. Rich sources of phenolic acids are blueberry (1,881-2,112 mg/Kg), cherry (290-1,280 mg/Kg), pear (44-1,270 mg/Kg), apple (2-258 mg/Kg), orange (21-182 mg/Kg, potato (100-190 mg/Kg) and coffee (56 g/Kg/Dry weight) (GRN 000327). Phenolic substances are also present in soybeans (2.1-3.4 g/kg), and consequently in soy protein isolates (Tepavčević et al. 2010). They are in general considered as safe and also have antioxidant effects. The main concern for their natural presence in rapeseed products is not their potential toxicity, but their negative impact on animal nutrition, notably for the pig and poultry industries. Phenolic acids are associated with poor palatability due to bitterness or astringency, thus affecting the feed intake of animals. In addition, they interfere with nutrient uptake in the digestive system.

In canola, sinapine – the choline ester of sinapic acid – is the most abundant of all small phenolics. Sinapine is converted into trimethylamine by the intestinal microflora and is then absorbed. Most animals have the ability to convert trimethylamine to trimethylamine oxide, a compound that is easily excreted. However, some animals cannot fully metabolize trimethylamine. This is notably the case for laying hens that started to produce eggs smelling 'fishy' or 'crabby'. The problem was traced back to the sinapine content of canola meal and to the leaching of trimethylamine into the eggs, giving them a fishy odor (Bonnardeaux 2007, OECD 2011).

6.7.3 Phytic acid

The levels of phytate found in rapeseed protein isolates is <0.14% (see Table 14) and,as discussed in this dossier, are lower than the levels found in commonly consumed foods. Moreover, phytate levels on RPI90 are much lower than the phytate levels reported to cause adverse effects in male or female rats fed rapeseed proteins (Jones, 1979; Shah et al., 1979). The antinutritional actions of phytate are shown in the following by are only seen at high levels in foods.

Phytic acid is the principal storage form of phosphor in many seeds. It is a strong chelator of important minerals, such as calcium, zinc and iron and could therefore contribute to mineral deficiencies by reducing their bioavailability. Phytate can also chelate the vitamin niacin (B3) which could contribute to vitamin B3 deficiency (Reddy 2002). Phytate is a common component of many food products such as cereals approximating %?. It is present in wheat and is known to cause zinc deficiency in humans in regions of the world where unleavened bread makes up a large proportion of the diet (Jones 1979). In several studies of rats fed protein concentrates containing between 5 and 7.5% adverse effect hasve been shown. When fed pregnant rats, loss of appetite, wasting, apathy, reduced litter size and an increase in numbers of still-born pups was found (Eklund 1973, Eklund 1975, Jones 1979). These adverse effects were attributed to a chelation of zinc by phytate, causing a zinc deficiency in the animals. Serum analyses obtained from the treated-rats revealed low zinc values but normal levels of calcium, magnesium, iron and copper (Jones 1979). Similarly, in a group of female rats fed rapeseed proteins containing a high level of phytate salts (1.61% of the total rat diet) for two weeks before breeding, levels of zinc in maternal serum, liver, femur and in the pups were significantly lower than the comparable levels in the other two groups. In addition, the rat body weights were reduced (Shah et al. 1979). On the other hand, a group of female rats fed with rapeseed proteins and supplemented with zinc did not show anorexia, and there was neither a significant difference between reproductive performances of the supplemented group and the control group nor was there any significant difference between the zinc levels determined between these two groups. A similar experiment was performed on male rats (Jones 1979). The group of male rats fed rapeseed protein concentrates showed marked reductions of serum and femur zinc content compared to the control group, while these zinc levels were normal in the group of male rats receiving rapeseed protein concentrates as well as zinc supplementation. No visible abnormalities could be seen in the zinc deficient animals, but these rats gained weight at a slower rate than those receiving zinc supplementation or than the control rats. It therefore seems that male rats are not subjected to as much stress as the pregnant rats when experiencing a zinc deficiency.

Phytic acid is ingested with many plant-derived foods. Soy protein isolate is reported to contain 1.6-2.0 % phytic acid (Honig, Wolf & Rackis 1984). Lower values (0.49-0.84 %) were reported more recently (Hurrell et al. 1992). In tofu, 1.46-2.90 % phytic acid was found (on a dry matter basis). Phytic acid/phytate is present in cereals such as maize 0.72-2.22 %, wheat 0.39-1.35 %, rice 0.06-1.08%, barley 0.38-1.16%, sorghum 0.57-3.35 %, oat 0.42-1.16%, rye 0.54-1.46 %, millet 0.18-1.67 %, triticale 0.50-1.89 % and wild rice 2.20% (on dry matter basis). The level of phytic acid/phytate has also been identified in several legumes such as kidney beans 0.61-2.3 %, broad beans 0.51-1.77 %, peas 0.22-1.22 % dry cowpeas 0.37-2.90 %, chickpeas 0.28-1.60 % and lentils 0.27-1.51 % (on dry matter basis). Several type of nuts contain Phytic acid/phytate ranging from 0.17-9.42 % (on dry matter basis) (Schlemmer, Frølich, Prieto & Grasesn 2009).

In addition, 90-day toxicology studies performed with napin-rich protein isolate containing 3.35% phytate fed orally to rats at up to 20% of their diet did not affect the plasma concentration of zinc (Mejia et al. 2009b). These results strongly suggest that the very low levels of phytate present in RPI90 (< 0.14%) are not of toxicological concern.

It has been demonstrated that technological processes to manufacture rapeseed products further eliminate significant amounts of anti-nutritional factors. For example, isolation of canola proteins has been shown to eliminate up to 95% of glucosinolates, 92% of phytic acid and 100% of tannic acid (Mansour et al. 1993).

6.7.4 Glucosinolates

This level of glucosinolats in DSM rapeseed protein isolates is below the acceptable daily intake (ADI) derived by European Food Safety Authority (EFSA) for AITC of 20 µg/kg bw/day (EFSA panel on food additives and nutrient sources added to food (ANS) 2010) and therefore does not represent any toxicological concern (Table 12). The raw material used for the production of the rapeseed protein is the canola or rapeseed, bred for low glucosinolate, (i.e. less than 30 µmol glucosinolates/g meal). In addition, by optimizing the extraction process of the rapeseed protein it is possible to reduce the glucosinolate levels to insignificant levels. The very low typical values <0.1 µmol glucosinolates/g in the rapeseed protein isolates described in this dossier are shown in Table 12. In addition, Allyl isothiocyanates (AITC) levels were below detection limit (< 3 ppm). Thus, taking into account a maximum use level of RPI 90 of 30% in the final food (see **Table 1)** and a maximum of 40.2% of total protein available for replacement (O'Neil, 2012) an exaggerated exposure scenario can be calculated. Assuming 90th percentile protein intake levels of 3.2 g/kg bw/day for an adult of 60 kg body weight and 9.6 g/ kg bw/day for a child of 12 kg body weight (see **section 6.8**) and a content of 3 ppm AITC, the maximum intake will be 1.16 µg AITC/kg bw/day for adults and 3.47 µg AITC/kg bw/day for children

Glucosinolates are a class of water soluble, sulfur or nitrogen-containing glucosides that occur as secondary metabolites in virtually all species of *Brassica*. On their own, glucosinolates are innocuous, but when cells of the seed are ruptured, glucosinolates come in contact with the enzyme myrosinase. This enzyme, present in *Brassica* species, hydrolyzes the glucosinolates by cleaving off the glucose group. The remaining unstable molecules are then quickly converted into a wide range of glucosinolate derivatives including isothiocyanates, nitriles, thiocyanates and 5-vinyloxazolidine-2-thione (VOT), with the release of sulphur. Heating during the production process inactivates the myrosinase, though this does not completely eliminate the effects of glucosinolates because intestinal microflora also produces myrosinase (Tripathi, Mishra 2007).

In human, isothiocyanates, thiocyanates and VOT are described as goitrogenic, reducing the ability of the thyroid to absorb iodine (Downey 2005).

Nitriles on the other hand can affect animal performance and can be toxic to the liver and kidneys (Tripathi, Mishra 2007). Nitriles lead to hypertrophy of the target organs, disruption of the normal lobular structure of the liver and irregular proliferation of the bile duct. They can also produce rapid kidney lesions, along with elevated plasma levels of nitrogen, urea and creatinine. Experiments performed in animals suggest that they interact with reduced glutathione, thus leading to substantial alterations in tissue glutathione levels in the liver, kidney, adrenals and lungs.

Due to their derivatives, glucosinolate levels of 18 to 30 µmol/g canola meal have been shown to have antinutritional or toxic effects in animal studies. On the other hand, a lower level of glucosinolates content has been reported to have a positive effect on health (Tan et al. 2011) and notably on cancer prevention (Lampe, Peterson 2002). Rapeseed proteins containing high levels of glucosinolates fed to rats have directly contributed to anti-thyroidal effects and reduction of the animal body weight (Tripathi, Mishra 2007). However, it has been shown that the purification of rapeseed proteins to remove glucosinolates eliminates the negative effects on the thyroid (Loew et al. 1976, Jones 1979, Kroll, Przybilski 1991). While feeding rats 20 or 40% protein isolates containing 930 ppm glucosinolates led to slight anti-thyroid effects, purification of the proteins to 30 ppm glucosinolates abolished the adverse thyroid effects in the rats fed rapeseed protein isolates at 20 or 40% of the total dietary protein (Loew et al. 1976). Similarly, beagle dogs and rats were fed for 90 days a 20% protein diet containing 20 or 40% rapeseed protein concentrate (with 290 ppm goitrin and 900 ppm isothiocyanates) (Jones 1979). While no effects were observed on the dogs, the higher concentration of rapeseed proteins led to anti-thyroid effects in rats. Repeating this toxicity study with rapeseed protein concentrates containing lower levels of residual glucosinolates (20 ppm goitrin and 30 ppm isothiocyanates) did not lead to any adverse effects on treated rats. In order to further investigate the toxicological effects of rapeseed proteins and their components on the thyroid gland, rats were fed a diet containing 10% of one of three rapeseed protein products – industrial rapeseed meal, rapeseed protein isolate prepared from the meal by extraction, ultra- and diafiltration, or rapeseed extraction residue obtained by protein extraction of the meal (Kroll, Przybilski 1991). The toxicological effect on the thyroid of the three diets was tested with a thyroid stimulation test. While the industrial rapeseed meal – containing high levels of glucosinolates – led to a clear impairment of rat thyroid function, thyrotoxic effects were considerably reduced with both rapeseed protein isolate and rapeseed extraction residue. These results strongly suggest that the anti-thyroidal effects observed with rapeseed proteins can be attributed to the presence of a high level of glucosinolates.

6.7.5 Protease Inhibitors

Protease inhibitors are known components of seed crops and at high concentrations can limit the nutritional value of a protein (Rackis & Gumbmann, 1981). Heating proteins either during isolation or during the manufacture of consumer goods is known to denature the inhibitors. Our analysis of RPI90 has indicates that the concentration of protease inhibitor in RPI90 is not outside the range of other protein sources in the diet and since most of the consumer goods anticipated to contain RPI90 are heat processed, the potential for an excessive intake of the protease inhibitor is minimal.

6.7.6 Comparison of anti-nutrients in RPI90 to prior notified rapeseed protein isolates

The concentrations of anti-nutrients in RPI90 are similar to that of other rapeseed protein isolates notified to the FDA.

Table 15 Anti-nutrients in RPI90 and other rapeseed protein isolates

Anti-nutrient	RPI90	Napin Rich RPI Mejia et al. 2009a	Cruciferin Rich RPI Mejia et al. 2009b	Isolexx GRN000386	Vitalexx GRN000386
Total glucosinolates (μmol/g)	<0.1	0.80	1.22	0.09	0.21
Erucic Acid %	<0.005	<0.0025	<0.0025	0.002	0.003
Phytic Acid %	<0.14	3.34	0.32	0.85	0.5
Total Phenolics %	0.07	0.25	0.37	0.14	0.39

6.7.7 Additional considerations

Allergenicity, hypersensitivity and immune response

RPI90 is not expected to be allergenic except for those individuals allergic to mustard protein. At the request of DSM. the Food Allergy Research and Resource Program (FARRP) at the University of Nebraska review data it had accumulated regarding allergenicity to rapeseed proteins. FARRP re-evaluated the five rapeseed protein sequences DSM provided using AllergenOnline.org version 16, released January, 2016 with full-length FASTA and sliding 80mer FASTA (Goodman et al., 2016). They also ran a comparison with the NCBI-Protein database using BLASTP with default values, and keyword “allergen” as well as no keyword, for confirmation. The sequences were also run against the Celiac Database to evaluate potential matches of peptides and proteins using the Celiac Database (linked from AllergenOnline.org) with both exact peptide match and FASTA vs. the gluten/gliadin dataset. The following are the results of their evaluation.

1. CRU1_BRANA.
MARLSSLLSFSLALLIFLHGSTAQQFPNECQLDQLNALEPSHVLKAEAGRIEVWDHHAP
QLRCSGVSFVRYIIESKGL YLPSFFSTAKLSFVAKGEGLMGRWPGCAETFQDSSVFQP
SGGSPSGEGQGQGQQGQGQGHQGQGQGQQGQQGQQGQQSQGQGFRDMHQKVE
HI RTGDTIATHPGVAQWFYNDGNQPLVIVSVLDLASHQNQLDRNPR PFYLAGNNPQGQ
VWIEGREQQPQKNILNGFTPEVLAKAFKI DVRTAQQLQNQQDN RGNIIRVQGPFSVI RPP
LRSQRPQETEVNGLEETICSARCTDNLDDPSNADVYKPQLGYISTLNSYDLPILRFLRLS
ALRGSIRQNAMVLPQWNANANAVL YVTDGEAHVQVVNDNGDRVFDGQVSQGQLLSIP
QGFSWKRATSEQFRWIEFKTNANAQINTLAGRTSVLRGLPLEVISNGYQISLEEARRVK
FNTIETTL THSSGPASYGGPRKADA

Allergen matches AllergenOnline.org FASTA The sequence has relatively high (58%, E score 4 x 10^{-12} or 10^{-44}) identity match over essentially the full 500 AA length to two 11S globulin proteins in mustard, *Sinapis alba* white mustard (sometimes called yellow mustard), an annual mustard grown for seeds. In addition, the highest identity match in an 80 AA window was to the 11S globulins of this mustard. The 11S globulin is an allergen with ~41% to 45% sequence identity to some tree nut and seed 11S allergens (Cashew, walnut, hazelnut, pecan, almond, sesame, pistachio and Brazil nut). The only study clearly directed at potential cross-reactivity of 11S albumins of mustard, tree nuts and peanuts was by Sirvent at al., 2012, and showed soma correlation by *in vitro* IgE testing to the Sin a 2, 11S globulin of mustard (but lower than IgE to 2S albumin (Sin a 1) and show *in vivo* skin test co-reactivity to extracts of seeds of mustard and almond, hazelnut, pistachio, walnut and peanut, which was individually variable between subjects and nuts/seeds, but more pronounced in subjects with clinical reactivity to white mustard 11S and one or more nuts in a small number of subjects. There was not conclusive proof that the SPT reactivity was all, or even mostly due to IgE binding to the 11S globulins.

Other studies have shown the 2S albumins and possibly Lipid Transfer proteins (LTP) are likely more important in clinical reactivity (Asero, 2014; Asero, 2011; Robotham et al., 2005; Pastorello at al., 2001).

The amino acid sequence of the CRU1_BRANA was around 43-45% identical to 11S globulin sequences of the tree nut allergens that were matched by Sin a 2. The identity matches for 80 amino acid windows were 50-63% Identical. That is as expected since some regions of large proteins are more likely conserved.

Due to the simple, repetitive sequences of some AA In the 11S sequence, there were low· to modest identity matches to some gluten and gliadin proteins with 20-40% identity, especially over shorter segments. The highest 8Omer sequences were higher than full length which is a common finding. The E scores were markedly lower than for matches of the Brassica 11S.

Celiac Database evaluation. The moderate matches to wheat (*Triticum sp.*) raises the question of whether the similarities are sufficient to elicit symptoms of celiac disease (CD). FARRP compared the five sequences to their Celiac Database of CD peptides using an exact match protocol that identifies query proteins that contain an exact match in any one CD peptide. The peptides were also tested using FASTA to the 68 representative gluten and gliadin proteins. The 11S globulin had low levels of identity and large E scores that are far from being at the levels of Identity that would be of concern (see database).

Confirmation of bioinformatics using NCBI with BLASTP. Searches of the NCBI Protein database with keyword limit of “allergen” gave similar results to the FASTA searches with AllergenOnline. The highest matches were to 11S globulin of *Sinapis alba*, and similar identity matches to tree nut, peanut and seed storage 11S globulins. When searched without any keyword the matches were very high in identity, with very small E scores to a wide variety of mustard and mustard relatives.

Searches of other 11S Brassica seed storage proteins.

2. CRU2_BRANA.

MARLSSLL YFSITVLIFLHGSTAQQFPNECQLDQLNALEPSHVLKAEAGRIEVWDHHAPQ
LRCSGVSFVRYIIESQGL YLPSFLNTANVSFVAKGQGLMGRWPGCAETFQDSSVFQPG
SGSPFGEGQGQGQQGQGQGQGQGQGKGQQGQGKGQQGQSQGQQGQGQGFRDM
HQKVEHI RSG DTIATHPGVAQWFYNNGNQPLVIVAVMDLASHQNQLDRNPSQFYLAGK
NPQGQSWLHGRGQQPQNNI LNGFSPEVLAQAFKI DVRTAQQLQNQQDNRGNIVRVQG
PFGVIRPPLKSQRPQETEANGLEETICSARCTDNLDDPSNADVYKPQLGYISILNSYOLPI
LRVLRLSALRGSIRQNAMVLPQWKSKSNAVL YVTDGEAQIQWNDNGDRVFDGQVSQG
QLLSIPQGFSWKRATSDQFRWI EFKTNANAQINTLAGRTSVMRGLPLEVIANGYQISLE
EARRVKFNTIETTL THSSGPASYGRPRKADA

The FASTA sequence comparison data results were very similar for CRU1 and CRU2 proteins as were CD (no peptide matches and low identity matches) and to NCBI.

3. CRU3_BRANA

MVKVPHLLVATFGVLLVLNGCLARQSLGVPPQLGNACNLONLDVLQPTETIKSEAGRVE
YWDHNNPQIRCAGVSVSRVIIEQGGL YLPTFFSSPKISYVVQGMGISGRVVPGCAETFM
DSQPMQGQQQGQPWQGQQGQQGQQGQQGQQGQQGQQGQQGQQGQQGQQGQQ
QQGFRDMHQKVEHVRHGOIIAITAGSSHWIYNTGDQPLVIICLLDIANYQNQLDRNPRTF
RL.AGNNPQGGSQQQQQQQQNMLSGFOPQVLAQALKIDVRL.AQELQNQQDSRGNIVRV
KGPFQWRPPLRQPYESEQWRHPRGPPQSPQDNGLEETICSMRTHENIDDPARADVY
KPNLGRVTSVNSYTLPILQYIRLSATRGILQGNAMVLPKYNMNANEIL YCTQGQARIQW
NDNGQNVLDQQVQKGQLWIPQGFAYWQSHQNNFEWISFKTNANAMVSTLAGRTSAL
RALPLEVITNAFQISLEEARRIKFNTLETTL TRARGGQPQLIEEIVEA

The FASTA matches to *Sinapis alba* 11S albumins were much more significant (90% identity and E scores of 2 e-122) for CRU3. However, the sequence matches to tree nuts, peanuts and seed storage proteins were similarly low (~44% identity) as for CRU1. The CRU3 is evidently a closer homologue of *Sinapis alba* than CRU1 and CRU2. Again, there were no matches to CD peptides and very poor scoring Identities by FASTA.

4. CRU4_BRANA

MGPTSLLSFFFTFL TLFHGFTAQQWPNECQLDQLNALEPSQIIKSEGGRIEVWDHHAPQ
LRCSGFAFERFVJEPQGLYLPTFLNAGKLTFVVHGHALMGKVTPGCAETFNDSPVFGQG
QGQEQGQGQGQGQGQGFRDMHQKVEHIRSGDTfATPPGVAQWFYNNGNEPLILVAA
ADIANNLNQLDRNLRPFLLAGNNPQGQQWLQGRQQQKQNNIFNGFAPQILAQAFKISVE
TAQKLQNQQVNRGNIVKVQGQFGVIRPPLRQGQGGQQPQEEGNGLEETLCTMRCTEN
LDDPSSADVYKPSLGYISTLNSYNLPILRFLRLSALRGSIHNNAMVLPQWNVNANAAL YV
TKGKAHIQNVNDNGQRVFDQEISKGQLLWPQGFAWKRATSQQFQWIEFKSNDNAQI
NTLAGRTSVMRGLPLEVISNGYQISPQEARSVKFSTLETTL TQSSGPMGYGMPRVEA

Results with CRU4 are very similar to those with CRU1 and CRU2. No Identity matches to CD peptide• and poor alignments to glutens.

5. GI:461840

MVKVPHLLVA TFGVLLVLNG CLARQSLGVP PQLGNACNLD NLDVLQPTET
IKSEAGRVEY WOHNNPQtRC AGVSVSRVII EQGGL YLPTF FSSPKISYVV
QGMGISGRW PGCAETFMOS QPMQGQQQGQ PWQGQQGQQG QQGQQGQQGQ
QGQQGQQGQQ GQQGQQGQQQ QGFRDMHQKV EHVRHGOIIA ITAGSSHWIY
NTGDQPLVII CLLDIANYQN QLDRNPRTFR LAGNNPQGGS QQQQQQQQNM
LSGFDPQVLA QALKIDVRLA QELQNQQDSR GNIVRVKGPF QWRPPLRQP
YESEQWRHPR GPPQSPQDNG LEETICSMRT HENIDDPARA DVYKPNLGRV
TSVNSYTLPI WIPQGFAYV VQSHQNNFEW ISFKTNANAM VSTLAGRTSA
LRALPLEVIT NAFQISLEEA RRIKFNTLET TLTRARGGQP QLIEEIVEAE QUENCE

Results with GI:461840 are between identity matches for CRU3 and CRU1 for comparison to *Sinapis alba*. The identities to tree nuts and 11S proteins of seeds and peanut are 30-44%. No matches to CD peptides, low identity scores to glutens.

The prospect of allergic cross-reactivity between 11 S albumins of *Brassica sp.* and *Sinapis alba* are considerably higher than to tree nut and seed storage proteins. Species in these genera are within the mustard tribe *Brassiceae* of the family *Brassicaceae*.

Clearly they are genetically closely related and the high sequence identities demonstrate conservation. As noted by many researchers, including Aalberse, 2000, proteins sharing greater than 70% identity are highly likely to be cross-reactive, those sharing less than 50% identity (overall) are not likely to share IgE cross-reactivity.

Because DSM rapeseed protein isolate had lower than 50% identity cross reactivity with the eight major allergens it is unlikely for RPI90 to illicit an allergenic reaction. Therefore RPI90 is not expected to be allergenic except for those individuals allergic to mustard protein.

Consequently, DSM will alert users of the commercial products **via the Product Data Sheet that RPI90 may cause allergic reaction in consumers who are allergic to mustard.** The complete report is in **Appendix 11.**

6.8 Acceptable Daily Intake

DSM rapeseed protein products are expected to be used for diverse applications such as a protein source, thickener, water binder, emulsifier, gelling agent, foaming agent, or texturizer. They will therefore be used in a number of food products. A maximum level of 30% rapeseed protein~~s~~ is expected in final food products. In order to estimate the intake of DSM rapeseed protein isolate via the diet, the traditional toxicological assumption of a worst-case scenario was taken. DSM assumed that this product will replace soy protein isolates in the diverse applications of these isolates existing on the market. DSM rapeseed protein isolate is not intended as an ingredients in infant food or infant formulae

Intake of DSM rapeseed protein isolate can therefore be estimated based on protein consumption by American people; following the same rationale as both Burcon, GRN000327 and BioExx, GRN000386. The 2015-2020 Dietary Guidelines Recommendations[14] are based on data from the Institute of Medicine (IOM)[15], where Dietary Reference Intakes are provided considering the essential guide to nutrient requirements. The IOM has set a Recommended Dietary Allowance (RDA) of 13 g/day for 1-3 years old, 19 g/day for 4-8 years old, 56 g/day for adult males and 46 g/day for adult females. In terms of exposure on a g/kg bw/day basis, this would result in 1.1 g/kg bw/day for 1-3 years old, 0.95 g/kg bw/day for 4-13 years old and 0.8 g /kg bw/day for adults. In addition, protein intake data in the U.S. population is available from the NHANES database (NHANES, What we eat in America, 2011-2012)[16]. In the U.S., the average protein intakes of adults range from 80.0 to 102.9 g/day in men and from 58.8 to 75.5 g/day in women, with average values of 98.8 g/day for men and 68.1 g/day for women. Standard toxicological practice uses a body weight of 60 kg for adults, this would result in an average intake of 1.6 g proteins/kg bw/day for men and 1.1 g proteins/kg bw/day for women, and at the 90th percentile intake would correspond to 3.2 g proteins/kg bw/day for men and 2.2 g proteins/kg bw/day for women[17], respectively. According to the same database, average protein intakes in children (2-19 years old) vary from 57.8 and 95.1 g/day for boys and from 53.3 to 63.2 g/day for girls. The age group 2-5 years old is estimated to have the highest protein intake on a per kg bw basis, with an average protein of 4.8 g proteins/kg bw/day for boys and 4.4 g/kg bw/day for girls considering a body weight of 12 kg for children. This

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[14] http://health.gov/dietaryguidelines/2015/guidelines/appendix-7/

[15] https://iom.nationalacademies.org/~/media/Files/Activity%20Files/Nutrition/DRIs/DRI_Macronutrients.pdf

[16] http://www.ars.usda.gov/SP2UserFiles/Place/80400530/pdf/1112/Table_1_NIN_GEN_11.pdf

[17] 90th percentile is approximately 2 times the intake level and 95th percentile approximately 4 times the intake level (US Food and Drug Administration, 2006).

corresponds to a 90th percentile intake of 9.6 g proteins/kg bw/day for boys and 8.8 g proteins/kg bw/day for girls.

Additionally, in order to estimate the intake of DSM rapeseed protein isolate product via the diet, the assumption is taken that this product will replace soy protein isolates in the diverse applications of these isolates existing on the market. Soy protein isolates are reported to be used in bakery products (bread, rolls and cakes), breakfast cereals, pastas, meat emulsions, candies, confections, desserts, soups and gravies (Singh et al. 2008).

Annual disappearance figures for a food commodity can be divided by the national population and by 365 days to obtain a 'per capita' estimate of the food that is available for consumption per day expressed as grams per person per day. The Soybean Board reported in 2014 that 2% of soybean production was used for human consumption (United Soybean Board, 2014), and considering that soybeans contain 36.5% of protein, with the assumptions of a US population of 300 million and soybean production of 75 million metric tonnes. Consumer exposure can be estimated by the 'per capita times 10' method of 0.55 million metric tonnes[18] x 10[19] / 365[20] x 300 million people[21] = 50 g soy protein/person/day. Considering a body weight of 60 kg for adults, this would lead to an exposure level of 0.83 g proteins/kg bw/day for men and 4.17 g/ kg bw/ day for a child of 12 kg body weight. This would lead to a 90th percentile intake of 1.7 g proteins/kg bw/day for an adult and 8.3 g proteins/kg bw/day for a child. The estimated exposure by the 'per capita times 10' method is in the same level as the estimated exposure based on the protein intake data in the U.S. population available from the NHANES database (NHANES, What we eat in America, 2011-2012)[22].

Even considering the worst case scenario where RPI90 would replace all dietary protein, both the mean and 90th percentiles intake values for adults and children would be well below the NOAEL of 11.24 g/kg bw/day reported for male rats reported by Meija et al. for the cruciferin-rich protein isolate and of 12.46 g/kg bw/day male rats for the napin-rich protein isolate (Mejia et al. 2009a, Mejia et al. 2009b). In practice, in the adult population, approximately 50% of protein intake comes from poultry, beef, cheese, milk, and yeast bread/rolls (O'Neil et al. 2012). Another 25% originates from fish and seafood, eggs, bakery products and nuts or seeds (O'Neil et al. 2012). Therefore, considering the known intake values for rapeseed protein isolate, the mean exposure levels will be at 0.4 g proteins/kg bw/day for men, 0.28 g proteins/kg bw/day for women, 1.2 g/kg bw/day for boys and 1.1 g/kg bw/day for girls, while the 90th percentiles will be not more than 0.8 g proteins/kg bw/day for men, 0.55 g proteins/kg bw/day for women, 2.4 g/kg bw/day for

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[18] Weight disappearance of the soybean protein production for human consumption

[19] Exaggeration factor = 10. This a maximization factor added to take into account the uneven distribution of consumption through the population.

[20] Days per year

[21] Population in US

[22] http://www.ars.usda.gov/SP2UserFiles/Place/80400530/pdf/1112/Table_1_NIN_GEN_11.pdf

boys and 2.2 g/kg bw/day for girls could be expected to come from rapeseed protein products.

DSM rapeseed protein isolate would not be expected to have 100% of the market share of all protein isolate product categories and moreover food intakes databases from which the estimate intakes are derived usually overestimate intakes, since they do not reflect the true chronic exposure conditions. These factors will typically overestimate the exposure of a macronutrient by a factor of 2- to 10-fold, indicating that additional safety factors are probably unnecessary (Munro et al. 1996). Even though the exposure levels to the rapeseed protein isolate were calculated considering the total protein dietary intake of the population at both mean and 90th percentile levels, and the replacement of the total protein of the diet diet, the estimated exposure level will be below the NOAEL's derived from the 13 weeks oral toxicity studies of rapeseed protein isolates described above (Mejia et al. 2009a, Mejia et al. 2009b).

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8. Environmental Safety

Amino acids are used by all forms of living organisms to build the proteins specific to their needs. Humans, animals and most microorganisms are capable of breaking down proteins to amino acids. Rapeseed Protein is composed of the same amino acids that are present in all plant, animal and human proteins. Rapeseed press cake has been used as an ingredient in animal food for over 30 years in North America or disposed in landfills without adverse environmental consequences. Therefore, the accidental release of rapeseed protein isolate into the environment is not expected to adversely affect the air, soil or water.

DSM's Rapeseed Protein Isolate, RPI90 is a GRAS substance and per 21 CFR §25.32, foods, food additives and color additives, including GRAS substances, are categorically excluded from the requirement to provide an environmental impact statement or an environmental assessment.

9. GRAS Panel Conclusion

Expert Panel Consensus Statement on the Generally Recognized as Safe (GRAS) Determination of the Proposed Uses of Canola/Rapeseed Protein Isolate in Food

September 13, 2016

Introduction

The undersigned, an independent panel of experts, qualified by their scientific training and national and international experience to evaluate the safety of food and food ingredients (the "Expert Panel"), was specially convened to evaluate the safety and "generally recognized as safe" ("GRAS") status of the intended use of canola/rapeseed protein isolate, referred to as DSM Food Specialties, Inc. (DSM) rapeseed protein isolate (RPI90), for its intended use as a protein source, thickener, water binder, emulsifier, gelling agent, foaming agent, or texturizer in human food products for consumption by adults and children 4 years of age and older, and for the toddler group 1 – 3 years.

For purposes of this review, "safe" or "safety" means that there is "a reasonable certainty in the minds of competent scientists that the substance is not harmful under the intended conditions of use," as defined by the U.S. Food and Drug Administration (FDA) in 21 CFR § 570.3(i).

DSM Food Specialties, Inc. ("DSM") performed a comprehensive search of the scientific literature, through May 2016, relating to the safety of the canola/rapeseed protein isolate with respect to its proposed use as a protein source, thickener, water binder, emulsifier, gelling agent, foaming agent, or texturizer in human food products. DSM summarized the results of the literature search and prepared a safety dossier, **["The Safety and the Generally Recognized As Safe (GRAS) of the Proposed Uses of Canola/Rapeseed Protein Isolate in Food-Summary of Data for Consideration by an Independent GRAS Panel"].**

The Expert Panel consisted of the following individuals: Dr. G. Harvey Anderson., Ph.D. (Executive Director, Centre for Child Nutrition and Health, Director, Program in Food Safety, Nutrition and Regulatory Affairs, Professor, Department of Nutritional Sciences, Faculty of Medicine, University of Toronto), Dr. Madhusudan G. Soni, Ph.D., FACN, F.A.T.S., Soni and Associates, Inc. and Dr. Stanley M. Tarka Jr., Ph.D., F.A.T.S. (The Pennsylvania State University College of Medicine, Tarka Group, Inc. and Panel Chair).

The Expert Panel critically evaluated DSM's safety documentation (the dossier), and other available data and information that the members of the Expert Panel believed to be pertinent to the safety of the proposed use of canola/rapeseed protein isolate in food (RPI90).

On September 13, 2016, the Expert Panel convened via teleconference, and independently, jointly, and unanimously concluded that DSM's rapeseed protein isolate (RPI90), produced consistent with current good manufacturing practice (cGMP) and meeting the stated specifications, is safe for use as a protein source, thickener, water binder, emulsifier, gelling agent, foaming agent, or texturizer in human food products. The Expert Panel further concluded unanimously that the intended use of DSM's rapeseed protein isolate (RPI90) produced from rapeseed presscake that is a byproduct of rapeseed oil production and that had been manufactured from the varieties *Brassica napus* and *Brassica juncea*, meeting appropriate food-grade specifications as described in the supporting dossier and manufactured consistent with current Good Manufacturing Practice (cGMP), as a protein source, thickener, water binder, emulsifier, gelling agent, foaming agent, or texturizer in human food products is GRAS based on scientific procedures. It is also the unanimous consensus opinion of this Expert Panel that other qualified experts would concur with these conclusions.

Summarized below are the data, information and interpretive analysis supporting the Expert Panel's conclusions.

9.1.1 Description

Rapeseed Protein Isolate (RPI) is the common name of the substance that is the subject of this GRAS determination. RPI90 is the commercial name and designation of the material. Rapeseed is also known as Canola.

The rapeseed protein isolate contains two major protein fractions: cruciferins and napins. Cruciferins are globulins and are the major storage protein in the seed. Cruciferins are composed of 6 subunits and has a total molecular weight of approximately 300 kDa. Napins are albumins and are a low molecular weight storage protein (14 kDa) composed of two disulfide-linked polypeptides (Tan et al., 2011). RPI90 contains approximately 40-65% cruciferins and 35-60% napins.

Oilseed rape species are derived from the *Brassica* genus of the *Brassicaceae* or *Cruciferae* family, also known as the mustard or cabbage family. *Brassica* species are one of the most widely cultivated species of plants used for human food. Among the *Brassicaceae*, rapeseed (*Brassica napus* and *Brassica rapa*, formerly *Brassica campestris*, also known as turnip rape or sarson), are important in the global oilseed economy.

The main raw material for the production of the rapeseed protein isolate is rapeseed press cake. Rapeseed cake is a byproduct of rapeseed oil production. The rapeseed used for this purpose is from the varieties *Brassica napus* and *Brassica juncea.* They are used currently to produce rapeseed oil for human consumption. These varieties contain only low levels of erucic acid and glucosinolate, and are also known as Canola or Rapeseed-00 (OECD, 2011). Canola must contain less than 2% erucic acid in the oil and less than 30 μmol/g glucosinolates in the air-dried, oil-free meal. The press cake is produced under Good Manufacturing Practices (GMP) and is suitable for use in food. This post-harvest processing follows the standard milling and extracting process used by the oilseed industry.

The process starts with an extraction step, in which rapeseed cake/meal is mixed with an aqueous salt solution (cake/meal to water ratio: 1:5 to 1:20) (0-5% NaCl) at a temperature between 40 - 75ºC. After 5 min to 2 hours the protein rich solution is separated from the insoluble material. The protein rich solution is hereafter referred to as the extract. The pH of the extract is adjusted and the extract is further processed to clarify the material and remove non-protein substances. Citric acid and/or ascorbic acid may be used as buffers. The residual fat and formed precipitates are removed via a solid/liquid separation step (e.g. a membrane filter press or centrifugation). The proteins are then concentrated and extracted by ultrafiltration (UF) followed by separation through centrifugation. The UF-DF step concentrates the protein and removes anti-nutritional factors (e.g. polyphenols, residual phytate, glucosinolates). Sodium bisulfite may be used to whiten the product if necessary. If sulfite is used the finished product will contain < 10 ppm.

Finally, the washed concentrate can be dried in a suitable dryer, like a spray drier (single or multistage) at an inlet temperature of 150-200^{0}C and an outlet temperature of 50-100^{0}C. The produced powder is the canola/rapeseed protein isolate that is the subject of this GRAS assessment.

All processing aids used in the manufacture of rapeseed protein isolate, including sodium chloride, pH adjustment titrants such as hydrochloric acid and sodium hydroxide and divalent cations such as calcium chloride, are food grade. Maltodextrin or any other food grade carbohydrates might be used to formulate the end-product depending on customer needs. As reported here, the DSM rapeseed protein isolate (RPI90) meet specifications for macronutrient components (protein, carbohydrate, fat, ash, moisture and fiber) found in conventional rapeseed protein isolates. Specifications are also provided for glucosinolates, and phytates as anti-nutritional factors. Amino acid composition analysis of five different lots demonstrates that a consistent product is being produced. Specifications for heavy metals, pesticides, microbiological and mycotoxin impurities in the DSM rapeseed protein isolate (RPI90) are appropriate for this food ingredient and analytical testing demonstrates that there is no concern from contamination or presence of these components.

With respect to acrylamide, it is known that acrylamide is produced when the amino acid arginine is heated in the presence of glucose to temperatures above 200 ^{o}C. Since the DSM process and the seed pressing process do not exceed 100 ^{o}C acrylamide cannot be produced. Out of an abundance of caution, DSM confirmed this understanding by having three lots of RPI90 analyzed by a third party laboratory. Each lot had an acrylamide concentration <5 µg/Kg, below the limit of quantification for the method. The FDA has not set a maximum concentration for acrylamide in any food or food ingredient at this time (FDA, 2016).

9.1.2 Intended Use and Estimated Daily Intake

The rapeseed protein isolate has broad functionality and can be used in a wide range of food applications. The purpose of using a protein isolate is for its nutritional contribution and/or its functionality. The nutritional purpose is to provide (essential) amino acids and the functional purpose is for the technical/sensory properties such as water binding, gelling, etc. DSM rapeseed protein isolate (RPI90) is intended for use as a protein source, thickener, water binder, emulsifier, gelling agent, foaming agent, or texturizer in human food products. These uses (% of final food) include: Prepared food (e.g. ready-to-eat meals, soups, pasta, meat analogues, snacks (maximum 30%), Bakery products (e.g. bread, rolls, doughnut, cookies, cakes, pies, batters, muffins, pasta, and cereal bars, cereals)-maximum use-25%, Sports nutrition (e.g. instant protein drinks, energy bars)-maximum use-9%, Weight management (e.g. meal replacement, nutritional bars)-maximum use-30%, Beverages (e.g. fruit juices, soft drinks, juice blends)-Maximum use-5%, Dairy products (e.g. desserts, ice cream, cheese, yogurt)-maximum use-10%, Medical nutrition (e.g. protein fortified drinks, ready-to-drink)-maximum use-9%, Elderly nutrition (e.g. foods specifically meant for the needs of elderly people)-maximum 9%, and Processed meat products (e.g. unspecified products where the addition of vegetable proteins is accepted)-maximum use-2%. The Panel noted that these are based on applications using other protein isolates, such as those from soy and whey, that you can find in the market today. There are two previously filed GRAS Notices for rapeseed / Canola protein isolates, GRN 327 and GRN 386 in which both sponsors indicated that rapeseed protein isolate is a suitable replacement for many commonly used protein sources in processed food products. It is unlikely that rapeseed protein would replace all the potential protein sources used in processed foods.

The intended use and use levels of DSM rapeseed protein isolate (RPI90) are identical to those included in GRN 327 (cruciferin-rich canola/rapeseed protein isolate (CRCPI) and napin-rich canola/rapeseed protein isolate (NRCPI)) and GRN 386 (canola protein isolate (CPI) and hydrolyzed canola protein isolate (HCPI)) and will merely be a possible replacement for their current use in these foods. A maximum level of 30% DSM rapeseed protein isolate (RPI90) is expected in final food products. In order to estimate the intake of DSM rapeseed protein isolate (RPI90) via the diet, the assumption is taken that this product will replace soy protein isolates in the diverse applications of these isolates existing on the market. DSM rapeseed protein isolate is not intended as an ingredient in infant food or infant formula.

These are based on applications using other protein isolates, such as those from soy and whey, that are readily available in the market today. In the previously filed two GRAS Notices for rapeseed / Canola protein isolates, GRN 327 and GRN 386, both sponsors indicated that rapeseed protein isolate is a suitable replacement for many commonly used protein sources in processed food products. It is unlikely that rapeseed protein would replace all the potential protein sources used in processed foods.

In examining protein intake, it was noted that the 2015-2020 Dietary Guidelines Recommendations[23] has set Recommended Dietary Allowance (RDA) for protein intake based on data from the Institute of Medicine (IOM)[24]. IOM has established RDA for proteins of 13 g/day for 1-3 years old, 19 g/day for 4-8 years old, 56 g/day for adult males and 46 g/day for adult females. In terms of exposure on a g/kg bw/day basis, this would result in 1.1 g/kg bw/day for 1-3 years old, 0.95 g/kg bw/day for 4-13 years old and 0.8 g /kg bw/day for adults. A tolerable upper intake level (UL) was not established by the IOM. However, protein intake data in the U.S. population is available from the NHANES database (NHANES, What we eat in America, 2011-2012)[25]. In the U.S., the average protein intakes of adults range from 80.0 to 110.0 g/day in men and from 58.8 to 75.5 g/day in women, with average values of 98.8 g/day for adult males and 68.1 g/day for adult women.

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[23] http://health.gov/dietaryguidelines/2015/guidelines/appendix-7/

[24] https://iom.nationalacademies.org/~/media/Files/Activity%20Files/Nutrition/DRIs/DRI_Macronutrients.pdf

[25] http://www.ars.usda.gov/SP2UserFiles/Place/80400530/pdf/1112/Table_1_NIN_GEN_11.pdf

In the previous GRAS Notifications (GRN 327 and GRN 386), both utilized the NHANES report of 1999-2004 to calculate and estimate exposure. The 2004 report indicates average protein consumptions for the four age groups (2-5 yr, 6-11 yr, 12-19 yr and >20 yr) as 59.3, 70.9, 80.9 and 80.4 g/day, respectively. However, the two GRAS notices report exposure to rapeseed protein due to use in proposed food categories as being 25.7, 25.8, 32.2 and 20.9 g/day, respectively. The value of 20.9 for the >20 age group appears to be low. It was also noted that the two GRAS Notices reported different age brackets indicating that the sponsors did not use the USDA reports but may have devised their own analysis of the dataset to arrive at values for different age groups. These two GRAS Notice rapeseed protein consumption values are on average 36.38% of the total protein consumed.

DSM utilized the report of O'Neil et al. (2012), to calculate the potential exposure to RPI90 in the food categories described above. The analysis of O'Neil et al. indicates that total protein from the food sources that could not contain RPI90, such as muscle meats, fish, eggs and nuts accounts for 59.8% of total protein intake leaving 40.2% for possible applications of RPI90, not too different from the value in the two GRAS Notices. Multiplying the mean protein consumption by 40.2% yields the possible RPI90 consumption. Doubling that value provides the probable 90th percentile value (FDA, 2006). Utilizing the latest 50th percentile body weight data for Americans from the Center for Disease Control (CDC 2010) the exposure in g/Kg BW/day was calculated.

The exposure ranges from 2.69 g/Kg BW/day for young children to 0.94 g/Kg BW/day for adults. These conservative exposure values are much lower than the NOAEL of 11.24 g/kg bw/day for male rats reported for the cruciferin-rich protein isolate and of 12.46 g/kg bw/day for male rats for the napin-rich protein isolate (Mejia et al., 2009a, Mejia et al., 2009b). The exposures are also similar to those reported in the two GRAS Notices which ranges from 3.1 to 0.75 g/Kg BW/day.

9.1.3 Assessment of Safety

Rapeseed oil, low in erucic acid, was recognized as GRAS in 1985 by the U.S. FDA (21 CFR § 184.1555(c), which is the edible oil obtained from *Brassica napus* or *Brassica campestris*). This GRAS status was then extended to canola oil from *Brassica juncea*.

In addition, two GRAS notices have been accepted by FDA with no questions for the use of canola proteins (GRN 386), as well as cruciferin- and napin-rich canola/rapeseed protein isolates (GRN 327) in several food products, including but not limited to baked goods, dairy products, meal replacements and nutritional bars and meet replacements.

Consistent with the expectations that a GRAS assessment would investigate the published literature addressing the safety of the substance under review and other similar materials, DSM provided the following information summarizing the scientific literature on safety assessments.

Rapeseed is a potential protein source for humans and many studies have been conducted to address the safety of rapeseed protein products. The first records of safety studies with rapeseed were obtained from exposure of livestock animals to rapeseed press cake. DSM provided a detailed summary of the outcomes of toxicological studies performed evaluating rapeseed meals and protein concentrates. The main toxic effects reported in some of these studies can be attributed to the anti-nutritional factors present in rapeseed meal, and concentrates rather than to the proteins themselves when isolated. Most likely, the adverse effects encountered in these studies could be attributed to a high presence of glucosinolate derivatives and phytic acids in rapeseed protein concentrates.

The safety of rapeseed protein isolates has also been shown (or confirmed) in 13 week toxicity studies that were performed with rats fed either a cruciferin-rich protein isolate (Puratein® from ADM/Burcon) or a napin-rich protein isolate (Supertein™ from ADM/Burcon) with low content of anti-nutritional factors (Mejia et al., 2009a, Mejia et al., 2009b).

These toxicity studies are the most relevant ones to assess the safety of the DSM rapeseed protein isolate (RPI90). Indeed, the DSM rapeseed protein isolate (RPI90) contains the same major rapeseed storage proteins cruciferin and napin as the protein isolates used by Meija et al. The composition of DSM and ADM/Burcon products is very comparable, with protein contents of at least 90%, and levels of moisture, ash, carbohydrates, fats and fibres in the same range for these products. In addition, the amino acid profiles of DSM and ADM/Burcon proteins are comparable.

Finally, similar to ADM/Burcon protein isolates, DSM rapeseed proteins have a low content of potentially toxic anti-nutritional factors, phytate levels being even lower in the DSM rapeseed protein isolates (RPI90).

The 13-week toxicity studies were reported by Meija et al. (2009a and b) and are described below and were conducted according to FDA Redbook guidelines for safety testing of food additives.

In rats fed the ADM napin-rich protein isolates, lower body weights and body weight gains were reported with the 10% diet in the male group and the 20% diet in male and female groups. Lower food consumption was found in all groups of protein isolate-treated males and in the 10% and 20% female groups (Meija et al., 2009b). The authors attributed these lower body weights, body weight gains and food consumption to a low palatability of the napin-rich protein isolates. Based on these observations, the NOEL for dietary administration of the napin-rich protein isolate was concluded to be 5% w/w, and the NOAEL 20% w/w, equivalent to 12.46 g/kg bw/day for males and 14.95 g/kg bw/day for females (Meija et al., 2009a).

9.1.4 Absorption, Distribution, Metabolism, and Excretion (ADME)

The amino acids of rapeseed protein isolate are relatively well absorbed (Galibois et al., 1989) and utilized (Bos et al., 2007). Both cruciferin and napin are proteins, and like any other protein they will be digested by normal metabolic processes. Therefore, there is no need for ADME-studies. Proteins are an essential part of the daily diet as an integral part of many food products. After ingestion, proteins are hydrolyzed in the gastrointestinal tract by proteolytic enzymes derived from the pancreas resulting in the release of dipeptides, tripeptides and free amino acids (Grimble, 1994). Carrier systems specific for the transport of either the amino acids or the di- and tripeptides are responsible for the efficient transport across the intestine wall. The amino acids resulting from the digestion of foods are used as building blocks for formation and maintenance of body proteins.

The digestibility of DSM rapeseed protein isolate is moderate, 87%, based on a human study by Bos et al. (Bos et al., 2007, Deglaire et al., 2009). DSM rapeseed protein isolate contains relatively high levels of all indispensable amino acids. Based on a scoring pattern for a 0.5-3 year-old child, the Digestible Indispensable Amino Acid Score (DIAAS) of DSM rapeseed protein isolate was calculated to be 95%, which is comparable to estimated DIAAS for soy protein isolate. A protein with a DIAAS between 75%-99% is considered a good source of protein according to FAO recommendations (FAO, 2013). The Protein Digestibility Corrected Amino Acid ratios for individual amino acids and PDCAAS for total protein based on requirements for children 2-5 years of age was calculated to be 87%.

Exposure to Potential Anti-Nutritional Factors

There are four (4) major compounds/classes of anti-nutritional factors to consider in the *Brassicaceae* or *Cruciferae* family of important agricultural crops around the world. These are erucic acid, phenolics (expressed as sinapic acid), phytic acid and glucosinolates.

Erucic acid is a fatty acid present in the oil of cruciferous plants, including rapeseed and canola. While no negative health effects have ever been documented in humans, rapeseed oil high in erucic acid has been associated with lipid and histological changes in the heart of experimental animals (OECD, 2011). However, similar myocardial lipidosis has also been observed in rats exposed to vegetable fatty acids (Neat et al., 1981), which has been suggested to be due to the fact that rats are less able to digest vegetable fats (containing erucic acid or not) than other animals. In addition, the toxicity of erucic acid has been studied in sub-chronic and short-term feeding studies. Most animal studies did not show any negative effect despite the high concentrations or unnatural scenarios of exposure. In one case, neonate piglets that have a limited ability to absorb these fats had their normal sow's milk replaced solely with rapeseed oil for one hundred percent of their caloric needs (Food Standards Australia and New Zealand (Australia NZ, 2003)). Lipidosis occurred in piglets very shortly after the beginning of feeding oil and increased in its severity in a dose–dependent manner. The severity of the lipidosis appeared to decline with time regardless of whether or not the feeding of erucic acid continued, suggesting that the animal liver responds by increasing enzyme levels to cope with the unusual diet. Myocardial lipidosis in animals can therefore be regarded as a short–term, reversible effect (Food Standards Australia and New Zealand (Australia NZ, 2003)).

Although a number of epidemiological studies on the human consumption of oils containing high levels of erucic acid exist, they do not indicate any association between erucic acid and the occurrence of heart disease (Food Standards Australia and New Zealand (Australia NZ, 2003)). Nevertheless, Food Standards Australia New Zealand has defined a tolerable intake of erucic acid for humans of 7.5 mg erucic acid/kg bw/day (Food Standards Australia and New Zealand, 2003). This tolerable intake was based on the level that was associated with increased myocardial lipidosis in nursling pigs.

Canola is, by design, low in erucic acid. FDA has defined a maximum level of 2% erucic acid for low erucic acid rapeseed oil to be used in food (21 CFR §184.1555). The erucic acid content of the protein isolates described in this dossier (<0. 005%) is well below the 2% maximum limit set by FDA. Additionally, taking into account a maximum use level of

RPI90 of 30% in final food as described in the dossier, a worst-case scenario of total protein replacement, where 90th percentile intake levels of 3.2 g RPI90/kg bw/day for an adult of 60 kg body weight and 9.6 g RPI90/ kg bw/day for a child of 12 kg body weight are considered, the content of 0.005% erucic acid will lead to a worst-case intake of 0.048 mg erucic acid/kg bw/day for adults and 0.144 mg erucic acid/kg bw/day for children. This level is well below the tolerable intake of 7.5 mg erucic acid/kg bw/day defined by Food Standards Australia New Zealand, and therefore, does not represent any toxicological concern.

The total phenolics concentration in the rapeseed protein isolates described in this dossier have been analyzed and were reported at concentrations of 600-900 ppm which are very low and below the levels found in the similar rapeseed protein isolates that were reviewed by FDA in GRN 327 and GRN 386.

Phenolic acids are common in all kinds of plants and are therefore present in a considerable part of the human diet. Examples of rich sources of phenolic acids are blueberry (1,881-2,112 mg/Kg), cherry (290-1,280 mg/Kg), pear (44-1,270 mg/Kg), apple (2-258 mg/Kg), orange (21-182 mg/Kg, potato (100-190 mg/Kg) and coffee (56 g/Kg/dry weight) (GRN, 327). Phenolic substances are also present in soybeans (2.1-3.4 g/kg), and consequently in soy protein isolates (Tepavčević et al., 2010). They are in general considered as safe and also have antioxidant effects. The main concern for their natural presence in rapeseed products is not their potential toxicity, but their negative impact on animal nutrition, notably for the pig and poultry industries. Phenolic acids are associated with poor palatability due to bitterness or astringency, thus affecting the feed intake of animals. In addition, they interfere with nutrient uptake in the digestive system.

In canola, sinapine – the choline ester of sinapic acid – is the most abundant of all small phenolics. Sinapine is converted into trimethylamine by the intestinal microflora and is then absorbed. Most animals have the ability to convert trimethylamine to trimethylamine oxide, a compound that is easily excreted. However, some animals cannot fully metabolize trimethylamine. This is notably the case for laying hens that started to produce eggs smelling 'fishy' or 'crabby'. The problem was traced back to the sinapine content of canola meal and to the leaching of trimethylamine into the eggs, giving them a fishy odor (Bonnardeaux 2007, OECD, 2011).

The third anti nutritional component is phytic acid. The levels of phytate found in rapeseed protein isolates is <0.14% and, as discussed in the GRAS dossier, are lower than the levels found in commonly consumed foods. Moreover, phytate levels in RPI90 are much lower than the phytate levels reported to cause adverse effects in male or female rats fed rapeseed proteins (Jones, 1979; Shah et al., 1979). The antinutritional actions of phytate are only seen at high levels in foods.

Phytic acid is the principal storage form of phosphorus in many seeds. It is a strong chelator of important minerals, such as calcium, zinc and iron and could therefore contribute to mineral deficiencies by reducing their bioavailability. Phytate can also chelate the vitamin niacin (B3) which could contribute to vitamin B3 deficiency (Reddy, 2002). Phytate is a common component of many food products such as cereals. It is present in wheat and is known to cause zinc deficiency in humans in regions of the world where unleavened bread makes up a large proportion of the diet (Jones, 1979). In several studies of rats fed protein concentrates containing between 5 and 7.5% of phytic acid, adverse effects have been observed. When fed to pregnant rats, loss of appetite, wasting, apathy, reduced litter size and an increase in numbers of still-born pups was found (Eklund, 1973, Eklund, 1975, Jones, 1979). These adverse effects were attributed to a chelation of zinc by phytate, causing a zinc deficiency in the animals. Serum analyses obtained from the treated-rats revealed low zinc values but normal levels of calcium, magnesium, iron and copper (Jones, 1979). Similarly, in a group of female rats fed rapeseed proteins containing a high level of phytate salts (1.61% of the total diet) for two weeks before breeding, levels of zinc in maternal serum, liver, femur and in the pups were significantly lower than the comparable levels in the other two groups. In addition, the rat body weights were reduced (Shah et al., 1979). On the other hand, a group of female rats fed rapeseed proteins and supplemented with zinc did not show anorexia, and there was neither a significant difference between reproductive performances of the supplemented group and the control group nor was there any significant difference between the zinc levels determined between these two groups. A similar experiment was performed on male rats (Jones, 1979). The group of male rats fed rapeseed protein concentrates showed marked reductions of serum and femur zinc content compared to the control group, while these zinc levels were normal in the group of male rats receiving rapeseed protein concentrates as well as zinc supplementation. No visible abnormalities could be seen in the zinc deficient animals, but these rats gained weight at a slower rate than those receiving zinc supplementation or than the control rats. It therefore seems that male rats are not subjected to as much stress as the pregnant rats when experiencing a zinc deficiency.

Phytic acid is ingested with many plant-derived foods. Soy protein isolate is reported to contain 1.6-2.0% phytic acid (Honig et al., 1984). Lower values (0.49-0.84%) were also previously reported (Hurrell et al., 1992). In tofu, 1.46-2.90% phytic acid was found (on a dry matter basis). Phytic acid/phytate is present in cereals such as maize 0.72-2.22 %, wheat 0.39-1.35 %, rice 0.06-1.08%, barley 0.38-1.16%, sorghum 0.57-3.35 %, oat 0.42-1.16%, rye 0.54-1.46 %, millet 0.18-1.67 %, triticale 0.50-1.89 % and wild rice 2.20% (on dry matter basis). The level of phytic acid/phytate has also been identified in several legumes such as kidney beans 0.61-2.3 %, broad beans 0.51-1.77 %, peas 0.22-1.22 % dry cowpeas 0.37-2.90 %, chickpeas 0.28-1.60 % and lentils 0.27-1.51 % (on dry matter basis). Several type of nuts contain Phytic acid/phytate ranging from 0.17-9.42 % (on dry matter basis) (Schlemmer et al., 2009). The levels of phytate in rapeseed protein isolates is <0.14% and are lower than those in common foods.

In addition, 90-day toxicology studies performed with napin-rich protein isolate containing 3.35% phytate fed to rats at up to 20% of their diet did not affect the plasma concentration of zinc (Mejia et al., 2009b). These results strongly suggest that the very low levels of phytate present in RPI90 (< 0.14%) are not of toxicological concern.

The final anti nutritional factor considered is the level of glucosinolates present in rapeseed protein isolate (<0.1%). The level of glucosinolates in DSM rapeseed protein isolates consumed from proposed food uses would be below the acceptable daily intake (ADI) derived by European Food Safety Authority (EFSA) for Allyl isothiocyanates (AITC) of 20 µg/kg bw/day (EFSA panel on food additives and nutrient sources added to food (ANS) 2010) and therefore does not represent any toxicological concern.

The raw material used for the production of the rapeseed proteins is the canola or rapeseed bred for low glucosinolate, is low in glucosinolate (i.e. less than 30 μmol glucosinolates/g meal). In addition, by optimizing the extraction process of the rapeseed protein, it is possible to reduce the glucosinolate levels to insignificant levels (<0.1 μmol glucosinolates/g in the rapeseed protein isolates). In addition, AITC levels were below detection limit (< 3 ppm). Thus, taking into account a maximum use level of RPI 90 of 30% in final food, a worst-case scenario of total protein replacement, where 90th percentile intake levels of 3.2 g/kg bw/day for an adult of 60 kg body weight and 9.6 g/ kg bw/day for a child of 12 kg body weight are considered and the content of 3 ppm AITC will lead to an intake of 2.88 μg AITC/kg bw/day for adults and 8.64 μg AITC/kg bw/day for children.

In summary, the concentrations of anti-nutrients in RPI90 are similar to that of other rapeseed protein isolates previously GRAS notified to the FDA. It has also been demonstrated that technological processes used to manufacture rapeseed products further eliminate significant amounts of anti-nutritional factors. For example, isolation of canola proteins has been shown to eliminate up to 95% of glucosinolates, 92% of phytic acid and 100% of tannic acid (Mansour et al., 1993).

Additional Considerations-Allergenicity, hypersensitivity and immune response

RPI90 is not expected to be allergenic except for those individuals allergic to mustard protein. At the request of DSM, the Food Allergy Research and Resource Program (FARRP) at the University of Nebraska reviewed data it had accumulated regarding allergenicity to rapeseed proteins. FARRP re-evaluated the five rapeseed protein sequences DSM provided. The sequences were also run against the Celiac Database to evaluate potential matches of peptides and proteins using the Celiac Database (linked from AllergenOnline.org) with both exact peptide match and FASTA vs. the gluten/gliadin dataset.

Because DSM rapeseed protein isolate had lower than 50% identity cross reactivity with the eight major allergens, it is unlikely for RPI90 to illicit an allergenic reaction. Therefore, it was concluded that RPI90 is not expected to be allergenic except for those individuals allergic to mustard protein. Consequently, DSM will alert users of the commercial products **via the Product Data Sheet that RPI90 may cause allergic reaction in consumers who are allergic to mustard.**

Summary

DSM's Rapeseed Protein Isolate (RPI90) is intended to be used as a nutritional and functional ingredient in foods for humans serving as a protein source, thickener, water binder, emulsifier, gelling agent, foaming agent, or texturizer in human food products for consumption by adults and children 4 years of age and older, and for the toddler group 1 – 3 years. The substance will be marketed as dry powder with a nominal protein concentration of > 90%.

Rapeseed protein isolate is a relatively new food ingredient and was the subject of two prior GRAS Notices, GRN 327- *Cruciferin-rich canola/rapeseed protein isolate and napin-rich canola/rapeseed protein isolate* in 2010 and GRN 386-*Canola protein isolate and hydrolyzed canola protein isolate* in 2011. Both Notices received no questions letters from the FDA Center for Food Safety and Nutrition. The intended uses of RPI90 are identical to those identified in these GRAS notices. DSM rapeseed protein isolate is not intended as an ingredient in infant food or infant formula. It is expected to be used up to a maximum level of 30% rapeseed proteins isolate in consumer food products.

RPI90 is manufactured following cGMP by a multistep process starting with rapeseed press cake, the by-product of rapeseed oil production. Rapeseed varieties used for the production of human edible vegetable oil are low in the anti-nutrition factor erucic acid. The protein is extracted from the press cake by aqueous saline precipitation followed by several purification steps, filtration, washing and ultrafiltration. The washed concentrate is dried in a suitable dryer, like a spray drier (single or multistage) at an inlet temperature of 150-200^{0}C and an outlet temperature of 50-100^{0}C. The purified final product is a brownish powder that is stable at room and elevated temperatures (20 and 40^{o}C respectively) for a minimum of 18 months.

Results of literature searches for information on the toxicological properties of rapeseed proteins were evaluated. Studies reviewed addressed the different fields of toxicological risk assessment included metabolism and pharmacokinetics (single administration) and toxicokinetics, short-term acute and repeated dose toxicity and genotoxicity studies (Ames test and Chromosomal Aberration in Vitro).

Rapeseed protein isolates from low erucic acid varieties of the plant have been reported to be not clastogenic, not mutagenic and to have an NOAEL of between 11.24 and 14.95 g/Kg BW/ day with rats during a 13-week study.

Because RPI90 is manufactured in a similar manner as the previously notified rapeseed protein isolates and is manufactured from the same varieties of low erucic acid, commercial rapeseed oil crops it was determined that the published information was sufficient to support the safety of RPI90.

The safety of canola/rapeseed protein isolates has been demonstrated in two 13-week toxicity studies performed in rats fed either a cruciferin-rich protein isolate (Puratein® from ADM/Burcon) or a napin-rich protein isolate (Supertein™ from ADM/Burcon) with low content of anti-nutritional factors (Mejia et al., 2009a and 2009b). These published and peer-reviewed safety studies can be used to bridge the toxicological assessment of RPI90 and to support its safety. DSM RPI90 contain the same major rapeseed storage proteins cruciferin and napin as the protein isolates used by Meija et al. The composition of DSM and ADM/Burcon products is very comparable, with protein contents of at least 90%, and levels of moisture, ash, carbohydrates, fats and fibres in the same range for these products. In addition, DSM and ADM/Burcon amino acid profiles are comparable. Finally, similar to ADM/Burcon protein isolates, DSM rapeseed protein isolate has a low content of potentially toxic anti-nutritional factors, including glucosinates, erucic acid, total phenolics (sinapic acid) and phytate levels being even lower in DSM rapeseed protein isolates.

Analysis of RPI90 for the presence of anti-nutrition factors and contaminants revealed that the protein isolate has impurity and contaminant levels (heavy metals, mycotoxins, acrylamide) that are well below contemporary levels of concern and are similar to or below the levels reported in the two GRAS Notices referenced above for similar rapeseed protein isolates. Because rapeseed is a member of the mustard family, cross-reactivity for individuals allergic to mustard is possible and this will be noted in product literature to address labeling. No cross-reactivity with the eight major allergens was discovered.

In assessing the impact of DSM's RPI90 on total protein intake, DSM also considered the worst case scenario where RPI90 would replace all dietary protein, and determined that both the mean and 90th percentiles intake values for adults and children would be well below the NOAEL of 11.24 g/kg bw/day reported for male rats by Meija et al. for the cruciferin-rich protein isolate and of 12.46 g/kg bw/day for the napin-rich protein isolate (Mejia et al., 2009a, Mejia et al., 2009b). In practice, in the adult population, approximately 50% of protein intake comes from poultry, beef, cheese, milk, and yeast bread/rolls (O'Neil et al., 2012). Another 25% originates from fish and seafood, eggs, bakery products and nuts or seeds (O'Neil et al., 2012). The estimated exposure to RPI90 ranges from 2.00 g/Kg BW/day for young children to 0.46 g/Kg BW/day for adults. These conservative exposure values are much lower than the NOAEL of 11.24 g/kg bw/day for male rats reported for the cruciferin-rich protein isolate and of 12.46 g/kg bw/day for male rats for the napin-rich protein isolate (Mejia et al., 2009a, Mejia et al., 2009b). The exposures are also similar to those reported in the two GRAS Notices which ranges from 3.1 to 0.75 g/Kg BW/day.

DSM rapeseed protein isolate would not be expected to have 100% of the market share of all protein isolate product categories and moreover food intake databases from which the estimate intakes are derived usually overestimate intakes, since they do not reflect the true chronic exposure conditions. These factors will typically overestimate the exposure of a macronutrient by a factor of 2- to 10-fold, indicating that additional safety factors are probably unnecessary (Munro et al., 1996). Even though the exposure levels to the rapeseed protein isolate were calculated considering the total protein dietary intake of the population at both mean and 90th percentile levels, and the replacement of the total protein of the diet, the estimated exposure level will be below the NOAEL's derived from the 13 weeks oral toxicity studies of rapeseed protein isolates described above (Mejia et al., 2009a, Mejia et al., 2009b).

Based on the information provided in the dossier and summarized above, the use of DSM rapeseed protein isolate (RPI90) as a food ingredient for the uses specified herein can be concluded to be safe. General recognition of safety through scientific procedures requires common knowledge throughout the scientific community knowledgeable about the safety of food ingredients that there is a reasonable certainty that a substance is not harmful under the intended conditions of use in foods. The aforementioned regulatory and scientific reviews related to the consumption and safety of the rapeseed protein isolate have been published in the scientific literature, and therefore are generally available and generally known among the community of qualified food ingredient safety experts. There is broad-based and widely disseminated knowledge concerning rapeseed protein isolates. The data and publicly available information supporting the safety of the proposed uses of DSM rapeseed protein isolate (RPI90) as a nutritional and functional ingredient in foods for humans serving as a protein source, thickener, water binder, emulsifier, gelling agent, foaming agent, or texturizer in human food products for consumption by adults and children 4 years of age and older, and for the toddler group 1 – 3 years as proposed in this dossier are not only widely known and disseminated, but are also commonly accepted among qualified food safety experts. The proposed uses of DSM rapeseed protein isolate (RPI90) as a nutritional and functional ingredient in foods for humans serving as a protein source, thickener, water binder, emulsifier, gelling agent, foaming agent, or texturizer in human food products for consumption by adults and children 4 years of age and older, and for the toddler group 1 – 3 years therefore can be concluded to be safe and generally recognized as safe (GRAS) through scientific procedures.

9.2 Conclusion

We, the members of the Expert Panel, have individually and collectively critically evaluated the published and unpublished data and information summarized above, and conclude that the intended uses of DSM rapeseed protein isolate (RPI90) as a nutritional and functional ingredient in foods for humans serving as a protein source, thickener, water binder, emulsifier, gelling agent, foaming agent, or texturizer in human food products for consumption by adults and children 4 years of age and older, and for the toddler group 1-3 years up to a maximum level of 30% rapeseed proteins isolate in consumer food products, produced consistent with current Good Manufacturing Practice (cGMP) and meeting appropriate food-grade specifications as presented in the supporting dossier ["The Safety and the Generally Recognized As Safe (GRAS) of the Proposed Uses of Canola/Rapeseed Protein Isolate in Food-Summary of Data for Consideration by an Independent GRAS Panel"] are safe and suitable.

We, the members of the Expert Panel, further conclude that the intended uses of DSM rapeseed protein isolate (RPI90), produced consistent with current Good Manufacturing Practice (cGMP) and meeting appropriate food-grade specifications as presented in the supporting dossier are "Generally Recognized as Safe" (GRAS) based on scientific procedures.

It is our opinion that other qualified experts would concur with these conclusions.

(b) (6) | (b) (6) September 13, 2016

G. Harvey Anderson, Ph.D. | Date
Department of Nutritional Sciences
Faculty of Medicine
University of Toronto (Panel Member)

(b) (6) | 13 September 2016

Madhusudan G. Soni, Ph.D., F.A.C.N., F.A.T.S. | Date
Soni and Associates, Inc. (Panel Member)

(b) (6) | 13 September, 2016

Stanley M. Tarka, Jr., Ph.D., F.A.T.S. (Panel Chair) | Date
The Pennsylvania State University College of
Medicine, Tarka Group, Inc. (Panel Chair)

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10. Appendixes

Appendix 1	Appendix 1
Appendix *2*	CoA's of three independent and representative batches of rapeseed protein isolate
Appendix 3	Mycotoxin reports
Appendix 4	RPI90 pesticide analysis
Appendix 5	Acrylamide analysis
Appendix 6	Data stability study Canola/ rapeseed protein isolate
Appendix 7	GMP+ Feed certificate of a rapeseed press cake supplier
Appendix 8	Pesticide residue analysis of a typical batch of rapeseed press cake
Appendix 9	Analytical data of three independent and representative batches of the raw material rapeseed press cake
Appendix 10	Rape Seed press cake contaminants
Appendix 11	Allergen report
Appendix 12	Typical amino acid composition of three batches of RPI90
Appendix 13	DIAAS calculation
Appendix 14	Protease inhibitor analysis

Appendix 1
Production facility GMP

NIZO food research B.V.
Kernhemseweg 2, 6718 ZB Ede, The Netherlands
P.O. Box 20, 6710 BA Ede, The Netherlands
T +31 (0)318 65 95 11 **F** +31 (0)318 65 04 00
E info@nizo.com **W** www.nizo.com

Statement food grade status Processing Centre Nizo food research

The Processing Centre of Nizo food research is able to produce various food grade products. The food grade status of the Processing Centre is expressed by the following:

- ISO 9001 certified by Det Norske Veritas (DNV)
- Recognized as a producer of dairy products by COKZ, registration number NL Z 0097 EC.
  http://www.cokz.nl/Documents/Register%20van%20in%20Nederland%20erkende%20zuivelbedrijven%20in%20het%20kader%20van%20EU-hygi%C3%ABnepakket%20per%2001-04-2016.pdf
- Recognized as a producer of feed products, GMP+ certified by Det Norske Veritas (DNV), registration number PDV 20726, www.pvd.nl
- HACCP system operational

Signed for and on behalf of Nizo food research

(b) (6)

Signature	[redacted]
Name:	W.R.Postma
Function:	QESH manager
Date:	20-06-2016

Appendix 2
Certificates of Analyses three batches of Canola/ Rapeseed protein isolate

CERTIFICATE OF ANALYSIS

RA-DLF-00072284

Name of the product	Canola/Rapeseed Protein (RPI90)
Batch	(b) (6) [redacted]
Status	Pilot batch
Date of manufacture	September 2015
Date of expiration	September 2016
Date of issue	April 28, 2016

Parameter	Unit	Specification	Method	Result
Total protein (% via N*6.25 as such)	% w/w	≥ 90	AOCS Ba 4e-93	96.3
Carbohydrates	% w/w	≤ 7	By difference	0
Fat (direct)	% w/w	≤ 2	AOCS Ba 3-38 ISO 12966-3	< 0.1
Ash	% w/w	≤ 4	FCC v6, 1065	0.71
Moisture	% w/w	≤ 7	FCC v7, 1133 (100% -dm)	4.3
Total plate count	cfu/g	≤ 10^4	ISO 4833:2003	110

Allergy information: Rapeseed protein may cause allergic reaction to consumers who are allergic to mustard and products thereof.

Signature (b) (6) [redacted] emarks (if any):

(b) (6) [redacted]

DSM Food Specialties B.V., Alexander Fleminglaan 1, 2613 AX Delft, the Netherlands

HEALTH · NUTRITION · MATERIALS

DSM
BRIGHT SCIENCE. BRIGHTER LIVING.

CERTIFICATE OF ANALYSIS

RA-DLF-00072287

Name of the product	Canola/Rapeseed Protein (RPI90)
Batch	(b) (6) [redacted]
Status	Pilot batch
Date of manufacture	October 2015
Date of expiration	October 2016
Date of issue	April 28, 2016

Parameter	Unit	Specification	Method	Result
Total protein (% via N*6.25 as such)	% w/w	≥ 90	AOCS Ba 4e-93	98.1
Carbohydrates	% w/w	≤ 7	By difference	0
Fat (direct)	% w/w	≤ 2	AOCS Ba 3-38 ISO 12966-3	< 0.1
Ash	% w/w	≤ 4	FCC v6, 1065	0.08
Moisture	% w/w	≤ 7	FCC v7, 1133 (100% -dm)	3.3
Total plate count	cfu/g	≤ 10^4	ISO 4833:2003	270

Allergy information: Rapeseed protein may cause allergic reaction to consumers who are allergic to mustard and products thereof.

(b) (6) S[redacted]marks (if any):

DSM Food Specialties B.V., Alexander Fleminglaan 1, 2613 AX Delft, the Netherlands

DSM
BRIGHT SCIENCE. BRIGHTER LIVING.

CERTIFICATE OF ANALYSIS

RA-DLF-00072288

Name of the product	Canola/Rapeseed Protein (RPI90)
Batch	(b) (6) [redacted]
Status	Pilot batch
Date of manufacture	December 2015
Date of expiration	December 2016
Date of issue	April 28, 2016

Parameter	Unit	Specification	Method	Result
Total protein (% via N*6.25 as such)	% w/w	≥ 90	AOCS Ba 4e-93	98.8
Carbohydrates	% w/w	≤ 7	By difference	0
Fat (direct)	% w/w	≤ 2	AOCS Ba 3-38 ISO 12966-3	< 0.1
Ash	% w/w	≤ 4	FCC v6, 1065	0.08
Moisture	% w/w	≤ 7	FCC v7, 1133 (100% -dm)	2.3
Total plate count	cfu/g	≤ 10^4	ISO 4833:2003	70

Allergy information: Rapeseed protein may cause allergic reaction to consumers who are allergic to mustard and [redacted]oducts thereof.

Signat (b) (6) [redacted] emarks (if any):

Although diligent care has been used to ensure that the information provided herein is accurate, nothing contained herein can be construed to imply any representation or warranty for which we assume legal responsibility, including without limitation any warranties as to the accuracy, currency or completeness of this information or of non-infringement of third party intellectual property rights. The content of this document is subject to change without further notice. This document is non-controlled and will not be automatically replaced when changed. Please contact us for the latest version of this document or for further information. Since the user's product formulations, specific use applications and conditions of use are beyond our control, we make no warranty or representation regarding the results which may be obtained by the user. It shall be the responsibility of the user to determine the suitability of our products for the user's specific purposes and the legal status for the user's intended use of our products.

DSM Food Specialties B.V., Alexander Fleminglaan 1, 2613 AX Delft, the Netherlands

Appendix 3
Mycotoxin Reports

Premier Analytical Services
The Lord Rank Centre
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High Wycombe
Bucks HP12 3QS
Tel. 01494 526191 Fax. 01494 428128

1288

CERTIFICATE OF ANALYSIS

Nicolas Abello
DSM Food Specialties
DSM Biotechnology Centre
624-0280
PO Box 1. 2600 MA Delft
The Netherlands

Test Report No. EX16B-0433(2)

Samples Received 06/06/2016

Test Report Date 23/06/2016

Lab Code 16B-02143

Sample Description RPI - 1536 - 01 - G

Test Method	Toxin	Recovery (%)	Result (µg/kg)
BA-TM-03	Deoxynivalenol (DON)	107	<10
BA-TM-03	Diacetoxyscirpenol (DAS)	105	<10
BA-TM-03	3-Acetyldeoxynivalenol (3AcDON)	107	<10
BA-TM-03	15-Acetyldeoxynivalenol (15AcDON)	105	<10
BA-TM-03	Fusarenone X (Fus X)	106	<10
BA-TM-03	Nivalenol (NIV)	105	<10
BA-TM-03	Neosolaniol (NEO)	103	<10
BA-TM-03	T2 Toxin (T2)	101	<10
BA-TM-03	HT2 Toxin (HT2)	102	<10
BA-TM-10	Aflatoxin B1	95	<0.1
BA-TM-10	Aflatoxin B2	101	<0.1
BA-TM-10	Aflatoxin G1	80	<0.1
BA-TM-10	Aflatoxin G2	88	<0.1
BA-TM-10	Total Aflatoxin	91	<0.4
BA-TM-31	Fumonisin B1	101	<10
BA-TM-31	Fumonisin B2	100	<10
BA-TM-31	Fumonisin B3	101	<10

Note: all results corrected for recovery (matrix matched).

Re-issue of Report: EX16B-0433 (1)

(b) (6)

...………Mrs S Patel (Section Manager, Bioanalytical Chemistry)

Premier Analytical Services
The Lord Rank Centre
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UKAS TESTING
1288

CERTIFICATE OF ANALYSIS

Nicolas Abello
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Test Report No. EX16B-0433(2)

Samples Received 06/06/2016

Test Report Date 23/06/2016

Lab Code 16B-02144

Sample Description RPI - 1543 - 02 - P

Test Method	Toxin	Recovery (%)	Result (µg/kg)
BA-TM-03	Deoxynivalenol (DON)	107	<10
BA-TM-03	Diacetoxyscirpenol (DAS)	105	<10
BA-TM-03	3-Acetyldeoxynivalenol (3AcDON)	107	<10
BA-TM-03	15-Acetyldeoxynivalenol (15AcDON)	105	<10
BA-TM-03	Fusarenone X (Fus X)	106	<10
BA-TM-03	Nivalenol (NIV)	105	<10
BA-TM-03	Neosolaniol (NEO)	103	<10
BA-TM-03	T2 Toxin (T2)	101	<10
BA-TM-03	HT2 Toxin (HT2)	102	<10
BA-TM-10	Aflatoxin B1	95	<0.1
BA-TM-10	Aflatoxin B2	101	<0.1
BA-TM-10	Aflatoxin G1	80	<0.1
BA-TM-10	Aflatoxin G2	88	<0.1
BA-TM-10	Total Aflatoxin	91	<0.4
BA-TM-31	Fumonisin B1	101	<10
BA-TM-31	Fumonisin B2	100	<10
BA-TM-31	Fumonisin B3	101	<10

Note: all results corrected for recovery (matrix matched).

Re-issue of Report: EX16B-0433 (1)

(b) (6) [redacted]

.......Mrs S Patel (Section Manager, Bioanalytical Chemistry)

These results only relate to the sample(s) submitted for testing and do not guarantee the bulk of the material to be of equal quality.
Test marked # in this certificate are not included in the UKAS accreditation schedule for the Laboratory.
Deviations from Test Method(s) - None unless specified. N.M. = Not measured. N.D. = Not detected.
Opinion and interpretations expressed herein are outside the scope of UKAS accreditation.

Premier Analytical Services
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CERTIFICATE OF ANALYSIS

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Test Report No. EX16B-0433(2)

Samples Received 06/06/2016

Test Report Date 23/06/2016

Lab Code 16B-02145

Sample Description RPI - 1549 - 01 - P

Test Method	Toxin	Recovery (%)	Result (µg/kg)
BA-TM-03	Deoxynivalenol (DON)	107	<10
BA-TM-03	Diacetoxyscirpenol (DAS)	105	<10
BA-TM-03	3-Acetyldeoxynivalenol (3AcDON)	107	<10
BA-TM-03	15-Acetyldeoxynivalenol (15AcDON)	105	<10
BA-TM-03	Fusarenone X (Fus X)	106	<10
BA-TM-03	Nivalenol (NIV)	105	<10
BA-TM-03	Neosolaniol (NEO)	103	<10
BA-TM-03	T2 Toxin (T2)	101	<10
BA-TM-03	HT2 Toxin (HT2)	102	<10
BA-TM-10	Aflatoxin B1	95	<0.1
BA-TM-10	Aflatoxin B2	101	<0.1
BA-TM-10	Aflatoxin G1	80	<0.1
BA-TM-10	Aflatoxin G2	88	<0.1
BA-TM-10	Total Aflatoxin	91	<0.4
BA-TM-31	Fumonisin B1	101	<10
BA-TM-31	Fumonisin B2	100	<10
BA-TM-31	Fumonisin B3	101	<10

Note: all results corrected for recovery (matrix matched).

Re-issue of Report: EX16B-0433 (1)

(b) (6)

....[redacted]..........Mrs S Patel (Section Manager, Bioanalytical Chemistry)

These results only relate to the sample(s) submitted for testing and do not guarantee the bulk of the material to be of equal quality.
Test marked # in this certificate are not included in the UKAS accreditation schedule for the Laboratory.
Deviations from Test Method(s) - None unless specified. N.M. = Not measured. N.D. = Not detected.
Opinion and interpretations expressed herein are outside the scope of UKAS accreditation.

Premier Analytical Services
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1288

CERTIFICATE OF ANALYSIS

Nicolas Abello
DSM Food Specialties
DSM Biotechnology Centre
624-0280
PO Box 1. 2600 MA Delft
The Netherlands

Test Report No. EX16B-0433(2)

Samples Received 06/06/2016

Test Report Date 23/06/2016

Lab Code 16B-02146

Sample Description RPI - 1615 - 01 - G

Test Method	Toxin	Recovery (%)	Result (µg/kg)
BA-TM-03	Deoxynivalenol (DON)	107	<10
BA-TM-03	Diacetoxyscirpenol (DAS)	105	<10
BA-TM-03	3-Acetyldeoxynivalenol (3AcDON)	107	<10
BA-TM-03	15-Acetyldeoxynivalenol (15AcDON)	105	<10
BA-TM-03	Fusarenone X (Fus X)	106	<10
BA-TM-03	Nivalenol (NIV)	105	<10
BA-TM-03	Neosolaniol (NEO)	103	<10
BA-TM-03	T2 Toxin (T2)	101	<10
BA-TM-03	HT2 Toxin (HT2)	102	<10
BA-TM-10	Aflatoxin B1	95	<0.1
BA-TM-10	Aflatoxin B2	101	<0.1
BA-TM-10	Aflatoxin G1	80	<0.1
BA-TM-10	Aflatoxin G2	88	<0.1
BA-TM-10	Total Aflatoxin	91	<0.4
BA-TM-31	Fumonisin B1	101	<10
BA-TM-31	Fumonisin B2	100	<10
BA-TM-31	Fumonisin B3	101	<10

Note: all results corrected for recovery (matrix matched).

Re-issue of Report: EX16B-0433 (1)

(b) (6)

....Mrs S Patel (Section Manager, Bioanalytical Chemistry)

These results only relate to the sample(s) submitted for testing and do not guarantee the bulk of the material to be of equal quality.
Test marked # in this certificate are not included in the UKAS accreditation schedule for the Laboratory.
Deviations from Test Method(s) - None unless specified. N.M. = Not measured. N.D. = Not detected.
Opinion and interpretations expressed herein are outside the scope of UKAS accreditation.

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1288

CERTIFICATE OF ANALYSIS

Nicolas Abello
DSM Food Specialties
DSM Biotechnology Centre
624-0280
PO Box 1. 2600 MA Delft
The Netherlands

Test Report No. EX16B-0433(2)

Samples Received 06/06/2016

Test Report Date 23/06/2016

Lab Code 16B-02147

Sample Description RPC - 95423

Test Method	Toxin	Recovery (%)	Result (µg/kg)
BA-TM-03	Deoxynivalenol (DON)	107	<10
BA-TM-03	Diacetoxyscirpenol (DAS)	105	<10
BA-TM-03	3-Acetyldeoxynivalenol (3AcDON)	107	<10
BA-TM-03	15-Acetyldeoxynivalenol (15AcDON)	105	<10
BA-TM-03	Fusarenone X (Fus X)	106	<10
BA-TM-03	Nivalenol (NIV)	105	<10
BA-TM-03	Neosolaniol (NEO)	103	<10
BA-TM-03	T2 Toxin (T2)	101	<10
BA-TM-03	HT2 Toxin (HT2)	102	<10
BA-TM-10	Aflatoxin B1	95	<0.1
BA-TM-10	Aflatoxin B2	101	<0.1
BA-TM-10	Aflatoxin G1	80	<0.1
BA-TM-10	Aflatoxin G2	88	<0.1
BA-TM-10	Total Aflatoxin	91	<0.4
BA-TM-31	Fumonisin B1	101	<10
BA-TM-31	Fumonisin B2	100	<10
BA-TM-31	Fumonisin B3	101	<10

Note: all results corrected for recovery (matrix matched).

Re-issue of Report: EX16B-0433 (1)

(b) (6)

.. ..Mrs S Patel (Section Manager, Bioanalytical Chemistry)

These results only relate to the sample(s) submitted for testing and do not guarantee the bulk of the material to be of equal quality.
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Deviations from Test Method(s) - None unless specified. N.M. = Not measured. N.D. = Not detected.
Opinion and interpretations expressed herein are outside the scope of UKAS accreditation.

Appendix 4
Pesticide Reports

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CANCELS AND REPLACES*

DSM Food Specialties BV
For the attention of
Mr. Leon Coulier
A. Fleminglaan 1
2613 AX DELFT
NEDERLAND

Copy to : Meneer / mevrouw Abello (Nicolas.Abello@dsm.com), Meneer / mevrouw Boogers (Ilco.Boogers@DSM.COM), Meneer / mevrouw Quality department (fss-postoffice.dbs@dsm.com)

Email Leon.Coulier@dsm.com

Sample code Nr.	**890-2016-00009820**	**Report Date**	**16/06/2016**
Analytical Report Nr.	**AR-16-RM-009629-02 / 890-2016-00009820**		

(*this report cancels and replaces the previous one, numbered AR-16-RM-009629-01/890-2016-00009820 dated 09/06/2016 which must be destroyed)

Your contact for Customer Service : Elze Noordzij

Our reference :	890-2016-00009820/ AR-16-RM-009629-02		
Client reference :	**RPI-1543-02-P**		
Sample described as :			
		Your purchase order reference :	4701625406
Sample reception date :	06/06/2016	**Analysis starting date :**	06/06/2016
Analyses requested :	PZV01: Multitest pesticides TQ RMA00: Monstervoorbereiding Chemie RMA05: Project handeling		

Projectnaam	DIC/PoFu	**Order ontvangen**	06/06/2016
Monster nr	RPI-1543-02-P	**Artikel/product nr**	Rapeseed protein isolate
Monsteromschrijving	Rapeseed protein isolate		

PESTICIDES RESIDUES		Results
ZVP04	**ZV Quantitative screening GC-MS TQ Method : CEN/TR 16468, mod.**	
	Screened pesticides	<LOQ
ZVP05	**ZV Quantitative screening LC-MS Method : CEN/TR 15641, mod.**	
	Screened pesticides	<LOQ

List of screened molecules and not detected (* = limit of quantification)

ZVP04 ZV Quantitative screening GC-MS TQ (LOQ* mg/kg)

1,4-dimethylnaphtalene (0.01)	1-Naphthol (0.01)	2,4,6-Trichlorophenol (2) (0.01)	2,4-DDD (0.01)	2,6-Dichlorobenzamide (0.01)	2-Phenylphenol (0.01)
3,4-dichloroaniline (0.02)	4,4 -DDD + 2,4 -DDT (0.01)	4,4 -DDT (0.01)	4,4-DDE (0.01)	a, b, d- BHC (0.01)	Acibenzolar-s-methyl (0.01)
Aclonifen (0.01)	Acrinathrin (0.01)	Alachlor (0.01)	Aldrin (0.01)	Allethrin (0.02)	Ametryn (0.01)
Aminocarb (0.01)	Amitraz (0.02)	Anthraquinone (0.01)	Azinphos-ethyl (0.01)	Azoxystrobine (0.02)	Barban/Chlorbufam/Chlorpropham (as 3-Chloroaniline (0.05)
Benalaxyl (0.01)	Bendiocarb (0.01)	Benfluralin (0.01)	Bifenazate (0.05)	Bifenox (0.01)	Bifenthrin (0.01)
Biphenyl (0.01)	Bitertanol (0.01)	Bromacil (0.01)	Bromocyclen (0.01)	Bromophos-ethyl (0.01)	Bromophos-methyl (0.01)
Bromopropylate (0.01)	Bromuconazole (0.02)	Bupirimate (0.01)	Buprofezin (0.01)	Cadusaphos (0.01)	Captafol (0.05)
Captan (0.01)	Captan/Folpet (sum) (0.01)	Carbaryl (0.01)	Carbofuran (0.01)	Carbofuran (Sum) (0.01)	Carbofuranphenol (0.01)
Carbophenothion-methyl (0.01)	Carbosulfan (0.02)	Chinomethionate (0.01)	Chlorbufam (0.01)	Chlordane, cis- (0.01)	Chlordane, trans- (0.01)
Chlorfenapyr (0.01)	Chlorfenson (0.01)	Chlorfenvinphos (0.01)	Chlorfenvinphos cis (0.01)	Chlorfenvinphos trans (0.01)	Chloridazone (0.05)
Chlorobenzilate (0.01)	Chloroneb (0.01)	Chlorothalonil (0.01)	Chlorpropham (0.01)	Chlorpropham (Sum) (0.01)	Chlorpyrifos (-ethyl) (0.01)
Chlorpyrifos-methyl (0.01)	Chlorthal-dimethyl (0.01)	Chlorthiamid (0.2)	Chlozolinate (0.01)	Clefoxydim (0.05)	Clodinafop (0.01)
Clomazone (0.01)	Cloquintocet-mexyl (0.01)	Coumaphos (0.01)	Cyanazine (0.01)	Cyanofenphos (0.01)	Cyanophos (0.01)
Cycloate (0.01)	Cyfluthrin (0.01)	Cyhalothrin (0.01)	Cyhalothrin, lambda- (0.01)	Cypermethrin (0.01)	Cyphenothrin (0.05)
Cyproconazole (0.01)	Cyprodinil (0.01)	DDT (total) (0.01)	Deltamethrin (0.01)	Demeton-O (0.01)	Demeton-S (0.01)
Demeton-S-methyl (0.01)	Desmetryn (0.01)	Diazinon (0.01)	Dichlobenil (0.02)	Dichlofenthion (0.01)	Dichloranilin-3,5 (0.02)
Dichlorobenzophenone, p,p- (0.01)	Dicloran (0.01)	Dicofol, p,p- (0.01)	Dieldrin (0.01)	Dieldrin (Sum) (0.01)	Diethofencarb (0.01)
Difenoconazole (0.01)	Diflufenican (0.01)	Dimethoate (0.01)	Dimethylaminosulphotoluidide (DMST) (0.02)	Diniconazole (0.01)	Diphenamid (0.01)
Diphenylamine (0.01)	Disulfoton (0.02)	Disulfoton (sum) (0.02)	Disulfoton-sulfon (0.01)	Ditalimfos (0.01)	Endosulfan (total) (0.04)
Endosulfan sulphate (0.02)	Endosulfan, alpha- (0.01)	Endosulfan, beta- (0.01)	Endrin (0.01)	EPN (0.01)	Epoxiconazole (0.01)
EPTC (0.01)	Esfenvalerate (0.01)	Etaconazole (0.01)	Ethion (0.01)	Ethofumesate (0.01)	Ethoprophos (0.01)
Ethoxyquin (0.01)	Etofenprox (0.01)	Etridiazole (0.02)	Etrimfos (0.01)	Famoxadone (0.05)	Fenarimol (0.01)
Fenazaquin (0.01)	Fenfluthrin (0.01)	Fenhexamid (0.02)	Fenitrothion (0.01)	Fenobucarb (0.01)	Fenothrine (0.01)
Fenoxycarb (0.05)	Fenpiclonil (0.01)	Fenpropidin (0.01)	Fenpropimorph (0.01)	Fenpyroximate (0.02)	Fenson (0.01)
Fensulfothion (0.01)	Fenthion (0.01)	Fenthion-sulfoxide (0.01)	Fenvalerate (all isomers) (0.01)	Fipronil (0.005)	Fipronil (sum) (0.005)
Fipronil-sulfone (0.005)	Fluazifop-butyl (0.01)	Fluchloralin (0.01)	Flucythrinate (0.01)	Fludioxonil (0.01)	Fluquinconazole (0.01)

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CANCELS AND REPLACES*

ZVP04 ZV Quantitative screening GC-MS TQ (LOQ* mg/kg)

Flurprimidol (0.01)	Flusilazole (0.01)	Flutolanil (0.01)	Folpet (0.01)	Fonofos (0.01)	Formothion (0.01)
Fuberidazole (0.01)	Furalaxyl (0.01)	Furmecyclox (0.05)	Halfenprox (0.01)	Haloxyfop-2-ethoxyethyl (0.01)	HCH (sum) (0.02)
HCH, alpha- (0.01)	HCH, beta- (0.01)	HCH, delta- (0.01)	Heptachlor (0.01)	Heptachlor (sum) (0.01)	Heptachlor epoxide, cis- (0.01)
Heptachlor epoxide, trans- (0.02)	Heptenophos (0.01)	Hexachlorobenzene (HCB) (0.01)	Hexachlorobutadiene (0.01)	Hexaconazole (0.01)	Hexazinone (0.01)
Imazethapyr (0.05)	Iodofenphos (0.01)	Iprobenfos (0.01)	Iprodione (0.01)	Isazophos (0.01)	Isocarbofos (0.01)
Isodrin (0.01)	Isofenphos (0.01)	Isofenphos-methyl (0.01)	Isofenphos-oxon (0.01)	Isoprocarb (0.01)	Isoproturon (0.01)
Isoxadifen-ethyl (0.01)	Kresoxim-methyl (0.01)	Lenacil (0.01)	Leptophos (0.01)	Malaoxon (0.01)	Malathion, fyfanon (0.01)
Malathion/Malaoxon (sum) (0.02)	Mecarbam (0.01)	Mepanipyrim (0.01)	Mephosfolan (0.02)	Mepronil (0.01)	Metalaxyl (0.01)
Metazachlor (0.01)	Methabenzthiazuron (0.01)	Methacriphos (0.01)	Methidathion (0.01)	Methiocarb (0.01)	Methiocarb (sum) (0.02)
Methoprotryne (0.01)	Methoxychlor (0.01)	Methyl Parathion (0.01)	Metobromuron (0.01)	Metolcarb (0.01)	Metrafenone (0.01)
Metribuzin (0.01)	Mevinphos (0.01)	Mirex (0.02)	Molinate (0.01)	Myclobutanil (0.01)	Naphthalene Acetamide (0.05)
Napropamide (0.01)	Nitrapyrin (0.01)	Nitrofen (0.01)	Nitrothal-isopropyl (0.01)	Norflurazon (0.01)	o,p'-DDE (0.01)
Ofurace (0.01)	Oxadiazon (0.01)	Oxadixyl (0.02)	Oxydemeton-methyl (sum) (0.01)	Oxyfluorfen (0.01)	Paraoxon (0.01)
Paraoxon-methyl (0.01)	Parathion (0.01)	Parathion-methyl (Sum) (0.01)	Penconazole (0.01)	Pencycuron (0.02)	Pendimethalin (0.01)
Pentachloranisole (0.01)	Pentachloroaniline (0.01)	Pentachlorobenzene (0.01)	Pentachlorophenol (0.05)	Permethrin-cis (0.01)	Permethrins (sum) (0.02)
Permethrin-trans (0.01)	Perthane (0.01)	Phenkapton (0.01)	Phenothrin (0.02)	Phenthoate (0.01)	Phosalone (0.01)
Phosfolan (0.02)	Phosmet (0.01)	Phosmet (Sum) (0.02)	Phthalimid (0.01)	Picoxystrobin (0.01)	Piperonyl butoxide (PBO) (0.01)
Pirimicarb (0.01)	Pirimicarb (Sum) (0.01)	Pirimicarb, desmethyl- (0.01)	Pirimicarb, desmethyl-formamido- (0.01)	Pirimiphos-ethyl (0.01)	Pirimiphos-methyl (0.01)
Procymidone (0.01)	Profenofos (0.01)	Profluralin (0.01)	Promecarb (0.01)	Prometryn (0.01)	Pronamide (0.01)
Propachlor (0.01)	Propanil (0.01)	Propargite (0.02)	Propazine (0.01)	Propetamphos (0.01)	Propham (0.01)
Propiconazole (0.01)	Propoxur (0.01)	Propoxycarbazone (0.05)	Prosulfocarb (0.01)	Prothioconazole (0.01)	Prothioconazole-desthio (0.01)
Prothiofos (0.01)	Pyraflufen-ethyl (0.01)	Pyrazophos (0.01)	Pyrethrins (0.2)	Pyridaben (0.01)	Pyridaphenthion (0.01)
Pyrifenox (E-) (0.01)	Pyrifenox (Z-) (0.01)	Pyrimethanil (0.01)	Pyriproxyfen (0.01)	Quinalphos (0.01)	Quinoxyfen (0.01)
Quintozene (0.01)	Quintozene (sum) (0.01)	Quizalofop ethyl (0.01)	Ronnel (0.01)	S 421 (0.05)	Silthiofam (0.01)
Simazine (0.01)	S-Metolachlor (0.01)	Spiromesifen (0.01)	Spiroxamine (0.01)	Sulfotep (2) (0.01)	Sulphur (S) (0.2)
Sulprofos (0.01)	tau-Fluvalinate (0.01)	Tebuconazole (0.01)	Tebufenpyrad (0.01)	Tecnazene (0.01)	Tefluthrin (0.01)
Telodrin (0.01)	Terbacil (0.01)	Terbumeton (0.01)	Terbuthylazine (0.01)	Terbutryn (0.01)	Tetrachlorvinphos (0.01)
Tetraconazole (0.01)	Tetradifon (0.01)	Tetramethrin (0.01)	Tetrasul (0.01)	THPI (Tetrahydrophthalimide) (0.01)	Tolclofos-methyl (0.01)
Transfluthrin (0.01)	Triadimefon (0.01)	Triadimenol (0.01)	Triadimenol/Triadimefon (sum) (0.02)	Triallate (0.01)	Triazamate (0.01)
Triazophos (0.01)	Trichloronat (0.01)	Trifloxystrobin (0.01)	Triflumizole (0.01)	Trifluralin (0.01)	Trinexapac-ethyl (0.01)
Trithion (0.01)	Vinclozolin (0.01)	Vinclozolin (Sum) (0.01)			

ZVP05 ZV Quantitative screening LC-MS (LOQ* mg/kg)

1,2,4-triazole (0.1)	1-Naphthylacetic acid (0.05)	2,4,5-T (0.01)	2,4,6-Trichlorophenoxyacetic Acid (0.01)	2,4-D (0.01)	2,4-D butyric acid (2,4-DB) (0.01)
2,4'-Formoxylidid (0.01)	2-Naphthyloxyacetic acid (0.01)	3-Hydroxycarbofuran (0.01)	3-ketocarbofuran (0.01)	4-CPA (0.01)	6-Benzyladenine (0.01)
6-Chlor-3-phenylpyridazin-4-ol (0.01)	Abamectin (0.01)	Acephate (0.01)	Acequinocyl (0.01)	Acetamiprid (0.01)	Alanycarb (0.01)
Aldicarb (0.01)	Aldicarb (sum) (0.01)	Aldicarb-sulfone (0.01)	Aldicarb-sulfoxide (0.01)	Ametoctradin (0.01)	Aminopyralid (0.25)
Amisulbrom (0.01)	Amitraz (0.05)	Amitraz (as 2,4-Dimethylaniline) (0.1)	Amitraz (sum) (0.01)	Amitrole (0.5)	Anilazine (0.05)
Asulam (0.01)	Atrazine (0.01)	Avermectin B1a (0.01)	Avermectin B1b (0.01)	Azaconazole (0.01)	Azadirachtin (0.01)
Azamethiphos (0.01)	Azimsulfuron (0.01)	Azinphos-methyl (0.01)	Azoxystrobine (0.01)	Barban (0.01)	Benoxacor (0.01)
Bentazone (0.01)	Benthiavalicarb, isopropyl- (0.01)	Bitertanol (0.01)	Bixafen (0.01)	Boscalid (0.01)	Bromoxynil (0.01)
Bromuconazole (0.01)	Bupirimate (0.01)	Buprofezin (0.01)	Butafenacil (0.01)	Butocarboxim-sulfoxide (0.01)	Butoxycarboxim (0.01)
Buturon (0.01)	Carbaryl (0.01)	Carbendazim (0.01)	Carbendazim/Benomyl (sum) (0.01)	Carbetamide (0.01)	Carbofuran (0.01)
Carbofuran (Sum) (0.01)	Carbosulfan (0.01)	Carfentrazone (0.01)	Carpropamid (0.01)	Chloorthiofos (0.01)	Chloramben (0.1)
Chlorantraniliprole (0.01)	Chlorbromuron (0.01)	Chlordecon (0.01)	Chlordimeform (0.01)	Chlorfluazuron (0.01)	Chlorothalonil-4-hydroxy (0.01)
Chlorotoluron (0.01)	Chlorthiofos-sulfone (0.01)	Chlorthion (0.01)	Cinerin I (0.01)	Clethodim (0.01)	Clethodim/Sethoxydim (Sum) (0.01)
Climbazole (0.01)	Clofentezine (0.01)	Clopyralid (0.5)	Clothianidin (0.01)	Crimidine (0.01)	Cyantraniliprole (0.01)
Cyazofamid (0.01)	Cycloxydim (0.01)	Cyflufenamid (0.01)	Cyflumetofen (0.01)	Cymoxanil (0.01)	Cyproconazole (0.01)
Cyprodinil (0.01)	Cyromazine (0.05)	Cythioate (0.01)	Daminozide (0.01)	Demeton-S-methyl-sulfone (0.01)	Desmedipham (0.01)
Diafenthiuron (0.01)	Dicamba (0.05)	Dichlofluanid (0.01)	Dichlorophen (0.01)	Dichlorprop (0.01)	Dichlorvos (0.01)
Diclobutrazol (0.01)	Dicrotophos (0.01)	Diethofencarb (0.01)	Diethyltoluamide (0.01)	Difenoconazole (0.01)	Diflubenzuron (0.01)
Dimethenamid (0.01)	DIMETHIRIMOL (0.01)	Dimethoate (0.01)	Dimethoate/Omethoate (sum) (0.01)	Dimethomorph (0.01)	Dimethylaminosulphotoluidide (DMST) (0.01)
Dimethylphenylsulfamide (DMSA) (0.01)	Dimoxystrobin (0.01)	Diniconazole (0.01)	Dinocap (0.01)	Dinotefuran (0.01)	Dipropetryn (0.01)
Dithianon (0.01)	Diuron (0.01)	Dodemorf (0.01)	Dodine (0.01)	Emamectin, benzoate- (0.01)	Epoxiconazole (0.01)
Ethiofencarb (0.01)	Ethiofencarb (sum) (0.01)	Ethiofencarb-sulfone (0.01)	Ethiofencarb-sulfoxide (0.01)	Ethiprole (0.01)	Ethirimol (0.01)
Ethoxysulfuron (0.01)	Ethylene thiourea (ETU) (0.5)	Etofenprox (0.01)	Etoxazole (0.01)	Famophos (0.01)	Famoxadone (0.01)
Fenamidone (0.01)	Fenamiphos (sum) (0.01)	Fenamiphos-sulfone (0.01)	Fenamiphos-sulfoxide (0.01)	Fenarimol (0.02)	Fenazaquin (0.01)
Fenbuconazole (0.01)	Fenhexamid (0.01)	Fenoprop (0.01)	Fenoxycarb (0.01)	Fenpropidin (0.01)	Fenpropimorph (0.01)
Fenpyrazamine (0.01)	Fenpyroximate (0.01)	Fenthion (0.01)	Fenthion (sum) (0.01)	Fenthion-oxon (0.01)	Fenthion-oxon-sulfone (0.01)
Fenthion-oxon-sulfoxide (0.01)	Fenthion-sulfone (0.01)	Fenthion-sulfoxide (0.01)	Fipronil (0.01)	Flazasulfuron (0.01)	Flonicamid (0.01)
Flonicamid (Sum) (0.01)	Florasulam (0.01)	Fluazifop (0.01)	Fluazifop-P-butyl (0.01)	Fluazinam (0.01)	Flubendiamide (0.01)
Flucycloxuron (0.01)	Flufenacet (0.01)	Flufenoxuron (0.01)	Flumioxazin (0.01)	Fluopicolid (0.01)	Fluopyram (0.01)
Fluotrimazole (0.01)	Fluoxastrobin (0.01)	Flupyradifurone (0.01)	Fluquinconazole (0.01)	Fluroxypyr (0.02)	Fluroxypyr (Sum) (0.01)
Fluroxypyr-Methylheptyl (0.01)	Flusilazole (0.01)	Fluthiacet-methyl (0.01)	Flutolanil (0.01)	Flutriafol (0.01)	Fluxapyroxad (0.01)
Forchlorfenuron (0.01)	Formetanate (0.01)	Fosetyl-aluminium (0.5)	Fosthiazate (0.01)	Furalaxyl (0.01)	Furathiocarb (0.01)
Furmecyclox (0.02)	HALOFENOZIDE (0.01)	Haloxyfop (0.01)	Hexaconazole (0.01)	Hexaflumuron (0.01)	Hexythiazox (0.01)
HYMEXAZOL (0.1)	Imazalil (0.01)	Imazaquin (0.01)	Imibenconazole (0.01)	Imidacloprid (0.01)	Indoxacarb (0.01)
Iodosulfuron methyl (0.01)	Ioxynil (0.02)	Iprovalicarb (0.01)	Isocarbofos (0.01)	Isoprothiolane (0.01)	Isopyrazam (0.01)
Isouron (0.01)	Isoxaben (0.01)	Isoxaflutole (0.01)	Isoxathion (0.01)	Jasmolin I (0.01)	Kresoxim-methyl (0.01)
Lenacil (0.01)	Linuron (0.01)	Lufenuron (0.01)	Malathion (Sum) (0.01)	Malathion, fyfanon (0.01)	Maleic hydrazide (MH-30) (0.5)
Mandipropamid (0.05)	MCPA (0.01)	MCPA/MCPB (sum) (0.01)	MCPB (0.01)	Mecoprop (0.01)	Mefenacet (0.01)
Mefenpyr-diethyl (0.01)	Mepanipyrim (0.01)	Mephosfolan (0.01)	Mepronil (0.01)	MEPTYLDINOCAP (0.01)	Mesosulfuron-methyl (0.01)

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CANCELS AND REPLACES*

Sample code Nr.	**890-2016-00009820**	**Report Date**	**16/06/2016**	**Page 3/3**
Analytical Report Nr.	**AR-16-RM-009629-02 / 890-2016-00009820**			

ZVP05 ZV Quantitative screening LC-MS (LOQ* mg/kg)

Mesotrione (0.01)	Metaflumizone (0.01)	Metalaxyl (0.01)	Metaldehyde (0.01)	Metamitron (0.01)	Metasyatox-R (0.01)
Metconazole (0.02)	Methamidophos (0.01)	Methidathion (0.01)	Methiocarb (0.01)	Methiocarb (sum) (0.01)	Methiocarb-sulfone (0.01)
Methiocarb-sulfoxide (0.01)	Methomyl (0.01)	Methomyl/Thiodicarb (sum) (0.01)	Methoxyfenozide (0.01)	Metobromuron (0.01)	Metoxuron (0.01)
Metsulfuron-methyl (0.02)	Milbemectin (sum) (0.1)	Milbemectin A3 (0.1)	Milbemectin A4 (0.1)	Monocrotophos (0.01)	Monolinuron (0.01)
Monuron (0.01)	Myclobutanil (0.01)	N-2,4-dimethylphenyl-N-methylform amidine (0.01)	Naled (0.01)	Neburon (0.01)	Nicosulfuron (0.01)
Nitenpyram (0.01)	Nitralin (0.01)	Novaluron (0.01)	Nuarimol (0.01)	Omethoate (0.01)	Oxadixyl (0.01)
Oxamyl (0.01)	Oxasulfuron (0.01)	Oxycarboxin (0.01)	Oxydemeton-methyl (sum) (0.01)	Paclobutrazol (0.01)	Paraoxon-ethyl (0.01)
Paraoxon-methyl (0.01)	Parathion-methyl (Sum) (0.01)	Pebulate (0.01)	Penconazole (0.01)	Pencycuron (0.01)	Penflufen (0.01)
Penthiopyrad (0.01)	Phenamiphos (0.01)	Phenisopham (0.01)	Phenmedipham (0.01)	Phorate (0.01)	Phorate (sum) (0.01)
Phorate-sulfone (0.01)	Phorate-sulfoxide (0.01)	Phosalone (0.01)	Phosmet (0.01)	Phosmet (Sum) (0.01)	Phosmet-oxon (0.01)
Phosphamidon (0.01)	Phoxim (0.01)	Picaridin (0.01)	Picloram (0.1)	Picolinafen (0.01)	Picoxystrobin (0.01)
Pinoxaden (0.01)	Piperonyl butoxide (PBO) (0.01)	Pirimicarb (0.01)	Pirimicarb (Sum) (0.01)	Pirimicarb, desmethyl- (0.01)	Prochloraz (0.01)
Prochloraz (Sum) (0.01)	Prochloraz-desimidazole-amino (0.01)	Prochloraz-desimidazole-formylami no (0.01)	Profenofos (0.01)	Prohexadione Calcium (0.05)	Pronamide (0.01)
Propamocarb Hydrochloride (0.01)	Propaquizafop (0.01)	Propiconazole (0.01)	Propoxur (0.01)	Proquinazid (0.01)	Prosulfocarb (0.01)
Prothiocarb (0.01)	Prothiocarb hydrochloride (0.01)	Prothioconazole (0.1)	Prothioconazole-desthio (0.01)	Pymetrozine (0.01)	Pyracarbolid (0.01)
Pyraclofos (0.01)	Pyraclostrobin (0.01)	Pyrazophos (0.01)	Pyrethrins (0.01)	Pyrethrins (Total Isomers) (0.01)	Pyridaben (0.01)
Pyridalyl (0.01)	Pyridaphenthion (0.01)	Pyridate (0.01)	Pyridate (Sum) (0.01)	Pyrifenox (0.01)	Pyrimethanil (0.01)
Pyrimidifen (0.01)	Pyriproxyfen (0.01)	Quinclorac (0.01)	Quinmerac (0.01)	Quizalofop (0.01)	Rimsulfuron (0.01)
Rotenone (0.01)	Saflufenacil (0.01)	Sethoxydim (0.01)	Silafluofen (0.01)	Simazine (0.01)	Spinetoram (0.01)
Spinosad (Sum) (0.01)	Spinosad A (0.01)	Spinosad D (0.01)	Spirodiclofen (0.01)	Spirotetramat (0.01)	Spirotetramate (Sum) (0.01)
Spirotetramat-enol (0.01)	Spirotetramat-enolglucoside (0.05)	Spirotetramat-ketohydroxy (0.01)	Spirotetramat-monohydroxy (0.01)	Spiroxamine (0.01)	Sulcotrione (0.02)
Sulfentrazone (0.02)	Tebuconazole (0.01)	Tebufenozide (0.01)	Tebufenpyrad (0.01)	Teflubenzuron (0.01)	TEMBOTRIONE (0.01)
Tepraloxydim (0.01)	Terbufos-sulfone (0.01)	Terbufos-sulfoxide (0.01)	Tetraconazole (0.01)	TFNA (0.01)	TFNA-AM (0.01)
TFNG (0.01)	Thiabendazole (0.01)	Thiacloprid (0.01)	Thiamethoxam (0.01)	Thiamethoxam (Sum) (0.01)	Thidiazuron (0.01)
Thiobencarb (0.01)	Thiocyclam (0.05)	Thiodicarb (0.01)	Thiofanox (0.01)	Thiofanox-sulfone (0.01)	Thiofanox-sulfoxide (0.01)
Thiometon (0.01)	Thiophanate-methyl (0.01)	Tolclofos-methyl (0.01)	Tolylfluanid (0.01)	Tolylfluanid (Sum) (0.01)	Tralkoxydim (0.01)
Triadimefon (0.01)	Triadimenol (0.01)	Triadimenol/Triadimefon (sum) (0.01)	Triapenthenol (0.01)	Triazophos (0.01)	Triazoxide (0.01)
Tribenuron-methyl (0.05)	Trichlorfon (0.01)	Triclopyr (0.01)	Tricyclazole (0.01)	Tridemorph (0.01)	Trifloxystrobin (0.01)
Triflumizole (0.01)	Triflumuron (0.01)	Triflusulfuron-methyl (0.01)	Triforine (0.01)	Trimethycarb, 3,4,5- (0.01)	Trinexapac-ethyl (0.01)
Triticonazole (0.01)	Uniconazole (0.01)	Valifenalate (0.01)	Vamidothion (0.01)	Warfarin (0.01)	Zoxamide (0.01)

SIGNATURE

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Rapporten zonder stempel zijn ongeldig.
Reports without stamp are not valid.

(b) (6) [redacted]

Mirjam Kortekaas
Business Unit Manager

Report electronically validated by Vince Leeuwestein

EXPLANATORY NOTE

This certificate may only be reproduced complete. The results are only valid for the sample.
The uncertainty of measurement for the applied methods of analysis are retrievable from the ASM department
Opinions and interpretations in this certificate are outside the scope of accreditation.
The samples will be stored until 84 days after the date of reception.
The analyses that state -M after the reference method should be interpreted as equal to the aforementioned reference method.

The tests identified by the two letters code ZV are performed in laboratory Eurofins Lab Zeeuws-Vlaanderen.

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CANCELS AND REPLACES*

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For the attention of
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Sample code Nr.	**890-2016-00009821**	**Report Date**	**16/06/2016**
Analytical Report Nr.	**AR-16-RM-009630-02 / 890-2016-00009821**		

(*this report cancels and replaces the previous one, numbered AR-16-RM-009630-01/890-2016-00009821 dated 09/06/2016 which must be destroyed)

Your contact for Customer Service : Elze Noordzij

Our reference :	890-2016-00009821/ AR-16-RM-009630-02		
Client reference :	**RPI-1549-01-P**		
Sample described as :			
		Your purchase order reference :	4701625406
Sample reception date :	06/06/2016	**Analysis starting date :**	06/06/2016
Analyses requested :	PZV01: Multitest pesticides TQ RMA00: Monstervoorbereiding Chemie		

Projectnaam	DIC/PoFu	**Order ontvangen**	06/06/2016
Monster nr	RPI-1549-01-P	**Artikel/product nr**	Rapeseed protein isolate
Monsteromschrijving	Rapeseed protein isolate		

PESTICIDES RESIDUES			Results
ZVP04	**ZV**	**Quantitative screening GC-MS TQ Method : CEN/TR 16468, mod.**	
		Screened pesticides	<LOQ
ZVP05	**ZV**	**Quantitative screening LC-MS Method : CEN/TR 15641, mod.**	
		Screened pesticides	<LOQ

List of screened molecules and not detected (* = limit of quantification)

ZVP04 ZV Quantitative screening GC-MS TQ (LOQ* mg/kg)

1,4-dimethylnaphtalene (0.01)	1-Naphthol (0.01)	2,4,6-Trichlorophenol (2) (0.01)	2,4-DDD (0.01)	2,6-Dichlorobenzamide (0.01)	2-Phenylphenol (0.01)
3,4-dichloroaniline (0.02)	4,4 -DDD + 2,4 -DDT (0.01)	4,4 -DDT (0.01)	4,4-DDE (0.01)	a, b, d- BHC (0.01)	Acibenzolar-s-methyl (0.01)
Aclonifen (0.01)	Acrinathrin (0.01)	Alachlor (0.01)	Aldrin (0.01)	Allethrin (0.02)	Ametryn (0.01)
Aminocarb (0.01)	Amitraz (0.02)	Anthraquinone (0.01)	Azinphos-ethyl (0.01)	Azoxystrobine (0.02)	Barban/Chlorbufam/Chlorpropham (as 3-Chloroaniline (0.05)
Benalaxyl (0.01)	Bendiocarb (0.01)	Benfluralin (0.01)	Bifenazate (0.05)	Bifenox (0.01)	Bifenthrin (0.01)
Biphenyl (0.01)	Bitertanol (0.01)	Bromacil (0.01)	Bromocyclen (0.01)	Bromophos-ethyl (0.01)	Bromophos-methyl (0.01)
Bromopropylate (0.01)	Bromuconazole (0.02)	Bupirimate (0.01)	Buprofezin (0.01)	Cadusaphos (0.01)	Captafol (0.05)
Captan (0.01)	Captan/Folpet (sum) (0.01)	Carbaryl (0.01)	Carbofuran (0.01)	Carbofuran (Sum) (0.01)	Carbofuranphenol (0.01)
Carbophenothion-methyl (0.01)	Carbosulfan (0.02)	Chinomethionate (0.01)	Chlorbufam (0.01)	Chlordane, cis- (0.01)	Chlordane, trans- (0.01)
Chlorfenapyr (0.01)	Chlorfenson (0.01)	Chlorfenvinphos (0.01)	Chlorfenvinphos cis (0.01)	Chlorfenvinphos trans (0.01)	Chloridazone (0.05)
Chlorobenzilate (0.01)	Chloroneb (0.01)	Chlorothalonil (0.01)	Chlorpropham (0.01)	Chlorpropham (Sum) (0.01)	Chlorpyrifos (-ethyl) (0.01)
Chlorpyrifos-methyl (0.01)	Chlorthal-dimethyl (0.01)	Chlorthiamid (0.2)	Chlozolinate (0.01)	Clefoxydim (0.05)	Clodinafop (0.01)
Clomazone (0.01)	Cloquintocet-mexyl (0.01)	Coumaphos (0.01)	Cyanazine (0.01)	Cyanofenphos (0.01)	Cyanophos (0.01)
Cycloate (0.01)	Cyfluthrin (0.01)	Cyhalothrin (0.01)	Cyhalothrin, lambda- (0.01)	Cypermethrin (0.01)	Cyphenothrin (0.05)
Cyproconazole (0.01)	Cyprodinil (0.01)	DDT (total) (0.01)	Deltamethrin (0.01)	Demeton-O (0.01)	Demeton-S (0.01)
Demeton-S-methyl (0.01)	Desmetryn (0.01)	Diazinon (0.01)	Dichlobenil (0.02)	Dichlofenthion (0.01)	Dichloranilin-3,5 (0.02)
Dichlorobenzophenone, p,p- (0.01)	Dicloran (0.01)	Dicofol, p,p- (0.01)	Dieldrin (0.01)	Dieldrin (Sum) (0.01)	Diethofencarb (0.01)
Difenoconazole (0.01)	Diflufenican (0.01)	Dimethoate (0.01)	Dimethylaminosulphotoluidide (DMST) (0.02)	Diniconazole (0.01)	Diphenamid (0.01)
Diphenylamine (0.01)	Disulfoton (0.02)	Disulfoton (sum) (0.02)	Disulfoton-sulfon (0.01)	Ditalimfos (0.01)	Endosulfan (total) (0.04)
Endosulfan sulphate (0.02)	Endosulfan, alpha- (0.01)	Endosulfan, beta- (0.01)	Endrin (0.01)	EPN (0.01)	Epoxiconazole (0.01)
EPTC (0.01)	Esfenvalerate (0.01)	Etaconazole (0.01)	Ethion (0.01)	Ethofumesate (0.01)	Ethoprophos (0.01)
Ethoxyquin (0.01)	Etofenprox (0.01)	Etridiazole (0.02)	Etrimfos (0.01)	Famoxadone (0.05)	Fenarimol (0.01)
Fenazaquin (0.01)	Fenfluthrin (0.01)	Fenhexamid (0.02)	Fenitrothion (0.01)	Fenobucarb (0.01)	Fenothrine (0.01)
Fenoxycarb (0.05)	Fenpiclonil (0.01)	Fenpropidin (0.01)	Fenpropimorph (0.01)	Fenpyroximate (0.02)	Fenson (0.01)
Fensulfothion (0.01)	Fenthion (0.01)	Fenthion-sulfoxide (0.01)	Fenvalerate (all isomers) (0.01)	Fipronil (0.005)	Fipronil (sum) (0.005)
Fipronil-sulfone (0.005)	Fluazifop-butyl (0.01)	Fluchloralin (0.01)	Flucythrinate (0.01)	Fludioxonil (0.01)	Fluquinconazole (0.01)
Flurprimidol (0.01)	Flusilazole (0.01)	Flutolanil (0.01)	Folpet (0.01)	Fonofos (0.01)	Formothion (0.01)

CANCELS AND REPLACES*

ZVP04 ZV Quantitative screening GC-MS TQ (LOQ* mg/kg)

Fuberidazole (0.01)	Furalaxyl (0.01)	Furmecyclox (0.05)	Halfenprox (0.01)	Haloxyfop-2-ethoxyethyl (0.01)	HCH (sum) (0.02)
HCH, alpha- (0.01)	HCH, beta- (0.01)	HCH, delta- (0.01)	Heptachlor (0.01)	Heptachlor (sum) (0.01)	Heptachlor epoxide, cis- (0.01)
Heptachlor epoxide, trans- (0.02)	Heptenophos (0.01)	Hexachlorobenzene (HCB) (0.01)	Hexachlorobutadiene (0.01)	Hexaconazole (0.01)	Hexazinone (0.01)
Imazethapyr (0.05)	Iodofenphos (0.01)	Iprobenfos (0.01)	Iprodione (0.01)	Isazophos (0.01)	Isocarbofos (0.01)
Isodrin (0.01)	Isofenphos (0.01)	Isofenphos-methyl (0.01)	Isofenphos-oxon (0.01)	Isoprocarb (0.01)	Isoproturon (0.01)
Isoxadifen-ethyl (0.01)	Kresoxim-methyl (0.01)	Lenacil (0.01)	Leptophos (0.01)	Malaoxon (0.01)	Malathion, fyfanon (0.01)
Malathion/Malaoxon (sum) (0.02)	Mecarbam (0.01)	Mepanipyrim (0.01)	Mephosfolan (0.02)	Mepronil (0.01)	Metalaxyl (0.01)
Metazachlor (0.01)	Methabenzthiazuron (0.01)	Methacriphos (0.01)	Methidathion (0.01)	Methiocarb (0.01)	Methiocarb (sum) (0.02)
Methoprotryne (0.01)	Methoxychlor (0.01)	Methyl Parathion (0.01)	Metobromuron (0.01)	Metolcarb (0.01)	Metrafenone (0.01)
Metribuzin (0.01)	Mevinphos (0.01)	Mirex (0.02)	Molinate (0.01)	Myclobutanil (0.01)	Naphthalene Acetamide (0.05)
Napropamide (0.01)	Nitrapyrin (0.01)	Nitrofen (0.01)	Nitrothal-isopropyl (0.01)	Norflurazon (0.01)	o,p'-DDE (0.01)
Ofurace (0.01)	Oxadiazon (0.01)	Oxadixyl (0.02)	Oxydemeton-methyl (sum) (0.01)	Oxyfluorfen (0.01)	Paraoxon (0.01)
Paraoxon-methyl (0.01)	Parathion (0.01)	Parathion-methyl (Sum) (0.01)	Penconazole (0.01)	Pencycuron (0.02)	Pendimethalin (0.01)
Pentachloranisole (0.01)	Pentachloroaniline (0.01)	Pentachlorobenzene (0.01)	Pentachlorophenol (0.05)	Permethrin-cis (0.01)	Permethrins (sum) (0.02)
Permethrin-trans (0.01)	Perthane (0.01)	Phenkapton (0.01)	Phenothrin (0.02)	Phenthoate (0.01)	Phosalone (0.01)
Phosfolan (0.02)	Phosmet (0.01)	Phosmet (Sum) (0.02)	Phthalimid (0.01)	Picoxystrobin (0.01)	Piperonyl butoxide (PBO) (0.01)
Pirimicarb (0.01)	Pirimicarb (Sum) (0.01)	Pirimicarb, desmethyl- (0.01)	Pirimicarb, desmethyl-formamido- (0.01)	Pirimiphos-ethyl (0.01)	Pirimiphos-methyl (0.01)
Procymidone (0.01)	Profenofos (0.01)	Profluralin (0.01)	Promecarb (0.01)	Prometryn (0.01)	Pronamide (0.01)
Propachlor (0.01)	Propanil (0.01)	Propargite (0.02)	Propazine (0.01)	Propetamphos (0.01)	Propham (0.01)
Propiconazole (0.01)	Propoxur (0.01)	Propoxycarbazone (0.05)	Prosulfocarb (0.01)	Prothioconazole (0.01)	Prothioconazole-desthio (0.01)
Prothiofos (0.01)	Pyraflufen-ethyl (0.01)	Pyrazophos (0.01)	Pyrethrins (0.2)	Pyridaben (0.01)	Pyridaphenthion (0.01)
Pyrifenox (E-) (0.01)	Pyrifenox (Z-) (0.01)	Pyrimethanil (0.01)	Pyriproxyfen (0.01)	Quinalphos (0.01)	Quinoxyfen (0.01)
Quintozene (0.01)	Quintozene (sum) (0.01)	Quizalofop ethyl (0.01)	Ronnel (0.01)	S 421 (0.05)	Silthiofam (0.01)
Simazine (0.01)	S-Metolachlor (0.01)	Spiromesifen (0.01)	Spiroxamine (0.01)	Sulfotep (2) (0.01)	Sulphur (S) (0.2)
Sulprofos (0.01)	tau-Fluvalinate (0.01)	Tebuconazole (0.01)	Tebufenpyrad (0.01)	Tecnazene (0.01)	Tefluthrin (0.01)
Telodrin (0.01)	Terbacil (0.01)	Terbumeton (0.01)	Terbuthylazine (0.01)	Terbutryn (0.01)	Tetrachlorvinphos (0.01)
Tetraconazole (0.01)	Tetradifon (0.01)	Tetramethrin (0.01)	Tetrasul (0.01)	THPI (Tetrahydrophthalimide) (0.01)	Tolclofos-methyl (0.01)
Transfluthrin (0.01)	Triadimefon (0.01)	Triadimenol (0.01)	Triadimenol/Triadimefon (sum) (0.02)	Triallate (0.01)	Triazamate (0.01)
Triazophos (0.01)	Trichloronat (0.01)	Trifloxystrobin (0.01)	Triflumizole (0.01)	Trifluralin (0.01)	Trinexapac-ethyl (0.01)
Trithion (0.01)	Vinclozolin (0.01)	Vinclozolin (Sum) (0.01)			

ZVP05 ZV Quantitative screening LC-MS (LOQ* mg/kg)

1,2,4-triazole (0.1)	1-Naphthylacetic acid (0.05)	2,4,5-T (0.01)	2,4,6-Trichlorophenoxyacetic Acid (0.01)	2,4-D (0.01)	2,4-D butyric acid (2,4-DB) (0.01)
2,4'-Formoxylidid (0.01)	2-Naphthyloxyacetic acid (0.01)	3-Hydroxycarbofuran (0.01)	3-ketocarbofuran (0.01)	4-CPA (0.01)	6-Benzyladenine (0.01)
6-Chlor-3-phenylpyridazin-4-ol (0.01)	Abamectin (0.01)	Acephate (0.01)	Acequinocyl (0.01)	Acetamiprid (0.01)	Alanycarb (0.01)
Aldicarb (0.01)	Aldicarb (sum) (0.01)	Aldicarb-sulfone (0.01)	Aldicarb-sulfoxide (0.01)	Ametoctradin (0.01)	Aminopyralid (0.25)
Amisulbrom (0.01)	Amitraz (0.05)	Amitraz (as 2,4-Dimethylaniline) (0.1)	Amitraz (sum) (0.01)	Amitrole (0.5)	Anilazine (0.05)
Asulam (0.01)	Atrazine (0.01)	Avermectin B1a (0.01)	Avermectin B1b (0.01)	Azaconazole (0.01)	Azadirachtin (0.01)
Azamethiphos (0.01)	Azimsulfuron (0.01)	Azinphos-methyl (0.01)	Azoxystrobine (0.01)	Barban (0.01)	Benoxacor (0.01)
Bentazone (0.01)	Benthiavalicarb, isopropyl- (0.01)	Bitertanol (0.01)	Bixafen (0.01)	Boscalid (0.01)	Bromoxynil (0.01)
Bromuconazole (0.01)	Bupirimate (0.01)	Buprofezin (0.01)	Butafenacil (0.01)	Butocarboxim-sulfoxide (0.01)	Butoxycarboxim (0.01)
Buturon (0.01)	Carbaryl (0.01)	Carbendazim (0.01)	Carbendazim/Benomyl (sum) (0.01)	Carbetamide (0.01)	Carbofuran (0.01)
Carbofuran (Sum) (0.01)	Carbosulfan (0.01)	Carfentrazone (0.01)	Carpropamid (0.01)	Chloorthiofos (0.01)	Chloramben (0.1)
Chlorantraniliprole (0.01)	Chlorbromuron (0.01)	Chlordecon (0.01)	Chlordimeform (0.01)	Chlorfluazuron (0.01)	Chlorothalonil-4-hydroxy (0.01)
Chlorotoluron (0.01)	Chlorthiofos-sulfone (0.01)	Chlorthion (0.01)	Cinerin I (0.01)	Clethodim (0.01)	Clethodim/Sethoxydim (Sum) (0.01)
Climbazole (0.01)	Clofentezine (0.01)	Clopyralid (0.5)	Clothianidin (0.01)	Crimidine (0.01)	Cyantraniliprole (0.01)
Cyazofamid (0.01)	Cycloxydim (0.01)	Cyflufenamid (0.01)	Cyflumetofen (0.01)	Cymoxanil (0.01)	Cyproconazole (0.01)
Cyprodinil (0.01)	Cyromazine (0.05)	Cythioate (0.01)	Daminozide (0.01)	Demeton-S-methyl-sulfone (0.01)	Desmedipham (0.01)
Diafenthiuron (0.01)	Dicamba (0.05)	Dichlofluanid (0.01)	Dichlorophen (0.01)	Dichlorprop (0.01)	Dichlorvos (0.01)
Diclobutrazol (0.01)	Dicrotophos (0.01)	Diethofencarb (0.01)	Diethyltoluamide (0.01)	Difenoconazole (0.01)	Diflubenzuron (0.01)
Dimethenamid (0.01)	DIMETHIRIMOL (0.01)	Dimethoate (0.01)	Dimethoate/Omethoate (sum) (0.01)	Dimethomorph (0.01)	Dimethylaminosulphotoluidide (DMST) (0.01)
Dimethylphenylsulfamide (DMSA) (0.01)	Dimoxystrobin (0.01)	Diniconazole (0.01)	Dinocap (0.01)	Dinotefuran (0.01)	Dipropetryn (0.01)
Dithianon (0.01)	Diuron (0.01)	Dodemorf (0.01)	Dodine (0.01)	Emamectin, benzoate- (0.01)	Epoxiconazole (0.01)
Ethiofencarb (0.01)	Ethiofencarb (sum) (0.01)	Ethiofencarb-sulfone (0.01)	Ethiofencarb-sulfoxide (0.01)	Ethiprole (0.01)	Ethirimol (0.01)
Ethoxysulfuron (0.01)	Ethylene thiourea (ETU) (0.5)	Etofenprox (0.01)	Etoxazole (0.01)	Famophos (0.01)	Famoxadone (0.01)
Fenamidone (0.01)	Fenamiphos (sum) (0.01)	Fenamiphos-sulfone (0.01)	Fenamiphos-sulfoxide (0.01)	Fenarimol (0.02)	Fenazaquin (0.01)
Fenbuconazole (0.01)	Fenhexamid (0.01)	Fenoprop (0.01)	Fenoxycarb (0.01)	Fenpropidin (0.01)	Fenpropimorph (0.01)
Fenpyrazamine (0.01)	Fenpyroximate (0.01)	Fenthion (0.01)	Fenthion (sum) (0.01)	Fenthion-oxon (0.01)	Fenthion-oxon-sulfone (0.01)
Fenthion-oxon-sulfoxide (0.01)	Fenthion-sulfone (0.01)	Fenthion-sulfoxide (0.01)	Fipronil (0.01)	Flazasulfuron (0.01)	Flonicamid (0.01)
Flonicamid (Sum) (0.01)	Florasulam (0.01)	Fluazifop (0.01)	Fluazifop-P-butyl (0.01)	Fluazinam (0.01)	Flubendiamide (0.01)
Flucycloxuron (0.01)	Flufenacet (0.01)	Flufenoxuron (0.01)	Flumioxazin (0.01)	Fluopicolid (0.01)	Fluopyram (0.01)
Fluotrimazole (0.01)	Fluoxastrobin (0.01)	Flupyradifurone (0.01)	Fluquinconazole (0.01)	Fluroxypyr (0.02)	Fluroxypyr (Sum) (0.01)
Fluroxypyr-Methylheptyl (0.01)	Flusilazole (0.01)	Fluthiacet-methyl (0.01)	Flutolanil (0.01)	Flutriafol (0.01)	Fluxapyroxad (0.01)
Forchlorfenuron (0.01)	Formetanate (0.01)	Fosetyl-aluminium (0.5)	Fosthiazate (0.01)	Furalaxyl (0.01)	Furathiocarb (0.01)
Furmecyclox (0.02)	HALOFENOZIDE (0.01)	Haloxyfop (0.01)	Hexaconazole (0.01)	Hexaflumuron (0.01)	Hexythiazox (0.01)
HYMEXAZOL (0.1)	Imazalil (0.01)	Imazaquin (0.01)	Imibenconazole (0.01)	Imidacloprid (0.01)	Indoxacarb (0.01)
Iodosulfuron methyl (0.01)	Ioxynil (0.02)	Iprovalicarb (0.01)	Isocarbofos (0.01)	Isoprothiolane (0.01)	Isopyrazam (0.01)
Isouron (0.01)	Isoxaben (0.01)	Isoxaflutole (0.01)	Isoxathion (0.01)	Jasmolin I (0.01)	Kresoxim-methyl (0.01)
Lenacil (0.01)	Linuron (0.01)	Lufenuron (0.01)	Malathion (Sum) (0.01)	Malathion, fyfanon (0.01)	Maleic hydrazide (MH-30) (0.5)
Mandipropamid (0.05)	MCPA (0.01)	MCPA/MCPB (sum) (0.01)	MCPB (0.01)	Mecoprop (0.01)	Mefenacet (0.01)
Mefenpyr-diethyl (0.01)	Mepanipyrim (0.01)	Mephosfolan (0.01)	Mepronil (0.01)	MEPTYLDINOCAP (0.01)	Mesosulfuron-methyl (0.01)
Mesotrione (0.01)	Metaflumizone (0.01)	Metalaxyl (0.01)	Metaldehyde (0.01)	Metamitron (0.01)	Metasyatox-R (0.01)

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CANCELS AND REPLACES*

Sample code Nr.	**890-2016-00009821**	**Report Date 16/06/2016**	
Analytical Report Nr.	**AR-16-RM-009630-02 / 890-2016-00009821**		

ZVP05 ZV Quantitative screening LC-MS (LOQ* mg/kg)

Metconazole (0.02)	Methamidophos (0.01)	Methidathion (0.01)	Methiocarb (0.01)	Methiocarb (sum) (0.01)	Methiocarb-sulfone (0.01)
Methiocarb-sulfoxide (0.01)	Methomyl (0.01)	Methomyl/Thiodicarb (sum) (0.01)	Methoxyfenozide (0.01)	Metobromuron (0.01)	Metoxuron (0.01)
Metsulfuron-methyl (0.02)	Milbemectin (sum) (0.1)	Milbemectin A3 (0.1)	Milbemectin A4 (0.1)	Monocrotophos (0.01)	Monolinuron (0.01)
Monuron (0.01)	Myclobutanil (0.01)	N-2,4-dimethylphenyl-N-methylform amidine (0.01)	Naled (0.01)	Neburon (0.01)	Nicosulfuron (0.01)
Nitenpyram (0.01)	Nitralin (0.01)	Novaluron (0.01)	Nuarimol (0.01)	Omethoate (0.01)	Oxadixyl (0.01)
Oxamyl (0.01)	Oxasulfuron (0.01)	Oxycarboxin (0.01)	Oxydemeton-methyl (sum) (0.01)	Paclobutrazol (0.01)	Paraoxon-ethyl (0.01)
Paraoxon-methyl (0.01)	Parathion-methyl (Sum) (0.01)	Pebulate (0.01)	Penconazole (0.01)	Pencycuron (0.01)	Penflufen (0.01)
Penthiopyrad (0.01)	Phenamiphos (0.01)	Phenisopham (0.01)	Phenmedipham (0.01)	Phorate (0.01)	Phorate (sum) (0.01)
Phorate-sulfone (0.01)	Phorate-sulfoxide (0.01)	Phosalone (0.01)	Phosmet (0.01)	Phosmet (Sum) (0.01)	Phosmet-oxon (0.01)
Phosphamidon (0.01)	Phoxim (0.01)	Picaridin (0.01)	Picloram (0.1)	Picolinafen (0.01)	Picoxystrobin (0.01)
Pinoxaden (0.01)	Piperonyl butoxide (PBO) (0.01)	Pirimicarb (0.01)	Pirimicarb (Sum) (0.01)	Pirimicarb, desmethyl- (0.01)	Prochloraz (0.01)
Prochloraz (Sum) (0.01)	Prochloraz-desimidazole-amino (0.01)	Prochloraz-desimidazole-formylami no (0.01)	Profenofos (0.01)	Prohexadione Calcium (0.05)	Pronamide (0.01)
Propamocarb Hydrochloride (0.01)	Propaquizafop (0.01)	Propiconazole (0.01)	Propoxur (0.01)	Proquinazid (0.01)	Prosulfocarb (0.01)
Prothiocarb (0.01)	Prothiocarb hydrochloride (0.01)	Prothioconazole (0.1)	Prothioconazole-desthio (0.01)	Pymetrozine (0.01)	Pyracarbolid (0.01)
Pyraclofos (0.01)	Pyraclostrobin (0.01)	Pyrazophos (0.01)	Pyrethrins (0.01)	Pyrethrins (Total Isomers) (0.01)	Pyridaben (0.01)
Pyridalyl (0.01)	Pyridaphenthion (0.01)	Pyridate (0.01)	Pyridate (Sum) (0.01)	Pyrifenox (0.01)	Pyrimethanil (0.01)
Pyrimidifen (0.01)	Pyriproxyfen (0.01)	Quinclorac (0.01)	Quinmerac (0.01)	Quizalofop (0.01)	Rimsulfuron (0.01)
Rotenone (0.01)	Saflufenacil (0.01)	Sethoxydim (0.01)	Silafluofen (0.01)	Simazine (0.01)	Spinetoram (0.01)
Spinosad (Sum) (0.01)	Spinosad A (0.01)	Spinosad D (0.01)	Spirodiclofen (0.01)	Spirotetramat (0.01)	Spirotetramate (Sum) (0.01)
Spirotetramat-enol (0.01)	Spirotetramat-enolglucoside (0.05)	Spirotetramat-ketohydroxy (0.01)	Spirotetramat-monohydroxy (0.01)	Spiroxamine (0.01)	Sulcotrione (0.02)
Sulfentrazone (0.02)	Tebuconazole (0.01)	Tebufenozide (0.01)	Tebufenpyrad (0.01)	Teflubenzuron (0.01)	TEMBOTRIONE (0.01)
Tepraloxydim (0.01)	Terbufos-sulfone (0.01)	Terbufos-sulfoxide (0.01)	Tetraconazole (0.01)	TFNA (0.01)	TFNA-AM (0.01)
TFNG (0.01)	Thiabendazole (0.01)	Thiacloprid (0.01)	Thiamethoxam (0.01)	Thiamethoxam (Sum) (0.01)	Thidiazuron (0.01)
Thiobencarb (0.01)	Thiocyclam (0.05)	Thiodicarb (0.01)	Thiofanox (0.01)	Thiofanox-sulfone (0.01)	Thiofanox-sulfoxide (0.01)
Thiometon (0.01)	Thiophanate-methyl (0.01)	Tolclofos-methyl (0.01)	Tolylfluanid (0.01)	Tolylfluanid (Sum) (0.01)	Tralkoxydim (0.01)
Triadimefon (0.01)	Triadimenol (0.01)	Triadimenol/Triadimefon (sum) (0.01)	Triapenthenol (0.01)	Triazophos (0.01)	Triazoxide (0.01)
Tribenuron-methyl (0.05)	Trichlorfon (0.01)	Triclopyr (0.01)	Tricyclazole (0.01)	Tridemorph (0.01)	Trifloxystrobin (0.01)
Triflumizole (0.01)	Triflumuron (0.01)	Triflusulfuron-methyl (0.01)	Triforine (0.01)	Trimethycarb, 3,4,5- (0.01)	Trinexapac-ethyl (0.01)
Triticonazole (0.01)	Uniconazole (0.01)	Valifenalate (0.01)	Vamidothion (0.01)	Warfarin (0.01)	Zoxamide (0.01)

SIGNATURE

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Reports without stamp are not valid.

(b) (6)

Mirjam Kortekaas
Business Unit Manager

Report electronically validated by Vince Leeuwestein

EXPLANATORY NOTE

This certificate may only be reproduced complete. The results are only valid for the sample.
The uncertainty of measurement for the applied methods of analysis are retrievable from the ASM department.
Opinions and interpretations in this certificate are outside the scope of accreditation.
The samples will be stored until 84 days after the date of reception.
The analyses that state -M after the reference method should be interpreted as equal to the aforementioned reference method.

The tests identified by the two letters code ZV are performed in laboratory Eurofins Lab Zeeuws-Vlaanderen.

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CANCELS AND REPLACES*

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Sample code Nr.	**890-2016-00009822**	**Report Date**	**16/06/2016**
Analytical Report Nr.	**AR-16-RM-009631-02 / 890-2016-00009822**		

(*this report cancels and replaces the previous one, numbered AR-16-RM-009631-01/890-2016-00009822 dated 09/06/2016 which must be destroyed)

Your contact for Customer Service : Elze Noordzij

Our reference :	890-2016-00009822/ AR-16-RM-009631-02		
Client reference :	**RPI-1615-01-G**		
Sample described as :			
		Your purchase order reference :	4701625406
Sample reception date :	06/06/2016	**Analysis starting date :**	06/06/2016
Analyses requested :	PZV01: Multitest pesticides TQ RMA00: Monstervoorbereiding Chemie		

Projectnaam	DIC/PoFu	**Order ontvangen**	06/06/2016
Monster nr	RPI-1615-01-G	**Artikel/product nr**	Rapeseed protein isolate
Monsteromschrijving	Rapeseed protein isolate		

PESTICIDES RESIDUES	Results
ZVP04 ZV Quantitative screening GC-MS TQ Method : CEN/TR 16468, mod.	
Screened pesticides	<LOQ
ZVP05 ZV Quantitative screening LC-MS Method : CEN/TR 15641, mod.	
Screened pesticides	<LOQ

List of screened molecules and not detected (* = limit of quantification)

ZVP04 ZV Quantitative screening GC-MS TQ (LOQ* mg/kg)

1,4-dimethylnaphtalene (0.01)	1-Naphthol (0.01)	2,4,6-Trichlorophenol (2) (0.01)	2,4-DDD (0.01)	2,6-Dichlorobenzamide (0.01)	2-Phenylphenol (0.01)
3,4-dichloroaniline (0.02)	4,4 -DDD + 2,4 -DDT (0.01)	4,4 -DDT (0.01)	4,4-DDE (0.01)	a, b, d- BHC (0.01)	Acibenzolar-s-methyl (0.01)
Aclonifen (0.01)	Acrinathrin (0.01)	Alachlor (0.01)	Aldrin (0.01)	Allethrin (0.02)	Ametryn (0.01)
Aminocarb (0.01)	Amitraz (0.02)	Anthraquinone (0.01)	Azinphos-ethyl (0.01)	Azoxystrobine (0.02)	Barban/Chlorbufam/Chlorpropham (as 3-Chloroaniline (0.05)
Benalaxyl (0.01)	Bendiocarb (0.01)	Benfluralin (0.01)	Bifenazate (0.05)	Bifenox (0.01)	Bifenthrin (0.01)
Biphenyl (0.01)	Bitertanol (0.01)	Bromacil (0.01)	Bromocyclen (0.01)	Bromophos-ethyl (0.01)	Bromophos-methyl (0.01)
Bromopropylate (0.01)	Bromuconazole (0.02)	Bupirimate (0.01)	Buprofezin (0.01)	Cadusaphos (0.01)	Captafol (0.05)
Captan (0.01)	Captan/Folpet (sum) (0.01)	Carbaryl (0.01)	Carbofuran (0.01)	Carbofuran (Sum) (0.01)	Carbofuranphenol (0.01)
Carbophenothion-methyl (0.01)	Carbosulfan (0.02)	Chinomethionate (0.01)	Chlorbufam (0.01)	Chlordane, cis- (0.01)	Chlordane, trans- (0.01)
Chlorfenapyr (0.01)	Chlorfenson (0.01)	Chlorfenvinphos (0.01)	Chlorfenvinphos cis (0.01)	Chlorfenvinphos trans (0.01)	Chloridazone (0.05)
Chlorobenzilate (0.01)	Chloroneb (0.01)	Chlorothalonil (0.01)	Chlorpropham (0.01)	Chlorpropham (Sum) (0.01)	Chlorpyrifos (-ethyl) (0.01)
Chlorpyrifos-methyl (0.01)	Chlorthal-dimethyl (0.01)	Chlorthiamid (0.2)	Chlozolinate (0.01)	Clefoxydim (0.05)	Clodinafop (0.01)
Clomazone (0.01)	Cloquintocet-mexyl (0.01)	Coumaphos (0.01)	Cyanazine (0.01)	Cyanofenphos (0.01)	Cyanophos (0.01)
Cycloate (0.01)	Cyfluthrin (0.01)	Cyhalothrin (0.01)	Cyhalothrin, lambda- (0.01)	Cypermethrin (0.01)	Cyphenothrin (0.05)
Cyproconazole (0.01)	Cyprodinil (0.01)	DDT (total) (0.01)	Deltamethrin (0.01)	Demeton-O (0.01)	Demeton-S (0.01)
Demeton-S-methyl (0.01)	Desmetryn (0.01)	Diazinon (0.01)	Dichlobenil (0.02)	Dichlofenthion (0.01)	Dichloranilin-3,5 (0.02)
Dichlorobenzophenone, p,p- (0.01)	Dicloran (0.01)	Dicofol, p,p- (0.01)	Dieldrin (0.01)	Dieldrin (Sum) (0.01)	Diethofencarb (0.01)
Difenoconazole (0.01)	Diflufenican (0.01)	Dimethoate (0.01)	Dimethylaminosulphotoluidide (DMST) (0.02)	Diniconazole (0.01)	Diphenamid (0.01)
Diphenylamine (0.01)	Disulfoton (0.02)	Disulfoton (sum) (0.02)	Disulfoton-sulfon (0.01)	Ditalimfos (0.01)	Endosulfan (total) (0.04)
Endosulfan sulphate (0.02)	Endosulfan, alpha- (0.01)	Endosulfan, beta- (0.01)	Endrin (0.01)	EPN (0.01)	Epoxiconazole (0.01)
EPTC (0.01)	Esfenvalerate (0.01)	Etaconazole (0.01)	Ethion (0.01)	Ethofumesate (0.01)	Ethoprophos (0.01)
Ethoxyquin (0.01)	Etofenprox (0.01)	Etridiazole (0.02)	Etrimfos (0.01)	Famoxadone (0.05)	Fenarimol (0.01)
Fenazaquin (0.01)	Fenfluthrin (0.01)	Fenhexamid (0.02)	Fenitrothion (0.01)	Fenobucarb (0.01)	Fenothrine (0.01)
Fenoxycarb (0.05)	Fenpiclonil (0.01)	Fenpropidin (0.01)	Fenpropimorph (0.01)	Fenpyroximate (0.02)	Fenson (0.01)
Fensulfothion (0.01)	Fenthion (0.01)	Fenthion-sulfoxide (0.01)	Fenvalerate (all isomers) (0.01)	Fipronil (0.005)	Fipronil (sum) (0.005)
Fipronil-sulfone (0.005)	Fluazifop-butyl (0.01)	Fluchloralin (0.01)	Flucythrinate (0.01)	Fludioxonil (0.01)	Fluquinconazole (0.01)
Flurprimidol (0.01)	Flusilazole (0.01)	Flutolanil (0.01)	Folpet (0.01)	Fonofos (0.01)	Formothion (0.01)

ZVP04 ZV Quantitative screening GC-MS TQ (LOQ* mg/kg)

Fuberidazole (0.01)	Furalaxyl (0.01)	Furmecyclox (0.05)	Halfenprox (0.01)	Haloxyfop-2-ethoxyethyl (0.01)	HCH (sum) (0.02)
HCH, alpha- (0.01)	HCH, beta- (0.01)	HCH, delta- (0.01)	Heptachlor (0.01)	Heptachlor (sum) (0.01)	Heptachlor epoxide, cis- (0.01)
Heptachlor epoxide, trans- (0.02)	Heptenophos (0.01)	Hexachlorobenzene (HCB) (0.01)	Hexachlorobutadiene (0.01)	Hexaconazole (0.01)	Hexazinone (0.01)
Imazethapyr (0.05)	Iodofenphos (0.01)	Iprobenfos (0.01)	Iprodione (0.01)	Isazophos (0.01)	Isocarbofos (0.01)
Isodrin (0.01)	Isofenphos (0.01)	Isofenphos-methyl (0.01)	Isofenphos-oxon (0.01)	Isoprocarb (0.01)	Isoproturon (0.01)
Isoxadifen-ethyl (0.01)	Kresoxim-methyl (0.01)	Lenacil (0.01)	Leptophos (0.01)	Malaoxon (0.01)	Malathion, fyfanon (0.01)
Malathion/Malaoxon (sum) (0.02)	Mecarbam (0.01)	Mepanipyrim (0.01)	Mephosfolan (0.02)	Mepronil (0.01)	Metalaxyl (0.01)
Metazachlor (0.01)	Methabenzthiazuron (0.01)	Methacriphos (0.01)	Methidathion (0.01)	Methiocarb (0.01)	Methiocarb (sum) (0.02)
Methoprotryne (0.01)	Methoxychlor (0.01)	Methyl Parathion (0.01)	Metobromuron (0.01)	Metolcarb (0.01)	Metrafenone (0.01)
Metribuzin (0.01)	Mevinphos (0.01)	Mirex (0.02)	Molinate (0.01)	Myclobutanil (0.01)	Naphthalene Acetamide (0.05)
Napropamide (0.01)	Nitrapyrin (0.01)	Nitrofen (0.01)	Nitrothal-isopropyl (0.01)	Norflurazon (0.01)	o,p'-DDE (0.01)
Ofurace (0.01)	Oxadiazon (0.01)	Oxadixyl (0.02)	Oxydemeton-methyl (sum) (0.01)	Oxyfluorfen (0.01)	Paraoxon (0.01)
Paraoxon-methyl (0.01)	Parathion (0.01)	Parathion-methyl (Sum) (0.01)	Penconazole (0.01)	Pencycuron (0.02)	Pendimethalin (0.01)
Pentachloranisole (0.01)	Pentachloroaniline (0.01)	Pentachlorobenzene (0.01)	Pentachlorophenol (0.05)	Permethrin-cis (0.01)	Permethrins (sum) (0.02)
Permethrin-trans (0.01)	Perthane (0.01)	Phenkapton (0.01)	Phenothrin (0.02)	Phenthoate (0.01)	Phosalone (0.01)
Phosfolan (0.02)	Phosmet (0.01)	Phosmet (Sum) (0.02)	Phthalimid (0.01)	Picoxystrobin (0.01)	Piperonyl butoxide (PBO) (0.01)
Pirimicarb (0.01)	Pirimicarb (Sum) (0.01)	Pirimicarb, desmethyl- (0.01)	Pirimicarb, desmethyl-formamido- (0.01)	Pirimiphos-ethyl (0.01)	Pirimiphos-methyl (0.01)
Procymidone (0.01)	Profenofos (0.01)	Profluralin (0.01)	Promecarb (0.01)	Prometryn (0.01)	Pronamide (0.01)
Propachlor (0.01)	Propanil (0.01)	Propargite (0.02)	Propazine (0.01)	Propetamphos (0.01)	Propham (0.01)
Propiconazole (0.01)	Propoxur (0.01)	Propoxycarbazone (0.05)	Prosulfocarb (0.01)	Prothioconazole (0.01)	Prothioconazole-desthio (0.01)
Prothiofos (0.01)	Pyraflufen-ethyl (0.01)	Pyrazophos (0.01)	Pyrethrins (0.2)	Pyridaben (0.01)	Pyridaphenthion (0.01)
Pyrifenox (E-) (0.01)	Pyrifenox (Z-) (0.01)	Pyrimethanil (0.01)	Pyriproxyfen (0.01)	Quinalphos (0.01)	Quinoxyfen (0.01)
Quintozene (0.01)	Quintozene (sum) (0.01)	Quizalofop ethyl (0.01)	Ronnel (0.01)	S 421 (0.05)	Silthiofam (0.01)
Simazine (0.01)	S-Metolachlor (0.01)	Spiromesifen (0.01)	Spiroxamine (0.01)	Sulfotep (2) (0.01)	Sulphur (S) (0.2)
Sulprofos (0.01)	tau-Fluvalinate (0.01)	Tebuconazole (0.01)	Tebufenpyrad (0.01)	Tecnazene (0.01)	Tefluthrin (0.01)
Telodrin (0.01)	Terbacil (0.01)	Terbumeton (0.01)	Terbuthylazine (0.01)	Terbutryn (0.01)	Tetrachlorvinphos (0.01)
Tetraconazole (0.01)	Tetradifon (0.01)	Tetramethrin (0.01)	Tetrasul (0.01)	THPI (Tetrahydrophthalimide) (0.01)	Tolclofos-methyl (0.01)
Transfluthrin (0.01)	Triadimefon (0.01)	Triadimenol (0.01)	Triadimenol/Triadimefon (sum) (0.02)	Triallate (0.01)	Triazamate (0.01)
Triazophos (0.01)	Trichloronat (0.01)	Trifloxystrobin (0.01)	Triflumizole (0.01)	Trifluralin (0.01)	Trinexapac-ethyl (0.01)
Trithion (0.01)	Vinclozolin (0.01)	Vinclozolin (Sum) (0.01)			

ZVP05 ZV Quantitative screening LC-MS (LOQ* mg/kg)

1,2,4-triazole (0.1)	1-Naphthylacetic acid (0.05)	2,4,5-T (0.01)	2,4,6-Trichlorophenoxyacetic Acid (0.01)	2,4-D (0.01)	2,4-D butyric acid (2,4-DB) (0.01)
2,4'-Formoxylidid (0.01)	2-Naphthyloxyacetic acid (0.01)	3-Hydroxycarbofuran (0.01)	3-ketocarbofuran (0.01)	4-CPA (0.01)	6-Benzyladenine (0.01)
6-Chlor-3-phenylpyridazin-4-ol (0.01)	Abamectin (0.01)	Acephate (0.01)	Acequinocyl (0.01)	Acetamiprid (0.01)	Alanycarb (0.01)
Aldicarb (0.01)	Aldicarb (sum) (0.01)	Aldicarb-sulfone (0.01)	Aldicarb-sulfoxide (0.01)	Ametoctradin (0.01)	Aminopyralid (0.25)
Amisulbrom (0.01)	Amitraz (0.05)	Amitraz (as 2,4-Dimethylaniline) (0.1)	Amitraz (sum) (0.01)	Amitrole (0.5)	Anilazine (0.05)
Asulam (0.01)	Atrazine (0.01)	Avermectin B1a (0.01)	Avermectin B1b (0.01)	Azaconazole (0.01)	Azadirachtin (0.01)
Azamethiphos (0.01)	Azimsulfuron (0.01)	Azinphos-methyl (0.01)	Azoxystrobine (0.01)	Barban (0.01)	Benoxacor (0.01)
Bentazone (0.01)	Benthiavalicarb, isopropyl- (0.01)	Bitertanol (0.01)	Bixafen (0.01)	Boscalid (0.01)	Bromoxynil (0.01)
Bromuconazole (0.01)	Bupirimate (0.01)	Buprofezin (0.01)	Butafenacil (0.01)	Butocarboxim-sulfoxide (0.01)	Butoxycarboxim (0.01)
Buturon (0.01)	Carbaryl (0.01)	Carbendazim (0.01)	Carbendazim/Benomyl (sum) (0.01)	Carbetamide (0.01)	Carbofuran (0.01)
Carbofuran (Sum) (0.01)	Carbosulfan (0.01)	Carfentrazone (0.01)	Carpropamid (0.01)	Chloorthiofos (0.01)	Chloramben (0.1)
Chlorantraniliprole (0.01)	Chlorbromuron (0.01)	Chlordecon (0.01)	Chlordimeform (0.01)	Chlorfluazuron (0.01)	Chlorothalonil-4-hydroxy (0.01)
Chlorotoluron (0.01)	Chlorthiofos-sulfone (0.01)	Chlorthion (0.01)	Cinerin I (0.01)	Clethodim (0.01)	Clethodim/Sethoxydim (Sum) (0.01)
Climbazole (0.01)	Clofentezine (0.01)	Clopyralid (0.5)	Clothianidin (0.01)	Crimidine (0.01)	Cyantraniliprole (0.01)
Cyazofamid (0.01)	Cycloxydim (0.01)	Cyflufenamid (0.01)	Cyflumetofen (0.01)	Cymoxanil (0.01)	Cyproconazole (0.01)
Cyprodinil (0.01)	Cyromazine (0.05)	Cythioate (0.01)	Daminozide (0.01)	Demeton-S-methyl-sulfone (0.01)	Desmedipham (0.01)
Diafenthiuron (0.01)	Dicamba (0.05)	Dichlofluanid (0.01)	Dichlorophen (0.01)	Dichlorprop (0.01)	Dichlorvos (0.01)
Diclobutrazol (0.01)	Dicrotophos (0.01)	Diethofencarb (0.01)	Diethyltoluamide (0.01)	Difenoconazole (0.01)	Diflubenzuron (0.01)
Dimethenamid (0.01)	DIMETHIRIMOL (0.01)	Dimethoate (0.01)	Dimethoate/Omethoate (sum) (0.01)	Dimethomorph (0.01)	Dimethylaminosulphotoluidide (DMST) (0.01)
Dimethylphenylsulfamide (DMSA) (0.01)	Dimoxystrobin (0.01)	Diniconazole (0.01)	Dinocap (0.01)	Dinotefuran (0.01)	Dipropetryn (0.01)
Dithianon (0.01)	Diuron (0.01)	Dodemorf (0.01)	Dodine (0.01)	Emamectin, benzoate- (0.01)	Epoxiconazole (0.01)
Ethiofencarb (0.01)	Ethiofencarb (sum) (0.01)	Ethiofencarb-sulfone (0.01)	Ethiofencarb-sulfoxide (0.01)	Ethiprole (0.01)	Ethirimol (0.01)
Ethoxysulfuron (0.01)	Ethylene thiourea (ETU) (0.5)	Etofenprox (0.01)	Etoxazole (0.01)	Famophos (0.01)	Famoxadone (0.01)
Fenamidone (0.01)	Fenamiphos (sum) (0.01)	Fenamiphos-sulfone (0.01)	Fenamiphos-sulfoxide (0.01)	Fenarimol (0.02)	Fenazaquin (0.01)
Fenbuconazole (0.01)	Fenhexamid (0.01)	Fenoprop (0.01)	Fenoxycarb (0.01)	Fenpropidin (0.01)	Fenpropimorph (0.01)
Fenpyrazamine (0.01)	Fenpyroximate (0.01)	Fenthion (0.01)	Fenthion (sum) (0.01)	Fenthion-oxon (0.01)	Fenthion-oxon-sulfone (0.01)
Fenthion-oxon-sulfoxide (0.01)	Fenthion-sulfone (0.01)	Fenthion-sulfoxide (0.01)	Fipronil (0.01)	Flazasulfuron (0.01)	Flonicamid (0.01)
Flonicamid (Sum) (0.01)	Florasulam (0.01)	Fluazifop (0.01)	Fluazifop-P-butyl (0.01)	Fluazinam (0.01)	Flubendiamide (0.01)
Flucycloxuron (0.01)	Flufenacet (0.01)	Flufenoxuron (0.01)	Flumioxazin (0.01)	Fluopicolid (0.01)	Fluopyram (0.01)
Fluotrimazole (0.01)	Fluoxastrobin (0.01)	Flupyradifurone (0.01)	Fluquinconazole (0.01)	Fluroxypyr (0.02)	Fluroxypyr (Sum) (0.01)
Fluroxypyr-Methylheptyl (0.01)	Flusilazole (0.01)	Fluthiacet-methyl (0.01)	Flutolanil (0.01)	Flutriafol (0.01)	Fluxapyroxad (0.01)
Forchlorfenuron (0.01)	Formetanate (0.01)	Fosetyl-aluminium (0.5)	Fosthiazate (0.01)	Furalaxyl (0.01)	Furathiocarb (0.01)
Furmecyclox (0.02)	HALOFENOZIDE (0.01)	Haloxyfop (0.01)	Hexaconazole (0.01)	Hexaflumuron (0.01)	Hexythiazox (0.01)
HYMEXAZOL (0.1)	Imazalil (0.01)	Imazaquin (0.01)	Imibenconazole (0.01)	Imidacloprid (0.01)	Indoxacarb (0.01)
Iodosulfuron methyl (0.01)	Ioxynil (0.02)	Iprovalicarb (0.01)	Isocarbofos (0.01)	Isoprothiolane (0.01)	Isopyrazam (0.01)
Isouron (0.01)	Isoxaben (0.01)	Isoxaflutole (0.01)	Isoxathion (0.01)	Jasmolin I (0.01)	Kresoxim-methyl (0.01)
Lenacil (0.01)	Linuron (0.01)	Lufenuron (0.01)	Malathion (Sum) (0.01)	Malathion, fyfanon (0.01)	Maleic hydrazide (MH-30) (0.5)
Mandipropamid (0.05)	MCPA (0.01)	MCPA/MCPB (sum) (0.01)	MCPB (0.01)	Mecoprop (0.01)	Mefenacet (0.01)
Mefenpyr-diethyl (0.01)	Mepanipyrim (0.01)	Mephosfolan (0.01)	Mepronil (0.01)	MEPTYLDINOCAP (0.01)	Mesosulfuron-methyl (0.01)
Mesotrione (0.01)	Metaflumizone (0.01)	Metalaxyl (0.01)	Metaldehyde (0.01)	Metamitron (0.01)	Metasyatox-R (0.01)

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CANCELS AND REPLACES*

LabCo

Sample code Nr.	**890-2016-00009822**	**Report Date 16/06/2016**	**Page 3/3**
Analytical Report Nr.	**AR-16-RM-009631-02 / 890-2016-00009822**		

ZVP05 ZV Quantitative screening LC-MS (LOQ* mg/kg)

Metconazole (0.02)	Methamidophos (0.01)	Methidathion (0.01)	Methiocarb (0.01)	Methiocarb (sum) (0.01)	Methiocarb-sulfone (0.01)
Methiocarb-sulfoxide (0.01)	Methomyl (0.01)	Methomyl/Thiodicarb (sum) (0.01)	Methoxyfenozide (0.01)	Metobromuron (0.01)	Metoxuron (0.01)
Metsulfuron-methyl (0.02)	Milbemectin (sum) (0.1)	Milbemectin A3 (0.1)	Milbemectin A4 (0.1)	Monocrotophos (0.01)	Monolinuron (0.01)
Monuron (0.01)	Myclobutanil (0.01)	N-2,4-dimethylphenyl-N-methylformamidine (0.01)	Naled (0.01)	Neburon (0.01)	Nicosulfuron (0.01)
Nitenpyram (0.01)	Nitralin (0.01)	Novaluron (0.01)	Nuarimol (0.01)	Omethoate (0.01)	Oxadixyl (0.01)
Oxamyl (0.01)	Oxasulfuron (0.01)	Oxycarboxin (0.01)	Oxydemeton-methyl (sum) (0.01)	Paclobutrazol (0.01)	Paraoxon-ethyl (0.01)
Paraoxon-methyl (0.01)	Parathion-methyl (Sum) (0.01)	Pebulate (0.01)	Penconazole (0.01)	Pencycuron (0.01)	Penflufen (0.01)
Penthiopyrad (0.01)	Phenamiphos (0.01)	Phenisopham (0.01)	Phenmedipham (0.01)	Phorate (0.01)	Phorate (sum) (0.01)
Phorate-sulfone (0.01)	Phorate-sulfoxide (0.01)	Phosalone (0.01)	Phosmet (0.01)	Phosmet (Sum) (0.01)	Phosmet-oxon (0.01)
Phosphamidon (0.01)	Phoxim (0.01)	Picaridin (0.01)	Picloram (0.1)	Picolinafen (0.01)	Picoxystrobin (0.01)
Pinoxaden (0.01)	Piperonyl butoxide (PBO) (0.01)	Pirimicarb (0.01)	Pirimicarb (Sum) (0.01)	Pirimicarb, desmethyl- (0.01)	Prochloraz (0.01)
Prochloraz (Sum) (0.01)	Prochloraz-desimidazole-amino (0.01)	Prochloraz-desimidazole-formylamino (0.01)	Profenofos (0.01)	Prohexadione Calcium (0.05)	Pronamide (0.01)
Propamocarb Hydrochloride (0.01)	Propaquizafop (0.01)	Propiconazole (0.01)	Propoxur (0.01)	Proquinazid (0.01)	Prosulfocarb (0.01)
Prothiocarb (0.01)	Prothiocarb hydrochloride (0.01)	Prothioconazole (0.1)	Prothioconazole-desthio (0.01)	Pymetrozine (0.01)	Pyracarbolid (0.01)
Pyraclofos (0.01)	Pyraclostrobin (0.01)	Pyrazophos (0.01)	Pyrethrins (0.01)	Pyrethrins (Total Isomers) (0.01)	Pyridaben (0.01)
Pyridalyl (0.01)	Pyridaphenthion (0.01)	Pyridate (0.01)	Pyridate (Sum) (0.01)	Pyrifenox (0.01)	Pyrimethanil (0.01)
Pyrimidifen (0.01)	Pyriproxyfen (0.01)	Quinclorac (0.01)	Quinmerac (0.01)	Quizalofop (0.01)	Rimsulfuron (0.01)
Rotenone (0.01)	Saflufenacil (0.01)	Sethoxydim (0.01)	Silafluofen (0.01)	Simazine (0.01)	Spinetoram (0.01)
Spinosad (Sum) (0.01)	Spinosad A (0.01)	Spinosad D (0.01)	Spirodiclofen (0.01)	Spirotetramat (0.01)	Spirotetramate (Sum) (0.01)
Spirotetramat-enol (0.01)	Spirotetramat-enolglucoside (0.05)	Spirotetramat-ketohydroxy (0.01)	Spirotetramat-monohydroxy (0.01)	Spiroxamine (0.01)	Sulcotrione (0.02)
Sulfentrazone (0.02)	Tebuconazole (0.01)	Tebufenozide (0.01)	Tebufenpyrad (0.01)	Teflubenzuron (0.01)	TEMBOTRIONE (0.01)
Tepraloxydim (0.01)	Terbufos-sulfone (0.01)	Terbufos-sulfoxide (0.01)	Tetraconazole (0.01)	TFNA (0.01)	TFNA-AM (0.01)
TFNG (0.01)	Thiabendazole (0.01)	Thiacloprid (0.01)	Thiamethoxam (0.01)	Thiamethoxam (Sum) (0.01)	Thidiazuron (0.01)
Thiobencarb (0.01)	Thiocyclam (0.05)	Thiodicarb (0.01)	Thiofanox (0.01)	Thiofanox-sulfone (0.01)	Thiofanox-sulfoxide (0.01)
Thiometon (0.01)	Thiophanate-methyl (0.01)	Tolclofos-methyl (0.01)	Tolylfluanid (0.01)	Tolylfluanid (Sum) (0.01)	Tralkoxydim (0.01)
Triadimefon (0.01)	Triadimenol (0.01)	Triadimenol/Triadimefon (sum) (0.01)	Triapenthenol (0.01)	Triazophos (0.01)	Triazoxide (0.01)
Tribenuron-methyl (0.05)	Trichlorfon (0.01)	Triclopyr (0.01)	Tricyclazole (0.01)	Tridemorph (0.01)	Trifloxystrobin (0.01)
Triflumizole (0.01)	Triflumuron (0.01)	Triflusulfuron-methyl (0.01)	Triforine (0.01)	Trimethycarb, 3,4,5- (0.01)	Trinexapac-ethyl (0.01)
Triticonazole (0.01)	Uniconazole (0.01)	Valifenalate (0.01)	Vamidothion (0.01)	Warfarin (0.01)	Zoxamide (0.01)

SIGNATURE

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Reports without stamp are not valid.

(b) (6)

Mirjam Kortekaas
Business Unit Manager

Report electronically validated by Vince Leeuwestein

EXPLANATORY NOTE

This certificate may only be reproduced complete. The results are only valid for the sample.
The uncertainty of measurement for the applied methods of analysis are retrievable from the ASM department.
Opinions and interpretations in this certificate are outside the scope of accreditation.
The samples will be stored until 84 days after the date of reception.
The analyses that state -M after the reference method should be interpreted as equal to the aforementioned reference method.

The tests identified by the two letters code ZV are performed in laboratory Eurofins Lab Zeeuws-Vlaanderen.

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Appendix 5
Acrylamide Analysis

eurofins | LabCo

Analytical report

DSM Food Specialties BV
For the attention of
Mr. Leon Coulier
A. Fleminglaan 1
2613 AX DELFT
NEDERLAND

Email Leon.Coulier@dsm.com

Copy to : Meneer / mevrouw Abello (Nicolas.Abello@dsm.com), Meneer / mevrouw Boogers (Ilco.Boogers@DSM.COM), Meneer / mevrouw Quality department (fss-postoffice.dbs@dsm.com)

Sample code Nr.	**890-2016-00012422**	**Report Date**	**18/07/2016**
Analytical Report Nr.	**AR-16-RM-012259-01 / 890-2016-00012422**		

Your contact for Customer Service : Elze Noordzij

Our reference :	890-2016-00012422/ AR-16-RM-012259-01		
Client reference :	**RPI-1536-01-G**		
Sample described as :			
Packaging :	Plastic jar - 100 gr.		
		Your purchase order reference :	4701625406
Sample reception date :	12/07/2016	**Analysis starting date :**	12/07/2016
Analyses requested :	JJ62M: Acrylamide (Baby food) RMA00: Sample preparation Chemistry RMA05: Project handling		

Project name	DIC/P0Fu	**Order received**	12/07/2016
Sample no	RPI-1536-01-G	**Article/product no**	Rapeseed Protein Isolate
Sample description	Rapeseed Protein Isolate		

CHEMICAL ANALYSIS		Results
JJ62M JC Acrylamide	**Method : Internal method, LC-MS/MS**	
(Q)	Acrylamide	<5 µg/kg

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Rotterdam

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(b) (6)

Mirjam Kortekaas
Business Unit Manager

Report electronically validated by K ki Brekelmans

EXPLANATORY NOTE

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The tests identified by the two letters code JC are performed in laboratory Eurofins WEJ Contaminants GmbH. The symbol (Q) identifies the tests under accreditation EN ISO/IEC 17025:2005 DAKKS D-PL-14602-01-00.

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eurofins | LabCo

Analytical report

DSM Food Specialties BV
For the attention of
Mr. Leon Coulier
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NEDERLAND

Email Leon.Coulier@dsm.com

Copy to : Meneer / mevrouw Abello (Nicolas.Abello@dsm.com), Meneer / mevrouw Boogers (Ilco.Boogers@DSM.COM), Meneer / mevrouw Quality department (fss-postoffice.dbs@dsm.com)

Sample code Nr.	**890-2016-00012423**	**Report Date**	**18/07/2016**
Analytical Report Nr.	**AR-16-RM-012258-01 / 890-2016-00012423**		

Your contact for Customer Service : Elze Noordzij

Our reference :	890-2016-00012423/ AR-16-RM-012258-01		
Client reference :	**RPI-1543-03-P**		
Sample described as :			
Packaging :	Plastic jar - 80 gr.		
		Your purchase order reference :	4701625406
Sample reception date :	12/07/2016	**Analysis starting date :**	12/07/2016
Analyses requested :	JJ62M: Acrylamide (Baby food) RMA00: Sample preparation Chemistry		

Project name	DIC/P0Fu	**Order received**	12/07/2016
Sample no	RPI-1543-03-P	**Article/product no**	Rapeseed Protein Isolate
Sample description	Rapeseed Protein Isolate		

CHEMICAL ANALYSIS	Results
JJ62M JC Acrylamide Method : Internal method, LC-MS/MS	
(Q) Acrylamide	<5 µg/kg

SIGNATURE

Eurofins | LabCo Rotterdam

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(b) (6)

Mirjam Kortekaas
Business Unit Manager

Report electronically validated by K ki Brekelmans

EXPLANATORY NOTE
This certificate may only be reproduced complete. The results are only valid for the sample.
The uncertainty of measurement for the applied methods of analysis are retrievable from the ASM department.
Opinions and interpretations in this certificate are outside the scope of accreditation.
The samples will be stored until 84 days after the date of reception.
The analyses that state -M after the reference method should be interpreted as equal to the aforementioned reference method.

The tests identified by the two letters code JC are performed in laboratory Eurofins WEJ Contaminants GmbH. The symbol (Q) identifies the tests under accreditation EN ISO/IEC 17025:2005 DAKKS D-PL-14602-01-00.

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Analytical report

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Sample code Nr.	**890-2016-00012424**	**Report Date**	**18/07/2016**
Analytical Report Nr.	**AR-16-RM-012257-01 / 890-2016-00012424**		

Your contact for Customer Service : Elze Noordzij

Our reference :	890-2016-00012424/ AR-16-RM-012257-01		
Client reference :	**RPI-1549-02-P**		
Sample described as :			
Packaging :	Plastic jar - 80 gr.		
		Your purchase order reference :	4701625406
Sample reception date :	12/07/2016	**Analysis starting date :**	12/07/2016
Analyses requested :	JJ62M: Acrylamide (Baby food) RMA00: Sample preparation Chemistry		

Project name	DIC/P0Fu	**Order received**	12/07/2016
Sample no	RPI-1549-02-P	**Article/product no**	Rapeseed Protein Isolate
Sample description	Rapeseed Protein Isolate		

CHEMICAL ANALYSIS	Results
JJ62M JC Acrylamide Method : Internal method, LC-MS/MS	
(Q) Acrylamide	<5 µg/kg

SIGNATURE

Rapporten zonder stempel zijn ongeldig.
Reports without stamp are not valid.

(b) (6)

Mirjam Kortekaas
Business Unit Manager

Report electronically validated by K ki Brekelmans

EXPLANATORY NOTE
This certificate may only be reproduced complete. The results are only valid for the sample.
The uncertainty of measurement for the applied methods of analysis are retrievable from the ASM department.
Opinions and interpretations in this certificate are outside the scope of accreditation.
The samples will be stored until 84 days after the date of reception.
The analyses that state -M after the reference method should be interpreted as equal to the aforementioned reference method.

The tests identified by the two letters code JC are performed in laboratory Eurofins WEJ Contaminants GmbH. The symbol (Q) identifies the tests under accreditation EN ISO/IEC 17025:2005 DAKKS D-PL-14602-01-00.

Eurofins Food Testing Rotterdam BV
Bijdorpplein 17-23
NL-2992 LB Barendrecht
the NETHERLANDS

Phone +31 180 643 000
Fax
ASM-NL-Rotterdam@eurofins.com
www.eurofins.com

Appendix 6
Stability Study Results

Stability study canola protein isolate

Procedure

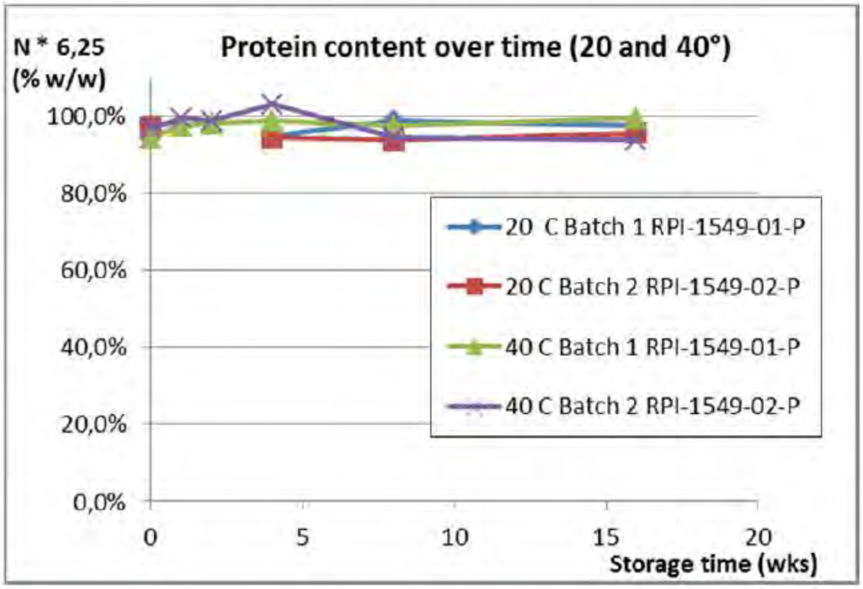
30 and 5 g Samples of two batches of canola/ rapeseed protein isolate were stored in tubes with minimum headspace and extra wrapped in air-tight aluminate foil were stored in incubators at 20 and 40°C. Over a period of 16 weeks, samples were taken from the incubator and analyzed on protein content and protein solubility.

The protein content was determined by Kjeldahl determination of nitrogen content multiplying with the accepted default protein conversion factor of 6.25. The standard deviation of this determination is 2% compared to the control sample and maximally relative 5% variation between duplicate samples.

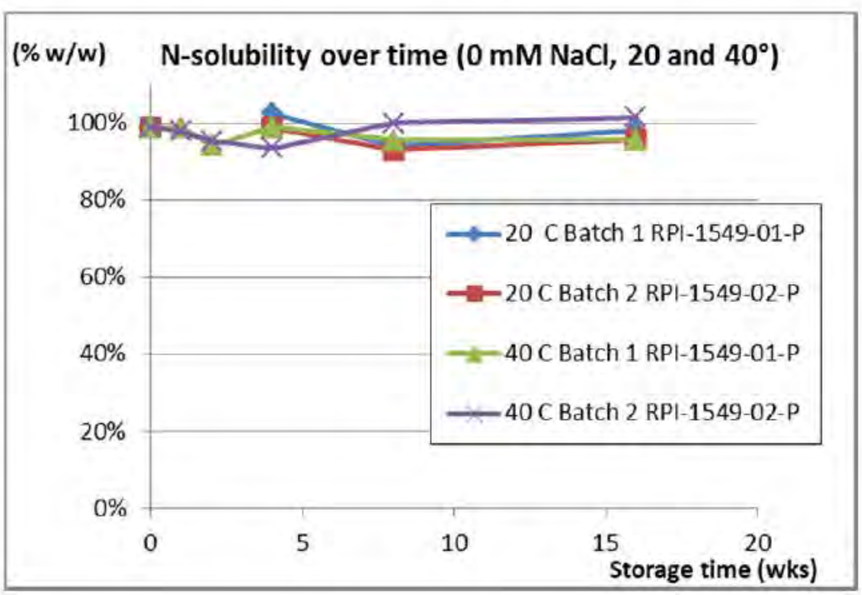
Protein solubility was determined at pH 6.8 and two different salt concentrations (0 and 150 mM). A canola protein isolate dispersion in water is incubated at a certain time and temperature to solubilize protein. Next, a solid/liquid separation is performed by centrifugation, and the soluble -clear- part is analyzed for protein content by Kjeldahl analysis. The protein solubility is expressed as percentage fraction of the soluble protein as to the total protein.

Results

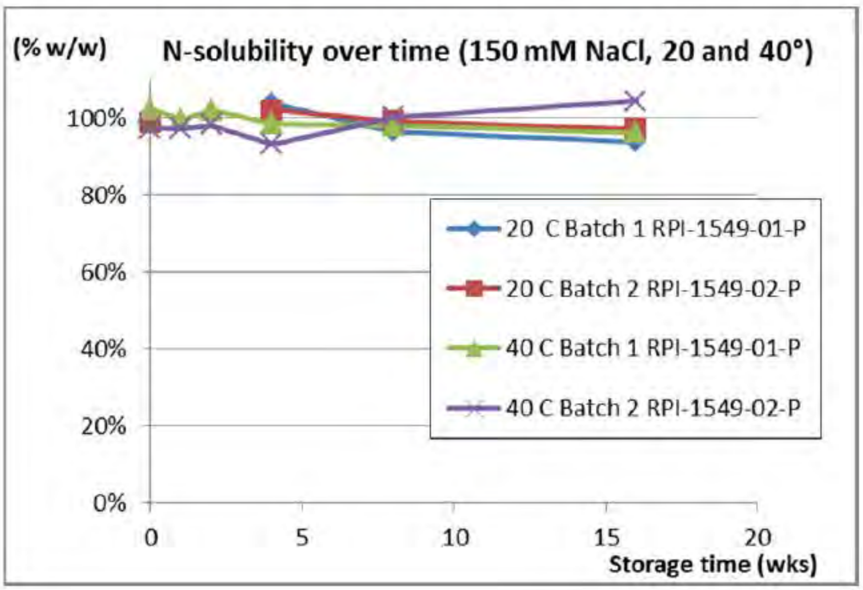
N * 6,25 (%w/w)				
Weeks	**20 C**	**20 C**	**40 C**	**40 C**
	Batch 1 RPI-1549-01-P	**Batch 2 RPI-1549-02-P**	**Batch 1 RPI-1549-01-P**	**Batch 2 RPI-1549-02-P**
0	94,4%	96,9%	94,4%	96,9%
1			97,5%	99,4%
2			98,1%	98,8%
4	95,0%	94,4%	98,8%	103,1%
8	98,8%	93,8%	97,5%	94,4%
16	97,5%	95,6%	99,4%	93,8%



N-solubility (%) at 0 mM NaC;				
Weeks	20 C	20 C	40 C	40 C
	Batch 1 RPI-1549-01-P	Batch 2 RPI-1549-02-P	Batch 1 RPI-1549-01-P	Batch 2 RPI-1549-02-P
0	99%	99%	99%	99%
1			99%	98%
2			94%	96%
4	103%	99%	99%	94%
8	94%	93%	96%	100%
16	98%	96%	96%	102%



N-solubility (%) at 150 mM NaC;				
Weeks	20 C	20 C	40 C	40 C
	Batch 1 RPI-1549-01-P	Batch 2 RPI-1549-02-P	Batch 1 RPI-1549-01-P	Batch 2 RPI-1549-02-P
0	99%	99%	102%	97%
1			100%	97%
2			102%	98%
4	104%	102%	99%	93%
8	97%	99%	98%	100%
16	94%	97%	96%	104%



Conclusion

Taking the variation of the analysis into account, the protein (N*6.25) content and protein solubility in the canola/ rapeseed protein isolate remain constant during 16 weeks storage at 20 and 40°C.

In general, industry practice indicates that 1 week of shelf life at 40°C represents 4 weeks of shelf life at 20°C.

Appendix 7
GMP Certificate
Rapeseed Meal Supplier

schouten certification

Process Certificate

GMP+ Feed Certification scheme – module Feed Safety Assurance **issued to:**

Ernst Rickermann Landhandel GmbH — Boschstrasse 11, 49770 Herzlake, Germany

for the business location(s): Boschstrasse 11, 49770 Herzlake, Germany
Registration number GMP+ Q520

Schouten Certification (with registration number PDV100264) declares that it has justifiable confidence that the process(es) mentioned below at the company location mentioned above comply (complies) with the applicable requirements and conditions of the standard(s) mentioned below of the GMP+ Feed Certification scheme – module Feed Safety Assurance (based on the GMP+ C6) of GMP+ International B.V. in Rijswijk, the Netherlands (www.GMPplus.org).

Standard(s)

B1	Production, trade and services (storage and transhipment)
B4	Transport (and affreightment)

The certificate relates to the process(es)

TCF	The trade in compound feeds.
TFM	The trade in feed materials.
PCF	The production and/or processing of compound feeds.
PFM	The production and/or processing of feed materials.
RT	Road transport of animal feeds.
AFRAT	Affreightment of rail transport of animal feeds.

(b) (6)

Number certificate	EP 16/02401
Valid from	08-02-2016
Valid until	31-01-2019
Date issued/modified	03-02-2016

Sch[redacted]

M.E.[redacted]

Schouten Certification B.V.
P.O. Box 1, NL-4280 CA Andel
tel. +31 (0)183 44 63 80
fax +31 (0)183 44 85 68
info@schoutencertification.nl
www.schoutencertification.nl
Chamber of Commerce 18068675
VAT NL811198236B01

Appendix 8
Pesticide Residue
Rapeseed Presscake

DSM Food Specialties BV
For the attention of
Mr. Leon Coulier
A. Fleminglaan 1
2613 AX DELFT
NEDERLAND

Copy to : Meneer / mevrouw Abello (Nicolas.Abello@dsm.com), Meneer / mevrouw Boogers (Ilco.Boogers@DSM.COM), Meneer / mevrouw Quality department (fss-postoffice.dbs@dsm.com)

Email Leon.Coulier@dsm.com

Sample code Nr.	**890-2016-00010137**	**Report Date**	**16/06/2016**
Analytical Report Nr.	**AR-16-RM-009912-02 / 890-2016-00010137**		

(*this report cancels and replaces the previous one, numbered AR-16-RM-009912-01/890-2016-00010137 dated 15/06/2016 which must be destroyed)

Your contact for Customer Service : Elze Noordzij

Our reference :	890-2016-00010137/ AR-16-RM-009912-02		
Client reference :	**RPC-95423**		
Sample described as :			
		Your purchase order reference :	4701625406
Sample reception date :	10/06/2016	**Analysis starting date :**	10/06/2016
Sampling/Transport :	TNT 166231149		
Analyses requested :	PZV01: Multitest pesticides TQ RMA00: Monstervoorbereiding Chemie		
Projectnaam	DIC/PoFu	**Order ontvangen**	10/06/2016
Batch nr	RPC-95423	**Artikel/product nr**	Rapeseed pressed cake
Monsteromschrijving	Rapeseed pressed cake		

PESTICIDES RESIDUES				Results
ZVP04	**ZV**	**Quantitative screening GC-MS TQ**	**Method : CEN/TR 16468, mod.**	
	Screened pesticides			<LOQ
ZVP05	**ZV**	**Quantitative screening LC-MS**	**Method : CEN/TR 15641, mod.**	
	Screened pesticides			<LOQ

List of screened molecules and not detected (* = limit of quantification)

ZVP04 ZV Quantitative screening GC-MS TQ (LOQ* mg/kg)

1,4-dimethylnaphtalene (0.01)	1-Naphthol (0.01)	2,4,6-Trichlorophenol (2) (0.01)	2,4-DDD (0.01)	2,6-Dichlorobenzamide (0.01)	2-Phenylphenol (0.01)
3,4-dichloroaniline (0.02)	4,4 -DDD + 2,4 -DDT (0.01)	4,4 -DDT (0.01)	4,4-DDE (0.01)	a, b, d- BHC (0.01)	Acibenzolar-s-methyl (0.01)
Aclonifen (0.01)	Acrinathrin (0.01)	Alachlor (0.01)	Aldrin (0.01)	Allethrin (0.02)	Ametryn (0.01)
Aminocarb (0.01)	Amitraz (0.02)	Anthraquinone (0.01)	Azinphos-ethyl (0.01)	Azoxystrobine (0.02)	Barban/Chlorbufam/Chlorpropham (as 3-Chloroaniline (0.05)
Benalaxyl (0.01)	Bendiocarb (0.01)	Benfluralin (0.01)	Bifenazate (0.05)	Bifenox (0.01)	Bifenthrin (0.01)
Biphenyl (0.01)	Bitertanol (0.01)	Bromacil (0.01)	Bromocyclen (0.01)	Bromophos-ethyl (0.01)	Bromophos-methyl (0.01)
Bromopropylate (0.01)	Bromuconazole (0.02)	Bupirimate (0.01)	Buprofezin (0.01)	Cadusaphos (0.01)	Captafol (0.05)
Captan (0.01)	Captan/Folpet (sum) (0.01)	Carbaryl (0.01)	Carbofuran (0.01)	Carbofuran (Sum) (0.01)	Carbofuranphenol (0.01)
Carbophenothion-methyl (0.01)	Carbosulfan (0.02)	Chinomethionate (0.01)	Chlorbufam (0.01)	Chlordane, cis- (0.01)	Chlordane, trans- (0.01)
Chlorfenapyr (0.01)	Chlorfenson (0.01)	Chlorfenvinphos (0.01)	Chlorfenvinphos cis (0.01)	Chlorfenvinphos trans (0.01)	Chloridazone (0.05)
Chlorobenzilate (0.01)	Chloroneb (0.01)	Chlorothalonil (0.01)	Chlorpropham (0.01)	Chlorpropham (Sum) (0.01)	Chlorpyrifos (-ethyl) (0.01)
Chlorpyrifos-methyl (0.01)	Chlorthal-dimethyl (0.01)	Chlorthiamid (0.2)	Chlozolinate (0.01)	Clefoxydim (0.05)	Clodinafop (0.01)
Clomazone (0.01)	Cloquintocet-mexyl (0.01)	Coumaphos (0.01)	Cyanazine (0.01)	Cyanofenphos (0.01)	Cyanophos (0.01)
Cycloate (0.01)	Cyfluthrin (0.01)	Cyhalothrin (0.01)	Cyhalothrin, lambda- (0.01)	Cypermethrin (0.01)	Cyphenothrin (0.05)
Cyproconazole (0.01)	Cyprodinil (0.01)	DDT (total) (0.01)	Deltamethrin (0.01)	Demeton-O (0.01)	Demeton-S (0.01)
Demeton-S-methyl (0.01)	Desmetryn (0.01)	Diazinon (0.01)	Dichlobenil (0.02)	Dichlofenthion (0.01)	Dichloranilin-3,5 (0.02)
Dichlorobenzophenone, p,p- (0.01)	Dicloran (0.01)	Dicofol, p,p- (0.01)	Dieldrin (0.01)	Dieldrin (Sum) (0.01)	Diethofencarb (0.01)
Difenoconazole (0.01)	Diflufenican (0.01)	Dimethoate (0.01)	Dimethylaminosulphotoluidide (DMST) (0.02)	Diniconazole (0.01)	Diphenamid (0.01)
Diphenylamine (0.01)	Disulfoton (0.02)	Disulfoton (sum) (0.02)	Disulfoton-sulfon (0.01)	Ditalimfos (0.01)	Endosulfan (total) (0.04)
Endosulfan sulphate (0.02)	Endosulfan, alpha- (0.01)	Endosulfan, beta- (0.01)	Endrin (0.01)	EPN (0.01)	Epoxiconazole (0.01)
EPTC (0.01)	Esfenvalerate (0.01)	Etaconazole (0.01)	Ethion (0.01)	Ethofumesate (0.01)	Ethoprophos (0.01)
Ethoxyquin (0.01)	Etofenprox (0.01)	Etridiazole (0.02)	Etrimfos (0.01)	Famoxadone (0.05)	Fenarimol (0.01)
Fenazaquin (0.01)	Fenfluthrin (0.01)	Fenhexamid (0.02)	Fenitrothion (0.01)	Fenobucarb (0.01)	Fenothrine (0.01)
Fenoxycarb (0.05)	Fenpiclonil (0.01)	Fenpropidin (0.01)	Fenpropimorph (0.01)	Fenpyroximate (0.02)	Fenson (0.01)
Fensulfothion (0.01)	Fenthion (0.01)	Fenthion-sulfoxide (0.01)	Fenvalerate (all isomers) (0.01)	Fipronil (0.005)	Fipronil (sum) (0.005)
Fipronil-sulfone (0.005)	Fluazifop-butyl (0.01)	Fluchloralin (0.01)	Flucythrinate (0.01)	Fludioxonil (0.01)	Fluquinconazole (0.01)

ZVP04 ZV Quantitative screening GC-MS TQ (LOQ* mg/kg)

Flurprimidol (0.01)	Flusilazole (0.01)	Flutolanil (0.01)	Folpet (0.01)	Fonofos (0.01)	Formothion (0.01)
Fuberidazole (0.01)	Furalaxyl (0.01)	Furmecyclox (0.05)	Halfenprox (0.01)	Haloxyfop-2-ethoxyethyl (0.01)	HCH (sum) (0.02)
HCH, alpha- (0.01)	HCH, beta- (0.01)	HCH, delta- (0.01)	Heptachlor (0.01)	Heptachlor (sum) (0.01)	Heptachlor epoxide, cis- (0.01)
Heptachlor epoxide, trans- (0.02)	Heptenophos (0.01)	Hexachlorobenzene (HCB) (0.01)	Hexachlorobutadiene (0.01)	Hexaconazole (0.01)	Hexazinone (0.01)
Imazethapyr (0.05)	Iodofenphos (0.01)	Iprobenfos (0.01)	Iprodione (0.01)	Isazophos (0.01)	Isocarbofos (0.01)
Isodrin (0.01)	Isofenphos (0.01)	Isofenphos-methyl (0.01)	Isofenphos-oxon (0.01)	Isoprocarb (0.01)	Isoproturon (0.01)
Isoxadifen-ethyl (0.01)	Kresoxim-methyl (0.01)	Lenacil (0.01)	Leptophos (0.01)	Malaoxon (0.01)	Malathion, fyfanon (0.01)
Malathion/Malaoxon (sum) (0.02)	Mecarbam (0.01)	Mepanipyrim (0.01)	Mephosfolan (0.02)	Mepronil (0.01)	Metalaxyl (0.01)
Metazachlor (0.01)	Methabenzthiazuron (0.01)	Methacriphos (0.01)	Methidathion (0.01)	Methiocarb (0.01)	Methiocarb (sum) (0.02)
Methoprotryne (0.01)	Methoxychlor (0.01)	Methyl Parathion (0.01)	Metobromuron (0.01)	Metolcarb (0.01)	Metrafenone (0.01)
Metribuzin (0.01)	Mevinphos (0.01)	Mirex (0.02)	Molinate (0.01)	Myclobutanil (0.01)	Naphthalene Acetamide (0.05)
Napropamide (0.01)	Nitrapyrin (0.01)	Nitrofen (0.01)	Nitrothal-isopropyl (0.01)	Norflurazon (0.01)	o,p'-DDE (0.01)
Ofurace (0.01)	Oxadiazon (0.01)	Oxadixyl (0.02)	Oxydemeton-methyl (sum) (0.01)	Oxyfluorfen (0.01)	Paraoxon (0.01)
Paraoxon-methyl (0.01)	Parathion (0.01)	Parathion-methyl (Sum) (0.01)	Penconazole (0.01)	Pencycuron (0.02)	Pendimethalin (0.01)
Pentachloranisole (0.01)	Pentachloroaniline (0.01)	Pentachlorobenzene (0.01)	Pentachlorophenol (0.05)	Permethrin-cis (0.01)	Permethrins (sum) (0.02)
Permethrin-trans (0.01)	Perthane (0.01)	Phenkapton (0.01)	Phenothrin (0.02)	Phenthoate (0.01)	Phosalone (0.01)
Phosfolan (0.02)	Phosmet (0.01)	Phosmet (Sum) (0.02)	Phthalimid (0.01)	Picoxystrobin (0.01)	Piperonyl butoxide (PBO) (0.01)
Pirimicarb (0.01)	Pirimicarb (Sum) (0.01)	Pirimicarb, desmethyl- (0.01)	Pirimicarb, desmethyl-formamido- (0.01)	Pirimiphos-ethyl (0.01)	Pirimiphos-methyl (0.01)
Procymidone (0.01)	Profenofos (0.01)	Profluralin (0.01)	Promecarb (0.01)	Prometryn (0.01)	Pronamide (0.01)
Propachlor (0.01)	Propanil (0.01)	Propargite (0.02)	Propazine (0.01)	Propetamphos (0.01)	Propham (0.01)
Propiconazole (0.01)	Propoxur (0.01)	Propoxycarbazone (0.05)	Prosulfocarb (0.01)	Prothioconazole (0.01)	Prothioconazole-desthio (0.01)
Prothiofos (0.01)	Pyraflufen-ethyl (0.01)	Pyrazophos (0.01)	Pyrethrins (0.2)	Pyridaben (0.01)	Pyridaphenthion (0.01)
Pyrifenox (E-) (0.01)	Pyrifenox (Z-) (0.01)	Pyrimethanil (0.01)	Pyriproxyfen (0.01)	Quinalphos (0.01)	Quinoxyfen (0.01)
Quintozene (0.01)	Quintozene (sum) (0.01)	Quizalofop ethyl (0.01)	Ronnel (0.01)	S 421 (0.05)	Silthiofam (0.01)
Simazine (0.01)	S-Metolachlor (0.01)	Spiromesifen (0.01)	Spiroxamine (0.01)	Sulfotep (2) (0.01)	Sulphur (S) (0.2)
Sulprofos (0.01)	tau-Fluvalinate (0.01)	Tebuconazole (0.01)	Tebufenpyrad (0.01)	Tecnazene (0.01)	Tefluthrin (0.01)
Telodrin (0.01)	Terbacil (0.01)	Terbumeton (0.01)	Terbuthylazine (0.01)	Terbutryn (0.01)	Tetrachlorvinphos (0.01)
Tetraconazole (0.01)	Tetradifon (0.01)	Tetramethrin (0.01)	Tetrasul (0.01)	THPI (Tetrahydrophthalimide) (0.01)	Tolclofos-methyl (0.01)
Transfluthrin (0.01)	Triadimefon (0.01)	Triadimenol (0.01)	Triadimenol/Triadimefon (sum) (0.02)	Triallate (0.01)	Triazamate (0.01)
Triazophos (0.01)	Trichloronat (0.01)	Trifloxystrobin (0.01)	Triflumizole (0.01)	Trifluralin (0.01)	Trinexapac-ethyl (0.01)
Trithion (0.01)	Vinclozolin (0.01)	Vinclozolin (Sum) (0.01)			

ZVP05 ZV Quantitative screening LC-MS (LOQ* mg/kg)

1,2,4-triazole (0.1)	1-Naphthylacetic acid (0.05)	2,4,5-T (0.01)	2,4,6-Trichlorophenoxyacetic Acid (0.01)	2,4-D (0.01)	2,4-D butyric acid (2,4-DB) (0.01)
2,4'-Formoxylidid (0.01)	2-Naphthyloxyacetic acid (0.01)	3-Hydroxycarbofuran (0.01)	3-ketocarbofuran (0.01)	4-CPA (0.01)	6-Benzyladenine (0.01)
6-Chlor-3-phenylpyridazin-4-ol (0.01)	Abamectin (0.01)	Acephate (0.01)	Acequinocyl (0.01)	Acetamiprid (0.01)	Alanycarb (0.01)
Aldicarb (0.01)	Aldicarb (sum) (0.01)	Aldicarb-sulfone (0.01)	Aldicarb-sulfoxide (0.01)	Ametoctradin (0.01)	Aminopyralid (0.25)
Amisulbrom (0.01)	Amitraz (0.05)	Amitraz (as 2,4-Dimethylaniline) (0.1)	Amitraz (sum) (0.01)	Amitrole (0.5)	Anilazine (0.05)
Asulam (0.01)	Atrazine (0.01)	Avermectin B1a (0.01)	Avermectin B1b (0.01)	Azaconazole (0.01)	Azadirachtin (0.01)
Azamethiphos (0.01)	Azimsulfuron (0.01)	Azinphos-methyl (0.01)	Azoxystrobine (0.01)	Barban (0.01)	Benoxacor (0.01)
Bentazone (0.01)	Benthiavalicarb, isopropyl- (0.01)	Bitertanol (0.01)	Bixafen (0.01)	Boscalid (0.01)	Bromoxynil (0.01)
Bromuconazole (0.01)	Bupirimate (0.01)	Buprofezin (0.01)	Butafenacil (0.01)	Butocarboxim-sulfoxide (0.01)	Butoxycarboxim (0.01)
Buturon (0.01)	Carbaryl (0.01)	Carbendazim (0.01)	Carbendazim/Benomyl (sum) (0.01)	Carbetamide (0.01)	Carbofuran (0.01)
Carbofuran (Sum) (0.01)	Carbosulfan (0.01)	Carfentrazone (0.01)	Carpropamid (0.01)	Chloorthiofos (0.01)	Chloramben (0.1)
Chlorantraniliprole (0.01)	Chlorbromuron (0.01)	Chlordecon (0.01)	Chlordimeform (0.01)	Chlorfluazuron (0.01)	Chlorothalonil-4-hydroxy (0.01)
Chlorotoluron (0.01)	Chlorthiofos-sulfone (0.01)	Chlorthion (0.01)	Cinerin I (0.01)	Clethodim (0.01)	Clethodim/Sethoxydim (Sum) (0.01)
Climbazole (0.01)	Clofentezine (0.01)	Clopyralid (0.5)	Clothianidin (0.01)	Crimidine (0.01)	Cyantraniliprole (0.01)
Cyazofamid (0.01)	Cycloxydim (0.01)	Cyflufenamid (0.01)	Cyflumetofen (0.01)	Cymoxanil (0.01)	Cyproconazole (0.01)
Cyprodinil (0.01)	Cyromazine (0.05)	Cythioate (0.01)	Daminozide (0.01)	Demeton-S-methyl-sulfone (0.01)	Desmedipham (0.01)
Diafenthiuron (0.01)	Dicamba (0.05)	Dichlofluanid (0.01)	Dichlorophen (0.01)	Dichlorprop (0.01)	Dichlorvos (0.01)
Diclobutrazol (0.01)	Dicrotophos (0.01)	Diethofencarb (0.01)	Diethyltoluamide (0.01)	Difenoconazole (0.01)	Diflubenzuron (0.01)
Dimethenamid (0.01)	DIMETHIRIMOL (0.01)	Dimethoate (0.01)	Dimethoate/Omethoate (sum) (0.01)	Dimethomorph (0.01)	Dimethylaminosulphotoluidide (DMST) (0.01)
Dimethylphenylsulfamide (DMSA) (0.01)	Dimoxystrobin (0.01)	Diniconazole (0.01)	Dinocap (0.01)	Dinotefuran (0.01)	Dipropetryn (0.01)
Dithianon (0.01)	Diuron (0.01)	Dodemorf (0.01)	Dodine (0.01)	Emamectin, benzoate- (0.01)	Epoxiconazole (0.01)
Ethiofencarb (0.01)	Ethiofencarb (sum) (0.01)	Ethiofencarb-sulfone (0.01)	Ethiofencarb-sulfoxide (0.01)	Ethiprole (0.01)	Ethirimol (0.01)
Ethoxysulfuron (0.01)	Ethylene thiourea (ETU) (0.5)	Etofenprox (0.01)	Etoxazole (0.01)	Famophos (0.01)	Famoxadone (0.01)
Fenamidone (0.01)	Fenamiphos (sum) (0.01)	Fenamiphos-sulfone (0.01)	Fenamiphos-sulfoxide (0.01)	Fenarimol (0.02)	Fenazaquin (0.01)
Fenbuconazole (0.01)	Fenhexamid (0.01)	Fenoprop (0.01)	Fenoxycarb (0.01)	Fenpropidin (0.01)	Fenpropimorph (0.01)
Fenpyrazamine (0.01)	Fenpyroximate (0.01)	Fenthion (0.01)	Fenthion (sum) (0.01)	Fenthion-oxon (0.01)	Fenthion-oxon-sulfone (0.01)
Fenthion-oxon-sulfoxide (0.01)	Fenthion-sulfone (0.01)	Fenthion-sulfoxide (0.01)	Fipronil (0.01)	Flazasulfuron (0.01)	Flonicamid (0.01)
Flonicamid (Sum) (0.01)	Florasulam (0.01)	Fluazifop (0.01)	Fluazifop-P-butyl (0.01)	Fluazinam (0.01)	Flubendiamide (0.01)
Flucycloxuron (0.01)	Flufenacet (0.01)	Flufenoxuron (0.01)	Flumioxazin (0.01)	Fluopicolid (0.01)	Fluopyram (0.01)
Fluotrimazole (0.01)	Fluoxastrobin (0.01)	Flupyradifurone (0.01)	Fluquinconazole (0.01)	Fluroxypyr (0.02)	Fluroxypyr (Sum) (0.01)
Fluroxypyr-Methylheptyl (0.01)	Flusilazole (0.01)	Fluthiacet-methyl (0.01)	Flutolanil (0.01)	Flutriafol (0.01)	Fluxapyroxad (0.01)
Forchlorfenuron (0.01)	Formetanate (0.01)	Fosetyl-aluminium (0.5)	Fosthiazate (0.01)	Furalaxyl (0.01)	Furathiocarb (0.01)
Furmecyclox (0.02)	HALOFENOZIDE (0.01)	Haloxyfop (0.01)	Hexaconazole (0.01)	Hexaflumuron (0.01)	Hexythiazox (0.01)
HYMEXAZOL (0.1)	Imazalil (0.01)	Imazaquin (0.01)	Imibenconazole (0.01)	Imidacloprid (0.01)	Indoxacarb (0.01)
Iodosulfuron methyl (0.01)	Ioxynil (0.02)	Iprovalicarb (0.01)	Isocarbofos (0.01)	Isoprothiolane (0.01)	Isopyrazam (0.01)
Isouron (0.01)	Isoxaben (0.01)	Isoxaflutole (0.01)	Isoxathion (0.01)	Jasmolin I (0.01)	Kresoxim-methyl (0.01)
Lenacil (0.01)	Linuron (0.01)	Lufenuron (0.01)	Malathion (Sum) (0.01)	Malathion, fyfanon (0.01)	Maleic hydrazide (MH-30) (0.5)
Mandipropamid (0.05)	MCPA (0.01)	MCPA/MCPB (sum) (0.01)	MCPB (0.01)	Mecoprop (0.01)	Mefenacet (0.01)
Mefenpyr-diethyl (0.01)	Mepanipyrim (0.01)	Mephosfolan (0.01)	Mepronil (0.01)	MEPTYLDINOCAP (0.01)	Mesosulfuron-methyl (0.01)

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CANCELS AND REPLACES*

Sample code Nr.	**890-2016-00010137**	**Report Date 16/06/2016**	**Page 3/3**
Analytical Report Nr.	**AR-16-RM-009912-02 / 890-2016-00010137**		

ZVP05 ZV Quantitative screening LC-MS (LOQ* mg/kg)

Mesotrione (0.01)	Metaflumizone (0.01)	Metalaxyl (0.01)	Metaldehyde (0.01)	Metamitron (0.01)	Metasyatox-R (0.01)
Metconazole (0.02)	Methamidophos (0.01)	Methidathion (0.01)	Methiocarb (0.01)	Methiocarb (sum) (0.01)	Methiocarb-sulfone (0.01)
Methiocarb-sulfoxide (0.01)	Methomyl (0.01)	Methomyl/Thiodicarb (sum) (0.01)	Methoxyfenozide (0.01)	Metobromuron (0.01)	Metoxuron (0.01)
Metsulfuron-methyl (0.02)	Milbemectin (sum) (0.1)	Milbemectin A3 (0.1)	Milbemectin A4 (0.1)	Monocrotophos (0.01)	Monolinuron (0.01)
Monuron (0.01)	Myclobutanil (0.01)	N-2,4-dimethylphenyl-N-methylformamidine (0.01)	Naled (0.01)	Neburon (0.01)	Nicosulfuron (0.01)
Nitenpyram (0.01)	Nitralin (0.01)	Novaluron (0.01)	Nuarimol (0.01)	Omethoate (0.01)	Oxadixyl (0.01)
Oxamyl (0.01)	Oxasulfuron (0.01)	Oxycarboxin (0.01)	Oxydemeton-methyl (sum) (0.01)	Paclobutrazol (0.01)	Paraoxon-ethyl (0.01)
Paraoxon-methyl (0.01)	Parathion-methyl (Sum) (0.01)	Pebulate (0.01)	Penconazole (0.01)	Pencycuron (0.01)	Penflufen (0.01)
Penthiopyrad (0.01)	Phenamiphos (0.01)	Phenisopham (0.01)	Phenmedipham (0.01)	Phorate (0.01)	Phorate (sum) (0.01)
Phorate-sulfone (0.01)	Phorate-sulfoxide (0.01)	Phosalone (0.01)	Phosmet (0.01)	Phosmet (Sum) (0.01)	Phosmet-oxon (0.01)
Phosphamidon (0.01)	Phoxim (0.01)	Picaridin (0.01)	Picloram (0.1)	Picolinafen (0.01)	Picoxystrobin (0.01)
Pinoxaden (0.01)	Piperonyl butoxide (PBO) (0.01)	Pirimicarb (0.01)	Pirimicarb (Sum) (0.01)	Pirimicarb, desmethyl- (0.01)	Prochloraz (0.01)
Prochloraz (Sum) (0.01)	Prochloraz-desimidazole-amino (0.01)	Prochloraz-desimidazole-formylamino (0.01)	Profenofos (0.01)	Prohexadione Calcium (0.05)	Pronamide (0.01)
Propamocarb Hydrochloride (0.01)	Propaquizafop (0.01)	Propiconazole (0.01)	Propoxur (0.01)	Proquinazid (0.01)	Prosulfocarb (0.01)
Prothiocarb (0.01)	Prothiocarb hydrochloride (0.01)	Prothioconazole (0.1)	Prothioconazole-desthio (0.01)	Pymetrozine (0.01)	Pyracarbolid (0.01)
Pyraclofos (0.01)	Pyraclostrobin (0.01)	Pyrazophos (0.01)	Pyrethrins (0.01)	Pyrethrins (Total Isomers) (0.01)	Pyridaben (0.01)
Pyridalyl (0.01)	Pyridaphenthion (0.01)	Pyridate (0.01)	Pyridate (Sum) (0.01)	Pyrifenox (0.01)	Pyrimethanil (0.01)
Pyrimidifen (0.01)	Pyriproxyfen (0.01)	Quinclorac (0.01)	Quinmerac (0.01)	Quizalofop (0.01)	Rimsulfuron (0.01)
Rotenone (0.01)	Saflufenacil (0.01)	Sethoxydim (0.01)	Silafluofen (0.01)	Simazine (0.01)	Spinetoram (0.01)
Spinosad (Sum) (0.01)	Spinosad A (0.01)	Spinosad D (0.01)	Spirodiclofen (0.01)	Spirotetramat (0.01)	Spirotetramate (Sum) (0.01)
Spirotetramat-enol (0.01)	Spirotetramat-enolglucoside (0.05)	Spirotetramat-ketohydroxy (0.01)	Spirotetramat-monohydroxy (0.01)	Spiroxamine (0.01)	Sulcotrione (0.02)
Sulfentrazone (0.02)	Tebuconazole (0.01)	Tebufenozide (0.01)	Tebufenpyrad (0.01)	Teflubenzuron (0.01)	TEMBOTRIONE (0.01)
Tepraloxydim (0.01)	Terbufos-sulfone (0.01)	Terbufos-sulfoxide (0.01)	Tetraconazole (0.01)	TFNA (0.01)	TFNA-AM (0.01)
TFNG (0.01)	Thiabendazole (0.01)	Thiacloprid (0.01)	Thiamethoxam (0.01)	Thiamethoxam (Sum) (0.01)	Thidiazuron (0.01)
Thiobencarb (0.01)	Thiocyclam (0.05)	Thiodicarb (0.01)	Thiofanox (0.01)	Thiofanox-sulfone (0.01)	Thiofanox-sulfoxide (0.01)
Thiometon (0.01)	Thiophanate-methyl (0.01)	Tolclofos-methyl (0.01)	Tolylfluanid (0.01)	Tolylfluanid (Sum) (0.01)	Tralkoxydim (0.01)
Triadimefon (0.01)	Triadimenol (0.01)	Triadimenol/Triadimefon (sum) (0.01)	Triapenthenol (0.01)	Triazophos (0.01)	Triazoxide (0.01)
Tribenuron-methyl (0.05)	Trichlorfon (0.01)	Triclopyr (0.01)	Tricyclazole (0.01)	Tridemorph (0.01)	Trifloxystrobin (0.01)
Triflumizole (0.01)	Triflumuron (0.01)	Triflusulfuron-methyl (0.01)	Triforine (0.01)	Trimethycarb, 3,4,5- (0.01)	Trinexapac-ethyl (0.01)
Triticonazole (0.01)	Uniconazole (0.01)	Valifenalate (0.01)	Vamidothion (0.01)	Warfarin (0.01)	Zoxamide (0.01)

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(b) (6) [redacted]

Mirja [redacted]
Business Unit Manager

Report electronically validated by Vince Leeuwestein

EXPLANATORY NOTE

This certificate may only be reproduced complete. The results are only valid for the sample.
The uncertainty of measurement for the applied methods of analysis are retrievable from the ASM department.
Opinions and interpretations in this certificate are outside the scope of accreditation.
The samples will be stored until 84 days after the date of reception.
The analyses that state -M after the reference method should be interpreted as equal to the aforementioned reference method.

The tests identified by the two letters code ZV are performed in laboratory Eurofins Lab Zeeuws-Vlaanderen.

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Appendix 9
Analytic Data - 3 Batches
Rapeseed Presscake

Analytical data of three rapeseed press cake batches

Parameter	Unit	T-94345	L-98285	R-95423
Protein (N*6.25)	% w/w	33.7	31.9	35.3
Moisture	% w/w	9.3	6.1	9.1
Ash	% w/w	6.3	6.5	6.2
Fat	% w/w	12.2	-	-
Total organic solids	% w/w	84.4	87.4	84.7
Carbohydrates (Eurofins)	% w/w	10.9	-	-
Total plate count	cfu/g	$2.4 \cdot 10^4$	$2.1 \cdot 10^4$	$2.0 \cdot 10^3$
Sulphite reducing anaerobes	cfu/g	240	150	3
Clostridium perfringens	Absent in 1 g	Absent	-	-

Appendix 10
Rapeseed Presscake
Contaminants

Test report

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Lower Saxony State Office for Consumer Protection and Food Safety

· Feed Institute Stade

Lower Saxony State Office for Consumer Protection and Food Safety - Heckenweg 6 - 21680 Stade

LAVES
Dezernat 41, Futtermittelüberwachung
Postfach 39 49

26029 Oldenburg

This matter is being dealt with by
Mr. Dominik Baumeister

E-mail:
Dominik.Baumeister@laves.niedersachsen.de

Fax:
04141 933-777

Your reference	Your letter of	My reference (Please quote in correspondence)	Direct line	Stade
L-98285		57.68	04141-933842	15.03.2016

Test report

Date of sampling:	23.02.2016	Logbook no.:	06-99916-00624
Date received:	24.02.2016	Order no.:	061602-000302
Beginning/end of examination:	24.02.2016 / 11.03.2016	Record no.:	LV4-KK-0029-2016
Sample packaged:	Loose, in ag	Tested by:	Kampmann
Sample sealed:	Yes		
Description according to Catalogue of Feed Materials:	Rapeseed cake (expeller)		
Trade name:	Rapsexpeller		

Results of the examination

	Reference matter Unit	**Result**	**LOQ**	**LOD**
Method: Reg. (EC)152/2009; App. III.A	**Original matter**			
Water	%	8.9		0.3

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LOD = limit of detection, LOQ = limit of quantification

Test report

Results of the examination

	Reference matter Unit	Result	LOQ	LOD
Method: VDLUFA vol. III, section 16.8.1	**Original matter**			
Chlorinated hydrocarbons (CHC)				
Hexachlorocyclohexane (alpha-isomers)	mg/kg	< LOD		0.005
Hexachlorocyclohexane (beta-isomers)	mg/kg	< LOD		0.005
Hexachlorocyclohexane (gamma isomers)	mg/kg	< LOD		0.005
Hexachlorobenzene (HCB)	mg/kg	< LOD		0.005
Aldrin	mg/kg	< LOD		0.005
Dieldrin	mg/kg	< LOD		0.005
Endrin	mg/kg	< LOD		0.005
Endrin ketone	mg/kg	< LOD		0.005
Heptachlor	mg/kg	< LOD		0.005
cis-Heptachlor epoxide	mg/kg	< LOD		0.005
cis-Chlordane (alpha)	mg/kg	< LOD		0.005
trans-Chlordane (gamma)	mg/kg	< LOD		0.005
p,p-DDT	mg/kg	< LOD		0.005
o,p-DDT	mg/kg	< LOD		0.005
p,p-DDE	mg/kg	< LOD		0.005
p,p-DDD	mg/kg	< LOD		0.005
Endosulfan (alpha)	mg/kg	< LOD		0.005
Endosulfan (beta)	mg/kg	< LOD		0.005
Endosulfan sulfate	mg/kg	< LOD		0.005
Method: PV 13 ICP-MS (elements)	**Original matter**			
Cobalt	mg/kg	< LOD		0.2
Arsenic	mg/kg	< LOD		0.5
Selenium	mg/kg	< LOD		0.2
Cadmium	mg/kg	< LOD		0.1
Mercury	mg/kg	< LOD		0.05
Lead	mg/kg	< LOD		0.5
Method: VDLUFA vol. III section 28.1.1-28.3; 8th supplement 2012	**Original matter**			
Aerobic mesophilic bacteria, product-typical, BG 1	CFU/g	4.1E+05		
Aerobic mesophilic bacteria, indicating deterioration, BG 2	CFU/g	6.9E+05		
Aerobic mesophilic bacteria, indicating deterioration, BG 3	CFU/g	< 1E+03		

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E-mail: Poststelle.FI-Stade@laves.niedersachsen.de www.laves.niedersachsen.de Where possible, please make an appointment for a visit.

Test report

Results of the examination

	Reference matter Unit	Result	LOQ	LOD
Method: VDLUFA vol. III, section 28.1.1-28.1.3; 8th supplement 2012	**Original matter**			
Molds and black molds, product-typical, BG 4	CFU/g	1.5E+03		
Molds and black molds, indicating deterioration, BG 5	CFU/g	2.2E+03		
Molds and black molds, indicating deterioration, BG 6	CFU/g	< 1E+02		
Method: VDLUFA vol. III, section 28.1.1-28.1.3; 8th supplement 2012	**Original matter**			
Yeasts, indicating deterioration, BG 7	CFU/g	4E+03		
Method: VDLUFA vol. III, section 28.1.4; 8th supplement 2012	**Original matter**			
Microbiology/deterioration	Quality stage 1			
Method: ASU L 00.00-32, 2006-09; 37°C, API List Dev.: spreading only from 2nd enrichment medium on 1 selective med. (Palcam agar), evaluation after 48 h	**Original matter**			
Listeria monocytogenes	/25 g	negative		
Method: ASU L 00.00-20, 2008-12; Brilliance agar, API E	**Original matter**			
Salmonella	/25 g	negative		
Method: Reg. EC 152/2009; App. VI	**Original matter**			
Microscopy: on animal constituents of land animals		negative		
Microscopy: on animal constituents of fish		negative		

pp:

Dominik Baumeister
Trial Director

The test report was created electronically and does not require signature.

LOD = limit of detection, LOQ = limit of quantification

Service building and parcel delivery address	Mailing address	Phone/fax	Opening hours	Bank details
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E-mail: Poststelle.FI-Stade@laves.niedersachsen.de www.laves.niedersachsen.de Where possible, please make an appointment for a visit.

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Lower Saxony State Office for Consumer Protection and Food Safety

· Feed Institute Stade

Lower Saxony State Office for Consumer Protection and Food Safety
- Heckenweg 6 - 21680 Stade

LAVES
Dez. 41, Futtermittelüberwachung
Postfach 39 49
26029 Oldenburg

This matter is being dealt with by
Dr. Scheffer

Fax:
04141 933-777
e-mail:
Andy.Scheffer@laves.niedersachsen.de

Your reference	Your letter of	My reference (Please quote in correspondence)	Direct line	Stade
		57.56-4252-P gu	(04141) 933840	14.04.2016

Test report (official feedstuff test)

Date of sampling:	23.02.2016	Logbook no.:	06-99916-00625
Date received:	24.02.2016	Order no.:	061602-000303
Beginning/end of examination:	24.02.2016 / 14.04.2016	Record no.:	LV4-KK-0030-2016
in:	Bag	Tested by:	Kampmann
Sample sealed:	Yes		
Feedstuff:	Straight feedstuff		
Trade name:	Rapsexpeller		

Test results:

	Declaration	Analysis in the original matter	Calculated on 88% dry matter
Water Method: Reg. (EC)152/2009; App. III, A		**8.9%**	
Dioxin (analyzed by LVI Oldenburg)		**see Appendix**	
Dioxin-like PCBs (analyzed by LVI Oldenburg)		**see Appendix**	

Indicator PCB
Method: PV 12 094: GC-MS-MS after liquid extraction (corresponds to Reg. (EC)152/2009; App. V B, section III)

PCB - 28	< 0.16 µg/kg
PCB - 52	< 0.16 µg/kg
PCB - 101	< 0.16 µg/kg
PCB - 138	< 0.16 µg/kg
PCB - 153	< 0.16 µg/kg
PCB - 180	< 0.16 µg/kg
Total NDL-PCB (lower bound)	0.0 µg/kg
Total NDL-PCB (medium bound)	0.5 µg/kg
Total NDL-PCB (upper bound	1.0 µg/kg

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LOD = limit of detection
LOQ = limit of quantification

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Service building and parcel delivery address	Mailing address	Phone/fax	Opening hours	Bank details
Heckenweg 6 21680 Stade	Heckenweg 6 21680 Stade	04141 933-6 04141 933-777	Mon – Thurs 08:00 - 15:00 Fri 08:00 - 14:30 Where possible, please make an appointment for a visit.	Nord LB (BIC 250 500 00) acc. no. 1 900 154 008 IBAN: DE 56 2505 0000 1900 1540 08 SWIFT/BIC: NOLA DE 2H
	E-mail:			

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· Feed Institute Stade

Lower Saxony State Office for Consumer Protection and Food Safety
- Heckenweg 6 - 21680 Stade

Page 2 of the test report (official feedstuff examination)

Date of sampling:	23.02.2016	Logbook no.:	06-99916-00625
Date received:	24.02.2016	Order no.:	061602-000303
Beginning/end of examination:	24.02.2016 / 14.04.2016	Record no.:	LV4-KK-0030-2016
in:	Bag	Tested by:	Kampmann
Sample sealed:	Yes		
Feed:	Straight feedstuff		
Trade name:	Rapsexpeller		

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Dr. Scheiffer
(Head of Department)

LOD = limit of detection
LOQ = limit of quantification

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Test report
Results of the examination of a feedstuff for PCDD/F
Extraction process: ASE (toluene, ethanol 70/30)

Dealt with by: ……...

WACO	02/999999
Type of feedstuff (for)	Straight feedstuff
Trade name	Rapsexpeller
Record number	LV4-KK-0030-2016
Collection date	23.02.2016
Sample no.	06-99916-00625
Date received	03.03.2016
ng/kg feedstuff (12% moisture)	
2,3,7,8-TCDF	0.01
2,3,7,8-TCDD	< 0.01
1,2,3,7,8-PeCDF	< 0.01
2,3,4,7,8-PeCDF	< 0.01
1,2,3,7,8-PeCDD	< 0.01
1,2,3,4,7,8-HxCDF	< 0.02
1,2,3,6,7,8-HxCDF	< 0.01
2,3,4,6,7,8-HxCDF	< 0.01
1,2,3,7,8,9-HxCDF	< 0.01
1,2,3,4,7,8-HxCDD	< 0.01
1,2,3,6,7,8-HxCDD	< 0.01
1,2,3,7,8,9-HxCDD	< 0.01
1,2,3,4,6,7,8-HpCDF	< 0.02
1,2,3,4,7,8,9-HpCDF	< 0.01
1,2,3,4,6,7,8-HpCDD	< 0.01
OCDF	< 0.04
OCDD	0.08
WHO-PCDD/F-TEQ (lower bound) (TEF 2005)	< 0.01
WHO-PCDD/F-TEQ (medium bound) (TEF 2005)	0.02
WHO-PCDD/F-TEQ (upper bound) (TEF 2005)	**0.03**
Dry matter (in %)	91.1

The accuracy of the WHO-PCDD/F-TEQ value is in the range of +/- 20% of the stated value.

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(Dr. Annette Knoll)

The above results refer exclusively to the tested sample.

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Test report
Results of the examination of a feedstuff for PCDD/F — Dealt with by: ……...
Total value of PCDD/F and dl-PCB
Extraction process: ASE (toluene, ethanol 70/30)

WACO	02/999999
Type of feedstuff	Feedstuff
for animal species	
Trade name	Rapsexpeller
Record number	LV4-KK-0030-2016
Collection date	23.02.2016
Sample no.	06-99916-00625
Date received	03.03.2016
ng/kg feedstuff (12% moisture)	
PCB081	0.04
PCB077	0.79
PCB126	0.73
PCB169	0.08
PCB105	3.29
PCB114	0.10
PCB118	5.39
PCB123	0.08
PCB156	0.65
PCB157	0.26
PCB167	0.21
PCB189	0.05
WHO-PCB-TEQ (lower bound) (TEF 2005)	0.08
WHO-PCB-TEQ (medium bound) (TEF 2005)	0.08
WHO-PCB-TEQ (upper bound) (TEF 2005)	**0.08**

Total value of PCDD/F and di-PCB	
ng/kg feedstuff (12% moisture)	
WHO-PCDD/F-TEQ (lower bound) (TEF 2005)	0.08
WHO-PCDD/F-TEQ (medium bound) (TEF 2005)	0.10
WHO-PCDD/F-TEQ (upper bound) (TEF 2005)	**0.11**
Dry matter (in %)	91.1

The accuracy of the WHO-PCB-TEQ and the WHO-PCDD/F-TEQ value is in the range of +/- 20% of the stated value.

pp

[signature]

(Dr. Annette Knoll)

The above results refer exclusively to the tested sample.

Test report

Stamp:
LAVES
Rec. 04 DEC. 2015
[initials]

[Logo]
Lower Saxony State Office for Consumer Protection and Food Safety

· Feed Institute Stade

Lower Saxony State Office for Consumer Protection and Food Safety - Heckenweg 6 - 21680 Stade

LAVES
Dezernat 41, Futtermittelkontrolldienst
Postfach 39 49

26029 Oldenburg

This matter is being dealt with by
Mr. Dominik Baumeister

E-mail:
Dominik.Baumeister@laves.niedersachsen.de

Fax:
04141 933-777

Your reference	Your letter of	My reference (Please quote in correspondence)	Direct line	Stade
R-95423		57.68	04141-933842	02.12.2015

Test report

Samples taken by: Rickermann Landhandel GmbH, Herzlake

Date of sampling:	11.12.2015	Logbook no.:	06-99915-03544
Date received:	11.13.2015	Order no.:	061511-000160
Beginning/end of examination:	11.13.2015 / 12.01.2015	Record no.:	LV4-KK-0146-2015
Sample packaged:	Loose, in bag	Tested by:	Kampmann
Sample sealed:	Yes		
Material to be examined:	Rapeseed cake (expeller)		
Trade name:	Rapskuchen (expeller)		

Results of the examination

	Reference matter Unit	**Result**	**LOQ**	**LOD**
Method: Reg. (EC)152/2009; App. III.A	Original matter			
Water	%	9.1		0.3
Method: PV 12 078 mycotoxin screening	Dry matter (88%)			
Aflatoxin B1	mg/kg	< LOD		0.002
Ochratoxin A	mg/kg	< LOD		0.048
Zearalenone	mg/kg	< LOD		0.05
Deoxynivalenol	mg/kg	< LOD		0.362
Total fumonisins	mg/kg	< LOD		1.54
Total T-2 and Ht-2 toxins	µg/kg	< LOD		30

The above results refer exclusively to the sample tested.
The information provided herewith is not for public distribution. It is for the intended recipient only and may not be disseminated to others.

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D-PL-14378-13-00

LOD = limit of detection, LOQ = limit of quantification

Test report

Results of the examination

	Reference matter Unit	Result	LOQ	LOD
Method: PV 13 ICP-MS (elements)	Original matter			
Cobalt	mg/kg	< LOD		0.2
Arsenic	mg/kg	< LOD		0.5
Selenium	mg/kg	< LOD		0.2
Cadmium	mg/kg	< LOD		0.1
Mercury	mg/kg	< LOD		0.05
Lead	mg/kg	< LOD		0.5
Method: Reg. (EC) 152/2009 App. III N	Dry matter (100%)			
HCl-insoluble ash	%	< LOD		0.3
Method: ASU L 00.00-20, 2008-12; Brilliance agar, APR E	Original matter			
Salmonella	/25 g in 2 x 25 g	negative		

pp
Dominik Baumeister
Trial Director

The test report was created electronically and does not require signature.

The above results refer exclusively to the sample tested.
The information provided herewith is not for public distribution. It is for the intended recipient only and may not be disseminated to others.

DAkkS
Deutsche Akkreditierungsstelle
D-PL-14378-13-00

LOD = limit of detection, LOQ = limit of quantification

Service building and parcel delivery address	Mailing address	Phone/fax	Opening hours	Bank details
Heckenweg 6 21680 Stade	Heckenweg 6 21680 Stade	04141 933-6 04141 933-777	Mon – Thurs 08:00 - 15:00 Fri 08:00 - 14:30	Nord LB (BIC 250 500 00) acc. no. 1 900 154 008 IBAN: DE 56 2505 0000 1900 1540 08 SWIFT/BIC: NOLADE2H

E-mail: Poststelle.FI-Stade@laves.niedersachsen.de www.laves.niedersachsen.de Where possible, please make an appointment for a visit.

Print date: 03.12.2015

Lower Saxony State Office for Consumer Protection and Food Safety
- Heckenweg 6 - 21680 Stade

[Logo]
Lower Saxony State Office for Consumer Protection and Food Safety

· Feed Institute Stade

LAVES
Dez. 41, Futtermittelüberwachung
Postfach 39 49
26029 Oldenburg

This matter is being dealt with by
Dr. Sacher-Rudorffer

Fax:
04141 933-777
e-mail:
Sylvia.Sacher-Rudorffer@laves.niedersachsen.de

Your reference	Your letter of	My reference (Please quote in correspondence)	Direct line	Stade
		57.5-4252-P schu	(04141) 933-728	03.08.2015

Test report (official feedstuff test)

Date of sampling:	30.06.15	Logbook no.:	06-99915-02114
Date received:	01.07.15	Order no.:	061507-000007
Beginning/end of examination:	01.07.15 / 30.07.15	Record no.:	LV4-KK-0084-2015
in:	Bag	Tested by:	Kampmann
Sample sealed:	Yes		
Feedstuff:	Straight feedstuff		
Trade name:	Rapskuchen/-expeller		

Test results:

	Declaration	Analysis in the original matter	Calculated on 88% dry matter
Water Method: Reg. (EC)152/2009; App. III, A		**9.6%**	

Animal ingredients
Method: Reg. (EC)152/2009; App. VI

Where microscopically detectable, no animal ingredients (muscle, animal hair, animal bones, fish scales, fish bones, blood, feathers etc.) were found.
Fats etc. cannot be detected microscopically.

Indicator PCB
Method: PV 12 094: GC-MS-MS after liquid extraction (corresponds to Reg. (EC)152/2009; App. V B, section III)

PCB - 28	< 0.16 µg/kg
PCB - 52	< 0.16 µg/kg
PCB - 101	< 0.16 µg/kg
PCB - 138	< 0.16 µg/kg
PCB - 153	< 0.16 µg/kg
PCB - 180	< 0.16 µg/kg
Total NDL-PCB (lower bound)	0.0 µg/kg
Total NDL-PCB (medium bound)	0.5 µg/kg
Total NDL-PCB (upper bound	1.0 µg/kg

	Declaration	Analysis in the original matter	Calculated on 88% dry matter
Crude fiber Method: Reg. (EC)152/2009; App. III, I	10.0%	**12.3%**	

DAkkS
Deutsche Akkreditierungsstelle
D-PL-14378-13-00

LOD = limit of detection
LOQ = limit of quantification

Lower Saxony State Office for Consumer Protection and Food Safety
- Heckenweg 6 - 21680 Stade

[Logo]
Lower Saxony State Office for Consumer Protection and Food Safety

· Feed Institute Stade

Page 2 of the test report (official feedstuff test)

Date of sampling:	30.06.15	Logbook no.:	06-99915-02114
Date received:	01.07.15	Order no.:	061507-000007
Beginning/end of examination:	01.07.15 / 30.07.15	Record no.:	LV4-KK-0084-2015
in:	Bag	Tested by:	Kampmann
Sample sealed:	Yes		
Feedstuff:	Straight feedstuff		
Trade name:	Rapskuchen/-expeller		

	Declaration	Analysis in the original matter	Calculated on 88% dry matter
Crude oils and fats (with HCl) Method: Reg. (EC)152/2009; App. III, H	10.0%	**12.5%**	
Crude protein (N x 6.25) Method: Reg. (EC)152/2009; App. III, C	30.0%	**31.6%**	
Salmonella Method: ASU L 00.00-20, 2008-12 Brilliance agar, API E		**negative in 2x 25 g**	
Listeria monocytogenes Method ASU L 00.00-32, 2006-09, 37°C, API List Deviations: Spreading only from the second enrichment medium on a selective medium (PALCAM agar), reading after 48 hours		**negative in 25 g**	

Microbiology/deterioration
Method: VDLUFA vol. III, section 28.1.1 – 28.1.4

Bacteria groups and bacteria contents	**Aerobic mesophilic bacteria**			**Molds and black molds**			**Yeasts**
Bacteria group	BG 1	BG 2	BG 3	BG 4	BG 5	BG 6	BG 7
Predominantly detected	Yellow bacteria	Bacillus			Aspergillus		
Microorganisms are regarded as	Product-typical	Displaying deterioration	Displaying deterioration	Product-typical	Displaying deterioration	Displaying deterioration	Displaying deterioration
Bacterial counts/g stipulated	2.1×10^4	1.8×10^4	$< 1.0 \times 10^2$	$< 1.0 \times 10^2$	4.0×10^2	$< 1.0 \times 10^2$	$< 1.0 \times 10^2$
Corresponding KZS	I	I	I	I	I	I	I

The above results refer exclusively to the sample tested. The information provided herewith is not for public distribution. It is for the intended recipient only and may not be passed on to others.

pp
[signature]
Dr. Sacher-Rudorffer
(Head of Department)

LOD = limit of detection
LOQ = limit of quantification

DAkkS
Deutsche Akkreditierungsstelle
D-PL-14378-13-00

Service building and parcel delivery address
Heckenweg 6
21680 Stade

Mailing address
Heckenweg 6
21680 Stade

E-mail:

Phone
04141 933-6
Fax
04141 933-777

Opening hours
Mon – Thurs 08:00 - 15:00
Fri 08:00 - 14:30
Where possible, please make an appointment for a visit.

Bank details
Nord LB (BIC 250 500 00) acc. no. 1 900 154 008
IBAN: DE56 2505 0000 1900 1540 08
SWIFT/BIC: NOLA DE 2H

LUFA – ITL Dr.-Hell-Str. 6, 24107 Kiel

TEUTOBURGER ÖLMÜHLE GMBH
GUTENBERGSTRASSE 16 A
49477 IBBENBÜREN

Date	31.08.2011
Customer no.:	10032050
Page 1 of 3	

TEST REPORT

Order no. 873724

Analysis no.	**665058**
Sample received	**19.08.2011**
Sampling	**17.08.2011**
Customer sample description	**Rapeseed cake straight feed**
	Catalogue no. 12201X, batch C-15832, production date 07.18.11
Packaging	**Debasafe, 40327403**
Feed code	Rapeseed cake/expeller

	Unit	Value in OM	Value in DM	Value in 88% DM			Method
Nutritive values/ingredients							
Dry matter	%	**91.9**					VDLUFA III 3.1
Crude ash	%	**6.2**	**6.7**	**5.9**			VDLUFA III 8.1
Crude protein	%	**31.9**	**34.7**	**30.5**			VDLUFA III / 4.1.1
Crude fiber	%	**11.1**	**12.1**	**10.6**			VDLUFA III / 6.1.1
Sugar	%	**9.6**	**10.5**	**9.2**			VDLUFA III / 7.1.1
Crude fat	%	**13.1**	**14.3**	**12.6**			VDLUFA III / 5.1.1.B
Calculated values (nutritive values/ingredients)							
Usable crude protein	g/kg	**170.8**	**185.9**	**163.6**			DLG feed value tables
Ruminal N balance	g/kg	**23.7**	**25.8**	**22.7**			DLG feed value tables
ME – cattle	MJ/kg	**12.8**	**13.9**	**12.2**			DLG feed value tables
NEL	MJ/kg	**7.8**	**8.5**	**7.5**			DLG feed value tables
ME – pig	MJ/kg	**13.4**	**14.6**	**12.8**			DLG feed value tables
Lysin	%	**1.80**	**1.96**	**1.72**			Calculated in acc. with Degussa
Trace elements / heavy metals							
Lead	mg/kg	**<0.10**	**<0.11**	**<0.10**			VDLUFA VII 2.2.2.5; ICPMS
Cadmium	mg/kg	**0.06**	**0.07**	**0.06**			VDLUFA VII 2.2.2.5; ICPMS
Mercury	mg/kg	**<0.02**	**<0.02**	**<0.019**			§ 64 LFGB L00.00-19
Arsenic	mg/kg	**<0.10**	**<0.11**	**<0.10**			VDLUFA VII 2.2.2.5; ICPMS
Mycotoxins							
Aflatoxin B1	µg/kg	**<0.3**	**<0.3**	**<0.3**			HPLC-VDLUFA vol. III, 16.1.4
Deoxynivalenol (DON)	mg/kg	**<0.05**	**<0.05**	**<0.05**			HPLC-MS/MS In-house method
Ochratoxin A	µg/kg	**0.32**					HPLC, in-house method
Polychlorinated dibenzo(p)-dioxins and furans							
2,3,7,8-tetra CDD	ng/kg	**<0.020**	**<0.020**	**<0.019**			VDLUFA VII 3.3.2.4

Date 31.08.2011
Customer no.: 10032050

Order no. 873724 Analysis no. 665058

	Unit	Value in OM	Value in DM	Value in 88% DM			*Method*
1,2,3,7,8-penta CDD	ng/kg	**<0.020**	**<0.022**	**<0.019**			VDLUFA VII 3.3.2.4
1,2,3,4,7,8-hexa CDD	ng/kg	**<0.050**	**<0.054**	**<0.048**			VDLUFA VII 3.3.2.4
1,2,3,6,7,8-hexa CDD	ng/kg	**<0.050**	**<0.054**	**<0.048**			VDLUFA VII 3.3.2.4
1,2,3,7,8,9-hexa CDD	ng/kg	**<0.050**	**<0.054**	**<0.048**			VDLUFA VII 3.3.2.4
1,2,3,4,6,7,8-hepta CDD	ng/kg	**<0.10**	**<0.11**	**<0.096**			VDLUFA VII 3.3.2.4
Octa-CDD	ng/kg	**<0.30**	**<0.33**	**<0.29**			VDLUFA VII 3.3.2.4
2,3,7,8-tetra CDF	ng/kg	**<0.020**	**<0.022**	**<0.019**			VDLUFA VII 3.3.2.4
1,2,3,7,8-penta CDF	ng/kg	**<0.020**	**<0.022**	**<0.019**			VDLUFA VII 3.3.2.4
2,3,4,7,8-penta CDF	ng/kg	**<0.020**	**<0.022**	**<0.019**			VDLUFA VII 3.3.2.4
1,2,3,4,7,8-hexa CDF	ng/kg	**<0.050**	**<0.054**	**<0.048**			VDLUFA VII 3.3.2.4
1,2,3,6,7,8-hexa CDF	ng/kg	**<0.050**	**<0.054**	**<0.048**			VDLUFA VII 3.3.2.4
1,2,3,7,8,9-hexa CDF	ng/kg	**<0.050**	**<0.054**	**<0.048**			VDLUFA VII 3.3.2.4
2,3,4,6,7,8-hexa CDF	ng/kg	**<0.050**	**<0.054**	**<0.048**			VDLUFA VII 3.3.2.4
1,2,3,4,6,7,8-hepta CDF	ng/kg	**<0.10**	**<0.11**	**<0.096**			VDLUFA VII 3.3.2.4
1,2,3,4,7,8,9-hepta CDF	ng/kg	**<0.10**	**<0.11**	**<0.096**			VDLUFA VII 3.3.2.4
Octa-CDF	ng/kg	**<0.30**	**<0.33**	**<0.29**			VDLUFA VII 3.3.2.4
I-TE (upper-bound)	ng/kg	**0.08**[xx)]	**0.09**	**0.078**			calculated
TE-WHO (upper-bound, only PCDD/F)	ng/kg	**0.09**[xx)]	**0.10**	**0.09**			calculated
Dioxin-like PCBs							
PCB 77	ng/kg	**<2.0**	**<2.18**	**<1.9**			VDLUFA VII 3.3.2.4
PCB 81	ng/kg	**<0.20**	**<0.22**	**<0.19**			VDLUFA VII 3.3.2.4
PCB 105	ng/kg	**<20.0**	**<21.8**	**<19.2**			VDLUFA VII 3.3.2.4
PCB 114	ng/kg	**<2.0**	**<2.18**	**<1.9**			VDLUFA VII 3.3.2.4
PCB 118	ng/kg	**<50.0**	**<54.4**	**<47.9**			VDLUFA VII 3.3.2.4
PCB 123	ng/kg	**<2.0**	**<2.18**	**<1.9**			VDLUFA VII 3.3.2.4
PCB 126	ng/kg	**<0.20**	**<0.22**	**<0.19**			VDLUFA VII 3.3.2.4
PCB 156	ng/kg	**<5.0**	**<5.44**	**<4.8**			VDLUFA VII 3.3.2.4
PCB 157	ng/kg	**<2.0**	**<2.18**	**<1.9**			VDLUFA VII 3.3.2.4
PCB 167	ng/kg	**<2.0**	**<2.18**	**<1.9**			VDLUFA VII 3.3.2.4
PCB 169	ng/kg	**<0.20**	**<0.218**	**<0.19**			VDLUFA VII 3.3.2.4
PCB 189	ng/kg	**<2.0**	**<2.18**	**<1.9**			VDLUFA VII 3.3.2.4
TE-WHO (upper-bound, only PCB)	ng/kg	**0.034**[xx)]	**0.037**	**0.033**			calculated
TE-WHO total (upper-bound, dioxins and PCBs)	ng/kg	**0.125**[xx)]	**0.137**	**0.119**			calculated
Polycyclic aromatic hydrocarbons (PAH)							
Acenaphthene	mg/kg	**<0.005**	**<0.005**	**<0.005**			as for VDLUFA VII 3.3.3.
Acenaphthylene	mg/kg	**<0.005**	**<0.005**	**<0.005**			as for VDLUFA VII 3.3.3
Anthracene	mg/kg	**<0.005**	**<0.005**	**<0.005**			as for VDLUFA VII 3.3.3
Benzo(a)anthracene	mg/kg	**<0.005**	**<0.005**	**<0.005**			as for VDLUFA VII 3.3.3
Benzo(a)pyrene	mg/kg	**<0.001**	**<0.001**	**<0.005**			as for VDLUFA VII 3.3.3
Benzo(b)fluoroanthene	mg/kg	**<0.005**	**<0.005**	**<0.005**			as for VDLUFA VII 3.3.3
Benzo(ghi)perylene	mg/kg	**<0.005**	**<0.005**	**<0.005**			as for VDLUFA VII 3.3.3
Benzo(k)fluoranthene	mg/kg	**<0.005**	**<0.005**	**<0.005**			as for VDLUFA VII 3.3.3

Order no. 873724 Analysis no. 665058

	Unit	Value in OM	Value in DM	Value in 88% DM			*Method*
Chrysene	mg/kg	**<0.005**	**<0.005**	**<0.005**			as for VDLUFA VII 3.3.3.
Dibenzo(a,h)anthracene	mg/kg	**<0.005**	**<0.005**	**<0.005**			as for VDLUFA VII 3.3.3
Fluoranthene	mg/kg	**<0.005**	**<0.005**	**<0.005**			as for VDLUFA VII 3.3.3
Fluorene	mg/kg	**<0.005**	**<0.005**	**<0.005**			as for VDLUFA VII 3.3.3
Indeno(1,2,3-cd)pyrene	mg/kg	**<0.005**	**<0.001**	**<0.005**			as for VDLUFA VII 3.3.3
Naphthalene	mg/kg	**0.04**	**0.04**	**0.04**			as for VDLUFA VII 3.3.3
Phenanthrene	mg/kg	**<0.01**	**<0.01**	**<0.01**			as for VDLUFA VII 3.3.3
Pyrene	mg/kg	**<0.005**	**<0.005**	**<0.005**			as for VDLUFA VII 3.3.3
Polychlorinated biphenyls (PCBs)							
PCB 28	mg/kg	**<0.005**	**<0.005**	**<0.005**			§ 64 LFGB L00.00-34
PCB 52	mg/kg	**<0.005**	**<0.005**	**<0.005**			§ 64 LFGB L00.00-34
PCB 101	mg/kg	**<0.005**	**<0.005**	**<0.005**			§ 64 LFGB L00.00-34
PCB 118	mg/kg	**<0.005**	**<0.005**	**<0.005**			§ 64 LFGB L00.00-34
PCB 138	mg/kg	**<0.005**	**<0.005**	**<0.005**			§ 64 LFGB L00.00-34
PCB 153	mg/kg	**<0.005**	**<0.005**	**<0.005**			§ 64 LFGB L00.00-34
PCB 180	mg/kg	**<0.005**	**<0.005**	**<0.005**			§ 64 LFGB L00.00-34
Microbiological tests							
Molds	CFU/g	**<1000(+)**					VDLUFA Methods Book III, 28.1.2
Salmonella spp. In 25 g		**Not detected**					ISO 6579:2007-10

[xx] For individual values below the LOQ, the limit of quantification was used as the basis for calculation and for values between the LOQ and the LOD the limit of detection was used.
Explanation: The sign “<” or unknown in the result column means that the substance in question cannot be quantified at the limit of quantification alongside it.
The sign “<…(+)” in the result column means that the substance in question was qualitatively found in the range between the limit of quantification and the limit of detection.

Explanation: substance: OM = original matter, DM = dry matter

LUFA – ITL Dr. Wehage, tel. 0431/1228-220

Beginning of tests: *19.08.11*
End of tests: *31.08.11*

The test results refer solely to the test objects. A plausibility test is only possible to a certain extent for samples of unknown origin. Excerpts from the report may not be duplicated without our written consent.

Appendix 11
Allergen Report

Study Title

Bioinformatics Analysis of Potential Allergenicity and Celiac Disease of Six Seed Storage Proteins from Rapeseed for Food Safety Evaluation

Authors

Richard E. Goodman

Study Completed On

26 July, 2016

Performing Laboratory

Richard E. Goodman, PhD, FAAAI
Private Consulting
8110 Dougan Circle
Lincoln, NE 68516

Laboratory Project ID REG-DSM_2016

Sponsor: DSM Food Specialties

Good Laboratory Practice Compliance Statement

This study was not conducted and reported in compliance with the requirements of the Good Laboratory Practice Standards (40 CFR Part 160) of the Code of Federal Regulations of the United States of America. This is a characterization assessment of the similarity of the introduced proteins to known and putative allergens based on source of the genes and the sequences of the proteins. There is no test system. However, raw data including PubMed searches and bioinformatics comparisons were archived in PDF format in the Authors laboratory with a copy given to the sponsor.

Applicant/Sponsor

DSM Food Specialties

Delft, The Netherlands

Author
(b) (6) [redacted] 2 September 2016

Name: Richard E. Goodman, Ph.D. FAAAAI Date

Title: Private Consultant and Research Professor, Food Allergy Research and Resource Program, Dept. of Food Science & Technology, University of Nebraska—Lincoln

Applicant/Sponsor

(b) (6) [redacted] *31 August 2016*

Signature Date

SUMMARY

DSM Innovation Company requested an evaluation of potential adverse immunological effects (allergic reactions or elicitation of celiac disease) for humans who may consume the major seed storage proteins of rapeseed (*Brassica napus*). Based on the close relationship with other mustard family (Brassiccaceae) members, particularly those in the tribe Brassiceae and close homology of many genes and proteins, those used for food made from seeds may be cross reactive. Spices (foods) area commonly consumed in some areas of the world from the following species *Brassica juncea* (Indian mustard, brown mustard), *Brassica nigra* (black mustard), and *Brassica rapa* (turnip and wild mustard, (*B. rapa* and *B. campestris*) as well as *Sinapis alba* (white mustard). The European Union and Canada recognize mustard (seed) as an important allergenic food that requires labeling.

The purpose of this study was to evaluate potential risks of food allergy and celiac disease based on sequence identity matches (bioinformatics) to known allergens in AllergenOnline.org database version 16; NCBI Protein database with keyword search limit of allergen; exact peptide matches with Celiac Database of AllergenOnline or high identity matches with FASTA to known celiac inducing glutens or gliadins.

The amino acid (AA) sequences of four 11S-12S globulin seed storage proteins of rapeseed *Brassica napus*; a non-specific lipid transfer protein (LTP) of *Brassica oleracea* known to be an allergen (Bra o 3) and the allergenic Napin-3 also known as a 2S albumin from *Brassica napus* were compared to sequences in AllergenOnline.org version 16 database as the most effective comparison database and method for allergenicity evaluation. The evaluation process is similar to that recommended by the CODEX Alimentarius Commission guidelines (2003) for evaluation of proteins introduced in genetically engineered crops. All six proteins were evaluated using an overall FASTA search, a sliding window (80 amino acids). The sequences were also compared to the NCBI Protein database using BLASTP 2.4.0+ using keyword limits "allergen" and "allergy" to ensure that no important matches could have been missed by using AllergenOnline.org as the only comparison tool.

Conclusions. As expected the sequences of the six rapeseed proteins have high sequence identities to the known mustard proteins that are allergens. While they also have moderate to high sequence identities to seed storage allergens of more distantly related plants, there is little evidence for clinical cross-reactivity between mustard seed proteins and homologues outside of Brassicaceae. There were no exact matches to peptides in the Celiac Database and only relatively low-scoring FASTA alignments far below the limits we suggest as risk factors for causing celiac disease. Due to the known risk of food allergy from mustard seed proteins, the recommendation is that food containing seed storage proteins from rapeseed should be labeled as containing mustard or mustard seed. None of the sequence alignment information suggests a risk of eliciting celiac disease.

Table of Contents

Section **Page**

Tables

Abbreviations

AA	Amino acids
BLASTP	Basic Local Alignment Search Tool, for proteins, from NCBI, ver. 2.4.0+
Ber e 1	Brazil nut 2S albumin allergen
Codex	Codex Alimentarius Commission
Cruciferins	Cruciferins (4) referred to as 11S or 12S globulin proteins
EU	European Union
FAO-WHO	Food and Agriculture Organization and World Health Organization of the United Nations
FASTA3	FAST-All, search program version 3 from W.R. Pearson
FDA	U.S. Food and Drug Administration
IgE	Immunoglobulin E (antibody isotype epsilon)
Napin	2S albumin from mustard (canola/rape)
NCBI	U.S. National Center for Biotechnology Information, Library of Medicine, National Institutes of Health
nsLTP	Non-specific lipid transfer protein
SPT	Skin prick test

Study Number: REG –DSM_2016

1.0 Introduction

Rapeseed and Canola (*Brassica napus*) varieties are grown primarily for production of industrial oils (biodiesel, hydraulic and lubricant oils) and edible oil (salad dressing, cooking oil, emulsifiers). The seeds average approximately 40-45% oil and 55-60% meal. The meal includes a high protein content (34-39% on a dry-matter basis), as well as high crude fiber. Major seed storage proteins include 11-S to 12S globulins (cruciferins) and 2S albumin (Tan et al., 2011). Historically canola and rapeseed meal has been used as an animal feed ingredient as it has a favorable mixture of amino acids, but less lysine than soybean meal and higher cysteine and methionine content. The protein mixture and food processing properties of canola meal (oil cake) means it is potentially a very useful protein source for human food (Tan et al., 2011). The processes used to extract oils and prepare canola meal can affect food and feed qualities through denaturation and aggregation (NSW Government report 2014).

In the past few decades, much of the focus of the public and food safety regulators has been on ensuring that foods derived from genetically modified (GM) crops is safe. The Codex Alimentarius Commission developed an internationally accepted guideline for evaluating the safety of such products (2003). The food safety assessment includes an evaluation of potential allergenicity of newly expressed proteins (Delaney et al., 2008). Some countries use similar processes to evaluate the safety of novel food ingredients. In the U.S. the Food and Drug Administration (FDA) encourages food developers to consult with them at the Center for Food Safety and Applied Nutrition (CFSAN). In many cases the products are evaluated in a formal process of evaluation including engaging non-employee scientists to determine if the new food should be accepted as generally recognized as safe (GRAS).

The allergenicity assessment of GM organisms intended for food use includes evaluation of the historical allergenicity of the source of the genes as well as the similarity of the newly expressed protein amino acid sequence expressed in a transgenic (or GM) crop in order to fully evaluate potential risks of food allergy (Codex Alimentarius Commission, 2003). If the source of the new gene(s) is a major allergen (e.g. eight commonly allergenic food sources in the US, 10 in Canada and 14 in the EU), individuals with allergies to the source would be asked to provide serum to test for IgE binding that might indicate the protein from the gene is a potential allergen. Under most labeling laws packaged foods containing the list of those commonly allergenic foods must be clearly labeled on packaged foods so that people who are allergic to the source would know to avoid consuming their allergic source. In both Canada and the EU mustard is considered a commonly allergenic food source. In the case of GM foods, if the gene from one of the major allergenic sources is transferred into a different organism, the developer must demonstrate that any newly expressed protein is not going to transfer allergenic materials from those sources into a new source organism.

However, the food ingredients envisioned by DSM are not likely to be produced by transferring genes and proteins from mustard (canola or rape) into other sources. Rather this is a processed food ingredient that is a co-product of the production of seed oil. As long as a processed food would be labeled to indicate that it contained mustard protein, those with allergy to mustard could avoid it.

Since there may be some concern that the mustard proteins might cause cross-reactive allergy for those allergic to tree nuts or peanuts that contain homologous proteins, DSM requested an evaluation of the similarity of mustard proteins to those of other known allergens including peanuts and tree nuts to evaluate potential risks of eliciting cross-reactive allergy using the bioinformatics model approach for evaluating new proteins in GM crops. The definition of mustard for the purpose of this evaluation includes members of the genus Brassica as well as Sinapis, two closely relative plant groups within the Brasssiceae tribe of the Brasicaceae family. There is little published data looking at IgE cross-reactivity (in vitro binding and in some cases skin prick tests - SPT) between seed storage proteins (11 S globulins or cruciferins, 2S albumins or napin, nsLTP) of mustard and tree nuts, but no evidence that the cross-reactivity leads to clinical reactions (Asero, 2011; Sirvent et al., 2012). It is difficult to demonstrate in vivo (SPT or food challenge) co-reactivity is due to IgE cross-reactivity as people are often poly-sensitized to different foods that could lead to independent allergies. Allergy to rapeseed proteins has been demonstrated in French and Finnish children with atopic dermatitis related to consumption of turnip rapeseeds and the primary sensitization seemed to be 2S albumin (Poikonen et al., 2009). That study demonstrated that the IgE binding was comparable and highly cross-reactive for the 2S albumins of *Brassica rapa*, *Brassica napus* and *Sinapis alba* (Poikonen et al., 2009). The nsLTP (Bra o 3) of *Brassica oleracea* was demonstrated to be cross-reactive in IgE binding studies between pollen and food (seeds) as it is expressed in both (Palacin et al., 2006).

In order to evaluate protein amino acid sequence identities that might be meaningful to indicate potential cross-reactivity, simple local alignments can be performed between the sequence of a test (query) protein and an allergen database such as the well-curated AllergenOnline.org database (Goodman et al., 2016) using FASTA3 (Goodman, 2006; Goodman, 2008) or the NCBI protein database with keyword limits "allergen" or "allergy" (Goodman, 2006; Siruguri et al., 2015) to identify proteins that might represent a risk of cross reactivity. Observations by Aalberse, 2000 and others (reviewed by Goodman et al., 2008; Cressman and Ladics, 2011) indicate that proteins sharing less than 50% identity over their full-lengths are unlikely to act as cross-reactive allergens. Proteins sharing 70% identity or more are highly likely to share IgE binding and presumed allergic cross-reactivity. As a precaution, the generally accepted criteria for allergenicity is a match of >35% identity over any segment of 80 or more amino acids between a novel protein and a proven allergen (Codex, 2003; Goodman et al., 2008; Goodman and Tetteh, 2011). Short sequence matches of eight contiguous amino acids have been suggested as potential cross-reactive targets (Metcalfe et al., 1996), or even six amino acids (FAO-WHO, 2001), but identity matches that short are highly likely to happen by chance alone and are not predictive (Silvanovich et al., 2006). In the case of a novel protein introduced into a GM crop, or a novel protein used as an ingredient without the associated whole food source, food safety regulators may require protein specific IgE binding tests if such a match occurs. Even if IgE binding is found it takes two or more IgE binding epitopes to be recognized in an allergic individual's IgE in order to activate basophils and mast cells, and potentially cause an allergic reaction (Goodman et al., 2008). Therefore in vitro IgE binding should be evaluated further using basophil assays, skin prick tests (SPT) or food challenges in order to prove conclusive evidence of risk.

This report summarizes the findings of an evaluation of the potential allergenicity of the major rape or canola proteins using the primary (amino acid or AA) sequence of four 11S (12S) albumins, the 2S napin and nsLTP of Brassica sp. to evaluate potential cross-reactivity beyond Brassicaceae. I have chosen to use the sequence of the 2S albumin protein of Brazil nut (Altenbach et al., 1987) as a positive control with limited cross-family IgE binding cross-reactivity. This protein was discovered to be a potent food allergen called Ber e 1 in tests designed to evaluate the safety of a GM soybean since it had been transferred into soy to enhance the level of cysteine and methionine (Nordlee et al., 1996). This sequence comparisons used here include searching with FASTA3 using full-length sequence comparisons, sliding window of 80 AA and exact 8 contiguous AA identity matches as described in Siruguri et al. (2015). Additionally, sequences of two cystatin proteins and NPTII were compared to NCBI using BLASTP and the keywords "allergen" and "allergy" to identify matches to potentially allergenic proteins that might have been added to NCBI since the last update of AllergenOnline (January, 2016).

Celiac disease (CD) is known to occur only in consumers with specific genetic markers, class II major histocompatibility markers (MHCII) DQ2.5 and DQ8. Yet, while 30% of humans carry one or more copies of one of those two antigen presentation receptors, only approximately 1.3% of people in most countries suffer from celiac disease (Cecillo and Bonatto, 2015; Lionetti et al., 2015; Lundin et al., 2015). We constructed the celiac database (Goodman lab unpublished), to provide a bioinformatics screening tool for potential risks of inducing celiac disease. The exact matches to CD peptides or a high identity match and small E score in alignments with glutens and gliadins associated with celiac disease suggests potential risks of causing celiac disease and an indication that further testing by T-cell assays or bioassays might be needed for risks of CD. However, based on tests described on the website (AllergenOnline.org/celiachome.shtml) there is no reason to screen proteins from plants that are outside of the subfamily of grasses Pooideae, which includes wheat, barley, rye and oats. Yet we have not observed false positive bioinformatics matches from proteins outside of this subfamily and there are no known cases of eliciting CD with non-Pooideae food source materials. However, some consumers are questioning the safety of alternative food sources like mustard seeds as possible risk factors for CD. Therefore, we have performed searches of the CD database as described on the website (http://www.allergenonline.org/celiachome.shtml) for potential alignments at the request of DSM.

2.0 Purpose

The purpose of this study is to perform an evaluation of the potential allergenic cross-reactivity of the major seed storage proteins of rape/mustard to allergens outside of the

Brassicaceae family to evaluate potential risks of cross-reactivity to other important food allergen sources (e.g. tree nuts, peanut) as well as potential risks of celiac disease.

3.0 Methods

3.1 **Amino acid sequences of four cruciferins, one 2S albumin and one nsLTP of Brassica sp. and positive allergen control Ber e 1.** The protein (amino acid) sequences of the proteins expected to represent the majority of proteins within the seeds of canola/rapeseed and the most likely sources of food allergy to seeds of Brassica sp., are listed in Table 1. The Brazil nut (*Bertholletia excelsa*) 2S albumin allergenic protein (Ber e 1), P04403, was used as a positive allergen control in the bioinformatics searches. The Ber e 1 protein was previously demonstrated to be a clinically important allergen for a number of individuals who suffer severe allergic responses when eating Brazil nuts (Nordlee et al., 1996). The Ber e 1 is homologous to a number of 2S albumins from various tree nuts, but has been shown to have a low degree of in vitro cross-reactivity in terms of IgE binding for some subjects with allergy to peanuts (de Leon et al., 2005; de Leon et al., 2007; Rosenfeld et al., 2012).

3.2 **Sequence database search strategies.** The bioinformatics searches rely primarily on the use of the FASTA3 algorithm developed by Pearson at the University of Virginia (Pearson and Lipman, 1988) and BLASTP (Altschul et al., 1990).

3.2.1 Databases. The following public-accessible databases were used to evaluate potential allergenicity.

3.2.1.1 AllergenOnline.org. AllergenOnline was updated to version 16 in January, 2016 (Goodman et al., 2016). The database is available at www.allergenonline.org/. The complete allergen list of 1956 known or putative allergens from 778 allergenic taxonomic protein groups is shown in Appendix 1 (with GI numbers for the appropriate sequences in NCBI). This curated database is maintained by the Food Allergy Research and Resource Program of the University of Nebraska and is updated annually. The database includes known and putative allergens that have been identified as IgE binding proteins from food, airway, contact and venom allergen sources. The published evidence of allergenicity for each taxonomic protein group was evaluated by a panel of allergy and allergen experts before being included in the database. The database is freely accessible by web browser and is maintained by the Food Allergy Research and Resource Program within the University of Nebraska—Lincoln.

3.2.1.2 NCBI Protein. The general protein database maintained by the National Library of Medicine, National Institute of Health in the US is an uncurated database that is organized based on annotations. It is updated every few days. Many sequences in NCBI that are designated as allergens or associated with allergy by keywords are not included in the AllergenOnline.org database because they lack any published proof of allergy. The NCBI database may be searched by keywords or by sequence comparison (BLASTP). The NCBI public protein database may be found at http://www.ncbi.nlm.nih.gov/protein/.

3.2.1.3 Celiac Peptide and Gluten Protein database. A set of 1,016 peptides were identified from grains of the Pooideae subfamily of grasses (wheat, barley, rye and oats), including native and deamidated peptides of glutens (gliadins and glutenins) that have been shown to stimulate celiac associated T cells from those with celiac disease (CD), or stimulating toxicity in intestinal epithelia or intestinal inflammatory cells in CD subjects. The peptides are used in searches for exact peptide (AA) matches within any query sequence. The peptides are all based on binding to MHC DQ2.5, DQ8 or the nearly identical DQ2 receptors, but in addition, stimulated MHC restricted T cells from subjects with CD; or alternatively had specific toxic effects such as stimulating signal induction through the EGFR receptor of intestinal epithelial cells, stimulating IL-15 production by intestinal macrophages, inducing TNF expression from dendritic cells increasing HLA-E expression in intestinal epithelial cells, increasing intestinal permeability or signaling antigen presenting cells through TLR4 to secrete inflammatory cytokines (Jabri and Sollid, 2009). Sixty-eight representative gluten proteins containing at least one of the CD peptides were chosen for rapid screening using FASTA3 with criteria that allows for some AA substitutions, but conserved overall identity matches that might represent some risk from the query protein. Forty-five peptides are from *Triticum sp.*, eleven from *Hordeum vulgare* six from *Secale cereal*, five from *Avena sp.* and one artificial high molecular weight glutenin. The database (http://www.allergenonline.org/celiachome.shtml) is publically accessible from a link in the www.allergenonline.org webpage.

3.2.2 Search algorithms. The most important searches for risk assessment of allergenicity are amino acid sequence identity searches (FASTA or BLAST) comparing the query sequence to known allergens, looking for matches of >50% identity over the full length of the sequences. Since many sequences are somehow labeled as allergens in the public NCBI database, the use of the curated AllergenOnline.org database is the primary search database. An overall (full-length) FASTA3 search is the algorithm for optimum alignment. As a conservative assessment, Codex (2003) recommends a search for matches of >35% identity over 80 amino acid segments and the "sliding window" approach on the www.AllergenOnline.org website is a useful and convenient tool for that step. Some countries still demand a search for identity matches of 8 amino acids, and the word search method with www.AllergenOnline.org is effective to meet those demands. In addition, it is sometimes useful to run BLASTP on the NCBI Protein database using a keyword limit ("allergen") to verify that the www.AllergenOline.org database did not omit an important allergenic homologue of the novel protein that matches with at least 50% identity over the full-length. To help evaluate BLASTP results, a second BLASTP search should be performed without keyword limits to understand the similarity of the novel protein to other proteins, many of which humans are likely to have been exposed to without sensitizing or eliciting allergic responses. Details are provided below.

3.2.2.1 Searching AllergenOnline.org, full-length FASTA3. The primary search algorithm is a full-length FASTA3 version 35.04 search that gives optimum alignments using the default criteria defined by Pearson (2000). The default scoring matrix is BLOSUM 50 (Henikoff and Henikoff, 1992 and 1996). The penalty for each gap inserted into query or searched sequences to obtain optimal alignments is calculated as ($-q + -r*k$), where q (10) is an initial penalty for each independent gap, r (2) is a penalty for each amino acid position within the gap and k is the number of amino acid positions within the gap (Reese and Pearson, 2002). The default word size (ktup) is two (Pearson, 2000). The FASTA3 version used in these searches was 35.04 Jan. 15, 2009 (ftp://ftp.virginia.edu/pub/fasta/). Statistical values are calculated for each search and compared to expected values, as illustrated in the histogram of the computer output, if it is selected on the website. Alignment of regions containing low sequence complexity may lead to irrelevant alignments and are expected to show skewed distributions and should be reanalyzed after removing the low complexity regions (Pearson, 2000). Very small expectation values (*E* values) indicate probable evolutionary homology, and structural similarity. While the *E* value default for FASTA3 is set to 10, a value that does not indicate significant similarity, distantly related sequences will generally have *E* values less than 0.01, and highly similar sequences that probably represent close homology are more likely to have *E* values much less than 1e –7. If the statistical parameters calculated for an alignment between the query protein and any one allergen appear to indicate significant similarity, the percent identity over the length of the intact proteins may be evaluated for possible cross-reactivity in those sensitized to the matched allergen. As discussed by Aalberse (2000), a protein sharing greater than 70% identity over its length, relative to an allergen is likely to be cross-reactive, or share IgE binding. Those that have less than 50% identity are not very likely to be cross-reactive.

3.2.2.2 Searching Allegenonline.org; sliding window of 80 AA. The identification of relatively short regions of high identity shared by a query sequence and an allergen may indicate similarities that could also share IgE binding, or cross-reactivity. Based on the recommendation of Codex (2003), the FASTA3 algorithm was used to compare all possible contiguous amino acid segments of each of the six test proteins against all sequences listed in AllergenOnline. Every possible contiguous 80-amino acid sequence of each query protein was searched, beginning with amino acids 1-80, then 2-81, 3-82 and so on until the last 80 amino acid segment of each protein was compared with the database on AllergenOnline, using the same FASTA3 algorithm used for the overall-comparison. In this case, only the *E* values and percent identities [(# identical residues / 80 or more amino acids) * 100%)] were evaluated to consider potential cross-reactivity. Alignments of less than 80 amino acids in length were recalculated to normalize the identity to an 80 amino acid score, by increasing the denominator to 80, without altering the numerator. Therefore an alignment with 38 identical amino acids over a length of 40 (=95%), would be recalculated to 47.5%. The reason for the adjustment is that alignments less than 80 amino acids long may have very high identities, and would therefore be more likely to act as a cross-reactive allergen if the matched region represented an IgE epitope, than longer alignments of markedly lower identity scores. When the FASTA3 program inserts gaps in the query sequence to provide optimal alignment, the length of the alignment will exceed 80 amino acids. Rather than "correcting" the alignment identity scores, the same criterion of 35% identity is maintained as per the recommendation of Codex (2003). The rationale by Codex (2003) for recommending that alignments of >35% identity over segments as short as 80 amino acids is that proteins sometimes contain structural motifs that are comprised of sequences much shorter than the intact protein, and that these structural motifs may include a conformational IgE binding epitope. In such a situation, the overall sequence identity for the aligned proteins may be significantly less than 35%, even though a short region could contain an important cross-reactive epitope. This criterion is more conservative than empirical data would suggest is common for cross-reactive proteins (Aalbersee, 2000). It should also help to identify potentially cross-reactive proteins that are not true homologues of an allergen that have significant local identities that might provide an immunological target for IgE antibodies in those with allergies to the matched allergen. The current algorithm will identify any match containing 28 identically aligned, identical amino acids in an overlap of 80 amino acids. The output of the 80 amino acid FASTA3 search includes a table of each allergen that was matched, and the total number of 80-amino acid matches of greater than 35% identity. An additional file of all alignments is maintained to allow location and further evaluation of any significant match.

3.2.2.3 Searching AllergenOnline.org, eight contiguous AA. The eight amino acid identity match often requested for GM crop protein evaluation is essentially a "word" matching program that looks for segments of 8 contiguous amino acids with a 100% identity match to any 8 amino acids segment of any allergen in the database. It is a very conservative estimator for cross-reactivity and over-predicts potential allergic cross-reactivity (Hileman et al., 2002; Silvanovich et al., 2006; Cressman and Ladics, 2009). Therefore this search was not performed to evaluate the mustard (canola/rape) proteins.

3.2.2.4 Searching NCBI Protein using BLASTP with limit "allergen". Protein entries in the Entrez search and retrieval system are compiled and maintained by the NCBI of the National Institutes of Health (U.S.A.). The database is potentially updated or modified daily. Therefore the date of sequence searches by BLASTP is relevant to the dataset used in the BLASTP searches. Searches were performed in June and July, 2016. Amino acid sequences were entered in the query box of BLASTP: (http://blast.ncbi.nlm.nih.gov/Blast.cgi?PROGRAM=blastp&BLAST_PROGRAMS=blastp&PAGE_TYPE=BlastSearch&SHOW_DEFAULTS=on&LINK_LOC=blasthome). The database selected was Non-redundant protein sequences (nr). No organism exclusions were used. When desired, specific keywords were entered in the "Entrez Query" box to limit the search by specific criteria. BLASTP (protein-protein BLAST) was selected and the "BLAST" button was selected. Note that the BLASTP program version and parameters were changed on 2 June, 2016. The current version is BLASTP 2.4.0+. One primary alteration was a change from the seed site Word size from 2 or 3 in earlier versions, to 6 in version 2.4.0+. The change has reduced the number of irrelevant identity matches a bit as it is more stringent. Some other minor changes were also instituted with this version (threshold score from 11 to 21 and allowing cysteine modification). Results are presented with specific data of search parameters and results were captured by copying to a WORD file that was saved with all data related to the search. Search criteria (printed with every search), includes Word size (6), Expect value (10), Hitlist (100), Gapcosts (11,1), Matrix (BLOSUM62), Filter String (F), Genetic code (1), Window size (40), Threshold (21), Composition-based stats (2) and database date, number criteria were recorded for each search.

Interpreting BLASTP alignments for significance is based primarily on the percent identity over the full-length or most of the full length of the protein. A 100% match obviously means it is identical and all properties would be expected to be shared. A 50% - 70% match means the properties (enzymatic activity, allergenicity and toxicity) may well be shared or similar. Less than 35% identity overall is very unlikely to be meaningful. The *E* score statistic is affected by the database size, sequence length and other factors. *E* scores close to zero are significant; however, *E* scores as large as 1×10^{-7} (or 1e-7) may be significant, depending on the length of the proteins, the length of the alignments and the size of the database. Two proteins of very different lengths (626 AA vs 169 AA) can be 100% identical to respective homologous proteins, yet their *E* scores can vary markedly (*E* score = 1e-160; *E* score = 1e-114 respectively). Proteins having only short, but highly identical matches may have an *E* score of 1e-2 and if the full-length proteins are much longer than the alignment, there is little chance the function of the proteins will be shared.

3.2.2.5 Searching NCBI Protein using BLASTP without limit. The purpose of this BLASTP search is to compare the four proteins to all known protein sequences to evaluate whether there are other similar proteins from other organisms that might provide information of safe exposure or harm to homologues of this protein.

3.2.2.6 Searching the Celiac database. The primary search is for any exact AA sequence match between the query AA sequence and any one of the 1,016 CD peptides. It is a "word" search routine requiring an exact match. The secondary search is a FASTA3, version 35.04. Results must be manually evaluated looking for matches with E scores smaller than 1 x 10e-15, with greater than 45% identity over more than half the length of one or more of the matched CD (68) proteins, or at least 100 AA.

4.0 Results and Discussion. The summary results for the amino acid sequences of the mustard (canola/rape) seed storage proteins (four cruciferins, one 2S albumin and one nsLTP) are presented here, along with those for the positive allergen control, Ber e 1.

4.1 AllergenOnline.org comparisons using full-length FASTA3.

4.1.1 Cruciferins. Many alignments were identified to sequences in AllergenOnline.org version 16 for the four cruciferin proteins with *E* scores less than 1, which is a default cut-off for recognition Table 2. However, only the best three alignments were shown for each of the four cruciferins. The highest scoring alignments were to various mustard allergens, with 50% to >90% sequence identity over the full-length of these conserved proteins. The next best matches were 41%-46t% to pistachio and cashew 11S albumins. Note that there is little evidence of clinical co-reactivity for mustard allergy and allergy to pistachio although there is some in vitro cross-reactivity (Sirvent et al., 2012). No publications were identified demonstrating cross-reactivity between mustard 2S albumins and tree nut or other non-mustard plants.

4.1.2 Napins, 2S albumins. Many alignments to sequences in AllergenOnline.org version 16 were identified for the mustard napin protein with *E* scores less than 10, with identity scores greater than 80%. The next best alignment was to pistachio 2S albumin, with an identity score of approximately 35% and markedly higher *E* score. There is no clear evidence of shared allergic cross-reactivity for mustard and tree nut 2S albumins.

4.1.3 Mustard nsLTP. The NPTII protein did produce eight low-scoring alignments with diverse sequences in AllergenOnline when the full-length FASTA3 algorithm was run with an *E* score cutoff of 10. All alignments had E score > 1. The % sequence identity and alignment lengths were low as shown in Table 4. None of the alignments raises any concerns of allergic cross-reactivity.

4.1.4 Positive allergen control Ber e 1. The Brazil nut 2S albumin, Ber e 1 is used as a positive control to demonstrate scoring that may represent matches to potentially cross-reactive homologous proteins. Ninety-five alignments were identified to various tree nut 2S albumins. The top scoring 10 are shown in Table 5. The highest scoring match was to Ber e 1 (100%), itself. The *E* score for this full-length alignment of 100% was small (1.3e-030). The next nine identity matches were to 2S albumins from other tree nuts and sesame seed that may have some modest in vitro cross-reactivity for some individuals allergic to Brazil nut (hazelnut, walnut and pecan) as well as to sesame seed, pistachio nut, sunflower nut, cashew nut. Published evidence of cross-reactivity with those seed sources is not common except between nuts within the same genus or at least family of plants as demonstrated by de Leon et al. (2005) and de Leon et al. (2007). These results suggest that Ber e 1 has the potential to be cross-reactive with low efficacy with other tree nut 2S albumins for some individuals with allergies to tree nuts.

4.2 AllergenOnline.org comparison using sliding 80 AA window FASTA3. Potential sequential sequence identities to 80 amino acid segments of proteins were evaluated for the cruciferins, napin (2S albumin) and nsLTP of mustard. The positive control protein Ber e 1 was also evaluated.

4.2.1 Cruciferins. The 80 AA alignments of the four cruciferins to allergens in AllergenOnline showed slightly less difference in identity between the mustard cruciferins and tree nut 11S albumins than the full-length alignments. Yet they were consistently higher across-mustard species 11S globulins by a few to nearly 10% higher identity matches compared to tree nut 11 S albumins (see table 6-9). The *Brassica sp.* and *Sinapis sp.* proteins were always higher in identity compared to tree nut 11 S globulins. Based on a lack of published evidence of cross-reactivity or co-reactivity, it seems the mustard to tree nut evolutionary or structural protein differences are high enough to have little risk of cross-reactivity.

4.2.2 Napins, 2S albumins. The results from the sliding 80 AA window were similar to the overall FASTA alignments. There is high identity across mustard family 2S albumins and high likelihood of in vitro cross-reactivity and in vivo co-reactivity. But there was a drop of >18% to nearly 50% between mustard family 2S albumin identity matches and those of tree nuts or legumes. This suggests little risk of cross-reactivity or co-reactivity beyond the mustard family.

4.2.3 nsLTP of mustard family proteins. There was nearly a 40% drop in identity matches between mustard family members and those of non-mustard family allergens when evaluating the 80 AA sliding window matches. It is highly unlikely that there is cross-reactivity or co-reactivity between mustard allergic and individuals allergic to various tree and fruit nsLTPs (see Table 11).

4.2.4 Ber e 1 positive allergen control. Eleven positive matches were identified when searching with the positive allergen control, Ber e 1 (Table 12). The highest scoring matches (except to Ber e 1 itself) were to 2S albumins of tree nuts (hazelnut, English and black walnuts and pecan) followed by sesame seeds, sunflower, castor bean, isoforms of sesame seed and wild buckwheat. There is some evidence of IgE binding shared among tree nut seed storage proteins and some individuals are allergic to various tree nuts, suggesting that clinical cross-reactivity may occur for some individuals, but co-sensitization is also a possibility that has not been eliminated. There is not good evidence of common cross-reactivity or clinical reactivity between Brazil nut and hazelnut, Brazil nut, walnut, pecan or other nuts.

4.3 BLASTP alignments compared to NCBI Proteins. The amino acid sequences of the four cruciferins, Napin-2S albumin, nsLTP and Ber e 1 positive control were compared to protein sequences in the NCBI protein database with both keyword limits "allergen" and "allergy". The results of the searches were saved and archived. They are summarized in table format and discussed in this report.

4.3.1 BLASTP comparisons with the keyword limit "allergen" and "allergy". The NCBI Protein database searches using "allergen" as the keyword limit produced results that were anticipated, with most matches to the most highly conserved allergen sequences similar to those found with AllergenOnline.

4.3.1.1 Cruciferins. In particular the cruciferins identified mustard family 11S globulins, with somewhat lower identity matches to some tree nut 11S globulins. Some differences are to be noted between cruciferins in that cruciferin 3 was most highly conserved between *Brassica sp.* and *Sinapis sp* at 85 to 90% identity. However, for cruciferins 1, 2 and 4, the identities were still roughly 10% higher than to tree nut allergens. This again seems to reflect the rare instances of reported in vitro IgE cross-reactivity and the lack of evidence of clinical cross-reactivity from mustards to tree nuts. The BLASTP results for cruciferins with "allergy" are a bit different. Since mustard has been reported to be a food allergen much less often than many of the commonly consumed tree nuts, there was not an association of *Brassica sp.* or *Sinapis sp.*, with the proteins found using "allergy". The sequence annotations are mostly from associations of published results of allergy from tree nuts such as pistachio, hazelnut and walnut. The identity matches are as low (35-45%) as those identified using "allergen" when there was a match with a tree nut allergen. This suggests that the primary concern for cross-reactivity should remain among the mustards, and there is not a high probability of cross-reactivity from mustard to tree nuts.

4.3.1.2 Napin. High identity matches (>80%) were observed for napins from *Brassica sp.* and *Sinapis sp.* using the keyword "allergen". One high identity match (82%) was found between *Brassica sp.* and *Sinapis alba* napin using "allergy" as the keyword limit and then the next highest scoring identities were all random noise with short alignments, high *E* scores and relatively low identities. Those were to a bacterial protein that has not been reported to be an allergen and the next two were short segments of very long (>9000 AA) protein sequence of the parasite *Toxoplasma gondii*. This high *E* scores and low identities demonstrate the irrelevance of the alignments.

4.3.1.3 nsLTP. The nsLTP of mustards have not been commonly reported as binding IgE. And the BLAST shows the best alignment to the model genome mustard *Arabidopsis thaliana* when "allergen" was used. This is a very small plant that is never consumed. Due to evolutionary homology, it is expected that there is conservation of the sequence in the mustard family, Brassicaceae (Cruciferae). The next highest scores are to apple nsLTPs, with many entries in NCBI and a number of reports of allergy in Spain to this protein, but few reports of allergy in other geographies. It seems to be due to the relatively common occurrence of allergy to peach LTP and higher sequence conservation between peach and apple LTP. In any event, the sequence identities are 20% lower to apple compared to even *Arabidopsis thaliana* and it is unlikely that there is a significant risk of cross-reactivity or clinical co-reactivity from mustard to apple due to nsLTP.

4.3.1.4 Ber e 1. The example of marked reduction in protein identity and very low level of cross-reactivity between families of tree nuts is demonstrated by the identity matches of the 2S albumin, Ber e 1. While there are a few reports of low-level IgE cross-reactivity, it seems to be not very important for clinical reactivity for the 2S albumins unless the sources are within the same taxonomic family (e.g. walnut and pecan).

4.5 Celiac disease screen of mustard proteins.

The six mustard proteins were compared to the AllergenOnline.org Celiac Database using both the exact peptide match and FASTA alignments.

4.5.1 Exact matches. There were no exact peptide matches with CD peptides with any of the mustard proteins (cruciferins, napin or nsLTP). The positive control, partial alpha-gliadin from *Triticum aestivum* had four peptide identities that matched in the CD database, demonstrating that the search was working.

4.5.2 FASTA matches. The FASTA comparison of the six mustard proteins to the 68 representative CD proteins did not identify any matches with *E* scores, percent identities and lengths of alignments that indicate potential risks of eliciting CD (*E* score <1e-15, >45% identity over at least 100 AA alignment) are shown in Table 18. The best alignments were to homologues, but E scores >0.001, identities of <36% for alignment lengths of 79 to nearly 300 AA. Those matches do not represent a potential risk of eliciting CD. The positive CD control (Table 19), half-length alpha gliadin of wheat was used to demonstration the functionality of the program and the database, which showed more than four alignments of ~ 99% identity, with E scores smaller than 1e-15 and long alignments. There were also a number of alignments that did not quite reach the criteria necessary to suggest potential risks of eliciting CD reactions.

5.0 Conclusions.

The bioinformatics and literature searches demonstrate that closely related species in the mustard family, in the genus *Brassica* and *Sinapis*, are likely to elicit cross-reactivity in those sensitized and allergic to any member of those genera. The reactivity could be due to sensitization to cruciferins (11S globulins), napins (2S albumins) or non-specific Lipid transfer proteins. Thus, foods derived from canola, rape and mustard should be given similar food labels to help those with allergies to any of those food sources avoid allergic reactions. Based on the literature, most of the subjects are likely to be diagnosed as having allergy to mustard. Since there has been some concern that individuals with CD may suffer elicitation or maintenance of their immune response due to exposure to other non-grain protein sources, we evaluated the sequence identity matches of the major mustard seed storage proteins against AllergenOnline.org Celiac Disease database. None of the mustard proteins had any exact matches and the FASTA results are quite low. It is therefore highly unlikely their immune system would be stimulated by exposure to mustard (canola or rape) proteins. And the sequence identity matches to glutens are very poor, confirming the low risk of triggering CD response in those consuming mustard.

6.0 References

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Table 1 Amino acid sequences of the six rapeseed seed storage proteins, Ber e 1 and partial alpha-gliadin. The amino acid sequences of the six proteins included in this evaluation are indicated below along with the protein database accession number, the length in amino acids and the sequence (single letter code). The Brazil nut 2S albumin, Ber e 1 is used as a positive allergen control, the c-terminal half of Alpha-gliadin from *Triticum dicoccoides* is used as a positive control for CD.

Protein	Accession #	Length (AA)	Protein AA sequence
CRU1_BRANA	P33523	490	MARLSSLLSFSLALLIFLHGSTAQQFPNECQLDQLNALEPSHVLKAEAGRIEVWDHHAPQLRCSGVSFVRYII ESKGLYLPSFFSTAKLSFVAKGEGLMGRVVPGCAETFQDSSVFQPSGGSPSGEGQGQGQQGQQGHQGQG QGQQGQQGQQGQQSQGQGFRDMHQKVEHIRTGDTIATHPGVAQWFYNDGNQPLVIVSVLDLASHQNQLD RNPRPFYLAGNNPQGQVWIEGREQQPQKNILNGFTPEVLAKAFKIDVRTAQQLQNQQDNRGNIIRVQGPFS VIRPPLRSQRPQETEVNGLEETICSARCTDNLDDPSNADVYKPQLGYISTLNSYDLPILRFLRLSALRGSIRQN AMVLPQWNANANAVLYVTDGEAHVQVVNDNGDRVFDGQVSQGQLLSIPQGFSVVKRATSEQFRWIEFKT NANAQINTLAGRTSVLRGLPLEVISNGYQISLEEARRVKFNTIETTLTHSSGPASYGGPRKADA
CRU2_BRANA	P33524	496	MARLSSLLYFSITVLIFLHGSTAQQFPNECQLDQLNALEPSHVLKAEAGRIEVWDHHAPQLRCSGVSFVRYII ESQGLYLPSFLNTANVSFVAKGQGLMGRVVPGCAETFQDSSVFQPGSGSPFGEGQGQGQQGQGQGQGQGQ GKGQQGQGKGQQGQSQGQQGQGQGFRDMHQKVEHIRSGDTIATHPGVAQWFYNNGNQPLVIVAVMDLA SHQNQLDRNPSQFYLAGKNPQGQSWLHGRGQQPQNNILNGFSPEVLAQAFKIDVRTAQQLQNQQDNRGNI VRVQGPFGVIRPPLKSQRPQETEANGLEETICSARCTDNLDDPSNADVYKPQLGYISILNSYDLPILRVLRLSA LRGSIRQNAMVLPQWKSKSNAVLYVTDGEAQIQVVNDNGDRVFDGQVSQGQLLSIPQGFSVVKRATSDQF RWIEFKTNANAQINTLAGRTSVMRGLPLEVIANGYQISLEEARRVKFNTIETTLTHSSGPASYGRPRKADA
CRU3_BRANA	P33525	509	MVKVPHLLVATFGVLLVLNGCLARQSLGVPPQLGNACNLDNLDVLQPTETIKSEAGRVEYWDHNNPQIRC AGVSVSRVIIEQGGLYLPTFFSSPKISYVVQGMGISGRVVPGCAETFMDSQPMQGQQQGQPWQGQQGQQG QQGQQGQQGQQGQQGQQGQQGQQGQQQQGFRDMHQKVEHVRHGDIIAITAGSSHWIYNTGDQPLV IICLLDIANYQNQLDRNPRTFRLAGNNPQGGSQQQQQQQNMLSGFDPQVLAQALKIDVRLAQELQNQQD SRGNIVRVKGPFQVVRPPLRQPYESEQWRHPRGPPQSPQDNGLEETICSMRTHENIDDPARADVYKPNLGR VTSVNSYTLPILQYIRLSATRGILQGNAMVLPKYNMNANEILYCTQGQARIQVVNDNGQNVLDQQVQKGQ LVVIPQGFAYVVQSHQNNFEWISFKTNANAMVSTLAGRTSALRALPLEVITNAFQISLEEARRIKFNTLETTL TRARGGQPQLIEEIVEA

CRU4_BRANA	P33522	465	MGPTSLLSFFFTFLTLFHGFTAQQWPNECQLDQLNALEPSQIIKSEGGRIEVWDHHAPQLRCSGFAFERFVIE PQGLYLPTFLNAGKLTFVVHGHALMGKVTPGCAETFNDSPVFGQGQGQEQGQGQGQGQGFRDMHQK VEHLRSGDTIATPPGVAQWFYNNGNEPLILVAAADIANNLNQLDRNLRPFLLAGNNPQGQQWLQGRQQQK QNNIFNGFAPQILAQAFKISVETAQKLQNQQVNRGNIVKVQGQFGVIRPPLRQGQGGQQPQEEGNGLEETLC TMRCTENLDDPSSADVYKPSLGYISTLNSYNLPILRFLRLSALRGSIHNNAMVLPQWNVNANAALYVTKGK AHIQNVNDNGQRVFDQEISKGQLLVVPQGFAVVKRATSQQFQWIEFKSNDNAQINTLAGRTSVMRGLPLEV ISNGYQISPQEARSVKFSTLETTLTQSSGPMGYGMPRVEA
Napin 2S albumin	P80208.1	125	SAGPFRIPKCRKEFQQAQHLRACQQWLHKQAMQSGSGPQGPQQRPPLLQQCCNELHQEEPLCVCPTLKGA SRAVKQQVRQQQGQQGQQLQQVISRIYQTATHLPKVCNIPQVSVCPFQKTMPGPS
nsLTP Bra o 3	XP_0136 23213	112	MASALSFFTCLVLTVCIVASVDAAISCGTVTSNLAPCAVYLMKGGPVPAPCCAGVSKLNSMAKTTPDRQQ ACKCLKTAAKNVNPSLASSLPGKCGVSIPYPISMSTNCDTVK
Ber e 1	P04403	146	MAKISVAAAALLVLMALGHATAFRATVTTTVVEEENQEECREQMQRQQMLSHCRMYMRQQ MEESPYQTMPRRGMEPHMSECCEQLEGMDESCRCEGLRMMMMRMQQEEMQPRGEQMRRMM RLAENIPSRCNLSPMRCPMGGSIAGF
Alpha-gliadin *T. dicoccoides* c-terminal half	AAZ737 28.1	156	EQQILQQILQQQLIPCMDVVLQQHNIAHGRSQVLQQSTYQLLQELCCQHLWQIPEQSQCQAIHNVVHAIILH QQQKQQQQPSSQVSFQQPLQQYPLGQGSFRPSQQNPQAQGSVQPQQLPQFEEIRNLALQTLPAMCNVYIPP YCTIAPFGIFGTN

Table 2 AllergenOnline full-length sequence comparison using FASTA3 with Cruciferins. Relatively high scoring identity alignments were found for the four cruciferin 11 S globulins. Only the top three matches with an E score < 1 and percent identity greater than 35% for each of the cruciferins.

Sequence GI#	Organism	Description	Length AA	*E* score	% Identity in alignment	AA Alignment length
		CRU1_BRANA				
62240390	*Sinapis alba* White mustard	11S globulin precursor	510	4.2e-52	58.9	501
110349085	*Pistacia vera* Pistachio	11S globulin precursor Pis v 2.0201	472	2.4e-39	41.8	493
156001070	*Pistacia vera* Pistachio	11S globulin precursor	472	4.9e-39	41.6	493
		CRU2_BRANA				
62240390	*Sinapis alba* White mustard	11S globulin precursor	510	5.6e-71	57.5	503
110349085	*Pistacia vera* Pistachio	11S globulin precursor Pis v 2.0201	472	9.5e-35	41.3	499
156001070	*Pistacia vera* Pistachio	11S globulin precursor	472	1.8e-34	41.1	499
		CRU3_BRANA				
62240390	*Sinapis alba* White mustard	11S globulin precursor	510	2.6e-122	91.6	510
62240392	*Sinapis alba* White mustard	11S globulin precursor	523	2.5e-91	90.1	523
25991543	*Anacardium occidentale* Cashew	Allergen Ana o 2	457	5.2e-42	46.2	487
		CRU4_BRANA				
62240390	*Sinapis alba* White mustard	11S globulin precursor	510	2.6e-59	55.0	471
62240392	*Sinapis alba* White mustard	11S globulin precursor	523	8.6e-58	53.3	482
110349085	*Pistacia vera* Pistachio	11S globulin precursor Pis v 2.0201	472	2e-055	45.6	471

Table 3 AllergenOnline full-length sequence comparison using FASTA3 with 2S albumin Napin. High scoring identity alignments were found with the 2S albumin of mustards *(Brassica sp., Sinapis alba* and lower identity matches to mustard 2S albumins (10 matches) before a 2S albumin of pistachio.

Sequence GI#	Organism	Description	Length AA	*E* score	% identity in alignment	AA Alignment length
75107016	*Brassica napus* Rape	Napin-3 BnIII	125	3.9e-29	100	125
32363444	*Brassica juncea* Indian mustard	Bra j 1 e	129	1.6e-26	89.1	129
1009438	*Sinapis alba* White mustard	Sin a 1.0106	145	9.2e-18	81.9	144
110349081	*Pistachia vera* Pistachio	Pis v 1	149	2.9e-5	34.8	112

Table 4 AllergenOnline full-length sequence comparison using FASTA3 with nsLTP. Moderately high scoring identity alignments were found with the nsLTPs of other species, however, the best matches were at approximately 57% identity with modest *E* scores to strawberry and many apple nsLTPS. There is no published evidence of clinical co-reactivity or IgE cross-reactivity that is significant.

Sequence GI#	Organism	Description	Length AA	*E* score	% identity in alignment	AA Alignment length
922434456	*Brassica oleracea* Cabbage	nsLTP	112	2.1e-38	100	112
67937767	*Fragaria x ananassa* Strawberry	nsLTP	117	4.9e-21	55.6	117
50659879	*Malus domestica* Apple	nsLTP Mal d 3	115	6.3e-21	56.5	115

Table 5 AllergenOnline full-length sequence comparison using FASTA3 with Ber e 1. Ninety five alignments were identified using an *E* score cutoff smaller than 10 compared to Ber e 1 sequence (146 AA) accession P04403. The ten highest scoring are reported here (including the 100% match to itself). Sequence matches to 2S albumins of other species are moderately high in identity and full-length as expected.

Sequence GI#	Organism	Description	Length AA	*E* score	% identity in alignment	AA Alignment length
112754	*Bertholletia excelsa* Brazil nut	2S albumin, food allergen, Ber e 1	146	1.3e-030	100	146
226437844	*Corylus avellana* Hazelnut	2S albumin, food allergen, Cor a 14	147	5.2e-011	45.9	146
1794252	*Juglans regia* English walnut	2S albumin, food allergen, Jug r 1	139	1e-009	42	138
31321942	*Juglans nigra* Black walnut	2S albumin, food allergen, Jug n 1	161	1.5e-009	39.3	145
28207731	*Carya illinoinensis* Pecan	2S albumin, putative food allergen	143	5.9e-009	40	145
5381323	*Sesamum indicum* Sesame	2S albumin, food allergen, Ses i 2	148	6.7e-007	39.2	148
110349081	*Pistacia vera* Pistachio nut	2S albumin, food allergen, Pis v 1	149	1.4e-006	33.6	140
112745	*Helianthus annuus* Sunflower	2S albumin, food allergen, SFA8	141	1.5e-006	36.2	149
24473800	*Anacardium occidentale* Cashew nut	2S albumin, food allergen, Ana o 3	138	3.3e-006	31	145
21068	*Ricinus communis* castor bean	2S albumin, food allergen, Ric c 3	258	1.8e-005	38.5	104
13183175	*Sesamum indicum* Sesame	2S albumin, food allergen, Ses i 1	153	4.8e-005	35.4	147

Table 6 AllergenOnline comparison using sliding 80 AA window FASTA3 with Cruciferin 1. The 80 AA sliding window FASTA3 with an *E* score of 10 to identify matches with >35% identity. There were 59 matches exceeding the >35% identity limit. The taxonomic range was from white mustard (76%) through wheat although most were tree nuts, peanut or wheat and overall identity matches from 59% down to 37%.

GI number	Species	Best % Identity for any 80 AA segments	# of 80 AA segments with >35% ID	Full length FASTA alignment		
				E value	% ID	Length
62240390	*Sinapis alba*	76.50%	411 of 411	4.3e-052	58.90%	501
62240392	*Sinapis alba*	74.10%	411 of 411	3.9e-022	57.20%	512
557792009	*Corylus avellana*	63.70%	374 of 411	5.2e-026	43.60%	541
18479082	*Corylus avellana*	63.70%	383 of 411	1.1e-025	44.70%	532
307159114	*Prunus dulcis*	62.51%	410 of 411	8.1e-024	45.10%	508
523916668	*Prunus dulcis*	62.51%	161 of 411	2.3e-011	48.20%	193
25991543	*Anacardium occidentale*	61.30%	367 of 411	1.9e-026	44.40%	493
307159112	*Prunus dulcis*	58.80%	392 of 411	2.6e-024	43.60%	544
158998782	*Carya illinoinensis*	58.80%	347 of 411	6.4e-025	43.00%	537
158998780	*Carya illinoinensis*	58.80%	347 of 411	7.1e-025	43.00%	537

Table 7 AllergenOnline comparison using sliding 80 AA window FASTA3 with Cruciferin 2. The 80 AA sliding window FASTA3 with an *E* score of 10 to identify matches with >35% identity. There were 57 matches exceeding the >35% identity limit. The taxonomic range was from white mustard through wheat although most were tree nuts, peanut or wheat and overall identity matches from 72% down to 35%

GI number	Species	Best % Identity for any 80 AA segments	# of 80 AA segments with >35% ID	Full length FASTA alignment		
				E value	% ID	Length
62240390	Sinapis alba	72.80%	417 of 417	5.6e-071	57.50%	503
62240392	*Sinapis alba*	70.00%	417 of 417	6.4e-019	55.90%	515
18479082	*Corylus avellana*	63.70%	377 of 417	2.1e-030	42.30%	548
557792009	*Corylus avellana*	63.70%	355 of 417	1.9e-030	41.60%	548
307159114	*Prunus dulcis*	60.00%	402 of 417	2.2e-020	44.40%	500
523916668	*Prunus dulcis*	60.00%	162 of 417	8.8e-010	46.40%	194
25991543	*Anacardium occidentale*	60.00%	360 of 417	1.9e-022	42.40%	498
156001070	*Pistacia vera*	58.80%	370 of 417	1.8e-034	41.10%	499
110349085	*Pistacia vera*	58.80%	370 of 417	9.5e-035	41.30%	499
158998780	Carya illinoinensis	57.52%	342 of 417	2.9e-029	40.20%	540

Table 8 AllergenOnline comparison using sliding 80 AA window FASTA3 with Cruciferin 3. The 80 AA sliding window FASTA3 with an *E* score of 10 to identify matches with >35% identity. There were 82 matches exceeding the >35% identity limit. The taxonomic range was from white mustard through wheat although most were tree nuts, peanut or wheat and overall identity matches from 98.8% down to 35%

GI number	Species	Best % Identity for any 80 AA segments	# of 80 AA segments with >35% ID	Full length FASTA alignment		
				E value	% ID	Length
62240390	*Sinapis alba*	98.80%	430 of 430	2.6e-122	91.60%	510
62240392	*Sinapis alba*	97.50%	430 of 430	2.5e-091	90.10%	523
158998780	*Carya illinoinensis*	65.00%	355 of 430	1.3e-035	44.50%	535
158998782	*Carya illinoinensis*	65.00%	358 of 430	2.2e-035	44.70%	535
56788031	*Juglans regia*	63.79%	368 of 430	1.1e-036	44.50%	533
307159114	*Prunus dulcis*	60.04%	425 of 430	7.8e-023	47.00%	513
523916668	*Prunus dulcis*	60.04%	168 of 430	3.9e-011	49.70%	195
25991543	*Anacardium occidentale*	60.04%	379 of 430	5.2e-042	46.20%	487
18479082	*Corylus avellana*	58.80%	394 of 430	1.3e-035	45.60%	528
557792009	*Corylus avellana*	58.80%	391 of 430	9.9e-036	45.50%	528

Table 9 AllergenOnline comparison using sliding 80 AA window FASTA3 with Cruciferin 4. The 80 AA sliding window FASTA3 with an *E* score of 10 to identify matches with >35% identity. There were 51 matches exceeding the >35% identity limit. The taxonomic range was from white mustard through wheat although most were tree nuts, peanut or wheat and overall identity matches from 70% down to 35.4%

GI number	Species	Best % Identity for any 80 AA segments	# of 80 AA segments with >35% ID	Full length FASTA alignment		
				E value	% ID	Length
62240390	*Sinapis alba*	70.01%	386 of 386	2.6e-059	55.00%	471
62240392	*Sinapis alba*	65.03%	386 of 386	8.6e-058	53.30%	482
110349085	*Pistacia vera*	61.30%	379 of 386	2e-055	45.60%	471
156001070	*Pistacia vera*	61.30%	375 of 386	4.2e-055	45.40%	471
110349083	*Pistacia vera*	60.04%	365 of 386	1.8e-043	44.90%	481
25991543	*Anacardium occidentale*	59.30%	377 of 386	9.5e-041	45.90%	464
18479082	*Corylus avellana*	58.80%	386 of 386	1.3e-025	44.40%	502
557792009	*Corylus avellana*	58.80%	386 of 386	8.4e-026	44.10%	501
307159112	*Prunus dulcis*	57.52%	380 of 386	1.8e-026	40.90%	538
258588247	*Prunus dulcis*	57.52%	367 of 386	3.7e-026	41.40%	515

Table 10 AllergenOnline comparison using sliding 80 AA window FASTA3 with Napin. The 80 AA sliding window FASTA3 with an *E* score of 10 to identify matches with >35% identity. There were 25 matches exceeding the >35% identity limit. The taxonomic range was from mustard (100%) through wheat although most were tree nuts, peanut or wheat and overall identity matches from 100% down to 35%.

GI number	Species	Best % Identity for any 80 AA segments	# of 80 AA segments with >35% ID	Full length FASTA alignment		
				E value	% ID	Length
75107016	*Brassica napus*	100.00%	46 of 46	3.9e-029	100.00%	125
32363444	*Brassica juncea*	92.70%	46 of 46	1.6e-026	89.10%	129
51338758	*Sinapis alba*	91.60%	46 of 46	2.1e-017	82.60%	144
1009436	*Sinapis alba*	91.60%	46 of 46	1.1e-017	82.60%	144
1009438	*Sinapis alba*	91.60%	46 of 46	9.2e-018	81.90%	144
1009440	*Sinapis alba*	91.60%	46 of 46	1.1e-017	82.60%	144
1009442	*Sinapis alba*	90.40%	46 of 46	1.3e-017	81.30%	144
17697	*Brassica rapa*	90.00%	46 of 46	2.8e-016	80.90%	141
1009434	*Sinapis alba*	89.20%	46 of 46	2.7e-017	81.30%	144
26985163	*Brassica napus*	55.00%	46 of 46	3.5e-011	53.20%	111
110349081	*Pistacia vera*	38.76%	18 of 46	2.9e-005	34.80%	112
21068	*Ricinus communis*	38.71%	17 of 46	0.033	34.90%	109

Table 11 AllegenOnline comparison using sliding 80 AA window FASTA3 with nsLTP. The 80 AA sliding window FASTA3 with an *E* score of 10 to identify matches with >35% identity. There were 63 matches exceeding the >35% identity limit. The taxonomic range was from mustard (100%) through wheat although most were tree nuts, peanut or wheat and overall identity matches from 100% down to 35% the top 10 matches are shown.

GI number	Species	Best % Identity for any 80 AA segments	# of 80 AA segments with >35% ID	Full length FASTA alignment		
				E value	% ID	Length
922434456	Brassica oleracea	100.00%	33 of 33	2.1e-038	100.00%	112
110180523	Rubus idaeus	66.30%	33 of 33	1.2e-020	59.00%	117
289064179	Phaseolus vulgaris	65.40%	33 of 33	5.1e-020	59.10%	110
50199132	Citrus sinensis	63.90%	33 of 33	2e-018	61.50%	91
288561913	Morus nigra	62.70%	33 of 33	3.4e-017	61.50%	91
18477856	Fragaria x ananassa	62.70%	33 of 33	1.4e-020	55.60%	117
67937767	Fragaria x ananassa	62.70%	33 of 33	4.9e-021	55.60%	117
571256597	Cannabis sativa	62.70%	33 of 33	1.1e-016	61.50%	91
60735410	Lens culinaris	61.90%	33 of 33	1.6e-019	54.60%	119
50659879	Malus x domestica	61.40%	33 of 33	6.3e-021	56.50%	115

Table 12 AllergenOnline.org sliding 80 AA window using FASTA3 with Ber e 1. Eleven alignments were identified with matches to Ber e 1 sequence (146 AA) accession P04403 with results of >35% identity over 80 amino acids (including the 100% match to itself). The best 80 amino acid alignments are higher in identity than the full length match as expected for close homologues. The top 11 matches are shown.

GI number	Species	Best % Identity for any 80 AA segments	# of 80 AA segments with >35% ID	Full length FASTA alignment		
				E value	% ID	Length
112754	*Bertholletia excelsa*	100.00%	67 of 67	1.3e-030	100.00%	146
226437844	*Corylus avellana*	51.20%	67 of 67	5.2e-011	45.90%	146
1794252	*Juglans regia*	48.78%	59 of 67	1e-009	42.00%	138
28207731	*Carya illinoinensis*	47.50%	59 of 67	5.9e-009	40.00%	145
31321942	*Juglans nigra*	45.03%	59 of 67	1.5e-009	39.30%	145
5381323	*Sesamum indicum*	43.75%	67 of 67	6.7e-007	39.20%	148
112745	*Helianthus annuus*	38.80%	40 of 67	1.5e-006	36.20%	149
21068	*Ricinus communis*	38.80%	29 of 67	1.8e-005	38.50%	104
209165427	*Sesamum indicum*	38.50%	22 of 67	4.8e-005	35.40%	147
13183175	*Sesamum indicum*	38.50%	22 of 67	3.8e-005	35.40%	147
144228127	*Fagopyrum tataricum*	37.10%	4 of 67	0.00017	31.00%	116

Table 13 BLASTP comparison of Cruciferin 1 to 4 using NCBI Protein: "allergen" keyword limit. A number of modest alignments were identified using the BLASTP alignment with keyword limit "allergen". Only three alignments fit within the default *E* score limit.

Sequence Accession #	Organism	Description	Length AA	*E* score	% identity in alignment	AA Alignment length
		Cruciferin 1				
AAX77383.1	*Sinapis alba* White mustard	11S globulin	510	4e-175	56	504
AAN76862.1	*Anacardium occidentale* Cashew	Ano o 2	457	8e-130	43	492
AAL73404.1	*Corylus avellana* Hazelnut	11S globulin	515	9e-129	41	526
		Cruciferin 2				
AAX77383.1	*Sinapis alba* White mustard	11S globulin	510	7e-170	56	504
AAX77384.1	*Sinapis alba* White mustard	11S globulin	523	1e-129	59	328
AAN76862.1	*Anacardium occidentale* Cashew	Ano o 2	457	3e-124	41	498
		Cruciferin 3				
AAX77383.1	*Sinapis alba* White mustard	11S globulin	510	0.0	86	511
AAX77384.1	*Sinapis alba* White mustard	11S globulin	523	0.0	92	340
ACB55490.1	*Pistacia vera* Pistachio	Pis v 5.0101	473	5e-133	44	496
		Cruciferin 4				
AAX77383.1	*Sinapis alba* White mustard	11S globulin	510	1e-155	53	470

ACB55490.1	*Pistacia vera* Pistachio	Pis v 5.0101	473	8e-132	45	465
AAN76862.1	*Anacardium occidentale* Cashew	Ana o 2	457	7e-131	45	465

Table 14 BLASTP comparison of Cruciferin 1 to 4 using NCBI Protein: "allergy" keyword limit. Modest alignments were identified using the BLASTP alignment with keyword limit "allergen". Only three alignments fit within the default *E* score limit.

Sequence Accession #	Organism	Description	Length AA	*E* score	% identity in alignment	AA Alignment length
		Cruciferin 1				
AAL73404.1	*Corylus avellana* Hazelnut	11S globulin	515	3e-127	41	515
ACB55490.1	*Pistacia vera* Pistachio	Pis v 5.0101	472	8e-130	41	490
AAW29810.1	*Juglans regia* English walnut	11S globulin	507	3e-116	42	488
		Cruciferin 2				
ACB55490.1	*Pistacia vera* Pistachio	Pis v 5.0101 11S globulin	473	2e-120	40	482
AAL73404.1	*Corylus avellana* Hazelnut	11S globulin	515	2e-119	39	532
AAW29810.1	*Juglans regia* English walnut	11S globulin	507	5e-110	39	494
		Cruciferin 3				
ACB55490.1	*Pistacia vera* Pistachio	Pis v 5.0101 11S globulin	473	2e-131	44	496
AAW29810.1	*Juglans regia* English walnut	11S globulin	507	8e-126	42	530
AAL73404.1	*Corylus avellana* Hazelnut	11S globulin	515	7e-125	43	526
		Cruciferin 4				
ACB55490.1	*Pistacia vera* Pistachio	Pis v 5.0101 11S globulin	473	3e-130	45	465
AAL73404.1	*Corylus avellana* Hazelnut	11S globulin	515	2e-121	43	499
AAW29810.1	*Juglans regia* English walnut	11S globulin	507	2e-120	41	496

Table 15 BLASTP comparison of Napin to NCBI Protein using "allergen" and "allergy" keyword limits. A number of modest alignments were identified using the BLASTP alignment with keyword limit "allergen". Only three alignments fit within the default *E* score limit.

Sequence Accession #	Organism	Description	Length AA	*E* score	% identity in alignment	AA Alignment length
		Allergen				
P80208.1	*Brassica napus* Mustard rape	Napin III 1.7S albumin	125	3e-89	100	125
CAA62910.1	*Sinapis alba* White mustard	Sin a 1.0105	145	4e-71	82	144
CAA62912.1	*Sinapis alba* White mustard	Sin a 1.0107	145	6e-71	82	144
P15322.2	*Sinapis alba* White mustard	Sin a 1	145	1e-69	82	144
		Allergy				
P15322.2	*Sinapis alba* White mustard	Sin a 1	145	2e-68	82	144
EEX53711.1	*Prevotella sp.* Gram neg. bacteria	Hypothetical protein	215	0.005	29	41
KYF44282.1	*Toxoplasma gondii* Parasite	Chorein	9744	0.019	43	28
KYK66472.1	*Toxoplasma gondii* Parasite	Chorein	9064	0.019	43	28

Table 16 BLASTP comparison of nsLTP to NCBI Protein using "allergen" and "allergy" keyword limits. A number of modest alignments were identified using the BLASTP alignment with keyword limit "allergen". Only three alignments fit within the default *E* score limit.

Sequence Accession #	Organism	Description	Length AA	*E* score	% identity in alignment	AA Alignment length
		Allergen				
NP_568904.1	*Arabidopsis thaliana* Mustard	nsLTP4	112	2e-58	79	112
NP_568905.1	*Arabidopsis thaliana* Mustard	nsLTP3	115	3e-58	77	115
AAT80652.1	*Malus domestica* Apple	nsLTP	115	3e-38	57	115
AAT80650.1	*Malus domestica* Apple	nsLTP	115	4e-38	57	115
		Allergy				
AAT80652.1	*Malus domestica* Apple	nsLTP	115	1e-36	57	115
AAT80650.1	*Malus domestica* Apple	nsLTP	115	1e-36	57	115
AAT80665.1	*Malus domestica* Apple	nsLTP	115	6e-36	56	115
AAT80663.1	*Malus domestica* Apple	nsLTP	115	1e-35	56	115

Table 17 BLASTP comparison of Ber e 1 to NCBI Protein using "allergen" and "allergy" keyword limits. Many alignments were identified using an *E* score cutoff less than 10 to evaluate Ber e 1 sequence (146 AA). The top scoring 7 proteins are shown here for "allergen" and five for "allergen". The highly significant alignments were to variants of Ber e 1. There was a marked reduction in sequence identity and *E* score significance on lower scoring alignments, which were identified by AllergenOnline as well.

Sequence Accession #	Organism	Description	Length AA	*E* score	% identity in alignment	AA Alignment length
		Allergen				
P04403.2	*Bertholletia excelsa* Brazil nut food allergen	Brazil nut 2S albumin (Ber e 1)	146	3e-101	100	146
2LVF	*Bertholletia excelsa* Brazil nut food allergen	Brazil nut partial sequence 2S albumin (Ber e 1)	114	4e-65	95	114
AAO32314.1	*Cayra illinoinensis* Pecan food allergen	Pecan 2S albumin (Car I 1)	138	9e-27	40	145
AAB41308.1	*Juglans regia* English walnut food	English walnut 2S albumin (Jug r 1)	139	4e-23	41	138
AAM54365.1	*Juglans nigra* Black walnut food	Black walnut 2S albumin (Jug n 1)	161	8e-20	39	127
ACO56333.1	*Corylus avellana* Hazelnut food	Hazelnut 2S albumin (Cor a 14)	147	1e-19	45	124
ABG73108	*Pistacia vera* Pistacchio food	Pistachio 2S albumin (Pis v 1)	149	1e-16	33	140
		Allergy				
AAB41308.1	*Juglans regia* English walnut	2S albumin	139	2e-26	41	138
BAB79444.1	*Fagopyrum esculentum* Buckwheat	BW8KD allergen	133	2e-8	38	69
ACI41245.1	*Sesamum indicum* Sesame	2S albumin	153	5e-8	38	63
ACI41244.1	*Sesamum indicum* Sesame	2S albumin	153	1e-7	38	63
ACG59281.1	*Triticum aestivum* Wheat	CM16 major allergy	143	5e-4	26	135

Table 18 FASTA comparison: all six mustard proteins to the Celiac Disease database. The top two scoring proteins matched are shown here and none of them meet the scoring criteria to suggest potential elicitation of CD.

Sequence Accession #	Organism	Description	Length AA	*E* score	% identity in alignment	AA Alignment length
		Cru 1				
CAA27052.1	*Triticum aestivum*	Glutenin	838	0.23	30	227
ABK54365.1	*Triticum aestivum*	High MW Glutenin	815	0.33	33	156
		Cru 2				
ABL14062.1	*Triticum aestivum*	High MW Glutenin	243	0.0063	32.6	221
ADF32930.1	*Triticum aestivum*	High MW Glutenin	827	0.024	31.7	230
		Cru 3				
ABK54365.1	*Triticum aestivum*	High MW Glutenin	815	0.002	34.1	223
ABQ14770.1	*Triticum aestivum*	High MW Glutenin	795	0.0025	33.1	272
		Cru 4				
ABL14062.1	*Triticum aestivum*	High MW Glutenin	243	0.097	29.4	228
ABQ14770.1	*Triticum aestivum*	High MW Glutenin	795	0.29	28.2	209
		Napin				
AAA32716.1	*Avena sativa*	Avenin	222	0.64	29.7	111
Q09114.1	*Avena sativa*	Avenin	182	0.76	32	100
		Triticum aestivum				
ACJ03454.1	*Triticum aestivum*	Gamma-gliadin	287	0.02	24.4	82
ACY08817.1	*Triticum aestivum*	Low MW glutenin	299	0.02	30.4	79

Table 19 FASTA comparison: partial alpha-gliadin from Triticum dicoccoides to Celiac Disease database. Nine alpha-gliadin proteins aligned with an *E* score less than 1e-15 and >100 AA alignment and identity >45%. Other proteins including gamma-gliadin of wheat, avenin of oats and hordein of barley met some of the criteria (>100 AA alignment, identity greater than 45%, but not all three criteria. The top scoring proteins matched are shown here (top four meet criteria) and some of the lower scoring matches that do not meet criteria.

Sequence Accession #	Organism	Description	Length AA	*E* score	% identity in alignment	AA Alignment length
FASTA						
CAB76963.1	*Triticum aestivum* Wheat	Alpha-gliadin	269	5.3e-32	99.4	156
CAB76955.1	*Triticum aestivum* Wheat	Alpha-gliadin	274	8.1e-32	98.7	156
CAB76960.1	*Triticum aestivum* Wheat	Alpha-gliadin	276	1.2e-31	98.1	156
CAB76962.1	*Triticum aestivum* Wheat	Alpha-gliadin	277	1.6e-31	98.1	156
Skip next 7 highest scoring alignments that are all to alpha-gliadin of *Triticum aestivum*						
AAQ63858.1	*Triticum aestivum* Wheat	Gamma-gliadin	311	1.5e-11	49.7	157
P08453.1	*Triticum aestivum* Wheat	Gamma-gliadin	327	2.2e-11	49	157
AAA32716.1	*Avena sativa* Oats	Avenin, alpha-amylase inhibitor	222	4e-11	46.5	166
BAA11251.1	*Triticum aestivum* Wheat	Gamma-gliadin	279	1.6e-10	46.5	159
ACU09493.1	*Hordeum vulgare* Barley	B hordein	265	8.2e-8	47.4	154
ABH01262.1	*Hordeum vulgare* Barley	B hordein	290	5.2e-7	42.6	169

Appendix 1 (next page): AllergenOnline.org version 16 (105 pages)

AllergenOnline version 16
27 January, 2016

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Acarus siro	Mite	Aca s 13	Aero Mite	Acarus Aca s 13	131	118638268	9
Acarus siro	Mite	Unassigned	Aero Insect	Acarus siro Group 4 allergen	517	118638278	9
Actinidia arguta	Hardy Kiwi	Unassigned	Food Plant	Actinidia arguta kiwellin	213	441482362	14
Actinidia arguta	Hardy Kiwi	Unassigned	Food Plant	Actinidia arguta kiwellin	213	441482364	14
Actinidia arguta	Hardy Kiwi	Unassigned	Food Plant	Actinidia arguta kiwellin	213	441482366	14
Actinidia chinensis	Kiwi	Unassigned	Food Plant	Actinidia Act c 1 Act d 1 Actinidin	380	190358935	9
Actinidia chinensis	Kiwi	Act c 1	Food Plant	Actinidia Act c 10 LTP	15	378548410	13
Actinidia chinensis	Kiwi	Act c 5.0102	Food Plant	Actinidia Act c 5 kiwellin	213	441482354	14
Actinidia chinensis	Kiwi	Act c 8.0101	Food Plant	Actinidia Act c 8 Act d 8 PR-10	159	281552896	11
Actinidia chinensis	Kiwi	Unassigned	Food Plant	Actinidia Act d 2 thaumatin like protein	20	68064399	7
Actinidia chinensis	Kiwi	Unassigned	Food Plant	Actinidia Act d 2 thaumatin like protein	225	441482370	14
Actinidia deliciosa	Kiwi	Act d 1	Food Plant	Actinidia Act c 1 Act d 1 Actinidin	380	15984	7
Actinidia deliciosa	Kiwi	Unassigned	Food Plant	Actinidia Act c 1 Act d 1 Actinidin	380	166317	7
Actinidia deliciosa	Kiwi	Unassigned	Food Plant	Actinidia Act c 1 Act d 1 Actinidin	380	193806686	12
Actinidia deliciosa	Kiwi	Act d 8.0101	Food Plant	Actinidia Act c 8 Act d 8 PR-10	157	281552898	11
Actinidia deliciosa	Kiwi	Act d 10.0201	Food Plant	Actinidia Act d 10 LTP	92	378548411	13
Actinidia deliciosa	Kiwi	Act d 10.0101	Food Plant	Actinidia Act d 10 LTP	92	378405189	13
Actinidia deliciosa	Kiwi	Act d 11	Food Plant	Actinidia Act d 11 Kirola MLP	150	332319679	12
Actinidia deliciosa	Kiwi	Act d 2.0101	Food Plant	Actinidia Act d 2 thaumatin like protein	225	71057064	7
Actinidia deliciosa	Kiwi	Unassigned	Food Plant	Actinidia Act d 2 thaumatin like protein	201	146737976	9
Actinidia deliciosa	Kiwi	Act d 4.0101	Food Plant	Actinidia Act d 4 Phytocystatin	116	40807635	7
Actinidia deliciosa	Kiwi	Act d 5.0101	Food Plant	Actinidia Act d 5 kiwellin	189	85701136	7
Actinidia deliciosa	Kiwi	Unassigned	Food Plant	Actinidia Act d 5 kiwellin	213	441482346	14

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Actinidia deliciosa	Kiwi	Unassigned	Food Plant	Actinidia Act d 5 kiwellin	213	441482348	14
Actinidia deliciosa	Kiwi	Unassigned	Food Plant	Actinidia Act d 5 kiwellin	213	441482350	14
Actinidia deliciosa	Kiwi	Unassigned	Food Plant	Actinidia Act d 5 kiwellin	213	441482352	14
Actinidia deliciosa	Kiwi	Act d 9.0101	Food Plant	Actinidia Act d 9, profilin	109	100	16
Actinidia eriantha	Climber (plant)	Unassigned	Food Plant	Actinidia eriantha kiwellin	213	441482356	14
Actinidia eriantha	Climber (plant)	Unassigned	Food Plant	Actinidia eriantha kiwellin	213	441482358	14
Actinidia eriantha	Climber (plant)	Unassigned	Food Plant	Actinidia eriantha kiwellin	213	441482360	14
Aedes aegypti	Yellow fever mosquito	Aed a 1	Venom or Salivary	Aedes Aed a 1 apyrase	562	556272	7
Aedes aegypti	Yellow fever mosquito	Unassigned	Venom or Salivary	Aedes Aed a 1 apyrase	562	193806340	10
Aedes aegypti	Yellow fever mosquito	Aed a 2	Venom or Salivary	Aedes Aed a 2	321	205525919	9
Aedes aegypti	Yellow fever mosquito	Aed a 3	Venom or Salivary	Aedes Aed a 3	253	2114497	7
Aedes aegypti	Yellow fever mosquito	Unassigned	Venom or Salivary	Aedes Aed a 3	273	94468546	7
Agrostis alba	Bent grass	Unassigned	Aero Plant	Agrostis Agr a 1	26	320606	7
Agrostis alba	Bent grass	Unassigned	Aero Plant	Agrostis Agr a 1	35	75139987	7
Agrostis alba	Bent grass	Unassigned	Aero Plant	Agrostis Agr a 1	35	75139989	7
Alnus glutinosa	Alder	Aln g 1	Aero Plant	Alnus Aln g 1	160	261407	7
Alnus glutinosa	Alder	Aln g 1.0101	Aero Plant	Alnus Aln g 4	85	3319651	7
Alternaria alternata	Fungus	Alt a 1.0101	Aero Fungi	Alternaria Alt a 1	157	1842045	7
Alternaria alternata	Fungus	Unassigned	Aero Fungi	Alternaria Alt a 1	115	21913174	7
Alternaria alternata	Fungus	Alt a 1.0102	Aero Fungi	Alternaria Alt a 1	157	45680856	7
Alternaria alternata	Fungus	Unassigned	Aero Fungi	Alternaria Alt a 1	133	390980892	13
Alternaria alternata	Fungus	Unassigned	Aero Fungi	Alternaria Alt a 1	130	508123617	15

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Alternaria alternata	Fungus	Alt a 10.0101	Aero Fungi	Alternaria Alt a 10 ADH	497	76666767	7
Alternaria alternata	Fungus	Alt a 12	Aero Fungi	Alternaria Alt a 12 Ribosomal BP P1	110	1350779	7
Alternaria alternata	Fungus	Alt a 13.0101	Aero Fungi	Alternaria Alt a 13	231	74611808	10
Alternaria alternata	Fungus	Alt a 3	Aero Fungi	Alternaria Alt a 3 HSP	152	14423730	7
Alternaria alternata	Fungus	Alt a 4	Aero Fungi	Alternaria Alt a 4 thioredoxin	436	85701160	7
Alternaria alternata	Fungus	Alt a 5	Aero Fungi	Alternaria Alt a 5 ribosomal P2	113	1850540	7
Alternaria alternata	Fungus	Unassigned	Aero Fungi	Alternaria Alt a 5 ribosomal P2	113	1173071	10
Alternaria alternata	Fungus	Alt a 6	Aero Fungi	Alternaria Alt a 6 enolase	438	14423684	7
Alternaria alternata	Fungus	Alt a 7.0101	Aero Fungi	Alternaria Alt a 7 flavodoxin	204	1168402	9
Alternaria alternata	Fungus	Alt a 8.0101	Aero Fungi	Alternaria Alt a 8 (mannitol dehydrogenase)	266	37780013	8
Alternaria alternata	Fungus	Unassigned	Aero Fungi	Alternaria Alt a 8 (mannitol dehydrogenase)	266	118595439	8
Alternaria alternata	Fungus	Alt a 14.0101	Aero Fungi	Alternaria MnSOD Alt a 14	191	529279957	15
Alternaria alternata	Fungus	Unassigned	Aero Fungi	Alternaria Nuc Transport 2	124	21748153	7
Alternaria alternata	Fungus	Unassigned	Aero Fungi	Alternaria TCTP IgE binding	169	112824341	11
Amaranthus retroflexus	Common Amaranth	Ama r 2.0101	Aero Plant	Amaranthus Ama r 2 Proflin	133	227937304	10
Ambrosia artemisiifolia	Short ragweed	Amb a 1.0101	Aero Plant	Ambrosia Amb a 1	396	113475	7
Ambrosia artemisiifolia	Short ragweed	Amb a 1.0201	Aero Plant	Ambrosia Amb a 1	398	113476	7
Ambrosia artemisiifolia	Short ragweed	Amb a 1.0301	Aero Plant	Ambrosia Amb a 1	397	113477	7
Ambrosia artemisiifolia	Short ragweed	Amb a 1.0401	Aero Plant	Ambrosia Amb a 1	392	113478	7
Ambrosia artemisiifolia	Short ragweed	Amb a 1.0303	Aero Plant	Ambrosia Amb a 1	397	166443	7
Ambrosia artemisiifolia	Short ragweed	Unassigned	Aero Plant	Ambrosia Amb a 1	396	302127810	12
Ambrosia artemisiifolia	Short ragweed	Amb a 1.0202	Aero Plant	Ambrosia Amb a 1	398	302127812	12
Ambrosia artemisiifolia	Short ragweed	Amb a 1.0304	Aero Plant	Ambrosia Amb a 1	397	302127814	12
Ambrosia artemisiifolia	Short ragweed	Amb a 1.0305	Aero Plant	Ambrosia Amb a 1	397	302127816	12

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Ambrosia artemisiifolia	Short ragweed	Unassigned	Aero Plant	Ambrosia Amb a 1	397	302127818	12
Ambrosia artemisiifolia	Short ragweed	Unassigned	Aero Plant	Ambrosia Amb a 1	397	302127820	12
Ambrosia artemisiifolia	Short ragweed	Unassigned	Aero Plant	Ambrosia Amb a 1	397	302127822	12
Ambrosia artemisiifolia	Short ragweed	Amb a 1.0402	Aero Plant	Ambrosia Amb a 1	387	302127824	12
Ambrosia artemisiifolia	Short ragweed	Unassigned	Aero Plant	Ambrosia Amb a 1	397	302127826	12
Ambrosia artemisiifolia	Short ragweed	Amb a 1.0502	Aero Plant	Ambrosia Amb a 1	397	302127828	12
Ambrosia artemisiifolia	Short ragweed	Amb a 10.0101	Aero Plant	Ambrosia Amb a 10	160	62249491	7
Ambrosia artemisiifolia	Short ragweed	Amb a 2	Aero Plant	Ambrosia Amb a 2	397	113479	7
Ambrosia artemisiifolia	Short ragweed	Unassigned	Aero Plant	Ambrosia Amb a 4	164	285005079	11
Ambrosia artemisiifolia	Short ragweed	Amb a 4.0101	Aero Plant	Ambrosia Amb a 4	164	291197394	12
Ambrosia artemisiifolia	Short ragweed	Unassigned	Aero Plant	Ambrosia Amb a 4	111	291482306	12
Ambrosia artemisiifolia	Short ragweed	Unassigned	Aero Plant	Ambrosia Amb a 4	140	291482308	12
Ambrosia artemisiifolia	Short ragweed	Unassigned	Aero Plant	Ambrosia Amb a 4	134	291482310	12
Ambrosia artemisiifolia	Short ragweed	Unassigned	Aero Plant	Ambrosia Amb a 4	96	291482314	12
Ambrosia artemisiifolia	Short ragweed	Unassigned	Aero Plant	Ambrosia Amb a 4	110	291482316	12
Ambrosia artemisiifolia	Short ragweed	Unassigned	Aero Plant	Ambrosia Amb a 4	116	291482318	12
Ambrosia artemisiifolia	Short ragweed	Amb a 6	Aero Plant	Ambrosia Amb a 6	118	14285595	7
Ambrosia artemisiifolia	Short ragweed	Unassigned	Aero Plant	Ambrosia Amb a 8 profilin	133	34851182	7
Ambrosia artemisiifolia	Short ragweed	Unassigned	Aero Plant	Ambrosia Amb a 8 profilin	131	34851180	7
Ambrosia artemisiifolia	Short ragweed	Unassigned	Aero Plant	Ambrosia Amb a 8 profilin	131	34851178	7
Ambrosia artemisiifolia	Short ragweed	Amb a 8.0101	Aero Plant	Ambrosia Amb a 8 profilin	133	62249502	7
Ambrosia artemisiifolia	Short ragweed	Amb a 8.0102	Aero Plant	Ambrosia Amb a 8 profilin	133	62249512	7
Ambrosia artemisiifolia	Short ragweed	Amb a 9.0101	Aero Plant	Ambrosia Amb a 9	83	62249470	7
Ambrosia artemisiifolia	Short ragweed	Amb a 9.0102	Aero Plant	Ambrosia Amb a 9	83	62249481	7
Ambrosia artemisiifolia (elatior)	Short ragweed	Amb a 3	Aero Plant	Ambrosia Amb a 3	101	416636	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Ambrosia artemisiifolia (elatior)	Short ragweed	Amb a 5	Aero Plant	Ambrosia Amb a 5 Ra5	45	114090	7
Ambrosia psilostachya	Western ragweed	Amb p 5.0101	Aero Plant	Ambrosia Amb a 5 Ra5	77	515953	7
Ambrosia psilostachya	Western ragweed	Unassigned	Aero Plant	Ambrosia Amb a 5 Ra5	77	515954	7
Ambrosia psilostachya	Western ragweed	Amb p 5.0201	Aero Plant	Ambrosia Amb a 5 Ra5	77	515955	7
Ambrosia psilostachya	Western ragweed	Unassigned	Aero Plant	Ambrosia Amb a 5 Ra5	77	515956	7
Ambrosia psilostachya	Western ragweed	Unassigned	Aero Plant	Ambrosia Amb a 5 Ra5	77	515957	7
Ambrosia trifida	Giant ragweed	Amb t 5	Aero Plant	Ambrosia Amb t 5 Ra5G	73	114091	7
Amphioctopus fangsiao	Octopus	Unassigned	Food Animal	Amphioctopus arginine kinase	348	340742817	12
Anacardium occidentale	Cashew	Ana 0 1.0102	Food Plant	Anacardium Ana o 1	536	21666498	7
Anacardium occidentale	Cashew	Ana 0 1.0101	Food Plant	Anacardium Ana o 1	538	21914823	7
Anacardium occidentale	Cashew	Ana o 2	Food Plant	Anacardium Ana o 2	457	25991543	7
Anacardium occidentale	Cashew	Ana o 3	Food Plant	Anacardium Ana o 3	138	24473800	7
Ananas comosus	Pineapple	Ana c 2.0101	Aero Plant	Ananas Ana c 2 Bromelain precursor	351	75277440	7
Ananas comosus	Pineapple	Ana c 1.0101	Food Plant	Ananas profilin Ana c 1	131	75306610	10
Anisakis pegreffii	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 12	264	442577845	14
Anisakis pegreffii	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 12	264	442577847	14
Anisakis pegreffii	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 12	264	442577849	14
Anisakis pegreffii	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 2 paramyosin	869	442577833	14

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Anisakis simplex	Parasitic fish worm	Ani s 1	Food Animal	Anisakis Ani s 1 protease inhibitor	194	47605452	7
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 1 protease inhibitor	163	442577863	14
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 1 protease inhibitor	163	442577865	14
Anisakis simplex	Parasitic fish worm	Ani s 10.0101	Food Animal	Anisakis Ani s 10	231	272574378	11
Anisakis simplex	Parasitic fish worm	Ani s 11.0101	Food Animal	Anisakis Ani s 11	307	323575361	12
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 11	160	323575363	12
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 11	287	323575365	12
Anisakis simplex	Parasitic fish worm	Ani s 12.0101	Food Animal	Anisakis Ani s 12	295	323575367	12
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 12	264	442577851	14
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 12	264	442577853	14
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 12	264	442577855	14
Anisakis simplex	Parasitic fish worm	Ani s 2	Food Animal	Anisakis Ani s 2 paramyosin	473	8453086	7
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 2 paramyosin	869	42559536	9
Anisakis simplex	Parasitic fish worm	Ani s 3	Food Animal	Anisakis Ani s 3 tropomyosin	284	14423976	7
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 3 tropomyosin	284	350285785	13

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Anisakis simplex	Parasitic fish worm	Ani s 4	Food Animal	Anisakis Ani s 4	14	47605398	7
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 4	115	110346534	8
Anisakis simplex	Parasitic fish worm	Ani s 5.0101	Food Animal	Anisakis Ani s 5 SXP/RAL-2 family protein	152	121308878	8
Anisakis simplex	Parasitic fish worm	Ani s 7.0101	Food Animal	Anisakis Ani s 7 UA3-recognized allergen	1096	119524036	9
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 8 SXP/RAL-2 family protein 2	150	155676636	9
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 8 SXP/RAL-2 family protein 2	150	155676682	9
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 8 SXP/RAL-2 family protein 2	150	155676684	9
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 8 SXP/RAL-2 family protein 2	150	155676686	9
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 8 SXP/RAL-2 family protein 2	150	155676688	9
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 8 SXP/RAL-2 family protein 2	150	155676690	9
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 8 SXP/RAL-2 family protein 2	150	155676692	9
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 8 SXP/RAL-2 family protein 2	150	155676694	9
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 8 SXP/RAL-2 family protein 2	150	155676696	9
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis Ani s 8 SXP/RAL-2 family protein 2	150	155676698	9
Anisakis simplex	Parasitic fish worm	Ani s 9.0101	Food Animal	Anisakis Ani s 9	147	157418806	9

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Anisakis simplex	Parasitic fish worm	Unassigned	Food Animal	Anisakis simplex troponin-like	161	6065738	7
Anthoxanthum odoratum	Sweet vernal grass	Unassigned	Aero Plant	Anthoxanthum Ant o 1	26	320607	7
Anthoxanthum odoratum	Sweet vernal grass	Ant o 1.0101	Aero Plant	Anthoxanthum Ant o 1	32	75139986	7
Anthoxanthum odoratum	Sweet vernal grass	Unassigned	Aero Plant	Anthoxanthum Ant o 1	32	75139990	7
Apis cerana	Indian honeybee	Unassigned	Venom or Salivary	Apis Api m 1 Api d 1 Api c 1	134	7435005	7
Apis cerana cerana	Indian honeybee	Api c 1.0101	Venom or Salivary	Apis Api m 1 Api d 1 Api c 1	134	12958583	15
Apis dorsata	Giant honeybee	Api d 1.0101	Venom or Salivary	Apis Api m 1 Api d 1 Api c 1	134	47117012	7
Apis dorsata	Giant honeybee	Unassigned	Venom or Salivary	Apis Api m 4 Melittin	26	126955	7
Apis mellifera	Honeybee	Api m 1	Venom or Salivary	Apis Api m 1 Api d 1 Api c 1	167	24418862	7
Apis mellifera	Honeybee	Unassigned	Venom or Salivary	Apis Api m 10 icarapin	223	94471622	7
Apis mellifera	Honeybee	Api m 10.0101	Venom or Salivary	Apis Api m 10 icarapin	175	94471624	7
Apis mellifera	Honeybee	Api m 2	Venom or Salivary	Apis Api m 2	382	585279	7
Apis mellifera	Honeybee	Unassigned	Venom or Salivary	Apis Api m 3 acid phosphatase	388	208342441	10
Apis mellifera	Honeybee	Api m 3.0101	Venom or Salivary	Apis Api m 3 acid phosphatase	388	74835477	12
Apis mellifera	Honeybee	Api m 4.0101	Venom or Salivary	Apis Api m 4 Melittin	70	5622	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Apis mellifera	Honeybee	Unassigned	Venom or Salivary	Apis Api m 4 Melittin	27	69552	7
Apis mellifera	Honeybee	Api m 5.0101	Venom or Salivary	Apis Api m 5 dipeptidylpeptidase	775	187281543	15
Apis mellifera	Honeybee	Unassigned	Venom or Salivary	Apis Api m 6	92	94400907	7
Apis mellifera	Honeybee	Unassigned	Venom or Salivary	Apis Api m 6	94	88770352	10
Apis mellifera	Honeybee	Api m 11.0101	Venom or Salivary	Apis mellifera	Api m 11	416	58585070
Apis mellifera	Honeybee	Api m 11.0201	Venom or Salivary	Apis mellifera	Api m 11	423	62910925
Apis mellifera	Honeybee	Api m 12.0101	Venom or Salivary	Apis mellifera Api m 12	1770	29329817	15
Apis mellifera carnica	Honeybee	Unassigned	Venom or Salivary	Apis Api m 10 icarapin	12	594708629	16
Apis mellifera carnica	Honeybee	Unassigned	Venom or Salivary	Apis Api m 10 icarapin	19	594708627	16
Apis mellifera carnica	Honeybee	Unassigned	Venom or Salivary	Apis Api m 10 icarapin	25	594708625	16
Apis mellifera carnica	Honeybee	Unassigned	Venom or Salivary	Apis Api m 10 icarapin	41	594708623	16
Apium graveolens	Celery	Api g 1.0101	Food Plant	Apium Api g 1	154	1346568	7
Apium graveolens	Celery	Api g 1.0201	Food Plant	Apium Api g 1	159	14423646	9
Apium graveolens	Celery	Api g 2.0101	Food Plant	Apium Api g 2	118	256600126	12
Apium graveolens	Celery	Api g 4	Food Plant	Apium Api g 4	134	4761578	7
Apium graveolens	Celery	Api g 5.0101	Food Plant	Apium Api g 5	86	33300920	10
Apium graveolens Rapaceum Group	Celery	Api g 6.0101	Food Plant	Apium graveolens Api g 6 LTP 2	67	550540827	15

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Agglutinin (lectin)	273	253289	7
Arachis hypogaea	Peanut	Ara h 1	Food Plant	Arachis Ara h 1	614	1168390	7
Arachis hypogaea	Peanut	Ara h 1	Food Plant	Arachis Ara h 1	626	1168391	7
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 1	299	46560474	7
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 1	303	46560472	7
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 1	428	46560476	7
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 1	619	312233063	12
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 1	418	375332427	13
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 1	418	347447588	13
Arachis hypogaea	Peanut	Ara h 2.0201	Food Plant	Arachis Ara h 2	172	26245447	7
Arachis hypogaea	Peanut	Ara h 2.0101	Food Plant	Arachis Ara h 2	169	31322017	7
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 2	156	15418705	10
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 2	158	224747150	10
Arachis hypogaea	Peanut	Ara h 3.0101	Food Plant	Arachis Ara h 3 Glycinin	507	3703107	7
Arachis hypogaea	Peanut	Ara h 3.0201	Food Plant	Arachis Ara h 3 Glycinin	530	5712199	7
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 3 Glycinin	538	21314465	7
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 3 Glycinin	219	22135348	7
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 3 Glycinin	512	112380623	8
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 3 Glycinin	530	199732457	10
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 3 Glycinin	510	224036293	10
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 3 Glycinin	512	312233065	12
Arachis hypogaea	Peanut	Ara h 5	Food Plant	Arachis Ara h 5	131	5902968	7
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 5	131	284810529	11
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 5	131	431812555	14
Arachis hypogaea	Peanut	Ara h 6	Food Plant	Arachis Ara h 6	129	5923742	7
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 6	144	17225991	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 6	127	159163254	9
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 6	145	75114094	10
Arachis hypogaea	Peanut	Ara h 7.0101	Food Plant	Arachis Ara h 7	160	5931948	7
Arachis hypogaea	Peanut	Ara h 7.0201	Food Plant	Arachis Ara h 7	164	158121995	10
Arachis hypogaea	Peanut	Ara h 8.0101	Food Plant	Arachis Ara h 8	157	37499626	7
Arachis hypogaea	Peanut	Ara h 8.0201	Food Plant	Arachis Ara h 8	153	145904610	9
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 8	157	169786740	9
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis Ara h 8	157	110676574	12
Arachis hypogaea	Peanut	Ara h 9.0101	Food Plant	Arachis Ara h 9 LTP isoallergens	116	161087230	10
Arachis hypogaea	Peanut	Ara h 9.0201	Food Plant	Arachis Ara h 9 LTP isoallergens	92	161610580	10
Arachis hypogaea	Peanut	Ara h 10.0101	Food Plant	Arachis hypogaea Ara h 10	169	113200509	15
Arachis hypogaea	Peanut	Ara h 10.0102	Food Plant	Arachis hypogaea Ara h 10	150	52001239	15
Arachis hypogaea	Peanut	Ara h 11.0101	Food Plant	Arachis hypogaea Ara h 11	137	71040655	15
Arachis hypogaea	Peanut	Unassigned	Food Plant	Arachis hypogaea Ara h 11	137	122218540	16
Argas reflexus	European pigeon tick	Arg r 1	Venom or Salivary	Argas Arg r 1	159	58371884	7
Argas reflexus	European pigeon tick	Unassigned	Venom or Salivary	Argas Arg r 1	144	322812205	12
Artemisia vulgaris	Mugwort	Art v 1	Aero Plant	Artemisia Art v 1	132	27818335	7
Artemisia vulgaris	Mugwort	Art v 2.0101	Aero Plant	Artemisia Art v 2	162	148887203	9
Artemisia vulgaris	Mugwort	Art v 3.0101	Aero Plant	Artemisia Art v 3	37	73621307	7
Artemisia vulgaris	Mugwort	Art v 3.0201	Aero Plant	Artemisia Art v 3	114	189544578	11
Artemisia vulgaris	Mugwort	Art v 3.0202	Aero Plant	Artemisia Art v 3	116	189544584	11
Artemisia vulgaris	Mugwort	Art v 3.0301	Aero Plant	Artemisia Art v 3	117	189544590	11
Artemisia vulgaris	Mugwort	Unassigned	Aero Plant	Artemisia Art v 3	117	189544595	11
Artemisia vulgaris	Mugwort	Art v 4.0101	Aero Plant	Artemisia Art v 4	133	25955969	15
Artemisia vulgaris	Mugwort	Art v 4.0201	Aero Plant	Artemisia Art v 4	133	25955971	15

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Artemisia vulgaris	Mugwort	Art v 6.0101	Aero Plant	Artemisia Art v 6 pectate lyase	396	62530263	8
Artemisia vulgaris	Mugwort	Art v 5.0101	Aero Plant	Artemisia mugwort Art v 5	82	62530265	15
Arthroderma benhamiae	Fungus	Unassigned	Contact	Trichophyton (Arthroderma) Tri m 4	726	23894232	7
Arthroderma benhamiae	Fungus	Unassigned	Contact	Trichophyton (Arthroderma) Tri r 2	292	23894240	7
Arthroderma benhamiae	Fungus	Unassigned	Contact	Trichophyton (Arthroderma) Tri r 2	404	23894244	7
Arthroderma vanbreuseghemii	Fungus	Unassigned	Contact	Trichophyton (Arthroderma) Tri m 4	726	219687753	10
Ascaris lumbricoides	Parasitic roundworm	Unassigned	Worm (parasite)	Ascaris Asc s 1	134	2735096	7
Ascaris lumbricoides	Parasitic roundworm	Unassigned	Worm (parasite)	Ascaris Asc s 1	134	2735098	7
Ascaris lumbricoides	Parasitic roundworm	Unassigned	Worm (parasite)	Ascaris Asc s 1	133	2735102	7
Ascaris lumbricoides	Parasitic roundworm	Unassigned	Worm (parasite)	Ascaris Asc s 1	133	2735106	7
Ascaris lumbricoides	Parasitic roundworm	Unassigned	Worm (parasite)	Ascaris Asc s 1	267	2735108	7
Ascaris lumbricoides	Parasitic roundworm	Unassigned	Worm (parasite)	Ascaris Asc s 1	267	2735110	7
Ascaris lumbricoides	Parasitic roundworm	Unassigned	Worm (parasite)	Ascaris Asc s 1	267	2735112	7
Ascaris lumbricoides	Parasitic roundworm	Unassigned	Worm (parasite)	Ascaris Asc s 1	134	2735114	7
Ascaris lumbricoides	Parasitic roundworm	Unassigned	Worm (parasite)	Ascaris Asc s 1	134	2735118	7
Ascaris lumbricoides	Parasitic roundworm	Unassigned	Worm (parasite)	Ascaris Asc s 1	134	2735100	7
Ascaris lumbricoides	Parasitic roundworm	Asc l 3.0101	Worm (parasite)	Ascaris tropomyosin Asc l 3	287	224016002	10

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Ascaris suum	Parasitic roundworm	Asc s 1	Worm (parasite)	Ascaris Asc s 1	68	299550	7
Ascaris suum	Parasitic roundworm	Asc s 1	Worm (parasite)	Ascaris Asc s 1	1365	77416849	7
Ascaris suum	Parasitic roundworm	Unassigned	Worm (parasite)	Ascaris Asc s 1	134	343197079	12
Ascaris suum	Parasitic roundworm	Asc s 13.0101	Worm (parasite)	Ascaris lumbricoides/suum Glutathione S-transfera	206	1170109	15
Aspergillus flavus	Fungus	Unassigned	Aero Fungi	Aspergillus Oryzin Asp o 13, fl 13	403	74665726	7
Aspergillus fumigatus	Fungus	Asp f 1	Aero Fungi	Aspergillus Asp f 1	125	3021324	7
Aspergillus fumigatus	Fungus	Asp f 1	Aero Fungi	Aspergillus Asp f 1	150	9280360	7
Aspergillus fumigatus	Fungus	Unassigned	Aero Fungi	Aspergillus Asp f 1	176	54039254	7
Aspergillus fumigatus	Fungus	Asp f 10	Aero Fungi	Aspergillus Asp f 10	395	963013	7
Aspergillus fumigatus	Fungus	Asp f 11	Aero Fungi	Aspergillus Asp f 11	178	5019414	7
Aspergillus fumigatus	Fungus	Asp f 18.0101	Aero Fungi	Aspergillus Asp f 18 and Asp n 18	495	2143220	7
Aspergillus fumigatus	Fungus	Asp f 2	Aero Fungi	Aspergillus Asp f 2	250	664852	7
Aspergillus fumigatus	Fungus	Asp f 2	Aero Fungi	Aspergillus Asp f 2	310	83300352	7
Aspergillus fumigatus	Fungus	Asp f 22	Aero Fungi	Aspergillus Asp f 22	438	13925873	7
Aspergillus fumigatus	Fungus	Unassigned	Aero Fungi	Aspergillus Asp f 22	438	83288046	7
Aspergillus fumigatus	Fungus	Asp f 23.0101	Aero Fungi	Aspergillus Asp f 23	392	21215170	7
Aspergillus fumigatus	Fungus	Unassigned	Aero Fungi	Aspergillus Asp f 23	392	83305621	7
Aspergillus fumigatus	Fungus	Asp f 27.0101	Aero Fungi	Aspergillus Asp f 27	163	91680605	7
Aspergillus fumigatus	Fungus	Asp f 28.0101	Aero Fungi	Aspergillus Asp f 28	108	91680607	7
Aspergillus fumigatus	Fungus	Asp f 29.0101	Aero Fungi	Aspergillus Asp f 29	110	91680609	7
Aspergillus fumigatus	Fungus	Asp f 3	Aero Fungi	Aspergillus Asp f 3	168	2769700	7
Aspergillus fumigatus	Fungus	Asp f 34.0101	Aero Fungi	Aspergillus Asp f 34	185	133920236	8
Aspergillus fumigatus	Fungus	Asp f 4	Aero Fungi	Aspergillus Asp f 4	286	3005839	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Aspergillus fumigatus	Fungus	Unassigned	Aero Fungi	Aspergillus Asp f 4	322	83300369	7
Aspergillus fumigatus	Fungus	Asp f 5	Aero Fungi	Aspergillus Asp f 5	634	3776613	7
Aspergillus fumigatus	Fungus	Unassigned	Aero Fungi	Aspergillus Asp f 5	634	85541646	11
Aspergillus fumigatus	Fungus	Asp f 6	Aero Fungi	Aspergillus Asp f 6	221	1648970	7
Aspergillus fumigatus	Fungus	Unassigned	Aero Fungi	Aspergillus Asp f 6	210	83305645	7
Aspergillus fumigatus	Fungus	Asp f 7	Aero Fungi	Aspergillus Asp f 7	270	83300389	7
Aspergillus fumigatus	Fungus	Asp f 8	Aero Fungi	Aspergillus Asp f 8	111	6686524	7
Aspergillus fumigatus	Fungus	Unassigned	Aero Fungi	Aspergillus Asp f 8	111	83305635	7
Aspergillus fumigatus	Fungus	Asp f 9	Aero Fungi	Aspergillus Asp f 9	302	2879890	7
Aspergillus fumigatus	Fungus	Unassigned	Aero Fungi	Aspergillus Endo-chitosanase	238	74629604	16
Aspergillus fumigatus Af293	Fungus	Unassigned	Aero Fungi	Aspergillus Asp f 2	304	66849502	7
Aspergillus fumigatus Af293	Fungus	Unassigned	Aero Fungi	Aspergillus Endo-chitosanase	242	74666748	16
Aspergillus fumigatus var. RP-2014	Fungus	Unassigned	Aero Fungi	Aspergillus Asp f 4	322	666434194	16
Aspergillus fumigatus var. RP-2014	Fungus	Unassigned	Aero Fungi	Aspergillus Asp f 7	270	666431137	16
Aspergillus niger	Fungus	Unassigned	Aero Fungi	Aspergillus Asp f 18 and Asp n 18	533	289172	7
Aspergillus niger	Fungus	Asp n 14	Aero Fungi	Aspergillus Asp n 14	804	2181180	7
Aspergillus niger	Fungus	Asp n 14	Aero Fungi	Aspergillus Asp n 14	804	4235093	7
Aspergillus oryzae	Fungus	Asp o 21	Aero Fungi	Aspergillus Asp o 21	499	94706935	7
Aspergillus oryzae	Fungus	Asp o 21.0101	Aero Fungi	Aspergillus Asp o 21	499	166531	15
Aspergillus oryzae	Fungus	Asp o 13	Aero Fungi	Aspergillus Oryzin Asp o 13, fl 13	403	129235	7
Aspergillus versicolor	Fungus	Unassigned	Aero Fungi	Aspergillus versicolor serine protease	403	294441150	16
Bacillus lentus	Bacteria	Unassigned	Bacteria airway	Bacillus lentus subtilisin	269	267048	9

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Bacillus licheniformis	Bacteria	Unassigned	Bacteria airway	Bacillus licheniformis subtlilisin	379	135016	9
Bacillus licheniformis	Bacteria	Unassigned	Bacteria airway	Bacillus licheniformis subtlilisin	374	11127680	9
Bacillus sp.	Bacteria	Unassigned	Bacteria airway	Bacillus lentus Esperase	361	1225905	9
Balanus rostratus	Crustacean	Unassigned	Food Animal	Balanus r tropomyosin	284	125659386	9
Bassia scoparia	summer cypress	Unassigned	Aero Plant	Bassia scoparia	Koc s 1	167	914410012
Batillus cornutus	Japanese turban shell	Unassigned	Food Animal	Batillus Tur c1	284	219806588	10
Bertholletia excelsa	Brazil nut	Ber e 1	Food Plant	Bertholletia Ber e 1	146	112754	7
Bertholletia excelsa	Brazil nut	Ber e 2	Food Plant	Bertholletia Ber e 2	465	30313867	7
Betula pendula	European white birch	Unassigned	Aero Plant	Betula glutathione S-transferase	237	573005958	16
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	51	320545	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	160	534898	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	159	534900	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	160	534910	7
Betula pendula	European white birch	Bet v 1.1601	Aero Plant	Betula Bet v 1	160	1321714	7
Betula pendula	European white birch	Bet v 1.1701	Aero Plant	Betula Bet v 1	160	1321716	7
Betula pendula	European white birch	Bet v 1.1801	Aero Plant	Betula Bet v 1	160	1321718	7

AllergenOnline version 16
27 January, 2016

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Betula pendula	European white birch	Bet v 1.1502	Aero Plant	Betula Bet v 1	160	1321720	7
Betula pendula	European white birch	Bet v 1.1901	Aero Plant	Betula Bet v 1	160	1321722	7
Betula pendula	European white birch	Bet v 1.2001	Aero Plant	Betula Bet v 1	160	1321724	7
Betula pendula	European white birch	Bet v 1.2101	Aero Plant	Betula Bet v 1	160	1321726	7
Betula pendula	European white birch	Bet v 1.2201	Aero Plant	Betula Bet v 1	160	1321728	7
Betula pendula	European white birch	Bet v 1m/n	Aero Plant	Betula Bet v 1	160	1168710	7
Betula pendula	European white birch	Bet v 1.0108	Aero Plant	Betula Bet v 1	160	1542861	7
Betula pendula	European white birch	Bet v 1.0109	Aero Plant	Betula Bet v 1	160	1542863	7
Betula pendula	European white birch	Bet v 1.0110	Aero Plant	Betula Bet v 1	160	1542865	7
Betula pendula	European white birch	Bet v 1.0111	Aero Plant	Betula Bet v 1	160	1542867	7
Betula pendula	European white birch	Bet v 1.0112	Aero Plant	Betula Bet v 1	160	1542869	7
Betula pendula	European white birch	Bet v 1.0113	Aero Plant	Betula Bet v 1	160	1542871	7
Betula pendula	European white birch	Bet v 1.0114	Aero Plant	Betula Bet v 1	160	1542873	7
Betula pendula	European white birch	Bet v 1.2301	Aero Plant	Betula Bet v 1	160	2414158	7

AllergenOnline version 16
27 January, 2016

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	160	2564220	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	160	2564222	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	160	2564224	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	160	2564228	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	160	4006928	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	160	4006945	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	160	4006953	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	160	4006955	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	160	4006957	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	160	4006959	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	160	4006961	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	160	4006965	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	160	4006967	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	159	4376216	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	159	4376219	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	159	4376220	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	159	4376221	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	159	4376222	7
Betula pendula	European white birch	Bet v 1 b1	Aero Plant	Betula Bet v 1	160	4590392	7
Betula pendula	European white birch	Bet v 1 b2	Aero Plant	Betula Bet v 1	160	4590394	7
Betula pendula	European white birch	bet v 1 b3	Aero Plant	Betula Bet v 1	160	4590396	7
Betula pendula	European white birch	Bet v 1.0701	Aero Plant	Betula Bet v 1	160	1168706	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	159	11514622	7
Betula pendula	European white birch	Bet v 1x	Aero Plant	Betula Bet v 1	21	30908931	7
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	159	38492423	7
Betula pendula	European white birch	Unassigned	Aero Plant	Betula Bet v 1	43	239734	7
Betula pendula	European white birch	Unassigned	Aero Plant	Betula Bet v 1	120	4006963	7
Betula pendula	European white birch	Unassigned	Aero Plant	Betula Bet v 1	120	4006947	7
Betula pendula	European white birch	Bet v 1.0203	Aero Plant	Betula Bet v 1	160	452742	8
Betula pendula	European white birch	Bet v 1	Aero Plant	Betula Bet v 1	159	159162097	9

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Betula pendula	European white birch	Unassigned	Aero Plant	Betula Bet v 1	159	560188693	15
Betula pendula	European white birch	Unassigned	Aero Plant	Betula Bet v 1	159	550544347	15
Betula pendula	European white birch	Unassigned	Aero Plant	Betula Bet v 1	160	565807648	15
Betula pendula	European white birch	Unassigned	Aero Plant	Betula Bet v 1	159	560188694	15
Betula pendula	European white birch	Unassigned	Aero Plant	Betula Bet v 1	159	560188692	15
Betula pendula	European white birch	Bet v 1.0101	Aero Plant	Betula Bet v 1	160	17938	15
Betula pendula	European white birch	Bet v 1.0102	Aero Plant	Betula Bet v 1	160	452732	15
Betula pendula	European white birch	Bet v 1.0103	Aero Plant	Betula Bet v 1	160	452734	15
Betula pendula	European white birch	Bet v 1.0104	Aero Plant	Betula Bet v 1	160	452736	15
Betula pendula	European white birch	Bet v 1.0106	Aero Plant	Betula Bet v 1	160	452740	15
Betula pendula	European white birch	Bet v 1.0107	Aero Plant	Betula Bet v 1	160	452744	15
Betula pendula	European white birch	Bet v 1.0201	Aero Plant	Betula Bet v 1	160	450885	15
Betula pendula	European white birch	Bet v 1.0202	Aero Plant	Betula Bet v 1	160	452730	15
Betula pendula	European white birch	Unassigned	Aero Plant	Betula Bet v 1	159	661918055	16
Betula pendula	European white birch	Unassigned	Aero Plant	Betula Bet v 1b	51	320546	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Betula pendula	European white birch	Unassigned	Aero Plant	Betula Bet v 2	133	157830684	9
Betula pendula	European white birch	Bet v 2.0101	Aero Plant	Betula Bet v 2	133	166953	11
Betula pendula	European white birch	Unassigned	Aero Plant	Betula Bet v 2	133	576017922	15
Betula pendula	European white birch	Bet v 3.0101	Aero Plant	Betula Bet v 3	205	488605	15
Betula pendula	European white birch	Bet v 4.0101	Aero Plant	Betula Bet v 4	85	809536	15
Betula pendula	European white birch	Bet v 6.0102	Aero Plant	Betula Bet v 6	308	10764491	7
Betula pendula	European white birch	Bet v 7	Aero Plant	Betula Bet v 7	173	21886603	7
Betula platyphylla	Japanese white birch	Unassigned	Aero Plant	Betula Bet v 1	160	12583681	7
Betula platyphylla	Japanese white birch	Unassigned	Aero Plant	Betula Bet v 1	160	12583683	7
Betula platyphylla	Japanese white birch	Unassigned	Aero Plant	Betula Bet v 1	160	12583685	7
Betula sp.	Birch	Unassigned	Aero Plant	Betula Bet v 1	51	298736	7
Betula sp.	Birch	Unassigned	Aero Plant	Betula Bet v 1b	51	298737	7
Blattella germanica	German cockroach	Unassigned	Aero Insect	Blattella chymotrypsin-like	252	757943154	16
Blattella germanica	German cockroach	Unassigned	Aero Insect	Blattella 36 kDa allergen	20	544618	7
Blattella germanica	German cockroach	Unassigned	Aero Insect	Blattella 36 kDa allergen	25	544619	7
Blattella germanica	German	Unassigned	Aero Insect	Blattella arginine kinase	356	221602737	10

	cockroach						
Species	**Common**	**IUIS Allergen**	**Type**	**Group**	**Length**	**GI#**	**Version**
Blattella germanica	German cockroach	Bla g 1.0201	Aero Insect	Blattella Bla g 1	492	4240395	7
Blattella germanica	German cockroach	Bla g 1.0101	Aero Insect	Blattella Bla g 1	412	4572592	7
Blattella germanica	German cockroach	Bla g 11.0101	Aero Insect	Blattella Bla g 11 alpha Amylase	515	85002763	15
Blattella germanica	German cockroach	Unassigned	Aero Insect	Blattella Bla g 2	330	62738637	7
Blattella germanica	German cockroach	Unassigned	Aero Insect	Blattella Bla g 2	352	145105726	9
Blattella germanica	German cockroach	Bla g 2.0101	Aero Insect	Blattella Bla g 2	352	1176397	11
Blattella germanica	German cockroach	Unassigned	Aero Insect	Blattella Bla g 2	334	315113421	12
Blattella germanica	German cockroach	Unassigned	Aero Insect	Blattella Bla g 3	657	262272875	11
Blattella germanica	German cockroach	Bla g 3.0101	Aero Insect	Blattella Bla g 3	657	262272877	11
Blattella germanica	German cockroach	Bla g 4	Aero Insect	Blattella Bla g 4	182	1166573	7
Blattella germanica	German cockroach	Unassigned	Aero Insect	Blattella Bla g 4	182	144952778	9
Blattella germanica	German cockroach	Unassigned	Aero Insect	Blattella Bla g 4	181	212675308	10
Blattella germanica	German cockroach	Unassigned	Aero Insect	Blattella Bla g 4	191	194350815	11
Blattella germanica	German cockroach	Unassigned	Aero Insect	Blattella Bla g 4	190	194350817	11

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Blattella germanica	German cockroach	Unassigned	Aero Insect	Blattella Bla g 5	200	144952780	9
Blattella germanica	German cockroach	Bla g 5.0101	Aero Insect	Blattella Bla g 5	200	2326190	11
Blattella germanica	German cockroach	Bla g 6.0101	Aero Insect	Blattella Bla g 6	151	82704032	8
Blattella germanica	German cockroach	Bla g 6.0201	Aero Insect	Blattella Bla g 6	151	82704034	8
Blattella germanica	German cockroach	Bla g 6.0301	Aero Insect	Blattella Bla g 6	154	82704036	8
Blattella germanica	German cockroach	Bla g 7.0101	Aero Insect	Blattella Bla g 7	284	8101069	7
Blattella germanica	German cockroach	Unassigned	Aero Insect	Blattella delta GST	216	161137518	11
Blomia tropicalis	Mite	Blo t 1	Aero Mite	Blomia Blo t 1.01	221	14276828	7
Blomia tropicalis	Mite	Unassigned	Aero Mite	Blomia Blo t 1.02	333	33667928	8
Blomia tropicalis	Mite	Unassigned	Aero Mite	Blomia Blo t 1.02	333	2	8
Blomia tropicalis	Mite	Blo t 10.0101	Aero Mite	Blomia Blo t 10	284	156938889	9
Blomia tropicalis	Mite	Blo t 11	Aero Mite	Blomia Blo t 11	875	21954740	7
Blomia tropicalis	Mite	Unassigned	Aero Insect	Blomia Blo t 12	69	723586656	16
Blomia tropicalis	Mite	Blo t 12	Aero Mite	Blomia Blo t 12	144	902012	7
Blomia tropicalis	Mite	Blo t 13	Aero Mite	Blomia Blo t 13.01	130	1377859	7
Blomia tropicalis	Mite	Blo t 21.0101	Aero Insect	Blomia Blo t 21	129	60679570	9
Blomia tropicalis	Mite	Unassigned	Aero Mite	Blomia Blo t 21	129	111120432	8
Blomia tropicalis	Mite	Unassigned	Aero Mite	Blomia Blo t 21	129	111494253	8
Blomia tropicalis	Mite	Unassigned	Aero Mite	Blomia Blo t 21	129	111120424	8
Blomia tropicalis	Mite	Unassigned	Aero Mite	Blomia Blo t 21	129	111120428	8
Blomia tropicalis	Mite	Blo t 3.0101	Aero Mite	Blomia Blo t 3	266	25989482	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Blomia tropicalis	Mite	Unassigned	Aero Mite	Blomia Blo t 3	266	33667930	8
Blomia tropicalis	Mite	Unassigned	Aero Insect	Blomia Blo t 4 alpha amylase	506	33667932	8
Blomia tropicalis	Mite	Blo t 5	Aero Mite	Blomia Blo t 5	134	4204917	7
Blomia tropicalis	Mite	Unassigned	Aero Mite	Blomia Blo t 5	134	111120436	9
Blomia tropicalis	Mite	Unassigned	Aero Mite	Blomia Blo t 5	134	111120450	9
Blomia tropicalis	Mite	Unassigned	Aero Mite	Blomia Blo t 5	119	160285626	9
Blomia tropicalis	Mite	Unassigned	Aero Insect	Blomia Blo t 7 non_iuis allergen	192	33667936	8
Blomia tropicalis	Mite	Unassigned	Aero Insect	Blomia Blo t 8	236	37958149	8
Blomia tropicalis	Mite	Blo t 8.0101	Aero Insect	Blomia Blo t 8	236	256665455	11
Bombus pennsylvanicus	Bumblebee	Bom p 1.0101	Venom or Salivary	Bombus Bom p 1	136	47117013	12
Bombus pennsylvanicus	Bumblebee	Bom p 4.0101	Venom or Salivary	Bombus Bom p 4 protease	243	75009997	12
Bombus terrestris	Bumblebee	Bom t 1.0101	Venom or Salivary	Bombus Bom t 1	136	14423832	7
Bombus terrestris	Bumblebee	Unassigned	Venom or Salivary	Bombus Bom t 4 protease	20	313471465	12
Bombyx mori	Silkworm	Bomb m 1.0101	Aero Insect	Bombyx Bomb m 1	355	82658675	15
Bos grunniens mutus	Yak	Unassigned	Food Animal	Bos Bos d 11 beta casein	259	942073448	16
Bos taurus	Bovine	Unassigned	Food Animal	Bos Alpha-s1 casein	93	162650	7
Bos taurus	Bovine	Unassigned	Food Animal	Bos Alpha-s1 casein	214	162794	7
Bos taurus	Bovine	Unassigned	Food Animal	Bos Alpha-s1 casein	76	162927	7
Bos taurus	Bovine	Bos d 9.0101	Food	Bos Alpha-s1 casein	214	30794348	8

Species	Common	IUIS Allergen	Animal Type	Group	Length	GI#	Version
Bos taurus	Bovine	Unassigned	Food Animal	Bos Alpha-s1 casein	205	159793197	9
Bos taurus	Bovine	Unassigned	Food Animal	Bos Alpha-s1 casein	172	159793201	9
Bos taurus	Bovine	Unassigned	Food Animal	Bos Alpha-s1 casein	129	159793217	9
Bos taurus	Bovine	Bos d 10.0101	Food Animal	Bos Bos d 10	222	27806963	15
Bos taurus	Bovine	Unassigned	Food Animal	Bos Bos d 11 beta casein	224	162797	7
Bos taurus	Bovine	Unassigned	Food Animal	Bos Bos d 11 beta casein	224	162805	7
Bos taurus	Bovine	Unassigned	Food Animal	Bos Bos d 11 beta casein	224	459292	7
Bos taurus	Bovine	Unassigned	Food Animal	Bos Bos d 12	190	162811	7
Bos taurus	Bovine	Bos d 12.0101	Food Animal	Bos Bos d 12	190	27881412	15
Bos taurus	Bovine	Unassigned	Aero Animal	Bos Bos d 2	172	2497701	9
Bos taurus	Bovine	Bos d 3	Aero Animal	Bos Bos d 3	101	2493414	7
Bos taurus	Bovine	Unassigned	Food Animal	Bos Bos d 4	142	295774	7
Bos taurus	Bovine	Bos d 4.0101	Food Animal	Bos Bos d 4	142	163283	15
Bos taurus	Bovine	Bos d 5	Food Animal	Bos Bos d 5	178	520	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Bos taurus	Bovine	Unassigned	Food Animal	Bos Bos d 5	14	162750	7
Bos taurus	Bovine	Unassigned	Food Animal	Bos Bos d 5	178	125910	9
Bos taurus	Bovine	Unassigned	Food Animal	Bos Bos d 5	178	195957138	10
Bos taurus	Bovine	Bos d 6	Food Animal	Bos Bos d 6	607	162648	7
Bos taurus	Bovine	Unassigned	Food Animal	Bos Bos d 6	607	3336842	7
Bos taurus	Bovine	Unassigned	Vaccine	Bos collagen alpha2	1364	27806257	11
Bos taurus	Bovine	Unassigned	Food Animal	Bos lactotransferrin	708	30794292	8
Brassica juncea	Mustard	Bra j 1	Food Plant	Brassica Bra j 1 2S albumin	129	32363444	9
Brassica napus	Rape	Bra n 1	Food Plant	Bra n 1	125	75107016	9
Brassica napus	Rape	Unassigned	Aero Plant	Bra n Bra r 2	83	2129801	7
Brassica napus	Rape	Unassigned	Aero Plant	Bra n Bra r 2	83	2129802	7
Brassica napus	Rape	Unassigned	Food Plant	Brassica napus 2S albumin	109	26985163	7
Brassica oleracea var. oleracea	Wild cabbage	Unassigned	Aero Plant	Brassica Bra o 3 LTP full length	112	922434456	16
Brassica rapa	Turnip	Unassigned	Aero Plant	Bra n Bra r 2	80	2129805	7
Brassica rapa	Turnip	Bra r 1.0101	Food Plant	Brassica Bra r 1	178	17697	9
Brassica rapa	Turnip	Bra r 5.0101	Food Plant	Brassica Calcim binding protein Group I	79	1255540	15
Brassica rapa subsp. rapa	Turnip	Unassigned	Aero Plant	Bra n Bra r 2	83	59800146	7
Brassica rapa subsp. rapa	Turnip	Bra r 2.0101	Contact	Brassica Bra r 2	91	32363456	9
Candida albicans	Yeast	Cand a 1.0101	Contact	Candida Cand a 1 Alcohol	350	608690	15

				dehydrogenase			
Species	**Common**	**IUIS Allergen**	**Type**	**Group**	**Length**	**GI#**	**Version**
Candida albicans	Yeast	Cand a 3.0101	Contact	Candida Cand a 3 Peroxysomal protein	236	37548637	7
Candida albicans	Yeast	Unassigned	Contact	Candida Enolase 1	440	232054	7
Canis familiaris	Dog	Can f 1.0101	Aero Animal	Canis Can f 1 Lipocalin	174	2598974	11
Canis familiaris	Dog	Can f 2	Aero Animal	Canis Can f 2 Lipocalin	177	29292272	7
Canis familiaris	Dog	Can f 2	Aero Animal	Canis Can f 2 Lipocalin	179	29292274	7
Canis familiaris	Dog	Can f 2.0101	Aero Animal	Canis Can f 2 Lipocalin	180	2598976	11
Canis familiaris	Dog	Can f 3	Aero Animal	Canis Can f 3 Serum albumin	265	633938	7
Canis familiaris	Dog	Can f 3	Aero Animal	Canis Can f 3 Serum albumin	585	3319897	7
Canis familiaris	Dog	Can f 3.0101	Aero Animal	Canis Can f 3 Serum albumin	608	22531688	15
Canis familiaris	Dog	Can f 4.0101	Aero Animal	Canis Can f 4 epithelial 18 kDa	174	262232390	12
Canis familiaris	Dog	Unassigned	Aero Animal	Canis Can f 4 epithelial 18 kDa	174	625295108	16
Canis familiaris	Dog	Can f 5.0101	Aero Animal	Canis Can f 5	260	868	15
Canis familiaris	Dog	Can f 6.0101	Aero Animal	Canis Can f 6 Lipocalin	190	374092884	13
Cannabis sativa	Hemp	Can s 3.0101	Aero Plant	Cannabis LTP Can s 3	91	571256597	15
Capsicum annuum	Bell pepper	Cap a 1	Food Plant	Capsicum Cap a 1	246	16609959	7
Capsicum annuum	Bell pepper	Cap a 2	Food Plant	Capsicum Cap a 2	131	16555785	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Carica papaya	Papaya	Unassigned	Food Plant	Carica Car p 1	345	129614	9
Carpinus betulus	Hornbeam	Car b 1.0102	Aero Plant	Carpinus Car b 1	159	402745	7
Carpinus betulus	Hornbeam	Car b 1.0103	Aero Plant	Carpinus Car b 1	160	1545875	7
Carpinus betulus	Hornbeam	Car b 1.0104	Aero Plant	Carpinus Car b 1	160	1545877	7
Carpinus betulus	Hornbeam	Car b 1.0105	Aero Plant	Carpinus Car b 1	160	1545879	7
Carpinus betulus	Hornbeam	Car b 1.0108	Aero Plant	Carpinus Car b 1	160	1545893	7
Carpinus betulus	Hornbeam	Car b 1.0301	Aero Plant	Carpinus Car b 1	161	1545895	7
Carpinus betulus	Hornbeam	Car b 1.0302	Aero Plant	Carpinus Car b 1	161	1545897	7
Carpinus betulus	Hornbeam	Unassigned	Aero Plant	Carpinus Car b 1	40	239735	7
Carpinus betulus	Hornbeam	Car b 1.0113	Aero Plant	Carpinus Car b 1	160	167472845	10
Carpinus betulus	Hornbeam	Car b 1.0109	Aero Plant	Carpinus Car b 1	160	167472837	10
Carpinus betulus	Hornbeam	Car b 1.0112	Aero Plant	Carpinus Car b 1	160	167472843	10
Carpinus betulus	Hornbeam	Car b 1.0111	Aero Plant	Carpinus Car b 1	160	167472841	10
Carpinus betulus	Hornbeam	Car b 1.0110	Aero Plant	Carpinus Car b 1	160	167472839	10
Carpinus betulus	Hornbeam	Unassigned	Aero Plant	Carpinus Car b 1	80	1008578	12
Carpinus betulus	Hornbeam	Unassigned	Aero Plant	Carpinus Car b 1	80	1008579	12
Carpinus betulus	Hornbeam	Unassigned	Aero Plant	Carpinus Car b 1	80	1008580	12
Carpinus betulus	Hornbeam	Car b 1.0101	Aero Plant	Carpinus Car b 1	159	402743	15
Carpinus betulus	Hornbeam	Car b 1.0106	Aero Plant	Carpinus Car b 1	160	1545881	15
Carpinus betulus	Hornbeam	Car b 1.0107	Aero Plant	Carpinus Car b 1	160	1545889	15
Carpinus betulus	Hornbeam	Car b 1.0201	Aero Plant	Carpinus Car b 1	159	402747	15
Carya illinoinensis	Pecan	Car i 1.0101	Food Plant	Carya Car i 1 Seed storage protein	143	28207731	7
Carya illinoinensis	Pecan	Car i 4.0101	Food Plant	Carya Car i 4 11s legumin	505	158998780	14
Carya illinoinensis	Pecan	Unassigned	Food Plant	Carya Car i 4 11s legumin	505	158998782	14
Caryota mitis	Fishtail Palm	Unassigned	Aero Plant	Caryota profilin	131	121277849	8
Castanea sativa	European	Cas s 1	Aero Plant	Castanea Cas s 1	160	16555781	7

	chestnut						
Species	**Common**	**IUIS Allergen**	**Type**	**Group**	**Length**	**GI#**	**Version**
Castanea sativa	European chestnut	Unassigned	Aero Plant	Castanea Cas s 1	159	212291466	10
Castanea sativa	European chestnut	Cas s 1.0101	Aero Plant	Castanea Cas s 1	159	212291464	10
Castanea sativa	European chestnut	Unassigned	Aero Plant	Castanea Cas s 1	159	212291468	10
Castanea sativa	European chestnut	Cas s 5	Food Plant	Castanea Cas s 5	316	1359600	7
Castanea sativa	European chestnut	Unassigned	Food Plant	Castanea Cas s 5	298	307159110	12
Catharanthus roseus	Madagascar periwinkle	Unassigned	Aero Plant	Catharanthus cyclophilin	178	659835152	16
Cavia porcellus	Domestic guinea pig	Cav p 1	Aero Animal	Cavia Cav p 1	15	32469617	7
Cavia porcellus	Domestic guinea pig	Cav p 2.0101	Aero Animal	Cavia Cav p 2	170	325910590	12
Cavia porcellus	Domestic guinea pig	Cav p 3.0101	Aero Animal	Cavia Cav p 3 lipocalin	170	325910592	12
Chamaecyparis obtusa	Japanese cypress	Cha o 1.0101	Aero Plant	Chamaecyparis Cha o 1	375	1514943	7
Chamaecyparis obtusa	Japanese cypress	Unassigned	Aero Plant	Chamaecyparis Cha o 2	514	47606004	7
Chamaecyparis obtusa	Japanese cypress	Unassigned	Aero Plant	Chamaecyparis Cha o 2	419	114841683	8
Charybdis feriatus	Crab	Cha f 1.0101	Food Animal	Charybdis Cha f 1	264	7024506	7
Chenopodium album	Pigweed	Che a 1	Aero Plant	Chenopodium Che a 1	168	22074346	7
Chenopodium album	Pigweed	Che a 2	Aero Plant	Chenopodium Che a 2	131	29465666	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Chenopodium album	Pigweed	Unassigned	Aero Plant	Chenopodium Che a 2	133	238886048	11
Chenopodium album	Pigweed	Che a 3	Aero Plant	Chenopodium Che a 3	86	29465668	7
Chionoecetes opilio	Snow Crab	Unassigned	Food Animal	Chionoecetes tropomyosin	284	308191588	12
Chironomus kiiensis	Midge	Chi k 10	Aero Insect	Chironomus Chi k 10	285	7321108	7
Chironomus thummi thummi	Midge	Chi t 1.01	Aero Insect	Chironomus Chi t 1	151	121219	7
Chironomus thummi thummi	Midge	Chi t 1.02	Aero Insect	Chironomus Chi t 1	151	121227	7
Chironomus thummi thummi	Midge	Chi t 2.0101	Aero Insect	Chironomus Chi t 2	158	2506460	7
Chironomus thummi thummi	Midge	Chi t 3.0601	Aero Insect	Chironomus Chi t 3	161	56405052	7
Chironomus thummi thummi	Midge	Chi t 3.0901	Aero Insect	Chironomus Chi t 3	151	121237	7
Chironomus thummi thummi	Midge	Chi t 3.0501	Aero Insect	Chironomus Chi t 3	161	121244	7
Chironomus thummi thummi	Midge	Chi t 3.0701	Aero Insect	Chironomus Chi t 3	161	56405054	7
Chironomus thummi thummi	Midge	Chi t 3.0702	Aero Insect	Chironomus Chi t 3	161	121248	7
Chironomus thummi thummi	Midge	Chi t 3.0801	Aero Insect	Chironomus Chi t 3	162	121249	7
Chironomus thummi thummi	Midge	Chi t 3.0301	Aero Insect	Chironomus Chi t 3	161	56405306	7
Chironomus thummi thummi	Midge	Chi t 3.0101	Aero Insect	Chironomus Chi t 3	160	1707908	7
Chironomus thummi thummi	Midge	Chi t 3.0401	Aero Insect	Chironomus Chi t 3	161	1707911	7

AllergenOnline version 16
27 January, 2016

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Chironomus thummi thummi	Midge	Chi t 3.0201	Aero Insect	Chironomus Chi t 3	162	2506461	7
Chironomus thummi thummi	Midge	Chi t 4	Aero Insect	Chironomus Chi t 4	151	121256	7
Chironomus thummi thummi	Midge	Chi t 9	Aero Insect	Chironomus Chi t 9	151	121259	7
Citrus limon	Lemon	Cit l 3.0101	Food Plant	Citrus LTP Cit s 3/Cit l 3	20	52783176	7
Citrus sinensis	Navel orange	Cit s 1.0101	Food Plant	Citrus Cit s 1	25	52782810	7
Citrus sinensis	Navel orange	Cit s 2.0101	Food Plant	Citrus Cit s 2	131	56000996	7
Citrus sinensis	Navel orange	Unassigned	Food Plant	Citrus LTP Cit s 3/Cit l 3	20	52783177	7
Citrus sinensis	Navel orange	Cit s 3	Food Plant	Citrus LTP Cit s 3/Cit l 3	91	50199132	7
Cladosporium cladosporioides	Fungus	Cla c 14.0101	Aero Fungi	Cladosporium Cla c 14	325	301015198	15
Cladosporium cladosporioides	Fungus	Cla c 9.0101	Aero Fungi	Cladosporium Cla c 9 Davidiella	388	148361511	11
Clupea harengus	Atlantic herring	Clu h 1.0101	Food Animal	Clupea Clu h 1	109	242253963	11
Clupea harengus	Atlantic herring	Clu h 1.0201	Food Animal	Clupea Clu h 1	110	242253965	11
Clupea harengus	Atlantic herring	Clu h 1.0301	Food Animal	Clupea Clu h 1	109	242253967	11
Cochliobolus lunatus	Fungus	Cur l 3.0101	Aero Fungi	Cochliobolus (Curvularia) Cur l 3	108	14585755	15
Cochliobolus lunatus	Fungus	Cur l 2.01	Aero Fungi	Cochliobolus (Curvularia) enolase Cur l 2.01	440	14585753	8
Cochliobolus lunatus	Fungus	Cur l 4.0101	Aero Fungi	Curvularia Cur l 4	506	193507493	15
Coffea arabica	Coffee	Cof a 3.0101	Food Plant	Coffea Cof a 3	65	494319676	15
Coffea arabica	Coffee	Cof a 1.0101	Food Plant	Coffea Cof a 1	263	296399179	15
Coffea arabica	Coffee	Cof a 2.0101	Food Plant	Coffea Cof a 2	80	494319674	15

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Coprinus comatus	Shaggy mane	Cop c 1	Food Fungi	Coprinus Cop c 1	81	4538529	7
Corylus avellana	European hazelnut	Cor a 1.0103	Aero Plant	Corylus Cor a 1	160	22684	7
Corylus avellana	European hazelnut	Cor a 1.0104	Aero Plant	Corylus Cor a 1	160	22686	7
Corylus avellana	European hazelnut	Cor a 1.0102	Aero Plant	Corylus Cor a 1	160	22690	7
Corylus avellana	European hazelnut	Cor a 1.0201	Aero Plant	Corylus Cor a 1	160	1321731	7
Corylus avellana	European hazelnut	Cor a 1.0301	Aero Plant	Corylus Cor a 1	160	1321733	7
Corylus avellana	European hazelnut	Cor a 1.0401	Food Plant	Corylus Cor a 1	161	5726304	7
Corylus avellana	European hazelnut	Cor a 1.0402	Food Plant	Corylus Cor a 1	161	11762102	7
Corylus avellana	European hazelnut	Cor a 1.0403	Food Plant	Corylus Cor a 1	161	11762104	7
Corylus avellana	European hazelnut	Cor a 1.0404	Food Plant	Corylus Cor a 1	161	11762106	7
Corylus avellana	European hazelnut	Cor a 1.0101	Food Plant	Corylus Cor a 1	160	22688	15
Corylus avellana	European hazelnut	Cor a 11	Food Plant	Corylus Cor a 11	448	19338630	7
Corylus avellana	European hazelnut	Cor a 12.0101	Food Plant	Corylus Cor a 12	159	49617323	15
Corylus avellana	European hazelnut	Cor a 13.0101	Food Plant	Corylus Cor a 13 Oleosin	140	29170509	7
Corylus avellana	European hazelnut	Cor a 14.0101	Food Plant	Corylus Cor a 14 2S albumin	147	226437844	11

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Corylus avellana	European hazelnut	Cor a 2.0101	Aero Plant	Corylus Cor a 2 profilins	131	12659206	7
Corylus avellana	European hazelnut	Cor a 2.0102	Aero Plant	Corylus Cor a 2 profilins	131	12659208	7
Corylus avellana	European hazelnut	Unassigned	Food Plant	Corylus Cor a 2 profilins	131	576017879	15
Corylus avellana	European hazelnut	Unassigned	Food Plant	Corylus Cor a 2 profilins	133	576017878	15
Corylus avellana	European hazelnut	Unassigned	Food Plant	Corylus Cor a 2 profilins	133	576017819	15
Corylus avellana	European hazelnut	Unassigned	Food Plant	Corylus Cor a 2 profilins	131	576017779	15
Corylus avellana	European hazelnut	Unassigned	Food Plant	Corylus Cor a 2 profilins	133	576017777	15
Corylus avellana	European hazelnut	Unassigned	Food Plant	Corylus Cor a 2 profilins	133	576017776	15
Corylus avellana	European hazelnut	Cor a 8	Food Plant	Corylus Cor a 8	115	13507262	7
Corylus avellana	European hazelnut	Unassigned	Aero Plant	Corylus Cor a 9	514	557792009	16
Corylus avellana	European hazelnut	Cor a 9	Food Plant	Corylus Cor a 9	515	18479082	7
Crangon crangon	Shrimp	Cra c 1.0101	Food Animal	Crangon Cra c 1 tropomyosin	284	238477263	12
Crangon crangon	Shrimp	Cra c 2.0101	Food Animal	Crangon Cra c 2 arginine kinase	356	238477265	12
Crangon crangon	Shrimp	Cra c 4.0101	Food Animal	Crangon Cra c 4 sarcoplasmic calcium-binding prote	193	238477327	12
Crangon crangon	Shrimp	Cra c 5.0101	Food Animal	Crangon Cra c 5 myosin light chain	153	238477331	12

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Crangon crangon	Shrimp	Cra c 6.0101	Food Animal	Crangon Cra c 6 troponin C	150	238477333	12
Crangon crangon	Shrimp	Cra c 8.0101	Food Animal	Crangon Cra c 8 triosephosphate isomerase	249	238477329	12
Crassostrea gigas	American oyster	Unassigned	Food Animal	Crassostrea Tropomyosin	233	15419048	7
Crassostrea gigas	American oyster	Unassigned	Food Animal	Crassostrea Tropomyosin	284	219806594	10
Crassostrea virginica	Eastern oyster	Unassigned	Food Animal	Crassostrea Tropomyosin	160	3668408	7
Crocus sativus	Saffron crocus	Cro s 2.0101	Aero Plant	Crocus profilin Cro s 2	131	58700651	7
Cryptomeria japonica	Japanese cedar	Unassigned	Aero Plant	Cryptomeria class IV chitinase	281	56550550	7
Cryptomeria japonica	Japanese cedar	Cry j 1.0102	Aero Plant	Cryptomeria Cry j 1	374	493634	8
Cryptomeria japonica	Japanese cedar	Cry j 1.0101	Aero Plant	Cryptomeria Cry j 1	374	493632	15
Cryptomeria japonica	Japanese cedar	Cry j 1.0103	Aero Plant	Cryptomeria Cry j 1	374	516728	15
Cryptomeria japonica	Japanese cedar	Cry j 2	Aero Plant	Cryptomeria Cry j 2	514	1171004	7
Cryptomeria japonica	Japanese cedar	Cry j 2	Aero Plant	Cryptomeria Cry j 2	514	24898904	7
Cryptomeria japonica	Japanese cedar	Cry j 2	Aero Plant	Cryptomeria Cry j 2	514	24898906	7
Cryptomeria japonica	Japanese cedar	Cry j 2	Aero Plant	Cryptomeria Cry j 2	514	24898908	7
Cryptomeria japonica	Japanese cedar	Unassigned	Aero Plant	Cryptomeria Cry j 2	514	114841607	8
Cryptomeria japonica	Japanese cedar	Unassigned	Aero Plant	Cryptomeria Cry j 2	514	114841617	8
Cryptomeria japonica	Japanese cedar	Unassigned	Aero Plant	Cryptomeria Cry j 2	514	114841629	8
Cryptomeria japonica	Japanese cedar	Unassigned	Aero Plant	Cryptomeria Cry j 2	514	114841635	8
Cryptomeria japonica	Japanese cedar	Unassigned	Aero Plant	Cryptomeria Cry j 2	514	114841641	8
Cryptomeria japonica	Japanese cedar	Unassigned	Aero Plant	Cryptomeria Cry j 2	514	114841653	8
Cryptomeria japonica	Japanese cedar	Unassigned	Aero Plant	Cryptomeria Cry j 2	514	114841657	8
Cryptomeria japonica	Japanese cedar	Unassigned	Aero Plant	Cryptomeria Cry j 2	514	114841663	8

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Cryptomeria japonica	Japanese cedar	Unassigned	Aero Plant	Cryptomeria Cry j 2	514	114841665	8
Cryptomeria japonica	Japanese cedar	Cry j 2.0101	Aero Plant	Cryptomeria Cry j 2	514	506858	9
Cryptomeria japonica	Japanese cedar	Unassigned	Aero Plant	Cryptomeria Cry j 2	65	123299282	9
Cryptomeria japonica	Japanese cedar	Unassigned	Aero Plant	Cryptomeria Isoflavone reductase-like protein	306	19847822	7
Cryptomeria japonica	Japanese cedar	Unassigned	Aero Plant	Cryptomeria pollen allergen CJP-8	165	291621332	12
Cryptomeria japonica	Japanese cedar	Unassigned	Aero Plant	Cryptomeria pollen allergen CPA63	472	293329689	12
Cryptomeria japonica	Japanese cedar	Unassigned	Aero Plant	Cryptomeria thaumatin like Cry j 3.8	225	139002766	8
Cucumis melo	Muskmelon	Cuc m 1	Food Plant	Cucumis Cuc m 1	731	807698	7
Cucumis melo	Muskmelon	Unassigned	Food Plant	Cucumis Cuc m 2	131	31559374	7
Cucumis melo	Muskmelon	Cuc m 2	Food Plant	Cucumis Cuc m 2	131	58263793	7
Cucumis melo	Muskmelon	Cuc m 3.0101	Food Plant	Cucumis Cuc m 3	41	46396595	9
Cucumis melo var. inodorus	Muskmelon	Unassigned	Food Plant	Cucumis Cuc m 3	151	171464770	9
Cucumis melo var. reticulatus	Netted muskmelon	Unassigned	Food Plant	Cucumis Cuc m 2	131	57021110	7
Cupressus arizonica	Arizona Cypress	Cup a 1	Aero Plant	Cupressus Cup a 1/Cup s 1	346	6562326	7
Cupressus arizonica	Arizona Cypress	Cup a 1	Aero Plant	Cupressus Cup a 1/Cup s 1	367	19069497	7
Cupressus arizonica	Arizona Cypress	Unassigned	Aero Plant	Cupressus Cup a 1/Cup s 1	347	118197955	8
Cupressus arizonica	Arizona Cypress	Unassigned	Aero Plant	Cupressus Cup a 4	165	261865475	11
Cupressus arizonica	Arizona Cypress	Unassigned	Aero Plant	Cupressus Cup s 3	199	9929163	7
Cupressus sempervirens	Mediterranean Cypress	Cup s 1.0101	Aero Plant	Cupressus Cup a 1/Cup s 1	367	8101711	7
Cupressus sempervirens	Mediterranean Cypress	Cup s 1.0102	Aero Plant	Cupressus Cup a 1/Cup s 1	367	8101713	7
Cupressus sempervirens	Mediterranean Cypress	Cup s 1.0103	Aero Plant	Cupressus Cup a 1/Cup s 1	367	8101715	7
Cupressus sempervirens	Mediterranean	Cup s 1.0104	Aero Plant	Cupressus Cup a 1/Cup s 1	367	8101717	7

	Cypress						
Species	**Common**	**IUIS Allergen**	**Type**	**Group**	**Length**	**GI#**	**Version**
Cupressus sempervirens	Mediterranean Cypress	Cup s 1.0105	Aero Plant	Cupressus Cup a 1/Cup s 1	367	8101719	7
Cupressus sempervirens	Mediterranean Cypress	Cup s 3.0102	Aero Plant	Cupressus Cup s 3	225	38456228	7
Cupressus sempervirens	Mediterranean Cypress	Cup s 3.0101	Aero Plant	Cupressus Cup s 3	225	38456226	11
Cynodon dactylon	Bermuda grass	Cyn d 1	Aero Plant	Cynodon Cyn d 1	25	451274	7
Cynodon dactylon	Bermuda grass	Cyn d 1	Aero Plant	Cynodon Cyn d 1	38	451275	7
Cynodon dactylon	Bermuda grass	Cyn d 1	Aero Plant	Cynodon Cyn d 1	34	691726	7
Cynodon dactylon	Bermuda grass	Cyn d 1.0204	Aero Plant	Cynodon Cyn d 1	244	10314021	7
Cynodon dactylon	Bermuda grass	Cyn d 1.0201	Aero Plant	Cynodon Cyn d 1	244	15384338	7
Cynodon dactylon	Bermuda grass	Cyn d 1.0202	Aero Plant	Cynodon Cyn d 1	262	16076693	7
Cynodon dactylon	Bermuda grass	Cyn d 1	Aero Plant	Cynodon Cyn d 1	262	16076695	7
Cynodon dactylon	Bermuda grass	Cyn d 1.0203	Aero Plant	Cynodon Cyn d 1	262	16076697	7
Cynodon dactylon	Bermuda grass	Cyn d 1.0101	Aero Plant	Cynodon Cyn d 1	246	7687901	10
Cynodon dactylon	Bermuda grass	Cyn d 12	Aero Plant	Cynodon Cyn d 12	131	2154730	7
Cynodon dactylon	Bermuda grass	Unassigned	Aero Plant	Cynodon Cyn d 7	71	1247373	7
Cynodon dactylon	Bermuda grass	Unassigned	Aero Plant	Cynodon Cyn d 7	73	1247375	7
Cynodon dactylon	Bermuda grass	Cyn d 7	Aero Plant	Cynodon Cyn d 7	82	1871507	7
Cynodon dactylon	Bermuda grass	Unassigned	Aero Plant	Cynodon Group 4 like-allergen FAD-linked oxidoredu	522	41393750	7
Cyprinus carpio	Carp	Cyp c 1.0101	Food Animal	Cyprinus Cyp c 1 Parvalbumin	109	17977825	7
Cyprinus carpio	Carp	Cyp c 1.0201	Food Animal	Cyprinus Cyp c 1 Parvalbumin	109	17977827	7
Dactylis glomerata	Orchard grass	Dac g 1	Aero Plant	Dactylis Dac g 1	264	18093991	7
Dactylis glomerata	Orchard grass	Dac g 1.0101	Aero Plant	Dactylis Dac g 1	240	33149333	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Dactylis glomerata	Orchard grass	Dac g 2	Aero Plant	Dactylis Dac g 2	196	1093120	7
Dactylis glomerata	Orchard grass	Dac g 2	Aero Plant	Dactylis Dac g 2	122	4007040	7
Dactylis glomerata	Orchard grass	Dac g 3	Aero Plant	Dactylis Dac g 3	96	1825459	7
Dactylis glomerata	Orchard grass	Dac g 4.0101	Aero Plant	Dactylis Dac g 4	55	32363463	9
Dactylis glomerata	Orchard grass	Dac g 5	Aero Plant	Dactylis Dac g 5	290	14423124	7
Dactylis glomerata	Orchard grass	Dac g 5	Aero Plant	Dactylis Dac g 5	265	18093971	7
Daucus carota	Carrot	Unassigned	Food Plant	Daucus cyclophilin	171	373939374	13
Daucus carota	Carrot	Dau c 1.0101	Food Plant	Daucus Dau c 1	168	1335877	7
Daucus carota	Carrot	Dau c 1.0102	Food Plant	Daucus Dau c 1	154	1663522	7
Daucus carota	Carrot	Dau c 1.0103	Food Plant	Daucus Dau c 1	154	2154732	7
Daucus carota	Carrot	Dau c 1.0104	Food Plant	Daucus Dau c 1	154	2154734	7
Daucus carota	Carrot	Dau c 1.0105	Food Plant	Daucus Dau c 1	154	2154736	7
Daucus carota	Carrot	Dau c 1.0201	Food Plant	Daucus Dau c 1	154	18652047	7
Daucus carota	Carrot	Unassigned	Food Plant	Daucus Dau c 1	154	19912791	7
Daucus carota	Carrot	Dau c 1.0301	Food Plant	Daucus Dau c 1	154	302379147	12
Daucus carota	Carrot	Unassigned	Food Plant	Daucus Dau c 1	154	302379149	12
Daucus carota	Carrot	Unassigned	Food Plant	Daucus Dau c 1	154	302379151	12
Daucus carota	Carrot	Unassigned	Food Plant	Daucus Dau c 1	154	302379153	12
Daucus carota	Carrot	Unassigned	Food Plant	Daucus Dau c 1	154	302379155	12
Daucus carota	Carrot	Unassigned	Food Plant	Daucus Dau c 1	154	302379157	12
Daucus carota	Carrot	Unassigned	Food Plant	Daucus Dau c 1	154	302379159	12
Daucus carota	Carrot	Dau c 4	Food Plant	Daucus Dau c 4	134	18652049	7
Daucus carota	Carrot	Dau c 5.0101	Food Plant	Daucus Dau c 5 isoflavone reductase	306	373939378	13
Daucus carota	Carrot	Unassigned	Food Plant	Daucus Dau c 5 isoflavone reductase	306	373939376	13
Davidiella tassiana	Fungus	Cla h 10	Aero Fungi	Cladosporium / Davidiella Cla h 10	496	76666769	7
Davidiella tassiana	Fungus	Cla h 5.0101	Aero Fungi	Cladosporium / Davidiella Cla h 5	111	5777795	10

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Davidiella tassiana	Fungus	Cla h 6	Aero Fungi	Cladosporium / Davidiella Cla h 6	440	467660	7
Davidiella tassiana	Fungus	Cla h 6	Aero Fungi	Cladosporium / Davidiella Cla h 6	440	6015094	7
Davidiella tassiana	Fungus	Cla h 7.0101	Aero Fungi	Cladosporium / Davidiella Cla h 7	204	467629	10
Davidiella tassiana	Fungus	Cla h 8.0101	Aero Fungi	Cladosporium / Davidiella Cla h 8	267	37780015	8
Davidiella tassiana	Fungus	Cla h 9.0101	Aero Fungi	Cladosporium / Davidiella Cla h 9 vacuolar serine	518	60116876	10
Davidiella tassiana	Fungus	Unassigned	Aero Fungi	Cladosporium / Davidiella Heat shock 70 kDa protei	643	729764	7
Davidiella tassiana	Fungus	Unassigned	Aero Fungi	Cladosporium / Davidiella Hydrophobin	105	22796153	7
Davidiella tassiana	Fungus	Unassigned	Aero Fungi	Cladosporium / Davidiella putative hydrolase	274	76446100	10
Davidiella tassiana	Fungus	Unassigned	Aero Fungi	Cladosporium / Davidiella Putative nuclear transpo	125	21748151	7
Dermatophagoides farinae	House dust mite	Der f 13.0101	Aero Mite	Dermatophagoides Der f 13	131	37958167	11
Dermatophagoides farinae	House dust mite	Der f 15	Aero Mite	Dermatophagoides Der f 15 Der p 15	555	5815436	7
Dermatophagoides farinae	House dust mite	Der f 16	Aero Mite	Dermatophagoides Der f 16	480	21591547	7
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der f 20 / Der p 20	356	37785884	8
Dermatophagoides farinae	House dust mite	Der f 20.0201	Aero Mite	Dermatophagoides Der f 20 / Der p 20	356	156938897	9
Dermatophagoides farinae	House dust mite	Der f 20.0101	Aero Mite	Dermatophagoides Der f 20 / Der p 20	356	685432792	15
Dermatophagoides farinae	House dust mite	Der f 24.0101	Aero Mite	Dermatophagoides Der f 24 and Der p 24 Ubiquinol	118	477541860	14
Dermatophagoides	House dust mite	Der f 25.0101	Aero Mite	Dermatophagoides Der f 25	247	442565872	14

farinae							
Species	**Common**	**IUIS Allergen**	**Type**	**Group**	**Length**	**GI#**	**Version**
Dermatophagoides farinae	House dust mite	Der f 25.0201	Aero Mite	Dermatophagoides Der f 25	247	685432812	15
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der f 27	427	37958175	8
Dermatophagoides farinae	House dust mite	Der f 27.0101	Aero Mite	Dermatophagoides Der f 27	427	685432794	15
Dermatophagoides farinae	House dust mite	Der f 28.0101	Aero Mite	Dermatophagoides Der f 28	659	442565876	14
Dermatophagoides farinae	House dust mite	Der f 28.0201	Aero Mite	Dermatophagoides Der f 28	654	685432788	15
Dermatophagoides farinae	House dust mite	Der f 29.0101	Aero Mite	Dermatophagoides Der f 29	164	37958141	8
Dermatophagoides farinae	House dust mite	Der f 30.0101	Aero Mite	Dermatophagoides Der f 30	171	442565878	14
Dermatophagoides farinae	House dust mite	Der f 1	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	321	730035	7
Dermatophagoides farinae	House dust mite	Der f 1.0101	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	321	27530349	7
Dermatophagoides farinae	House dust mite	Der f 1.0102	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	276	76097507	7
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	321	156106765	9
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	263	37958161	12
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	305	387178006	13
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	303	305387429	15

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Dermatophagoides farinae	House dust mite	Der f 1.0108	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	321	119633260	15
Dermatophagoides farinae	House dust mite	Der f 1.0109	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	321	119633262	15
Dermatophagoides farinae	House dust mite	Der f 1.0110	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	321	119633264	15
Dermatophagoides farinae	House dust mite	Der f 10.0101	Aero Mite	Dermatophagoides Der p 10 / Der f 10	299	1359436	7
Dermatophagoides farinae	House dust mite	Der f 11	Aero Mite	Dermatophagoides Der p 11 / Der f 11	692	13785807	7
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 11 / Der f 11	876	685432820	16
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 14 / Der f 14	341	729979	7
Dermatophagoides farinae	House dust mite	Der f 14.0101	Aero Mite	Dermatophagoides Der p 14 / Der f 14	349	1545803	7
Dermatophagoides farinae	House dust mite	Der f 2.0102	Aero Mite	Dermatophagoides Der p 2 / Der f 2	146	217306	7
Dermatophagoides farinae	House dust mite	Der f 2.0103	Aero Mite	Dermatophagoides Der p 2 / Der f 2	138	217308	7
Dermatophagoides farinae	House dust mite	Der f 2.0105	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	17978844	7
Dermatophagoides farinae	House dust mite	Der f 2.0108	Aero Mite	Dermatophagoides Der p 2 / Der f 2	146	55859470	7
Dermatophagoides farinae	House dust mite	Der f 2.0107	Aero Mite	Dermatophagoides Der p 2 / Der f 2	146	55859468	7
Dermatophagoides farinae	House dust mite	Der f 2.0106	Aero Mite	Dermatophagoides Der p 2 / Der f 2	146	55859466	7
Dermatophagoides farinae	House dust mite	Der f 2.0109	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	76097511	7

AllergenOnline version 16
27 January, 2016

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 2 / Der f 2	146	256631558	11
Dermatophagoides farinae	House dust mite	Der f 2.0112	Aero Mite	Dermatophagoides Der p 2 / Der f 2	140	37958157	12
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	387178018	13
Dermatophagoides farinae	House dust mite	Der f 2.0101	Aero Mite	Dermatophagoides Der p 2 / Der f 2	138	217304	15
Dermatophagoides farinae	House dust mite	Der f 2.0116	Aero Mite	Dermatophagoides Der p 2 / Der f 2	146	124696217	15
Dermatophagoides farinae	House dust mite	Der f 3	Aero Mite	Dermatophagoides Der p 3 / Der f 3	232	1314736	7
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 3 / Der f 3	259	163638970	9
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 3 / Der f 3	259	218203816	10
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 3 / Der f 3	259	218203818	10
Dermatophagoides farinae	House dust mite	Der f 3.0101	Aero Mite	Dermatophagoides Der p 3 / Der f 3	259	1311457	15
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 6 / Der f 6	20	404371	7
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 6 / Der f 6	279	218203826	10
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 6 / Der f 6	279	218203828	10
Dermatophagoides farinae	House dust mite	Der f 6.0101	Aero Mite	Dermatophagoides Der p 6 / Der f 6	279	6808530	11
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 7 / Der f 7	213	37958165	8

AllergenOnline version 16
27 January, 2016

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 7 / Der f 7	213	218203832	10
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 7 / Der f 7	213	685432798	16
Dermatophagoides farinae	House dust mite	Der f 18	Aero Mite	Dermatophagoides farinae Der f 18 Der p 18	462	27550039	7
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides farinae Der f 21 Chew	136	140089314	9
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides farinae Der f 21 Chew	136	140089316	9
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides farinae Der f 21 Chew	136	140089320	9
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides farinae Der f 21 Chew	136	140089322	9
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides farinae Der f 21 Chew	136	140089324	9
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides farinae Der f 21 Chew	136	140089326	9
Dermatophagoides farinae	House dust mite	Der f 21.0101	Aero Mite	Dermatophagoides farinae Der f 21 Chew	136	567768173	15
Dermatophagoides farinae	House dust mite	Unassigned	Aero Mite	Dermatophagoides Profilin	130	685432824	16
Dermatophagoides microceras	House dust mite	Der m 1.0101	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	30	127205	7
Dermatophagoides pteronyssinus	House dust mite	Der p 15.0101	Aero Mite	Dermatophagoides Der f 15 Der p 15	532	67975089	7
Dermatophagoides pteronyssinus	House dust mite	Der p 15.0102	Aero Mite	Dermatophagoides Der f 15 Der p 15	558	78128018	7
Dermatophagoides pteronyssinus	House dust mite	Der p 20.0101	Aero Mite	Dermatophagoides Der f 20 / Der p 20	356	188485735	10

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Dermatophagoides pteronyssinus	House dust mite	Der p 24.0101	Aero Mite	Dermatophagoides Der f 24 and Der p 24 Ubiquinol	118	922664427	16
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der f 30	180	15072346	7
Dermatophagoides pteronyssinus	House dust mite	Der p 1	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	222	21725560	7
Dermatophagoides pteronyssinus	House dust mite	Der p 1	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	222	21725562	7
Dermatophagoides pteronyssinus	House dust mite	Der p 1	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	222	21725564	7
Dermatophagoides pteronyssinus	House dust mite	Der p 1	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	222	21725566	7
Dermatophagoides pteronyssinus	House dust mite	Der p 1	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	222	21725568	7
Dermatophagoides pteronyssinus	House dust mite	Der p 1	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	222	21725570	7
Dermatophagoides pteronyssinus	House dust mite	Der p 1	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	222	21725572	7
Dermatophagoides pteronyssinus	House dust mite	Der p 1	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	222	21725574	7
Dermatophagoides pteronyssinus	House dust mite	Der p 1	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	222	21725576	7
Dermatophagoides pteronyssinus	House dust mite	Der p 1	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	222	21725578	7
Dermatophagoides pteronyssinus	House dust mite	Der p 1	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	222	21725580	7
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	216	61608445	7
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	222	83754033	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	223	157696052	9
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	222	223365887	10
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	320	195933901	10
Dermatophagoides pteronyssinus	House dust mite	Der p 1.0124	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	302	256095986	11
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	96	387592	11
Dermatophagoides pteronyssinus	House dust mite	Der p 1.0101	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	320	511953	12
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	304	387178004	13
Dermatophagoides pteronyssinus	House dust mite	Der p 1.0113	Aero Mite	Dermatophagoides Der p 1 Der f 1 Der m 1	302	76097505	15
Dermatophagoides pteronyssinus	House dust mite	Der p 10	Aero Mite	Dermatophagoides Der p 10 / Der f 10	284	2353266	7
Dermatophagoides pteronyssinus	House dust mite	Der p 10.0101	Aero Mite	Dermatophagoides Der p 10 / Der f 10	284	2440053	7
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 10 / Der f 10	281	80553470	7
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 10 / Der f 10	284	208970286	10
Dermatophagoides pteronyssinus	House dust mite	Der p 11.0101	Aero Mite	Dermatophagoides Der p 11 / Der f 11	875	37778944	7
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 13	131	302035350	12
Dermatophagoides pteronyssinus	House dust mite	Der p 14.0101	Aero Mite	Dermatophagoides Der p 14 / Der f 14	1662	20385544	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Dermatophagoides pteronyssinus	House dust mite	Der p 2	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	21465915	7
Dermatophagoides pteronyssinus	House dust mite	Der p 2	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	21725582	7
Dermatophagoides pteronyssinus	House dust mite	Der p 2	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	21725584	7
Dermatophagoides pteronyssinus	House dust mite	Der p 2	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	21725586	7
Dermatophagoides pteronyssinus	House dust mite	Der p 2	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	21725588	7
Dermatophagoides pteronyssinus	House dust mite	Der p 2	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	21725590	7
Dermatophagoides pteronyssinus	House dust mite	Der p 2	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	21725592	7
Dermatophagoides pteronyssinus	House dust mite	Der p 2	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	21725594	7
Dermatophagoides pteronyssinus	House dust mite	Der p 2	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	21725596	7
Dermatophagoides pteronyssinus	House dust mite	Der p 2	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	21725600	7
Dermatophagoides pteronyssinus	House dust mite	Der p 2	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	21725602	7
Dermatophagoides pteronyssinus	House dust mite	Der p 2	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	21725604	7
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	76097509	7
Dermatophagoides pteronyssinus	House dust mite	Der p 2.0114	Aero Mite	Dermatophagoides Der p 2 / Der f 2	146	99644635	7
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 2 / Der f 2	130	110560872	9

AllergenOnline version 16
27 January, 2016

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	157829757	9
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 2 / Der f 2	145	164415595	9
Dermatophagoides pteronyssinus	House dust mite	Der p 2.0101	Aero Mite	Dermatophagoides Der p 2 / Der f 2	145	9280543	10
Dermatophagoides pteronyssinus	House dust mite	Der p 2.0110	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	256095984	11
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	387178014	13
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 2 / Der f 2	129	387178008	13
Dermatophagoides pteronyssinus	House dust mite	Der p 21.0101	Aero Mite	Dermatophagoides Der p 21	140	85687540	7
Dermatophagoides pteronyssinus	House dust mite	Der p 23.0101	Aero Mite	Dermatophagoides Der p 23 Peritrophin-like protein	90	171466145	14
Dermatophagoides pteronyssinus	House dust mite	Der p 3	Aero Mite	Dermatophagoides Der p 3 / Der f 3	261	511476	7
Dermatophagoides pteronyssinus	House dust mite	Der p 4	Aero Mite	Dermatophagoides Der p 4	496	5059162	7
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 4	19	1351935	7
Dermatophagoides pteronyssinus	House dust mite	Der p 5.0102	Aero Mite	Dermatophagoides Der p 5	132	913285	7
Dermatophagoides pteronyssinus	House dust mite	Der p 5	Aero Mite	Dermatophagoides Der p 5	132	28798085	7
Dermatophagoides pteronyssinus	House dust mite	Der p 5.0101	Aero Mite	Dermatophagoides Der p 5	148	9072	15
Dermatophagoides pteronyssinus	House dust mite	Der p 6	Aero Mite	Dermatophagoides Der p 6 / Der f 6	20	1352239	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Dermatophagoides pteronyssinus	House dust mite	Der p 7.0101	Aero Mite	Dermatophagoides Der p 7 / Der f 7	215	1045602	7
Dermatophagoides pteronyssinus	House dust mite	Der p 7	Aero Mite	Dermatophagoides Der p 7 / Der f 7	215	10189811	7
Dermatophagoides pteronyssinus	House dust mite	Der f 7.0101	Aero Mite	Dermatophagoides Der p 7 / Der f 7	213	1311689	10
Dermatophagoides pteronyssinus	House dust mite	Der p 8.0101	Aero Mite	Dermatophagoides Der p 8	219	807138	7
Dermatophagoides pteronyssinus	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 8	219	60920878	7
Dermatophagoides pteronyssinus	House dust mite	Der p 18.0101	Aero Mite	Dermatophagoides farinae Der f 18 Der p 18	462	67975085	7
Dermatophagoides siboney	House dust mite	Unassigned	Aero Mite	Dermatophagoides Der p 2 / Der f 2	146	86450747	7
Dolichovespula arenaria	Yellow jacket	Dol a 5.0101	Venom or Salivary	Dolichovespula Venom allergen 5	203	156719	11
Dolichovespula maculata	Whiteface hornet	Dol m 1.02	Venom or Salivary	Dolichovespula Dol m 1 Phospholipase A1B	303	1709542	7
Dolichovespula maculata	Whiteface hornet	Dol m 1.0101	Venom or Salivary	Dolichovespula Dol m 1 Phospholipase A1B	317	288917	8
Dolichovespula maculata	Whiteface hornet	Dol m 2.0101	Venom or Salivary	Dolichovespula Dol m 2 Hyaluronidase	331	511604	11
Dolichovespula maculata	Whiteface hornet	Dol m 5.0101	Venom or Salivary	Dolichovespula Venom allergen 5	227	156715	11
Dolichovespula maculata	Whiteface hornet	Dol m 5.02	Venom or Salivary	Dolichovespula Venom allergen 5	212	552080	11
Epicoccum nigrum	Fungus	Epi p 1.0101	Aero Fungi	Epicoccum Epi p 1	18	24636820	9
Equus caballus	Horse	Equ c 1.0101	Aero Animal	Equus Equ c 1	187	1575778	11

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Equus caballus	Horse	Equ c 2.0101	Aero Animal	Equus Equ c 2	29	3121755	7
Equus caballus	Horse	Equ c 2.0102	Aero Animal	Equus Equ c 2	19	3121756	7
Equus caballus	Horse	Equ c 3.0101	Aero Animal	Equus Equ c 3	607	399672	7
Equus caballus	Horse	Equ c 4.0101	Aero Animal	Equus Equ c 4 and Equ c 5	228	126514234	8
Erimacrus isenbeckii	Horsehair crab	Unassigned	Food Animal	Erimacrus tropomyosin	284	125995169	8
Erimacrus isenbeckii	Horsehair crab	Unassigned	Food Animal	Erimacrus tropomyosin	284	125995171	8
Eriocheir sinensis	Chinese mitten crab	Unassigned	Food Animal	Eriocheir tropomyosin	284	134305330	8
Euphausia pacifica	North Pacific Krill	Unassigned	Food Animal	Euphausia	284	156712754	9
Euphausia superba	Krill	Unassigned	Food Animal	Euphausia	284	156712752	9
Euroglyphus maynei	House dust mite	Eur m 1.0101	Aero Mite	Euroglyphus Eur m 1	321	3941388	7
Euroglyphus maynei	House dust mite	Unassigned	Aero Mite	Euroglyphus Eur m 1	327	3941390	7
Euroglyphus maynei	House dust mite	Eur m 2.0102	Aero Mite	Euroglyphus Eur m 2	135	3941386	7
Euroglyphus maynei	House dust mite	Eur m 2.0101	Aero Mite	Euroglyphus Eur m 2	145	3941384	11
Evynnis japonica	Crimson seabream	Unassigned	Food Animal	Evynnis parvalbumin	109	327342663	12
Evynnis japonica	Crimson seabream	Unassigned	Food Animal	Evynnis parvalbumin	108	327342661	12
Fagopyrum esculentum	Buckwheat	Unassigned	Food Plant	Fagopyrum BW 8 kDa protein	133	17907758	7
Fagopyrum esculentum	Buckwheat	Unassigned	Food Plant	Fagopyrum esculentum 13S globulins IgE binding	453	584592120	15

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Fagopyrum esculentum	Buckwheat	Unassigned	Food Plant	Fagopyrum esculentum 13S globulins IgE binding	453	584592116	15
Fagopyrum esculentum	Buckwheat	Unassigned	Food Plant	Fagopyrum Fag e 2 Fag t 2	127	61970231	7
Fagopyrum esculentum	Buckwheat	Fag e 2.0101	Food Plant	Fagopyrum Fag e 2 Fag t 2	149	83416591	7
Fagopyrum esculentum	Buckwheat	Unassigned	Food Plant	Fagopyrum Legumin-like protein	565	29839254	9
Fagopyrum esculentum	Buckwheat	Unassigned	Food Plant	Fagopyrum Legumin-like protein	504	29839255	9
Fagopyrum esculentum	Buckwheat	Unassigned	Food Plant	Fagopyrum Legumin-like protein	538	29839419	9
Fagopyrum esculentum	Buckwheat	Fag e 3.0101	Food Plant	Fagopyrum vicilin-like protein	136	146217148	9
Fagopyrum tataricum	Buckwheat	Unassigned	Food Plant	Fagopyrum BW 8 kDa protein	133	144228127	8
Fagopyrum tataricum	Buckwheat	Fag t 2.0101	Food Plant	Fagopyrum Fag e 2 Fag t 2	149	320445237	12
Fagopyrum tataricum	Buckwheat	Unassigned	Food Plant	Fagopyrum Legumin-like protein	515	113200131	9
Fagus sylvatica	European Beech	Unassigned	Aero Plant	Fagus Fag s 1	160	212291472	10
Fagus sylvatica	European Beech	Fag s 1	Aero Plant	Fagus Fag s 1	160	212291470	10
Fagus sylvatica	European Beech	Unassigned	Aero Plant	Fagus Fag s 1	160	212291474	10
Farfantepenaeus aztecus	Brown shrimp	Pen a 1	Food Animal	Farfantepenaeus Pen a 1	284	73532979	7
Felis catus	Cat	Fel d 1	Aero Animal	Felis Fel d 1 Chain 1	88	1364212	7
Felis catus	Cat	Fel d 1	Aero Animal	Felis Fel d 1 Chain 1	92	1364213	7
Felis catus	Cat	Fel d 1	Aero Animal	Felis Fel d 1 Chain 1	92	1169665	7
Felis catus	Cat	Fel d 1.0101	Aero Animal	Felis Fel d 1 Chain 1	92	163825	7
Felis catus	Cat	Unassigned	Aero Animal	Felis Fel d 1 Chain 1	88	114326420	8
Felis catus	Cat	Unassigned	Aero Animal	Felis Fel d 1 chain 2	107	395407	8

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Felis catus	Cat	Fel d 1.0101	Aero Animal	Felis Fel d 1 chain 2	109	163823	12
Felis catus	Cat	Fel d 2.0101	Aero Animal	Felis Fel d 2	608	886485	7
Felis catus	Cat	Fel d 3	Aero Animal	Felis Fel d 3	98	17939981	7
Felis catus	Cat	Fel d 4	Aero Animal	Felis Fel d 4	186	45775300	7
Felis catus	Cat	Fel d 7.0101	Aero Animal	Felis Fel d 7	180	301072397	12
Felis catus	Cat	Fel d 8.0101	Aero Animal	Felis Fel d 8 latherin-like	228	303387468	12
Fenneropenaeus chinensis	Chinese white shrimp	Unassigned	Food Animal	Fenneropenaeus Arginine kinase	53	46486948	9
Fenneropenaeus chinensis	Chinese white shrimp	Unassigned	Food Animal	Fenneropenaeus Arginine kinase	53	46486951	9
Fenneropenaeus merguiensis	Banana Prawn	Unassigned	Food Animal	Fenneropenaeus hemocyanin banana shrimp	661	530340505	15
Fenneropenaeus merguiensis	Banana Prawn	Unassigned	Food Animal	Fenneropenaeus enolase	117	344049993	15
Forcipomyia taiwana	biting midges	For t 1.0101	Venom or Salivary	Forcipomyia For t 1	118	188572341	10
Forcipomyia taiwana	biting midges	For t 1.0101	Venom or Salivary	Forcipomyia For t 2	325	188572343	10
Fragaria x ananassa	Strawberry	Fra a 1	Food Plant	Fragaria Fra a 1	160	90185692	7
Fragaria x ananassa	Strawberry	Fra a 1	Food Plant	Fragaria Fra a 1	159	90185688	7
Fragaria x ananassa	Strawberry	Fra a 1	Food Plant	Fragaria Fra a 1	160	90185684	7
Fragaria x ananassa	Strawberry	Fra a 1	Food Plant	Fragaria Fra a 1	160	90185682	7
Fragaria x ananassa	Strawberry	Fra a 1	Food Plant	Fragaria Fra a 1	160	88082485	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Fragaria x ananassa	Strawberry	Unassigned	Food Plant	Fragaria Fra a 1	162	550544407	15
Fragaria x ananassa	Strawberry	Fra a 3.0101	Food Plant	Fragaria Fra a 3	117	18477856	15
Fragaria x ananassa	Strawberry	Fra a 3.0102	Food Plant	Fragaria Fra a 3	117	67937767	15
Fragaria x ananassa	Strawberry	Fra a 3.0201	Food Plant	Fragaria Fra a 3	117	67937765	15
Fragaria x ananassa	Strawberry	Fra a 3.0202	Food Plant	Fragaria Fra a 3	117	67937773	15
Fraxinus excelsior	European ash	Unassigned	Aero Plant	Fraxinus excelsior polcalcin	84	589912891	15
Fraxinus excelsior	European ash	Unassigned	Aero Plant	Fraxinus excelsior profilin	134	589912889	15
Fraxinus excelsior	European ash	Fra e 1.0201	Aero Plant	Fraxinus Fra e 1	146	34978692	7
Fraxinus excelsior	European ash	Fra e 1.0102	Aero Plant	Fraxinus Fra e 1	145	56122438	7
Fraxinus excelsior	European ash	Fra e 1.0101	Aero Plant	Fraxinus Fra e 1	145	33327133	7
Fulvia mutica	Mollusc	Unassigned	Food Animal	Fulvia tropomyosin	284	219806596	10
Fusarium culmorum	Fungus	Unassigned	Aero Fungi	Fusarium claimed Fus c 3	450	25361513	7
Fusarium culmorum	Fungus	Fus c 1	Aero Fungi	Fusarium Fus c 1	109	19879657	7
Fusarium culmorum	Fungus	Fus c 2	Aero Fungi	Fusarium Fus c 2	121	19879659	7
Fusarium proliferatum	Fungus	Fus p 4.0101	Aero Fungi	Fusarium Fus p 4	323	619498167	15
Gadus callarias	Baltic cod	Gad c 1	Food Animal	Gadus Gad c 1 Gad m 1	113	131112	7
Gadus morhua	Atlantic cod	Gad m 1.0101	Food Animal	Gadus Gad c 1 Gad m 1	109	14531014	7
Gadus morhua	Atlantic cod	Gad m 1.0201	Food Animal	Gadus Gad c 1 Gad m 1	109	14531016	7
Gadus morhua	Atlantic cod	Gad m 1.0102	Food Animal	Gadus Gad c 1 Gad m 1	109	148356691	9
Gadus morhua	Atlantic cod	Gad m 1.0202	Food Animal	Gadus Gad c 1 Gad m 1	109	148356693	9
Gadus morhua	Atlantic cod	Gad m 2.0101	Food Animal	Gadus Morhua Gad m 2	11	576011130	15

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Gadus morhua	Atlantic cod	Gad m 3.0101	Food Animal	Gadus morhua Gad m 3	15	576011086	15
Gallus gallus	Chicken	Gal d 1	Food Animal	Gallus Gal d 1	210	124757	7
Gallus gallus	Chicken	Unassigned	Food Animal	Gallus Gal d 1	210	209979542	10
Gallus gallus	Chicken	Gal d 2	Food Animal	Gallus Gal d 2	155	63052	7
Gallus gallus	Chicken	Gal d 2.0101	Food Animal	Gallus Gal d 2	386	129293	7
Gallus gallus	Chicken	Gal d 2	Food Animal	Gallus Gal d 2	386	808969	7
Gallus gallus	Chicken	Gal d 2	Food Animal	Gallus Gal d 2	385	15826578	7
Gallus gallus	Chicken	Unassigned	Food Animal	Gallus Gal d 2	385	34811333	7
Gallus gallus	Chicken	Gal d 3.0101	Food Animal	Gallus Gal d 3	705	757851	7
Gallus gallus	Chicken	Gal d 3	Food Animal	Gallus Gal d 3	705	1351295	7
Gallus gallus	Chicken	Gal d 4	Food Animal	Gallus Gal d 4	147	126608	7
Gallus gallus	Chicken	Gal d 4	Food Animal	Gallus Gal d 4	24	212279	7
Gallus gallus	Chicken	Gal d 4.0101	Food Animal	Gallus Gal d 4	147	63581	15
Gallus gallus	Chicken	Gal d 5	Food Animal	Gallus Gal d 5	615	63748	7
Gallus gallus	Chicken	Unassigned	Food Animal	Gallus Gal d 6 YGP42	284	3	14

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Gallus gallus	Chicken	Unassigned	Food Animal	Gallus gallus Gal d 7	192	55584149	16
Gallus gallus	Chicken	Unassigned	Food Animal	Gallus parvalbumin	110	225877920	10
Glossina morsitans morsitans	Tsetse fly	Unassigned	Venom or Salivary	Glossina Glo m 5	258	289740263	11
Glossina morsitans morsitans	Tsetse fly	Unassigned	Venom or Salivary	Glossina Glo m 5	259	289742475	11
Glossina morsitans morsitans	Tsetse fly	Unassigned	Venom or Salivary	Glossina Glo m 5	222	289742483	11
Glossina morsitans morsitans	Tsetse fly	Glo m 5.0101	Venom or Salivary	Glossina Glo m 5	259	8927462	11
Glycine max	Soybean	Gly m 1.0101	Food Plant	Glycine Gly m 1	80	123506	12
Glycine max	Soybean	Gly m 3.0102	Food Plant	Glycine Gly m 3	131	3021373	7
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m 3	131	156938901	9
Glycine max	Soybean	Gly m 3.0101	Food Plant	Glycine Gly m 3	131	3021375	15
Glycine max	Soybean	Gly m 4	Food Plant	Glycine Gly m 4	158	18744	7
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m 5.0101 alpha subunit beta congl	605	18536	7
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m 5.0101 alpha subunit beta congl	218	169927	7
Glycine max	Soybean	Gly m 5.0101	Food Plant	Glycine Gly m 5.0101 alpha subunit beta congl	543	9967357	15
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m 5.0201 alpha prime beta congly	639	169929	7
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m 5.0201 alpha prime beta congly	621	15425631	15
Glycine max	Soybean	Gly m 5.0201	Food Plant	Glycine Gly m 5.0201 alpha prime beta congly	559	9967361	15

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m 5.0301 beta sub unit beta congl	439	15425637	15
Glycine max	Soybean	Gly m 5.0301	Food Plant	Glycine Gly m 5.0301 beta sub unit beta congl	439	121282	15
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m 6.0101	495	18615	7
Glycine max	Soybean	Gly m 6.0101	Food Plant	Glycine Gly m 6.0101	495	169973	15
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m 6.0201	485	18609	7
Glycine max	Soybean	Gly m 6.0201	Food Plant	Glycine Gly m 6.0201	485	218265	15
Glycine max	Soybean	Gly m 6.0301	Food Plant	Glycine Gly m 6.0301	481	18639	7
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m 6.0401	562	18641	7
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m 6.0401	562	732706	7
Glycine max	Soybean	Gly m 6.0401	Food Plant	Glycine Gly m 6.0401	563	4249568	15
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m 6.0501	516	169969	7
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m 6.0501	240	169971	7
Glycine max	Soybean	Gly m 6.0501	Food Plant	Glycine Gly m 6.0501	517	10566449	15
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m 8 2s albumin	155	4097894	14
Glycine max	Soybean	Gly m 8.0101	Food Plant	Glycine Gly m 8 2s albumin	158	351727517	15
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m Bd 28K	373	187766751	10
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m Bd 28K	373	187766749	10
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m Bd 28K	373	187766747	10
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m Bd 28K	455	187766755	10
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m Bd 28K	476	410067729	15
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m Bd 30 kDa	379	129353	7
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m Bd 30 kDa	379	1199563	7
Glycine max	Soybean	Unassigned	Food Plant	Glycine Gly m Bd 30 kDa	379	3097321	7
Glycine max	Soybean	Unassigned	Food Plant	Glycine Major Gly 50 kDa allergen	17	85681057	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Glycine max	Soybean	Unassigned	Food Plant	Glycine Trypsin inhibitor	217	18770	7
Glycine max	Soybean	Unassigned	Food Plant	Glycine Trypsin inhibitor	217	18772	7
Glycine max	Soybean	Unassigned	Food Plant	Glycine Trypsin inhibitor	216	256429	7
Glycine max	Soybean	Unassigned	Food Plant	Glycine Trypsin inhibitor	203	256635	7
Glycine max	Soybean	Unassigned	Food Plant	Glycine Trypsin inhibitor	204	256636	7
Glycine max	Soybean	Unassigned	Food Plant	Glycine Trypsin inhibitor	208	510515	7
Glycine soja	Soybean	Unassigned	Food Plant	Glycine Gly m 6.0401	563	806556	7
Glycyphagus domesticus	Storage mite	Gly d 2.0101	Aero Mite	Glycyphagus Gly d 2	128	6179520	7
Glycyphagus domesticus	Storage mite	Gly d 2.0201	Aero Mite	Glycyphagus Gly d 2	125	7160811	7
Glycyphagus domesticus	Storage mite	Unassigned	Aero Mite	Glycyphagus Gly d 2	141	33772588	7
Haliotis discus discus	Disk abalone	Unassigned	Food Animal	Haliotis Hal m 1 tropomyosin	284	219806586	10
Haliotis discus discus	Disk abalone	Unassigned	Food Animal	Haliotis paramyosin	860	318609972	12
Haliotis diversicolor	Abalone	Unassigned	Food Animal	Haliotis Hal m 1 tropomyosin	284	9954249	7
Helianthus annuus	Sunflower	Hel a 2	Aero Plant	Helianthus Hel a 2	133	3581965	7
Helianthus annuus	Sunflower	Hel a 3.0101	Food Plant	Helianthus Hel a 3	116	31324341	15
Helianthus annuus	Sunflower	Unassigned	Food Plant	Helianthus Seed 2S albumin	141	112745	9
Helix aspersa	Brown garden snail	Hel as 1.0101	Food Animal	Helix Hel as 1 tropomyosin	284	4468224	7
Hevea brasiliensis	Para rubber tree	Hev b 1.0101	Contact	Hevea Hev b 1	138	18839	15
Hevea brasiliensis	Para rubber tree	Hev b 10.0101	Contact	Hevea Hev b 10	233	348137	7
Hevea brasiliensis	Para rubber tree	Hev b 10.0102	Contact	Hevea Hev b 10	205	5777414	7
Hevea brasiliensis	Para rubber tree	Hev b 10.0103	Contact	Hevea Hev b 10	205	10862818	7
Hevea brasiliensis	Para rubber tree	Hev b 11.0101	Contact	Hevea Hev b 11	295	14575525	7
Hevea brasiliensis	Para rubber tree	Hev b 12	Contact	Hevea Hev b 12	116	20135538	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Hevea brasiliensis	Para rubber tree	Hev b 13	Contact	Hevea Hev b 13	391	30909057	7
Hevea brasiliensis	Para rubber tree	Hev b 14.0101	Contact	Hevea Hev b 14 hevamine	208	313870530	12
Hevea brasiliensis	Para rubber tree	Hev b 15.0101	Contact	Hevea Hev b 15	70	571257122	15
Hevea brasiliensis	Para rubber tree	Hev b 2.0101	Contact	Hevea Hev b 2	374	1184668	7
Hevea brasiliensis	Para rubber tree	Hev b 2	Contact	Hevea Hev b 2	374	32765543	7
Hevea brasiliensis	Para rubber tree	Unassigned	Contact	Hevea Hev b 2	374	124294783	8
Hevea brasiliensis	Para rubber tree	Unassigned	Contact	Hevea Hev b 2	374	124294785	8
Hevea brasiliensis	Para rubber tree	Unassigned	Contact	Hevea Hev b 2	374	124365249	8
Hevea brasiliensis	Para rubber tree	Unassigned	Contact	Hevea Hev b 2	374	124365251	8
Hevea brasiliensis	Para rubber tree	Unassigned	Contact	Hevea Hev b 2	374	124365253	8
Hevea brasiliensis	Para rubber tree	Unassigned	Contact	Hevea Hev b 2	374	268037674	11
Hevea brasiliensis	Para rubber tree	Unassigned	Contact	Hevea Hev b 2	374	270315180	11
Hevea brasiliensis	Para rubber tree	Unassigned	Contact	Hevea Hev b 2	373	359359690	13
Hevea brasiliensis	Para rubber tree	Unassigned	Contact	Hevea Hev b 2	374	387778882	13
Hevea brasiliensis	Para rubber tree	Unassigned	Contact	Hevea Hev b 2	374	387778880	13
Hevea brasiliensis	Para rubber tree	Hev b 3.0101	Contact	Hevea Hev b 3	204	3818475	11
Hevea brasiliensis	Para rubber tree	Hev b 4.0101	Contact	Hevea Hev b 4	366	46410859	7
Hevea brasiliensis	Para rubber tree	Hev b 5	Contact	Hevea Hev b 5	151	1480457	7
Hevea brasiliensis	Para rubber tree	Hev b 6	Contact	Hevea Hev b 6	187	2832430	7
Hevea brasiliensis	Para rubber tree	Unassigned	Contact	Hevea Hev b 6	43	73535415	7
Hevea brasiliensis	Para rubber tree	Unassigned	Contact	Hevea Hev b 6	204	158342650	9
Hevea brasiliensis	Para rubber tree	Hev b 7.01	Contact	Hevea Hev b 7	388	1916805	7
Hevea brasiliensis	Para rubber tree	Hev b 7.02	Contact	Hevea Hev b 7	388	3087805	7
Hevea brasiliensis	Para rubber tree	Unassigned	Contact	Hevea Hev b 7	388	3288200	7
Hevea brasiliensis	Para rubber tree	Hev b 7	Contact	Hevea Hev b 7	388	6707018	7
Hevea brasiliensis	Para rubber tree	Unassigned	Contact	Hevea Hev b 7	387	41581137	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Hevea brasiliensis	Para rubber tree	Hev b 8.0203	Aero Mite	Hevea Hev b 8	131	6979171	11
Hevea brasiliensis	Para rubber tree	Hev b 8.0101	Contact	Hevea Hev b 8	131	3183706	7
Hevea brasiliensis	Para rubber tree	Hev b 8	Contact	Hevea Hev b 8	131	11513601	7
Hevea brasiliensis	Para rubber tree	Hev b 8.0201	Contact	Hevea Hev b 8	131	6979167	11
Hevea brasiliensis	Para rubber tree	Hev b 8.0202	Contact	Hevea Hev b 8	131	6979169	11
Hevea brasiliensis	Para rubber tree	Hev b 8.0102	Contact	Hevea Hev b 8	131	5689740	15
Hevea brasiliensis	Para rubber tree	Hev b 8.0204	Contact	Hevea Hev b 8	131	8919948	15
Hevea brasiliensis	Para rubber tree	Hev b 9	Contact	Hevea Hev b 9	445	9581744	7
Hevea brasiliensis	Para rubber tree	Unassigned	Contact	Hevea Hev b 9	445	14423687	9
Hevea brasiliensis subsp. brasiliensis	Para rubber tree	Hev b 11.0102	Contact	Hevea Hev b 11	295	27526732	7
Holcus lanatus	Velvet grass	Hol l 1.0101	Aero Plant	Holcus Hol l 1	265	414703	7
Holcus lanatus	Velvet grass	Hol l 1.0102	Aero Plant	Holcus Hol l 1	248	1167836	7
Holcus lanatus	Velvet grass	Unassigned	Aero Plant	Holcus Hol l 1	263	3860384	7
Holcus lanatus	Velvet grass	Unassigned	Aero Plant	Holcus Hol l 5	20	75140046	7
Holcus lanatus	Velvet grass	Hol l 5.0201	Aero Plant	Holcus Hol l 5	240	2266623	7
Holcus lanatus	Velvet grass	Hol l 5.0101	Aero Plant	Holcus Hol l 5	264	2266625	7
Holcus lanatus	Velvet grass	Unassigned	Aero Plant	Holcus Hol l 5	296	11991229	7
Homarus americanus	American lobster	Hom a 1.0102	Food Animal	Homarus Hom a 1	284	2660868	7
Homarus americanus	American lobster	Hom a 1.0101	Food Animal	Homarus Hom a 1	284	2660866	15
Hordeum vulgare	Barley	Unassigned	Aero Plant	Hordeum Alpha-amylase inhibitor component CMb	149	585290	7
Hordeum vulgare	Barley	Unassigned	Food Plant	Hordeum Hor v 20	289	1708280	15
Hordeum vulgare	Barley	Hor v 20.0101	Food Plant	Hordeum Hor v 20	286	288709	15
Hordeum vulgare	Barley	Unassigned	Aero Plant	Hordeum LTP 1	117	167077	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Hordeum vulgare	Barley	Unassigned	Food Plant	Hordeum LTP 1	134	19039	7
Hordeum vulgare	Barley	Unassigned	Aero Plant	Hordeum Trypsin inhibitor CMe	144	1405736	7
Hordeum vulgare subsp. vulgare	Barley	Unassigned	Aero Plant	Hordeum Alpha-amylase inhibitor BDAI-1	152	3367714	7
Hordeum vulgare subsp. vulgare	Barley	Unassigned	Aero Plant	Hordeum Alpha-amylase inhibitor component Cma	144	18955	7
Hordeum vulgare subsp. vulgare	Barley	Unassigned	Aero Plant	Hordeum Alpha-amylase inhibitor component Cma	145	439275	7
Hordeum vulgare subsp. vulgare	Barley	Hor v 15.0101	Food Plant	Hordeum Hor v 15	146	19003	15
Hordeum vulgare subsp. vulgare	Barley	Unassigned	Aero Plant	Hordeum Trypsin inhibitor CMe	148	19009	7
Humulus japonicus	Japanese hop	Hum j 1	Aero Plant	Humulus Humj1	155	33113263	7
Humulus scandens	Japanese hop	Unassigned	Aero Plant	Humulus profilin-like protein	131	34851176	7
Humulus scandens	Japanese hop	Unassigned	Aero Plant	Humulus profilin-like protein	131	34851174	7
Juglans nigra	Black walnut	Jug n 1.0101	Food Plant	Juglans Jug r 1 Jug n 1	161	31321942	7
Juglans nigra	Black walnut	Jug n 2.0101	Food Plant	Juglans Jug r 2	481	31321944	7
Juglans regia	English walnut	Jug r 1.0101	Food Plant	Juglans Jug r 1 Jug n 1	139	1794252	7
Juglans regia	English walnut	Jug r 2.0101	Food Plant	Juglans Jug r 2	593	6580762	7
Juglans regia	English walnut	Unassigned	Food Plant	Juglans Jug r 3	119	209484145	11
Juglans regia	English walnut	Jug r 4.0101	Food Plant	Juglans Jug r 4 seed storage protein	507	56788031	7
Juniperus ashei	Mountain cedar	Jun a 2	Aero Plant	Juniperus Jun a 2	507	9955725	7
Juniperus ashei	Mountain cedar	Jun a 3.0101	Aero Plant	Juniperus Jun a 3	225	9087177	8
Juniperus ashei	Mountain cedar	Jun a 1.010101	Aero Plant	Juniperus Jun a/v 1	367	4138877	7
Juniperus oxycedrus	Juniper	Unassigned	Aero Plant	Juniperus Jun a/v 1	367	15139849	7
Juniperus oxycedrus	Juniper	Jun o 4	Aero Plant	Juniperus Jun o 4	165	5391446	7
Juniperus rigida	Cedar	Unassigned	Aero Plant	Juniperus Jun a 3	225	38456224	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Juniperus rigida	Cedar	Unassigned	Aero Plant	Juniperus Jun a 3	225	38456222	7
Juniperus virginiana	Red cedar	Unassigned	Aero Plant	Juniperus Jun a 3	110	51316532	7
Juniperus virginiana	Red cedar	Jun v 1.0102	Aero Plant	Juniperus Jun a/v 1	367	8843917	7
Juniperus virginiana	Red cedar	Jun v 1.0101	Aero Plant	Juniperus Jun a/v 1	367	8843921	7
Lates calcarifer	Asian Seabass	Lat c 1.0101	Food Animal	Lates Lat c 1	109	56553743	15
Lates calcarifer	Asian Seabass	Lat c 1.0201	Food Animal	Lates Lat c 1	109	48526356	15
Lens culinaris	Lentil	Len c 3.0101	Food Plant	Lens Len c 3	118	60735410	15
Lens culinaris	Lentil	Len c 1.0101	Food Plant	Lens Len c 1	418	29539109	7
Lens culinaris	Lentil	Len c 1.0102	Food Plant	Lens Len c 1	415	29539111	7
Lepidoglyphus destructor	Storage mite	Unassigned	Aero Mite	Blomia Blo t 12	143	33943777	7
Lepidoglyphus destructor	Storage mite	Lep d 10.0101	Aero Mite	Lepidoglyphus Lep d 10	284	6900304	15
Lepidoglyphus destructor	Storage mite	Lep d 13.0101	Aero Mite	Lepidoglyphus Lep d 13	131	6523380	15
Lepidoglyphus destructor	Storage mite	Lep d 2.0102	Aero Mite	Lepidoglyphus Lep d 2	141	21213898	7
Lepidoglyphus destructor	Storage mite	Lep d 2.0202	Aero Mite	Lepidoglyphus Lep d 2	141	21213900	7
Lepidoglyphus destructor	Storage mite	Lep d 2	Aero Mite	Lepidoglyphus Lep d 2	141	1582223	7
Lepidoglyphus destructor	Storage mite	Lep d 2	Aero Mite	Lepidoglyphus Lep d 2	141	1582222	7
Lepidoglyphus destructor	Storage mite	Unassigned	Aero Mite	Lepidoglyphus Lep d 2	141	34495274	7
Lepidoglyphus destructor	Storage mite	Unassigned	Aero Mite	Lepidoglyphus Lep d 2	141	34495278	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Lepidoglyphus destructor	Storage mite	Unassigned	Aero Mite	Lepidoglyphus Lep d 2	140	34495280	7
Lepidoglyphus destructor	Storage mite	Unassigned	Aero Mite	Lepidoglyphus Lep d 2	141	34495282	7
Lepidoglyphus destructor	Storage mite	Unassigned	Aero Mite	Lepidoglyphus Lep d 2	141	34495284	7
Lepidoglyphus destructor	Storage mite	Unassigned	Aero Mite	Lepidoglyphus Lep d 2	141	34495286	7
Lepidoglyphus destructor	Storage mite	Unassigned	Aero Mite	Lepidoglyphus Lep d 2	141	34495288	7
Lepidoglyphus destructor	Storage mite	Unassigned	Aero Mite	Lepidoglyphus Lep d 2	141	34495290	7
Lepidoglyphus destructor	Storage mite	Lep d 2.0101	Aero Mite	Lepidoglyphus Lep d 2	98	587450	15
Lepidoglyphus destructor	Storage mite	Lep d 2.0201	Aero Mite	Lepidoglyphus Lep d 2	141	999458	15
Lepidoglyphus destructor	Storage mite	Lep d 5.0102	Aero Mite	Lepidoglyphus Lep d 5	171	34495292	7
Lepidoglyphus destructor	Storage mite	Lep d 5.0103	Aero Mite	Lepidoglyphus Lep d 5	169	34495294	7
Lepidoglyphus destructor	Storage mite	Lep d 5.0101	Aero Mite	Lepidoglyphus Lep d 5	110	6523378	15
Lepidoglyphus destructor	Storage mite	Lep d 7.0101	Aero Mite	Lepidoglyphus Lep d 7	216	6706282	15
Lepidorhombus whiffiagonis	Flat fish	Lep w 1.0101	Food Animal	Lepidorhombus Lep w 1 parvalbumin	109	208608078	10
Lepisma saccharina	Silverfish	Lep s 1	Aero Insect	Lepisma Tropomyosin	284	20387027	7
Lepisma saccharina	Silverfish	Unassigned	Aero Insect	Lepisma Tropomyosin	243	20387029	7
Ligustrum vulgare	Privet	Lig v 1.0101	Aero Plant	Ligustrum Lig v 1	145	3256210	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Ligustrum vulgare	Privet	Lig v 1.0102	Aero Plant	Ligustrum Lig v 1	145	3256212	7
Lilium longiflorum	Trumpet lily	Unassigned	Aero Plant	Lilium polygalacturonase	413	73913442	8
Litchi chinensis	Lychee nut	Lit c 1	Food Plant	Litchi Lit c 1	131	15809696	7
Litchi chinensis	Lychee nut	Unassigned	Food Plant	Litchi Lit c 1	131	83317152	7
Litopenaeus vannamei	Whiteleg Shrimp	Lit v 4.0101	Food Animal	Litopenaeus Lit v 4 sarcoplasmic Ca+ binding	193	223403273	11
Litopenaeus vannamei	Whiteleg Shrimp	Lit v 1.0101	Food Animal	Litopenaeus Lit v 1 tropomyosin	284	170791252	10
Litopenaeus vannamei	Whiteleg Shrimp	Lit v 2.0101	Food Animal	Litopenaeus Lit v 2	356	115492980	8
Litopenaeus vannamei	Whiteleg Shrimp	Lit v 3.0101	Food Animal	Litopenaeus Lit v 3 myosin	177	184198734	10
Lolium perenne	Perennial ryegrass	Lol p 1	Aero Plant	Lolium Lol p 1	263	126385	7
Lolium perenne	Perennial ryegrass	Lol p 1.0102	Aero Plant	Lolium Lol p 1	252	168314	7
Lolium perenne	Perennial ryegrass	Lol p 1.0101	Aero Plant	Lolium Lol p 1	263	168316	10
Lolium perenne	Perennial ryegrass	Lol p 1.0103	Aero Plant	Lolium Lol p 1	263	6599300	10
Lolium perenne	Perennial ryegrass	Lol p 11	Aero Plant	Lolium Lol p 11	134	47605808	7
Lolium perenne	Perennial ryegrass	Lol p 2.0101	Aero Plant	Lolium Lol p 2	97	126386	7
Lolium perenne	Perennial ryegrass	Lol p 2	Aero Plant	Lolium Lol p 2	88	939932	7
Lolium perenne	Perennial ryegrass	Lol p 3	Aero Plant	Lolium Lol p 3	97	126387	7
Lolium perenne	Perennial	Lol p 4.0101	Aero Plant	Lolium Lol p 4	423	55859464	7

	ryegrass						
Species	**Common**	**IUIS Allergen**	**Type**	**Group**	**Length**	**GI#**	**Version**
Lolium perenne	Perennial ryegrass	Lol p 5	Aero Plant	Lolium Lol p 5	301	4416516	7
Lolium perenne	Perennial ryegrass	Lol p 5	Aero Plant	Lolium Lol p 5	301	6634467	7
Lolium perenne	Perennial ryegrass	Lol p 5.0101	Aero Plant	Lolium Lol p 5	339	455288	10
Lolium perenne	Perennial ryegrass	Lol p 5.0102	Aero Plant	Lolium Lol p 5	307	332278195	12
Lupinus albus	white lupine	Unassigned	Food Plant	Lupinus albus congluten beta	531	89994190	14
Lupinus angustifolius	blue lupin	Unassigned	Food Plant	Lupinus Lup an 1 conglutin beta	521	149208401	9
Lupinus angustifolius	blue lupin	Unassigned	Food Plant	Lupinus Lup an 1 conglutin beta	455	149208403	9
Lupinus angustifolius	blue lupin	Lup an 1.0101	Food Plant	Lupinus Lup an 1 conglutin beta	611	169950562	10
Lycium barbarum	wolfberry	Unassigned	Food Plant	Lycium ltp	51	363805423	13
Macrobrachium rosenbergii	Giant River Prawn	Mac r 1.0101	Food Animal	Macrobrachium rosenbergii shrimp tropomyosin	284	288819271	11
Macrobrachium rosenbergii	Giant River Prawn	Unassigned	Food Animal	Macrobrachium rosenbergii shrimp tropomyosin	284	558698675	15
Macruronus magellanicus	Patagonian Grenadier	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	98	308191450	12
Macruronus magellanicus	Patagonian Grenadier	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	108	308191461	12
Macruronus magellanicus	Patagonian Grenadier	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	74	308191474	12
Macruronus novaezelandiae	Blue hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	83	308191475	12
Malassezia furfur	Yeast	Mala f 2	Contact	Malassezia Mala f 2	177	3445490	7
Malassezia furfur	Yeast	Mala f 3	Contact	Malassezia Mala f 3	166	3445492	7
Malassezia furfur	Yeast	Mala f 4	Contact	Malassezia Mala f 4	342	4587985	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Malassezia sympodialis	Yeast	Mala s 1	Contact	Malassezia Mala s 1	350	1261972	7
Malassezia sympodialis	Yeast	Mala s 10.0101	Contact	Malassezia Mala s 10 heat shock protein	773	28564467	14
Malassezia sympodialis	Yeast	Mala s 11	Contact	Malassezia Mala s 11 first 38 aa signal	237	28569698	7
Malassezia sympodialis	Yeast	Mala s 12.0101	Contact	Malassezia Mala s 12	618	78038796	7
Malassezia sympodialis	Yeast	Mala s 5	Contact	Malassezia Mala s 5	172	4138171	7
Malassezia sympodialis	Yeast	Mala s 6	Contact	Malassezia Mala s 6	162	4138173	7
Malassezia sympodialis	Yeast	Mala s 7	Contact	Malassezia Mala s 7	187	4138175	7
Malassezia sympodialis	Yeast	Mala s 8	Contact	Malassezia Mala s 8	179	7271239	7
Malassezia sympodialis	Yeast	Mala s 9	Contact	Malassezia Mala s 9	342	19069920	7
Malassezia sympodialis ATCC 42132	Yeast	Unassigned	Contact	Malassezia Mala s 10 heat shock protein	773	465797105	14
Malassezia sympodialis ATCC 42132	Yeast	Unassigned	Contact	Malassezia Mala s 11 first 38 aa signal	202	465795607	14
Malassezia sympodialis ATCC 42132	Yeast	Mala s 13	Contact	Malassezia Mala s 13 Thioredoxin Rev	107	465793078	14
Malassezia sympodialis ATCC 42132	Yeast	Unassigned	Contact	Malassezia Mala s 5	172	465794772	14
Malassezia sympodialis ATCC 42132	Yeast	Unassigned	Contact	Malassezia Mala s 9	342	465794420	14
Malus x domestica	Apple	Mal d 1.0301	Food Plant	Malus Mal d 1	159	1313966	7
Malus x domestica	Apple	Mal d 1.0401	Food Plant	Malus Mal d 1	160	1313968	7
Malus x domestica	Apple	Mal d 1.0402	Food Plant	Malus Mal d 1	160	1313970	7
Malus x domestica	Apple	Mal d 1.0403	Food Plant	Malus Mal d 1	160	1313972	7
Malus x domestica	Apple	Mal d 1.0206	Food Plant	Malus Mal d 1	159	2443824	7
Malus x domestica	Apple	Mal d 1.0103	Food Plant	Malus Mal d 1	159	4590364	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Malus x domestica	Apple	Mal d 1.0203	Food Plant	Malus Mal d 1	159	4590366	7
Malus x domestica	Apple	Mal d 1.0204	Food Plant	Malus Mal d 1	159	4590368	7
Malus x domestica	Apple	Mal d 1.0104	Food Plant	Malus Mal d 1	159	4590376	7
Malus x domestica	Apple	Mal d 1.0105	Food Plant	Malus Mal d 1	159	4590378	7
Malus x domestica	Apple	Mal d 1.0106	Food Plant	Malus Mal d 1	159	4590380	7
Malus x domestica	Apple	Mal d 1.0107	Food Plant	Malus Mal d 1	159	4590382	7
Malus x domestica	Apple	Mal d 1.0205	Food Plant	Malus Mal d 1	159	4590388	7
Malus x domestica	Apple	Mal d 1.0208	Food Plant	Malus Mal d 1	158	21685277	7
Malus x domestica	Apple	Mal d 1.0304	Food Plant	Malus Mal d 1	159	27922941	7
Malus x domestica	Apple	Mal d 1.0108	Food Plant	Malus Mal d 1	159	4768879	11
Malus x domestica	Apple	Mal d 1.0201	Food Plant	Malus Mal d 1	159	862307	11
Malus x domestica	Apple	Mal d 1.0102	Food Plant	Malus Mal d 1	159	886683	11
Malus x domestica	Apple	Mal d 1.0101	Food Plant	Malus Mal d 1	159	747852	15
Malus x domestica	Apple	Mal d 1.0109	Food Plant	Malus Mal d 1	159	15418742	15
Malus x domestica	Apple	Mal d 1.0207	Food Plant	Malus Mal d 1	159	15418744	15
Malus x domestica	Apple	Mal d 1.0302	Food Plant	Malus Mal d 1	159	15418738	15
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 2	26	1478293	7
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 2	246	60418842	7
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 2	246	60418848	7
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 2	246	30316292	8
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 2	158	218059718	10
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 2	158	218059715	10
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 2	193	392507603	13
Malus x domestica	Apple	Mal d 2.0101	Food Plant	Malus Mal d 2	245	3643249	15
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 3	115	50659891	7
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 3	115	50659889	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 3	115	50659885	7
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 3	115	50659879	7
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 3	115	50659859	7
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 3	115	38492338	7
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 3	115	14423814	9
Malus x domestica	Apple	Mal d 4.0302	Food Plant	Malus Mal d 4	131	28881453	7
Malus x domestica	Apple	Mal d 4.0102	Food Plant	Malus Mal d 4	131	28881457	7
Malus x domestica	Apple	Mal d 4.0202	Food Plant	Malus Mal d 4	131	28881455	7
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 4	131	60418854	7
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 4	131	60418858	7
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 4	131	60418862	7
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 4	131	60418866	7
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 4	131	164510842	9
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 4	131	164510858	9
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 4	131	164510860	9
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 4	77	218059730	10
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 4	115	218059733	10
Malus x domestica	Apple	Unassigned	Food Plant	Malus Mal d 4	131	218059728	10
Malus x domestica	Apple	Mal d 4.0301	Food Plant	Malus Mal d 4	131	4761584	11
Malus x domestica	Apple	Mal d 4.0201	Food Plant	Malus Mal d 4	131	4761586	11
Malus x domestica	Apple	Mal d 4.0101	Food Plant	Malus Mal d 4	131	4761588	11
Manihot esculenta	Cassava	Unassigned	Food Plant	Manihot Man e 5.0101	177	21585695	7
Manihot esculenta	Cassava	Man e 5.0101	Food Plant	Manihot Man e 5.0101	177	332713934	14
Manilkara zapota	Sapodilla plum	Unassigned	Food Plant	Manilkara Thaumatin like protein 1	12	442580988	14
Manilkara zapota	Sapodilla plum	Unassigned	Food Plant	Manilkara Thaumatin like protein 1	9	442570282	14
Manilkara zapota	Sapodilla plum	Unassigned	Food Plant	Manilkara Thaumatin like protein 1	207	663434113	15

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Marsupenaeus japonicus	Kuruma Shrimp	Unassigned	Food Animal	Marsupenaeus tropomyosin	284	125995159	8
Mercurialis annua	Annual mercury grass	Mer a 1	Aero Plant	Mercurialis Mer a 1	133	2959898	7
Merluccius australis australis	southern hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	108	308191452	12
Merluccius australis polylepis	Southern hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	108	308191453	12
Merluccius australis polylepis	Southern hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	108	308191464	12
Merluccius bilinearis	Silver hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	108	308191465	12
Merluccius bilinearis	Silver hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	108	308191478	12
Merluccius bilinearis	Silver hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	94	308191488	12
Merluccius capensis	Shallow-water cape hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	108	308191466	12
Merluccius gayi	Southern Pacific hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	108	308191455	12
Merluccius gayi	Southern Pacific hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	91	308191489	12
Merluccius merluccius	European hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	108	131116	12
Merluccius merluccius	European hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	108	308191469	12
Merluccius paradoxus	Deep-water cape hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	108	308191457	12
Merluccius paradoxus	Deep-water cape hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	108	308191470	12

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Merluccius paradoxus	Deep-water cape hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	95	308191483	12
Merluccius polli	Benguela hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	108	308191471	12
Merluccius polli	Benguela hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	69	308191484	12
Merluccius productus	North Pacific hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	108	308191459	12
Merluccius productus	North Pacific hake	Unassigned	Food Animal	Merluccius sp. Parvalbumin Hake	108	308191472	12
Mesocricetus auratus	Golden hamster	Unassigned	Aero Animal	Mesocricetus auratus Mes a 1	172	13124669	16
Metapenaeus ensis	Greasyback shrimp	Met e 1	Food Animal	Metapenaeus Met e 1 Tropomyosin	274	607633	7
Mimachlamys nobilis	Noble scallop	Unassigned	Food Animal	Mimachlamys Tropomyosin	284	9954253	7
Morus alba var. atropurpurea	White Mulberry	Unassigned	Food Plant	Morus winter accumulating protein	157	610664572	15
Morus bombycis	Mulberry	Unassigned	Food Plant	Morus winter accumulating protein	157	54311115	12
Morus bombycis	Mulberry	Unassigned	Food Plant	Morus winter accumulating protein	157	54311119	12
Morus nigra	Black mulberry	Mor n 3.0101	Food Plant	Morus Mor n 3 mulberry LTP	91	288561913	11
Mus musculus	Mouse	Mus m 1	Aero Animal	Mus Mus m 1	180	20178291	7
Mus musculus	Mouse	Mus m 1.0101	Aero Animal	Mus Mus m 1	180	295910	15
Mus musculus domesticus	Mouse	Mus m 1.0102	Aero Animal	Mus Mus m 1	180	199881	15
Musa acuminata	Banana	Unassigned	Food Plant	Musa Allergen Endo-Beta-1,3-Glucanase	312	83754908	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Musa acuminata	Banana	Mus a 4.0101	Food Plant	Musa Mus a 4	200	88191901	7
Musa acuminata	Banana	Mus a 2.0101	Food Plant	Musa Mus s 2	318	17932710	15
Musa acuminata	Banana	Mus xp 1	Food Plant	Musa profilin banana	131	14161635	7
Musa acuminata AAA Group	Banana	Unassigned	Food Plant	Musa Allergen Endo-Beta-1,3-Glucanase	340	6073860	14
Myrmecia banksi	Giant Bull Ant	Myr p 3.0101	Venom or Salivary	Myrmecia Myr p 3	84	51241753	15
Myrmecia pilosula	Jumper ant	Unassigned	Venom or Salivary	Myrmecia Myr p 1	112	1911819	7
Myrmecia pilosula	Jumper ant	Myr p 1.0101	Venom or Salivary	Myrmecia Myr p 1	112	312284	15
Myrmecia pilosula	Jumper ant	Myr p 2	Venom or Salivary	Myrmecia Myr p 2	75	1587177	7
Myrmecia pilosula	Jumper ant	Myr p 2.0101	Venom or Salivary	Myrmecia Myr p 2	75	1438761	10
Neptunea polycostata	Wrinkled Neptune	Unassigned	Food Animal	Neptunea tropomyosin	284	219806590	10
Nicotiana tabacum	Tobacco	Unassigned	Aero Plant	Nicotiana villin	520	57283139	7
Nicotiana tabacum	Tobacco	Unassigned	Aero Plant	Nicotiana villin	559	57283137	7
Octopus vulgaris	Octopus	Unassigned	Food Animal	Octopus tropomyosin	284	83715936	7
Olea europaea	Olive tree	Ole e 1	Aero Plant	Olea Ole e 1	145	14424429	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	137	1362128	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	136	1362129	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	136	1362130	7
Olea europaea	Olive tree	Ole e 1.0104	Aero Plant	Olea Ole e 1	145	1362131	7
Olea europaea	Olive tree	Ole e 1	Aero Plant	Olea Ole e 1	137	1362132	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	136	1362133	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Olea europaea	Olive tree	Ole e 1.0103	Aero Plant	Olea Ole e 1	145	1362136	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	136	1362137	7
Olea europaea	Olive tree	Ole e 1.0105	Aero Plant	Olea Ole e 1	146	2465127	7
Olea europaea	Olive tree	Ole e 1.0106	Aero Plant	Olea Ole e 1	146	2465129	7
Olea europaea	Olive tree	Ole e 1.0107	Aero Plant	Olea Ole e 1	146	2465131	7
Olea europaea	Olive tree	Ole e 1.0101	Aero Plant	Olea Ole e 1	130	13195753	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	134	37724597	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	135	37724593	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	132	37548753	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	131	33329758	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	132	33329756	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	132	33329754	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	131	33329752	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	131	33329750	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	129	33329748	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	131	33329744	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	132	33329738	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	132	33329732	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	132	33325115	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	140	145313982	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	140	145313984	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	140	145313988	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	140	145313990	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 1	140	145313992	9
Olea europaea	Olive tree	Ole e 10	Aero Plant	Olea Ole e 10	123	29465664	7
Olea europaea	Olive tree	Ole e 11.0102	Aero Plant	Olea Ole e 11.0101 and 0102	364	68270856	11

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Olea europaea	Olive tree	Ole e 11.0101	Aero Plant	Olea Ole e 11.0101 and 0102	364	269996495	11
Olea europaea	Olive tree	Unassigned	Aero Plant	olea Ole e 12	308	449061782	14
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 13	226	449061783	14
Olea europaea	Olive tree	Ole e 2	Aero Plant	Olea Ole e 2	134	3914427	7
Olea europaea	Olive tree	Ole e 2	Aero Plant	Olea Ole e 2	134	3914428	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 2	131	576017874	15
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 2	131	576017774	15
Olea europaea	Olive tree	Ole e 2.0101	Aero Plant	Olea Ole e 2	134	2465133	15
Olea europaea	Olive tree	Ole e 3.0101	Aero Plant	Olea Ole e 3	84	3337403	7
Olea europaea	Olive tree	Ole e 3	Aero Plant	Olea Ole e 3	52	37725377	7
Olea europaea	Olive tree	Ole e 5.0101	Aero Plant	Olea Ole e 5	30	122064581	8
Olea europaea	Olive tree	Ole e 5	Aero Plant	Olea Ole e 5	152	39840779	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	145313972	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160347106	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	144	160347108	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160347112	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160347120	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160347122	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160347124	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160347126	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160347130	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160347134	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160347138	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160962543	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160962547	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160962557	9

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160962569	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160962577	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160962583	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	144	160962587	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160962591	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160962597	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160962611	9
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 5	152	160962613	9
Olea europaea	Olive tree	Ole e 6.0101	Aero Plant	Olea Ole e 6	50	2276458	11
Olea europaea	Olive tree	Ole e 7	Aero Plant	Olea Ole e 7	21	22002032	7
Olea europaea	Olive tree	Ole e 8	Aero Plant	Olea Ole e 8	171	6901654	7
Olea europaea	Olive tree	Ole e 8.0101	Aero Plant	Olea Ole e 8	171	6901652	11
Olea europaea	Olive tree	Ole e 9	Aero Plant	Olea Ole e 9	460	14279169	7
Olea europaea	Olive tree	Unassigned	Aero Plant	Olea Ole e 9	101	166235350	9
Ommastrephes bartramii	red squid	Unassigned	Food Animal	Ommastrephes tropomyosin	284	83715934	7
Onchocerca volvulus	Parasitic nematode	Unassigned	Worm (parasite)	Onchocerca tropomyosin	284	42559586	12
Oncorhynchus keta	chum salmon	Onc k 5.0101	Food Animal	Oncorhynchus Onc k 5	193	296040357	15
Oncorhynchus mykiss	rainbow trout	Onc m 1.0101	Food Animal	Oncorhynchus Rainbow trout parv Onc m 1	108	288559139	11
Oncorhynchus mykiss	rainbow trout	Onc m 1.0201	Food Animal	Oncorhynchus Rainbow trout parv Onc m 1	107	288559140	11
Oratosquilla oratoria	mantis shrimp	Unassigned	Food Animal	Oratosquilla tropomyosin	284	162286975	9
Oreochromis mossambicus	Mozambique tilapia	Ore m 4.0101	Food Animal	Oreochromis Ore m 4 tropomyosin	284	410060781	14

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Oryctolagus cuniculus	European rabbit	Ory c 3.A.0101	Aero Animal	Oryctolagus Ory c 3	93	11993600	15
Oryctolagus cuniculus	European rabbit	Ory c 3.B.0101	Aero Animal	Oryctolagus Ory c 3	90	11993592	15
Oryza sativa	Rice	Unassigned	Food Plant	Oryza Glyoxalase I	291	84029333	7
Oryza sativa	Rice	Ory s 1.0101	Aero Plant	Oryza Ory s 1	263	1173557	8
Oryza sativa	Rice	Unassigned	Aero Plant	Oryza Ory s 1	267	8118439	7
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Glyoxalase I	291	16580747	7
Oryza sativa (japonica cultivar-group)	Rice	Ory s 1	Aero Plant	Oryza Ory s 1	267	109913547	8
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Aero Plant	Oryza putative polcalcin Phl p 7	82	45736119	7
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Trypsin alpha-amylase inhibitor	157	23616954	8
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Trypsin alpha-amylase inhibitor	165	218193	7
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Trypsin alpha-amylase inhibitor	157	218197	7
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Trypsin alpha-amylase inhibitor	111	1304216	7
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Trypsin alpha-amylase inhibitor	109	1304217	7
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Trypsin alpha-amylase inhibitor	113	1304218	7
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Trypsin alpha-amylase inhibitor	166	1398913	7
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Trypsin alpha-amylase inhibitor	160	1398915	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Trypsin alpha-amylase inhibitor	157	1398916	7
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Trypsin alpha-amylase inhibitor	160	1398918	7
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Trypsin alpha-amylase inhibitor	157	2827316	7
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Trypsin alpha-amylase inhibitor	166	114152865	8
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Trypsin alpha-amylase inhibitor	163	114152864	8
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Trypsin alpha-amylase inhibitor	160	23495787	8
Oryza sativa (japonica cultivar-group)	Rice	Unassigned	Food Plant	Oryza Trypsin alpha-amylase inhibitor	160	23616947	7
Ostrya carpinifolia	European hop hornbeam	Ost c 1.0101	Aero Plant	Ostrya Ost c 1pollen allergen	160	300872535	12
Pachycondyla chinensis	Asian needle ant	Unassigned	Venom or Salivary	Pachycondyla Pac c 3 allergen	199	169822894	10
Pandalus borealis	caribean shrimp	Pan b 1.0101	Food Animal	Pandalus Pan b 1	284	312831088	12
Panulirus stimpsoni	Lobster	Pan s 1.0101	Food Animal	Panulirus Pan s 1	274	3080761	11
Paralithodes camtschaticus	Kamchatka crab	Unassigned	Food Animal	Paralithodes tropomyosin	284	125995163	8
Paralithodes camtschaticus	Kamchatka crab	Unassigned	Food Animal	Paralithodes tropomyosin	284	125995165	8
Parietaria judaica	Weed	Par j 1	Aero Plant	Parietaria Par j 1	143	741844	7
Parietaria judaica	Weed	Par j 1.0102	Aero Plant	Parietaria Par j 1	176	1532058	7
Parietaria judaica	Weed	Par j 1.0101	Aero Plant	Parietaria Par j 1	133	992612	15

AllergenOnline version 16
27 January, 2016

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Parietaria judaica	Weed	Par j 1.0103	Aero Plant	Parietaria Par j 1	139	95007033	15
Parietaria judaica	Weed	Par j 1.0201	Aero Plant	Parietaria Par j 1	138	706811	15
Parietaria judaica	Weed	Par j 2.0102	Aero Plant	Parietaria Par j 2	133	1532056	7
Parietaria judaica	Weed	Par j 2.0101	Aero Plant	Parietaria Par j 2	133	2497750	7
Parietaria judaica	Weed	Par j 3.0102	Aero Plant	Parietaria Par j 3 profilin	131	14423869	7
Parietaria judaica	Weed	Par j 3.0101	Aero Plant	Parietaria Par j 3 profilin	132	14423876	7
Parietaria judaica	Weed	Par j 3.0201	Aero Plant	Parietaria Par j 3 profilin	131	444175753	14
Parietaria judaica	Weed	Par j 4.0101	Aero Plant	Parietaria Par j 4	84	201071363	15
Parietaria officinalis	Weed	Par o 1	Aero Plant	Parietaria Par o 1	12	75139847	7
Parietaria officinalis	Weed	Par o 1	Aero Plant	Parietaria Par o 1	17	1311509	7
Parietaria officinalis	Weed	Par o 1	Aero Plant	Parietaria Par o 1	15	1311510	7
Parietaria officinalis	Weed	Par o 1	Aero Plant	Parietaria Par o 1	15	1311511	7
Parietaria officinalis	Weed	Par o 1	Aero Plant	Parietaria Par o 1	15	1311512	7
Parietaria officinalis	Weed	Par o 1	Aero Plant	Parietaria Par o 1	30	1311513	7
Parietaria officinalis	Weed	Par o 1	Aero Plant	Parietaria Par o 1	24	1836011	7
Parietaria officinalis	Weed	Unassigned	Aero Plant	Parietaria Par o 1	25	1836010	7
Paspalum notatum	Bahia grass	Unassigned	Aero Plant	Paspalum group 13 pollen allergen	169	338930686	12
Paspalum notatum	Bahia grass	Unassigned	Aero Plant	Paspalum group 13 pollen allergen	169	338930684	12
Paspalum notatum	Bahia grass	Unassigned	Aero Plant	Paspalum group 13 pollen allergen	169	338930682	12
Paspalum notatum	Bahia grass	Unassigned	Aero Plant	Paspalum group 13 pollen allergen	169	338930680	12
Paspalum notatum	Bahia grass	Unassigned	Aero Plant	Paspalum group 13 pollen allergen	393	338930678	12
Paspalum notatum	Bahia grass	Unassigned	Aero Plant	Paspalum group 13 pollen allergen	393	338930676	12
Paspalum notatum	Bahia grass	Unassigned	Aero Plant	Paspalum group 13 pollen allergen	391	338930674	12
Paspalum notatum	Bahia grass	Unassigned	Aero Plant	Paspalum group 13 pollen allergen	395	338930672	12
Paspalum notatum	Bahia grass	Pas n 1.0101	Aero Plant	Paspalum Pas n 1 beta expansin	265	168419914	10
Penaeus monodon	Black tiger	Pen m 1.0101	Food	Penaeus Pen m 1 tropomyosin	284	60892782	15

	shrimp		Animal				
Species	**Common**	**IUIS Allergen**	**Type**	**Group**	**Length**	**GI#**	**Version**
Penaeus monodon	Black tiger shrimp	Pen m 2	Food Animal	Penaeus Pen m 2	356	27463265	7
Penaeus monodon	Black tiger shrimp	Unassigned	Food Animal	Penaeus Pen m 2	356	308154236	12
Penaeus monodon	Black tiger shrimp	Pen m 3.0101	Food Animal	Penaeus Pen m 3 myosin light chain	177	317383196	12
Penaeus monodon	Black tiger shrimp	Pen m 4.0101	Food Animal	Penaeus Pen m 4 sarcoplasmic calcium binding	193	317383198	12
Penicillium brevicompactum	Fungus	Pen b 26.0101	Aero Fungi	Penicillium Pen b 26	107	59894749	7
Penicillium chrysogenum	Fungus	Pen ch 18.0101	Aero Fungi	Penicillium Pen 18	494	7963902	7
Penicillium chrysogenum	Fungus	Pen ch 18	Aero Fungi	Penicillium Pen 18	494	14215732	7
Penicillium chrysogenum	Fungus	Pen ch 13.0101	Aero Fungi	Penicillium Pen ch 13	397	6684758	7
Penicillium chrysogenum	Fungus	Pen ch 13	Aero Fungi	Penicillium Pen ch 13	398	21069093	7
Penicillium chrysogenum	Fungus	Pen ch 20	Aero Fungi	Penicillium Pen ch 20	117	999009	7
Penicillium chrysogenum	Fungus	Pen ch 35.0101	Aero Fungi	Penicillium Pen ch 35	324	300679427	15
Penicillium citrinum	Fungus	Unassigned	Aero Fungi	Penicillium Pen 18	457	4588118	7
Penicillium citrinum	Fungus	Unassigned	Aero Fungi	Penicillium Pen 18	358	12005501	7
Penicillium citrinum	Fungus	Pen c 19	Aero Fungi	Penicillium Pen c 19	503	14423733	7
Penicillium citrinum	Fungus	Pen c 22	Aero Fungi	Penicillium Pen c 22	438	13991101	7
Penicillium citrinum	Fungus	Pen c 24	Aero Fungi	Penicillium Pen c 24	228	38326693	7
Penicillium citrinum	Fungus	Pen c 3	Aero Fungi	Penicillium Pen c 3	167	5326864	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Penicillium citrinum	Fungus	Pen c 30.0101	Aero Fungi	Penicillium Pen c 30	733	82754305	7
Penicillium citrinum	Fungus	Pen c 32.0101	Aero Fungi	Penicillium Pen c 32	290	121584258	8
Penicillium citrinum	Fungus	Unassigned	Aero Fungi	Penicillium Pen ch 13	397	4587983	7
Penicillium crustosum	Fungus	Pen cr 26.0101	Aero Fungi	Penicillium crustosum Pen cr 26 60s P1	107	371537645	13
Penicillium oxalicum	Fungus	Pen o 18.0101	Aero Fungi	Penicillium Pen 18	503	12005497	7
Periplaneta americana	American cockroach	Unassigned	Aero Insect	Periplaneta americana Per a 11	494	821092692	16
Periplaneta americana	American cockroach	Unassigned	Aero Insect	Periplaneta americana Per a 12	407	821092694	16
Periplaneta americana	American cockroach	Unassigned	Aero Insect	Periplaneta GST	216	60678789	7
Periplaneta americana	American cockroach	Unassigned	Aero Insect	Periplaneta GST	216	359326557	15
Periplaneta americana	American cockroach	Per a 7.0102	Aero Insect	Periplaneta Per 7	284	4378573	7
Periplaneta americana	American cockroach	Per a 7.0101	Aero Insect	Periplaneta Per 7	284	4468639	7
Periplaneta americana	American cockroach	Unassigned	Aero Insect	Periplaneta Per 7	284	239740599	11
Periplaneta americana	American cockroach	Per a 1.0201	Aero Insect	Periplaneta Per a 1	446	2231297	7
Periplaneta americana	American cockroach	Per a 1.0104	Aero Insect	Periplaneta Per a 1	274	2253610	7
Periplaneta americana	American cockroach	Per a 1.0103	Aero Insect	Periplaneta Per a 1	395	2580504	7
Periplaneta americana	American cockroach	Per a 1.0102	Aero Insect	Periplaneta Per a 1	228	2897849	7
Periplaneta americana	American	Per a 1.0101	Aero Insect	Periplaneta Per a 1	231	4240399	7

	cockroach						
Species	**Common**	**IUIS Allergen**	**Type**	**Group**	**Length**	**GI#**	**Version**
Periplaneta americana	American cockroach	Unassigned	Aero Insect	Periplaneta Per a 1	124	30144660	7
Periplaneta americana	American cockroach	Unassigned	Aero Insect	Periplaneta Per a 1	395	284518361	11
Periplaneta americana	American cockroach	Per a 10.0101	Aero Insect	Periplaneta Per a 10 ser protease	256	60678799	7
Periplaneta americana	American cockroach	Unassigned	Aero Insect	Periplaneta Per a 2	351	60678785	7
Periplaneta americana	American cockroach	Per a 2.0101	Aero Insect	Periplaneta Per a 2	351	313870534	12
Periplaneta americana	American cockroach	Per a 3.0201	Aero Insect	Periplaneta Per a 3	631	1531589	7
Periplaneta americana	American cockroach	Per a 3.0202	Aero Insect	Periplaneta Per a 3	470	1580794	7
Periplaneta americana	American cockroach	Per a 3.0203	Aero Insect	Periplaneta Per a 3	393	1580797	7
Periplaneta americana	American cockroach	Per a 3.0101	Aero Insect	Periplaneta Per a 3	685	2833325	9
Periplaneta americana	American cockroach	Unassigned	Aero Insect	Periplaneta Per a 3	688	284518363	11
Periplaneta americana	American cockroach	Unassigned	Aero Insect	Periplaneta Per a 3	685	289721058	11
Periplaneta americana	American cockroach	Unassigned	Aero Insect	Periplaneta Per a 4	183	60678787	7
Periplaneta americana	American cockroach	Unassigned	Aero Insect	Periplaneta Per a 4	163	215794707	10
Periplaneta americana	American cockroach	Unassigned	Aero Insect	Periplaneta Per a 4	167	212675312	10

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Periplaneta americana	American cockroach	Per a 6.0101	Aero Insect	Periplaneta Per a 6	151	60678791	8
Periplaneta americana	American cockroach	Unassigned	Aero Insect	Periplaneta Per a 9	356	50428904	8
Periplaneta americana	American cockroach	Per a 9.0101	Aero Insect	Periplaneta Per a 9	356	167782135	9
Periplaneta fuliginosa	Smokybrown cockroach	Unassigned	Aero Insect	Periplaneta Per 7	284	19310971	7
Perna viridis	Asian green mussell	Unassigned	Food Animal	Perna Tropomyosin	284	9954251	7
Persea americana	Avocado	Pers a 1	Food Plant	Persea Pers a 1	326	3201547	7
Phalaris aquatica	Canary grass	Unassigned	Aero Plant	Phalaris Pha a 1	20	409328	7
Phalaris aquatica	Canary grass	Pha a 1	Aero Plant	Phalaris Pha a 1	269	2498576	7
Phalaris aquatica	Canary grass	Pha a 5.0101	Aero Plant	Phalaris Pha a 5	320	2498577	7
Phalaris aquatica	Canary grass	Unassigned	Aero Plant	Phalaris Pha a 5	305	2498578	7
Phalaris aquatica	Canary grass	Unassigned	Aero Plant	Phalaris Pha a 5	294	2498579	7
Phalaris aquatica	Canary grass	Unassigned	Aero Plant	Phalaris Pha a 5	175	2498580	7
Phaseolus vulgaris	Kidney bean	Pha v 3.0101	Food Plant	Phaseolus Pha v 3	115	289064177	11
Phaseolus vulgaris	Kidney bean	Pha v 3.0201	Food Plant	Phaseolus Pha v 3	118	289064179	11
Phleum pratense	Common timothy	Phl p 1.0102	Aero Plant	Phleum Phl p 1	263	473360	7
Phleum pratense	Common timothy	Phl p 1.0101	Aero Plant	Phleum Phl p 1	263	3901094	7
Phleum pratense	Common timothy	Phl p 1	Aero Plant	Phleum Phl p 1	241	28373838	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 1	240	45823012	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 1	262	1582250	10

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Phleum pratense	Common timothy	Phl p 11	Aero Plant	Phleum Phl p 11	143	23452313	7
Phleum pratense	Common timothy	Phl p 12.0103	Aero Plant	Phleum Phl p 12	131	2415700	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 12	131	110644906	8
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 12	131	110644908	8
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 12	131	110644910	8
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 12	131	110644912	8
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 12	131	110644914	8
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 12	131	110644916	8
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 12	131	110644918	8
Phleum pratense	Common timothy	Phl p 12.0102	Aero Plant	Phleum Phl p 12	131	2415698	10
Phleum pratense	Common timothy	Phl p 12.0101	Aero Plant	Phleum Phl p 12	131	453976	15
Phleum pratense	Common timothy	Phl p 13	Aero Plant	Phleum Phl p 13	394	4826572	7
Phleum pratense	Common timothy	Phl p 2	Aero Plant	Phleum Phl p 2	122	415896	7
Phleum pratense	Common timothy	Phl p 4.0101	Aero Plant	Phleum Phl p 4	508	54144332	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 4	500	45108973	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 4	500	45108967	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 4	500	189014266	10
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 4	500	189014268	10
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 4	500	189014270	10
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 4	500	189014272	10
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 4	500	405944794	14
Phleum pratense	Common timothy	Phl p 4.0201	Aero Plant	Phleum Phl p 4	508	54144334	15
Phleum pratense	Common timothy	Phl p 5.0101	Aero Plant	Phleum Phl p 5	312	398830	7
Phleum pratense	Common timothy	Phl p 5	Aero Plant	Phleum Phl p 5	257	422005	7
Phleum pratense	Common timothy	Phl p 5	Aero Plant	Phleum Phl p 5	280	481397	7
Phleum pratense	Common timothy	Phl p 5	Aero Plant	Phleum Phl p 5	24	75139900	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	285	1092249	7
Phleum pratense	Common timothy	Phl p 5.0202	Aero Plant	Phleum Phl p 5	281	1684718	7
Phleum pratense	Common timothy	Phl p 5.0104	Aero Plant	Phleum Phl p 5	276	1684720	7
Phleum pratense	Common timothy	Phl p 5.0102	Aero Plant	Phleum Phl p 5	286	2398757	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Phleum pratense	Common timothy	Phl p 5.0105	Aero Plant	Phleum Phl p 5	276	3135497	7
Phleum pratense	Common timothy	Phl p 5.0106	Aero Plant	Phleum Phl p 5	276	3135499	7
Phleum pratense	Common timothy	Phl p 5.0107	Aero Plant	Phleum Phl p 5	276	3135501	7
Phleum pratense	Common timothy	Phl p 5.0108	Aero Plant	Phleum Phl p 5	276	3135503	7
Phleum pratense	Common timothy	Phl p 5.0103	Aero Plant	Phleum Phl p 5	312	3309039	7
Phleum pratense	Common timothy	Phl p 5.0203	Aero Plant	Phleum Phl p 5	295	3309041	7
Phleum pratense	Common timothy	Phl p 5.0206	Aero Plant	Phleum Phl p 5	290	3309045	7
Phleum pratense	Common timothy	Phl p 5.0207	Aero Plant	Phleum Phl p 5	287	3309047	7
Phleum pratense	Common timothy	Phl p 5	Aero Plant	Phleum Phl p 5	275	13430402	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	287	21725606	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	287	21725608	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	287	21725610	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	287	21725612	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	287	21725614	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	287	21725616	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	287	21725618	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	287	21725620	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	287	21725622	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	287	21725624	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	287	21725626	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	287	21725628	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	287	21725630	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	287	21725632	7
Phleum pratense	Common timothy	Phl p 5	Aero Plant	Phleum Phl p 5	102	28948464	7
Phleum pratense	Common timothy	Phl p 5.0109	Aero Plant	Phleum Phl p 5	284	29500897	7
Phleum pratense	Common timothy	Phl p 5.0201	Aero Plant	Phleum Phl p 5	284	2398759	10
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 5	309	345108717	13
Phleum pratense	Common timothy	Phl p 6.0102	Aero Plant	Phleum Phl p 6	138	3004465	7
Phleum pratense	Common timothy	Phl p 6.0101	Aero Plant	Phleum Phl p 6	138	3004467	7
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 6	106	3004469	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum Phl p 6	111	28374072	7
Phleum pratense	Common timothy	Phl p 7.0101	Aero Plant	Phleum Polcalin (Phl p 7)	78	3367732	10
Phleum pratense	Common timothy	Unassigned	Aero Plant	Phleum pollen allergen group 3	100	283806867	11
Phodopus sungorus	Siberian hamster	Unassigned	Aero Plant	Phodopus sungorus lipocalin	151	530376029	16
Phoenix dactylifera	Date palm	Pho d 2	Aero Plant	Phoenix Pho d 2	131	21322677	7
Pinus pinea	Pine	Unassigned	Aero Plant	Pinus pinea albumin	110	749495809	16
Pistacia vera	pistachio	Unassigned	Food Plant	Pistacia 11S globulin	472	156001070	9
Pistacia vera	pistachio	Pis v 2.0101	Food Plant	Pistacia 11S globulin	496	110349083	10
Pistacia vera	pistachio	Pis v 2.0201	Food Plant	Pistacia 11S globulin	472	110349085	10
Pistacia vera	pistachio	Pis v 1.0101	Food Plant	Pistacia Pis v 1 2S albumin	149	110349081	10
Pistacia vera	pistachio	Pis v 3.0101	Food Plant	Pistacia Pis v 3 vicilin	519	133711974	10
Pistacia vera	pistachio	Pis v 4.0101	Food Plant	Pistacia Pis v 4	230	149786150	9
Pisum sativum	Pea	Pis s 1.0102	Food Plant	Pisum Pis s 1	415	42414629	7
Pisum sativum	Pea	Pis s 1.0101	Food Plant	Pisum Pis s 1	415	42414627	7
Pisum sativum	Pea	Pis s 2.0101	Food Plant	Pisum Pis s 2	613	7339551	15
Plantago lanceolata	Narrow-leaved plantain	Pla l 1.0101	Aero Plant	Plantago Pla l 1	131	14422359	7
Plantago lanceolata	Narrow-leaved plantain	Pla l 1.0102	Aero Plant	Plantago Pla l 1	131	14422361	7
Plantago lanceolata	Narrow-leaved plantain	Pla l 1.0103	Aero Plant	Plantago Pla l 1	131	14422363	7
Plantago lanceolata	Narrow-leaved plantain	Unassigned	Aero Plant	Plantago Pla l 1	65	29163773	7
Platanus orientalis	oriental plane	Pla or 1.0101	Aero Plant	Platanus Pla or 1	170	162949336	9

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Platanus orientalis	oriental plane	Pla or 2.0101	Aero Plant	Platanus Pla or 2	378	162949338	9
Platanus x acerifolia	London plane tree	Unassigned	Aero Plant	Platanus acerifolia Pla a 3	118	110224778	16
Platanus x acerifolia	London plane tree	Unassigned	Aero Plant	Platanus acerifolia Pla a 3	93	930156468	16
Platanus x acerifolia	London plane tree	Pla a 1	Aero Plant	Platanus Pla a 1	179	26190140	7
Platanus x acerifolia	London plane tree	Pla a 2	Aero Plant	Platanus Pla a 2	377	49523394	7
Plodia interpunctella	Indian meal moth	Plo i 1.0101	Aero Insect	Plodia Plo i 1 Arginine kinase	355	15886861	7
Plodia interpunctella	Indian meal moth	Plo i 2.0101	Aero Insect	Plodia Plo i 2 thioredoxin	106	308193268	12
Poa pratensis	Kentucky bluegrass	Poa p 1	Aero Plant	Poa Poa p 1	20	280414	7
Poa pratensis	Kentucky bluegrass	Poa p 1	Aero Plant	Poa Poa p 1	26	320620	7
Poa pratensis	Kentucky bluegrass	Poa p 1.0101	Aero Plant	Poa Poa p 1	263	4090265	7
Poa pratensis	Kentucky bluegrass	Poa p 5	Aero Plant	Poa Poa p 5	303	11991227	7
Poa pratensis	Kentucky bluegrass	Unassigned	Aero Plant	Poa Poa p 9	373	113560	7
Poa pratensis	Kentucky bluegrass	Unassigned	Aero Plant	Poa Poa p 9	307	113562	7
Poa pratensis	Kentucky bluegrass	Unassigned	Aero Plant	Poa Poa p 9	131	539056	7
Poa pratensis	Kentucky bluegrass	Unassigned	Aero Plant	Poa Poa p 9	333	113561	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Polistes annularis	Paper wasp	Pol a 5.0101	Venom or Salivary	Polistes Pol 5	209	160780	7
Polistes annularis	Paper wasp	Pol a 1.0101	Venom or Salivary	Polistes Pol a 1 Pol d 1	301	5815249	11
Polistes annularis	Paper wasp	Pol a 2.0101	Venom or Salivary	Polistes Pol a 2	367	5815251	11
Polistes dominulus	Paper wasp	Pol d 5	Venom or Salivary	Polistes Pol 5	227	51093377	7
Polistes dominulus	Paper wasp	Pol d 1.0104	Venom or Salivary	Polistes Pol a 1 Pol d 1	316	45510893	7
Polistes dominulus	Paper wasp	Pol d 1.0103	Venom or Salivary	Polistes Pol a 1 Pol d 1	316	45510891	7
Polistes dominulus	Paper wasp	Pol d 1.0102	Venom or Salivary	Polistes Pol a 1 Pol d 1	316	45510889	7
Polistes dominulus	Paper wasp	Pol d 1.0101	Venom or Salivary	Polistes Pol a 1 Pol d 1	337	45510887	7
Polistes dominulus	Paper wasp	Pol d 4.0101	Venom or Salivary	Polistes Venom serine protease	277	30909091	7
Polistes exclamans	Paper wasp	Pol e 5.0101	Venom or Salivary	Polistes Pol 5	226	51093375	7
Polistes fuscatus	Paper wasp	Pol f 5	Venom or Salivary	Polistes Pol 5	205	549188	7
Polistes gallicus	Paper wasp	Pol g 5	Venom or Salivary	Polistes Pol 5	206	25091511	7
Polistes gallicus	Paper wasp	Unassigned	Venom or Salivary	Polistes Pol a 1 Pol d 1	42	41017429	7
Polybia paulista	wasp	Unassigned	Venom or Salivary	Polybia p hyaluronidase	345	302201583	12
Polybia paulista	wasp	Unassigned	Venom or Salivary	Polybia p hyaluronidase	288	302425085	12

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Polybia paulista	wasp	Unassigned	Venom or Salivary	Polybia p venom allergen 5	141	290792375	11
Polybia paulista	wasp	Unassigned	Venom or Salivary	Polybia p venom allergen 5	207	302595972	12
Polybia paulista	wasp	Pol p 1.0101	Venom or Salivary	Polybia Pol p 1.0101 phospholipase	322	166216292	9
Polybia paulista	wasp	Unassigned	Venom or Salivary	Polybia Pol p 1.0101 phospholipase	302	315190620	12
Pontastacus leptodactylus	Danube crayfish	Pon l 4.0101	Food Animal	Pontastacus Pon l 4	192	134309	15
Portunus pelagicus	blue swimmer crab	Por p 1.0101	Food Animal	Portunus Por p 1 tropomyosin	284	448278534	14
Portunus sanguinolentus	Crab	Unassigned	Food Animal	Portunus Por p 1.0101 tropomyosin	284	119674937	8
Portunus trituberculatus	Crab	Unassigned	Food Animal	Portunus Por p 1.0101 tropomyosin	284	151505281	9
Procambarus clarkii	red swamp crayfish	Unassigned	Food Animal	Procambarus red crayfish arginine kinase	357	375298901	13
Procambarus clarkii	red swamp crayfish	Unassigned	Food Animal	Procambarus tropomysin	284	225348412	10
Prosopis juliflora	mesquite	Pro j 2.0101	Aero Plant	Prosopis Pro j 2	133	625293889	15
Protortonia cacti	Arthropod	Unassigned	Food Animal	Protortonia	335	237769615	11
Prunus armeniaca	Apricot	Pru ar 1	Food Plant	Prunus PRP (Bet v 1 family)	160	2677826	7
Prunus armeniaca	Apricot	Unassigned	Food Plant	Prunus Pru 3	119	313575730	12
Prunus armeniaca	Apricot	Unassigned	Food Plant	Prunus Pru 3	117	313575732	12
Prunus armeniaca	Apricot	Pru ar 3.0101	Food Plant	Prunus Pru 3	117	313575734	12
Prunus armeniaca	Apricot	Unassigned	Food Plant	Prunus Pru 3	117	313575736	12
Prunus avium	Cherry	Pru av 1.0101	Food Plant	Prunus PRP (Bet v 1 family)	160	1513216	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Prunus avium	Cherry	Pru av 1.0203	Food Plant	Prunus PRP (Bet v 1 family)	160	44409496	7
Prunus avium	Cherry	Pru av 1.0202	Food Plant	Prunus PRP (Bet v 1 family)	160	44409474	7
Prunus avium	Cherry	Pru av 1.0201	Food Plant	Prunus PRP (Bet v 1 family)	160	44409451	7
Prunus avium	Cherry	Unassigned	Food Plant	Prunus PRP (Bet v 1 family)	159	159162378	9
Prunus avium	Cherry	Pru av 3	Food Plant	Prunus Pru 3	117	6715520	7
Prunus avium	Cherry	Unassigned	Food Plant	Prunus Pru 3	117	313575726	12
Prunus avium	Cherry	Unassigned	Food Plant	Prunus Pru 3	117	313575728	12
Prunus avium	Cherry	Pru av 4	Food Plant	Prunus Pru 4 Profilin peach cherry almond	131	4761582	7
Prunus avium	Cherry	Pru av 2	Food Plant	Prunus Pru av 2	245	1144346	7
Prunus domestica	Plum	Pru d 3	Food Plant	Prunus Pru 3	91	9297015	7
Prunus dulcis	Almond	Unassigned	Food Plant	Prunus persica Pru p 2 IUIS	241	190613941	10
Prunus dulcis	Almond	Pru du 4.0101	Food Plant	Prunus Pru 4 Profilin peach cherry almond	131	24473794	7
Prunus dulcis	Almond	Unassigned	Food Plant	Prunus Pru du 6 Amandin	531	258588247	11
Prunus dulcis	Almond	Unassigned	Food Plant	Prunus Pru du 6 Amandin	178	523916668	15
Prunus dulcis	Almond	Pru du 6.0101	Food Plant	Prunus Pru du 6 Amandin	551	307159112	15
Prunus dulcis	Almond	Pru du 6.0201	Food Plant	Prunus Pru du 6 Amandin	504	307159114	15
Prunus dulcis	Almond	Unassigned	Food Plant	Prunus Seed allergenic protein 2 (Conglutin gamma)	25	75107131	8
Prunus dulcis x Prunus persica	Plant hybrid	Unassigned	Food Plant	Prunus persica Pru p 2 IUIS	160	190613871	10
Prunus dulcis x Prunus persica	Plant hybrid	Unassigned	Food Plant	Prunus persica Pru p 2 IUIS	246	190613905	10
Prunus dulcis x Prunus persica	Plant hybrid	Unassigned	Food Plant	Prunus persica Pru p 2 IUIS	246	190613909	10
Prunus dulcis x Prunus persica	Plant hybrid	Pru p 2.0201	Food Plant	Prunus persica Pru p 2 IUIS	246	190613907	10

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Prunus dulcis x Prunus persica	Plant hybrid	Pru p 2.0101	Food Plant	Prunus persica Pru p 2 IUIS	246	190613911	10
Prunus dulcis x Prunus persica	Plant hybrid	Pru p 2.0301	Food Plant	Prunus persica Pru p 2 IUIS	242	190613903	10
Prunus dulcis x Prunus persica	Plant hybrid	Unassigned	Food Plant	Prunus Pru 4 Profilin peach cherry almond	131	190613937	10
Prunus persica	Peach	Unassigned	Food Plant	Prunus persica Pru p 2 IUIS	246	25091405	12
Prunus persica	Peach	Unassigned	Food Plant	Prunus persica Pru p 2 IUIS	242	25091406	12
Prunus persica	Peach	Unassigned	Food Plant	Prunus persica Pru p 2 IUIS	246	359744030	13
Prunus persica	Peach	Pru p 1.0101	Food Plant	Prunus PRP (Bet v 1 family)	160	82492265	7
Prunus persica	Peach	Unassigned	Food Plant	Prunus PRP (Bet v 1 family)	160	748758672	16
Prunus persica	Peach	Unassigned	Food Plant	Prunus PRP (Bet v 1 family)	160	748758670	16
Prunus persica	Peach	Pru p 3.0101	Food Plant	Prunus Pru 3	91	3287877	7
Prunus persica	Peach	Unassigned	Food Plant	Prunus Pru 3	117	54793477	7
Prunus persica	Peach	Unassigned	Food Plant	Prunus Pru 3	117	313575718	12
Prunus persica	Peach	Unassigned	Food Plant	Prunus Pru 3	117	544369592	15
Prunus persica	Peach	Pru p 4.01	Food Plant	Prunus Pru 4 Profilin peach cherry almond	131	27528310	7
Prunus persica	Peach	Pru p 4.02	Food Plant	Prunus Pru 4 Profilin peach cherry almond	131	27528312	7
Prunus persica	Peach	Pru p 7.0101	Food Plant	Prunus Pru p 7 Peamaclein	63	408407790	14
Pseudocardium sachalinensis	Mollusc	Unassigned	Food Animal	Pseudocardium tropomyosin	284	219806598	10
Punica granatum	Pomegranate	Pun g 1.0101	Food Plant	Punica Pun g 1	120	559797767	15
Punica granatum	Pomegranate	Pun g 1.0201	Food Plant	Punica Pun g 1	120	559797765	15
Punica granatum	Pomegranate	Pun g 1.0301	Food Plant	Punica Pun g 1	120	559797763	15
Pyrus communis	Pear	Pyr c 3.0101	Food Plant	Pyrus LTP Pyr c 3 IUIS	115	6715524	11
Pyrus communis	Pear	Unassigned	Food Plant	Pyrus LTP Pyr c 3 IUIS	94	355525862	13

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Pyrus communis	Pear	Unassigned	Food Plant	Pyrus LTP Pyr c 3 IUIS	94	355525860	13
Pyrus communis	Pear	Unassigned	Food Plant	Pyrus LTP Pyr c 3 IUIS	94	355525856	13
Pyrus communis	Pear	Pyr c 1.0101	Food Plant	Pyrus Pyr c 1	159	14423877	9
Pyrus communis	Pear	Pyr c 4	Food Plant	Pyrus Pyr c 4	131	4761580	7
Pyrus communis	Pear	Pyr c 5	Food Plant	Pyrus Pyr c 5	308	3243234	7
Quercus alba	Oak	Que a 1.0201	Aero Plant	Quercus Que a 1	159	167472847	10
Quercus alba	Oak	Que a 1.0401	Aero Plant	Quercus Que a 1	160	167472851	10
Quercus alba	Oak	Que a 1.0301	Aero Plant	Quercus Que a 1	160	167472849	10
Rana esculenta	Frog	Ran e 1	Food Animal	Rana Ran e 1	110	20796729	7
Rana esculenta	Frog	Ran e 2	Food Animal	Rana Ran e 2	109	20797081	7
Rana sp. CH-2001	Frog	Unassigned	Food Animal	Rana Ran e 1	110	20796733	7
Rana sp. CH-2001	Frog	Unassigned	Food Animal	Rana Ran e 2	109	20797085	7
Rattus norvegicus	Rat	Rat n 1	Aero Animal	Rattus Rat n 1	181	127533	7
Rattus norvegicus	Rat	Rat n 1	Aero Animal	Rattus Rat n 1	181	81890324	7
Rattus norvegicus	Rat	Rat n 1.0101	Aero Animal	Rattus Rat n 1	177	204261	15
Rhizopus oryzae	Fungus	Unassigned	Aero Fungi	Rhizopus Rhi o 1.0101	401	695094784	16
Rhodotorula mucilaginosa	Fungus	Rho m 1.0101	Aero Fungi	Rhodotorula Rho m 1	439	30314940	11
Rhodotorula mucilaginosa	Fungus	Rho m 2.0101	Aero Fungi	Rhodotorula Rho m 2	342	54654335	7
Ricinus communis	Castor bean	Ric c 1.0101	Food Plant	Ricinus Ric c 1	258	21068	15
Rubus idaeus	raspberry	Rub i 1.0101	Food Plant	Rubus Rub i 1	137	110180525	8
Rubus idaeus	raspberry	Rub i 3.0101	Food Plant	Rubus Rub i 3	117	110180523	8

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Salmo salar	Salmon	Sal s 1	Food Animal	Salmo Sal s 1	108	18281421	7
Salmo salar	Salmon	Unassigned	Food Animal	Salmo Sal s 1	109	209734468	10
Salmo salar	Salmon	Sal s 1.0101	Food Animal	Salmo Sal s 1	109	1322183	15
Salmo salar	Salmon	Unassigned	Food Animal	Salmo Sal s 2 enolase	432	385145180	13
Salmo salar	Salmon	Sal s 2.0101	Food Animal	Salmo Sal s 2 enolase	434	197632415	15
Salmo salar	Salmon	Unassigned	Food Animal	Salmo Sal s 3 aldolase	363	385145176	13
Salmo salar	Salmon	Sal s 3.0101	Food Animal	Salmo Sal s 3 aldolase	363	213511774	15
Salsola kali	Thistle	Sal k 1.0201	Aero Plant	Salsola pectin methylesterase Sal k 1.01 & 1.02	362	51242679	8
Salsola kali	Thistle	Sal k 1.0302	Aero Plant	Salsola pectin methylesterase Sal k 1.01 & 1.02	339	59895728	8
Salsola kali	Thistle	Sal k 1.0301	Aero Plant	Salsola pectin methylesterase Sal k 1.01 & 1.02	339	59895730	8
Salsola kali	Thistle	Unassigned	Aero Plant	Salsola pectin methylesterase Sal k 1.01 & 1.02	339	225810597	10
Salsola kali	Thistle	Sal k 1.0101	Aero Plant	Salsola Sal k 1	42	25090947	10
Salsola kali	Thistle	Unassigned	Aero Plant	Salsola Sal k 3 pollen allergen	757	225810599	10
Salsola kali	Thistle	Sal k 4.0101	Aero Plant	Salsola Sal k 4 profilin	133	239916566	11
Salsola kali	Thistle	Unassigned	Aero Plant	Salsola Sal k 4 profilin	133	589912885	15
Salsola kali	Thistle	Sal k 4.0201	Aero Plant	Salsola Sal k 4 profilin	133	300490499	15
Salsola kali	Thistle	Sal k 5.0101	Aero Plant	Salsola Sal k 5	151	300490501	15
Salvelinus fontinalis	Brook trout	Unassigned	Food	Salvelinus parvalbumin	109	288557438	11

Species	Common	IUIS Allergen	Animal Type	Group	Length	GI#	Version
Salvelinus fontinalis	Brook trout	Unassigned	Food Animal	Salvelinus parvalbumin	108	288557440	11
Sarcoptes scabiei type hominis	Scabies mite	Unassigned	Venom or Salivary	Sarcoptes Apolipoprotein Ssag1.2	330	27462848	7
Sarcoptes scabiei type hominis	Scabies mite	Unassigned	Venom or Salivary	Sarcoptes cysteine protease CO8	340	46406002	7
Sarcoptes scabiei type hominis	Scabies mite	Unassigned	Venom or Salivary	Sarcoptes cysteine proteases FO4	338	46406012	7
Sarcoptes scabiei type hominis	Scabies mite	Unassigned	Venom or Salivary	Sarcoptes cysteine proteases FO4	339	46406014	7
Sarcoptes scabiei type hominis	Scabies mite	Unassigned	Venom or Salivary	Sarcoptes cysteine proteases FO4	273	46406016	7
Sarcoptes scabiei type hominis	Scabies mite	Unassigned	Venom or Salivary	Sarcoptes Glutathione S-transferase Mu	219	27462836	7
Sarcoptes scabiei type hominis	Scabies mite	Unassigned	Venom or Salivary	Sarcoptes Glutathione S-transferase Mu	219	60920770	7
Sarcoptes scabiei type suis	Scabies mite	Unassigned	Aero Mite	Sarcoptes Apolipoprotein Ssag1.2	310	507480520	15
Sardinops sagax	South American pilchard	Sar sa 1.0101	Food Animal	Sardinops Sar sa 1 parvalbumin	109	193247972	10
Scapharca broughtonii	Clam	Unassigned	Food Animal	Scapharca tropomyosin	284	219806592	10
Schedonorus arundinaceus	Tall fescue	Unassigned	Aero Plant	Festuca group 1 allergen	35	75139991	7
Schedonorus arundinaceus	Tall fescue	Unassigned	Aero Plant	Festuca group 1 allergen	17	320610	7
Schedonorus arundinaceus	Tall fescue	Unassigned	Aero Plant	Festuca group 1 allergen	20	320611	7
Schistosoma japonicum	Schistosoma	Unassigned	Protozoan	Schistosoma profilin	129	29841461	7
Schistosoma japonicum	Schistosoma	Unassigned	Protozoan	Schistosoma tegumental antigen	191	2739154	7
Schizophyllum commune	Mushroom	Sch c 1.0101	Food Fungi	Schizophyllum Sch c 1	576	302681819	15

H4-8							
Species	**Common**	**IUIS Allergen**	**Type**	**Group**	**Length**	**GI#**	**Version**
Scomber japonicus	Chub mackerel	Unassigned	Food Animal	Scomber Parvalbumin	109	29420793	7
Scomber scombrus	Atlantic mackerel	Unassigned	Food Animal	Scomber Parvalbumin	109	288557436	11
Scylla paramamosain	green mud crab	Unassigned	Food Animal	Scylla arginine kinase	357	375298903	13
Scylla serrata	giant mud crab	Unassigned	Food Animal	Scylla sp. (mud crab) tropomyosin	284	151505279	9
Sebastes marinus	ocean perch (red fish)	Seb m 1.0101	Food Animal	Sebastes Seb m 1	109	242253959	11
Sebastes marinus	ocean perch (red fish)	Seb m 1.0201	Food Animal	Sebastes Seb m 1	110	242253961	11
Secale cereale	Rye	Sec c 20.0101	Food Plant	Secale Sec c 20	23	1699225	15
Secale cereale	Rye	Sec c 20.0201	Food Plant	Secale Sec c 20	29	1699228	15
Secale cereale	Rye	Sec c 38.0101	Food Plant	Secale Sec c 38.01	26	994865	10
Secale cereale	Rye	Unassigned	Aero Plant	Secale Sec c 4	520	55859456	7
Secale cereale	Rye	Unassigned	Aero Plant	Secale Sec c 4	518	55859454	7
Secale cereale	Rye	Unassigned	Aero Plant	Secale Sec c 5	16	75140047	7
Secale cereale	Rye	Sec c 5.0101	Food Plant	Secale Sec c 5	292	332205751	12
Sepia esculenta	cuttlefish	Unassigned	Food Animal	Sepia tropomyosin	284	83715928	7
Sepioteuthis lessoniana	bigfin reef squid	Unassigned	Food Animal	Sepioteuthis tropomyosin	284	83715930	7
Sesamum indicum	Sesame	Unassigned	Food Plant	Sesamum seed maturation-like protein	345	171853012	16
Sesamum indicum	Sesame	Ses i 1	Food Plant	Sesamum Ses i 1	153	13183175	7
Sesamum indicum	Sesame	Unassigned	Food Plant	Sesamum Ses i 1	153	209165427	10

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Sesamum indicum	Sesame	Ses i 2	Food Plant	Sesamum Ses i 2	148	5381323	7
Sesamum indicum	Sesame	Ses i 3	Food Plant	Sesamum Ses i 3	585	13183177	7
Sesamum indicum	Sesame	Ses i 4.0101	Food Plant	Sesamum Ses i 4 oleosin	166	10834827	13
Sesamum indicum	Sesame	Unassigned	Food Plant	Sesamum Ses i 5 oleosin	145	198250343	10
Sesamum indicum	Sesame	Ses i 5.0101	Food Plant	Sesamum Ses i 5 oleosin	145	5381321	15
Sesamum indicum	Sesame	Ses i 6.0101	Food Plant	Sesamum Ses i 6	459	5381325	15
Sesamum indicum	Sesame	Ses i 7.0101	Food Plant	Sesamum Ses i 7	497	13183173	15
Sinapis alba	White mustard	Sin a 1	Food Plant	Sinapis Sin a 1.01	145	1009434	7
Sinapis alba	White mustard	Sin a 1	Food Plant	Sinapis Sin a 1.01	145	1009436	7
Sinapis alba	White mustard	Sin a 1	Food Plant	Sinapis Sin a 1.01	145	1009438	7
Sinapis alba	White mustard	Sin a 1	Food Plant	Sinapis Sin a 1.01	145	1009440	7
Sinapis alba	White mustard	Sin a 1	Food Plant	Sinapis Sin a 1.01	145	1009442	7
Sinapis alba	White mustard	Sin a 1.0101	Food Plant	Sinapis Sin a 1.01	145	51338758	7
Sinapis alba	White mustard	Sin a 2.0101	Food Plant	Sinapis Sin a 2.01 11S globulin	510	62240390	7
Sinapis alba	White mustard	Unassigned	Food Plant	Sinapis Sin a 2.01 11S globulin	523	62240392	7
Sinapis alba	White mustard	Sin a 3.0101	Food Plant	Sinapis Sin a 3.01 LTP	92	156778059	12
Sinapis alba	White mustard	Sin a 4.0101	Food Plant	Sinapis Sin a 4.01 profilin	131	156778061	12
Sinonovacula constricta	Chinese razor clam	Unassigned	Food Animal	Sinonovacula tropomyosin [Song paper]	284	156145810	15

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Solanum lycopersicum (Lycopersicon esculentum)	Tomato	Unassigned	Food Plant	Solanum lycopersicum Sola l 6	96	460373045	16
Solanum lycopersicum (Lycopersicon esculentum)	Tomato	Sola l 1.0101	Food Plant	Solanum Sola l 1 profilin (Lyc e 1)	131	16555787	7
Solanum lycopersicum (Lycopersicon esculentum)	Tomato	Lyc e 1	Food Plant	Solanum Sola l 1 profilin (Lyc e 1)	131	17224229	7
Solanum lycopersicum (Lycopersicon esculentum)	Tomato	Sola l 2.0101	Food Plant	Solanum Sola l 2 Beta-fructofuranosidase (Lyc e 2)	553	18542113	7
Solanum lycopersicum (Lycopersicon esculentum)	Tomato	Sola l 2.0201	Food Plant	Solanum Sola l 2 Beta-fructofuranosidase (Lyc e 2)	636	18542115	7
Solanum lycopersicum (Lycopersicon esculentum)	Tomato	Unassigned	Food Plant	Solanum Sola l 3 LTP (Lyc e 3)	114	71360928	7
Solanum lycopersicum (Lycopersicon esculentum)	Tomato	Sola l 3.0101	Food Plant	Solanum Sola l 3 LTP (Lyc e 3)	114	1816535	15
Solanum lycopersicum (Lycopersicon esculentum)	Tomato	Sola l 4.0101	Food Plant	Solanum Sola l 4 PR-10 (Lyc e 4)	178	2887310	14
Solanum lycopersicum (Lycopersicon esculentum)	Tomato	Sola l 4.0201	Food Plant	Solanum Sola l 4 PR-10 (Lyc e 4)	160	565380268	15
Solanum lycopersicum (Lycopersicon esculentum)	Tomato	Unassigned	Food Plant	Solanum Sola l 4 PR-10 (Lyc e 4)	160	565380238	15
Solanum tuberosum	Potato	Unassigned	Food Plant	Solanum profilin-like	131	77416979	7
Solanum tuberosum	Potato	Unassigned	Food Plant	Solanum profilin-like	131	77999277	7
Solanum tuberosum	Potato	Unassigned	Food Plant	Solanum Sola t 1	386	21510	7
Solanum tuberosum	Potato	Unassigned	Food Plant	Solanum Sola t 1	386	21512	7
Solanum tuberosum	Potato	Unassigned	Food Plant	Solanum Sola t 1	386	21514	7
Solanum tuberosum	Potato	Unassigned	Food Plant	Solanum Sola t 1	386	169500	7
Solanum tuberosum	Potato	Sola t 1	Food Plant	Solanum Sola t 1	386	158517845	9
Solanum tuberosum	Potato	Sola t 2	Food Plant	Solanum Sola t 2	188	124148	7
Solanum tuberosum	Potato	Sola t 3	Food Plant	Solanum Sola t 3	222	20141344	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Solanum tuberosum	Potato	Sola t 3.0101	Food Plant	Solanum Sola t 3	186	1575306	15
Solanum tuberosum	Potato	Sola t 4.0101	Food Plant	Solanum Sola t 4	221	994779	15
Solen strictus	Gould's razor shell	Unassigned	Food Animal	Solen tropomyosin	284	219806602	10
Solenopsis geminata	Tropical Fire Ant	Sol g 4.0101	Venom or Salivary	Solenopsis Sol g 4 Sol i 4	137	7638028	7
Solenopsis geminata	Tropical Fire Ant	Sol g 4.0201	Venom or Salivary	Solenopsis Sol g 4 Sol i 4	137	7638030	7
Solenopsis invicta	Red fire ant	Sol i 4	Venom or Salivary	Solenopsis Sol g 4 Sol i 4	137	4038411	7
Solenopsis invicta	Red fire ant	Sol i 4.0101	Venom or Salivary	Solenopsis Sol g 4 Sol i 4	137	4038409	11
Solenopsis invicta	Red fire ant	Unassigned	Venom or Salivary	Solenopsis Sol i 1	58	1336809	7
Solenopsis invicta	Red fire ant	Unassigned	Venom or Salivary	Solenopsis Sol i 1	25	1336811	7
Solenopsis invicta	Red fire ant	Unassigned	Venom or Salivary	Solenopsis Sol i 1	26	1336812	7
Solenopsis invicta	Red fire ant	Unassigned	Venom or Salivary	Solenopsis Sol i 1	26	1336813	7
Solenopsis invicta	Red fire ant	Sol i 1.0101	Venom or Salivary	Solenopsis Sol i 1	346	51093373	7
Solenopsis invicta	Red fire ant	Sol i 2.0101	Venom or Salivary	Solenopsis Sol i and Sol r Venom allergen II	138	549179	7
Solenopsis invicta	Red fire ant	Sol i 3.0101	Venom or Salivary	Solenopsis Venom allergen III	234	2293571	11
Solenopsis richteri	Black fire ant	Sol r 2.0101	Venom or Salivary	Solenopsis Sol i and Sol r Venom allergen II	119	6136162	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Solenopsis richteri	Black fire ant	Sol r 3.0101	Venom or Salivary	Solenopsis Venom allergen III	211	6136163	7
Solenopsis saevissima	Brazilian fire ant	Unassigned	Venom or Salivary	Solenopsis Sol g 4 Sol i 4	137	291092710	12
Sorghum halepense	Johnson grass	Sor h 1.0101	Aero Plant	Sorghum Sor h 1	266	674275729	15
Sorghum halepense	Johnson grass	Sor h 1.0201	Aero Plant	Sorghum Sor h 1	266	674275731	15
Sorghum halepense	Johnson grass	Sor h 13.0101	Aero Plant	Sorghum Sor h 13	422	674275737	15
Sorghum halepense	Johnson grass	Sor h 13.0201	Aero Plant	Sorghum Sor h 13	410	674275739	15
Stachybotrys chartarum	Fungus	Sta 3.0101	Aero Fungi	Stachybotrys Sta c 3	144	253970748	14
Staphylococcus aureus	Bacteria	Unassigned	Bacteria skin	Staphylococcus enterotoxin SEA	233	1633233	9
Staphylococcus aureus	Bacteria	Unassigned	Bacteria skin	Staphylococcus enterotoxin SEB	254	83308249	9
Staphylococcus aureus	Bacteria	Unassigned	Bacteria skin	Staphylococcus enterotoxin SEC	266	462026	9
Staphylococcus aureus	Bacteria	Unassigned	Bacteria skin	Staphylococcus enterotoxin SED	258	119654	9
Staphylococcus aureus	Bacteria	Unassigned	Bacteria skin	Staphylococcus enterotoxin TSST 1	234	136457	9
Stemphylium callistephi	Fungus	Unassigned	Aero Fungi	Stemphylium major allergen alt a1-like	137	49476467	7
Stemphylium sp. CID1012	Fungus	Unassigned	Aero Fungi	Stemphylium major allergen alt a1-like	137	152060760	9
Stemphylium vesicarium	Fungus	Unassigned	Aero Fungi	Stemphylium major allergen alt a1-like	137	49476465	7

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Strongyloides stercoralis	Parasitic nematode	Unassigned	Worm (parasite)	Strongyloides L3NieAg.01	229	5669875	7
Suidasia medanensis	Mite	Unassigned	Aero Mite	Suidasia putative Sui m 2	141	45738062	7
Sus scrofa	Pig	Unassigned	Aero Animal	Sus Porcine Pepsin	385	118572685	11
Syringa vulgaris	Lilac	Syr v 3.0101	Aero Plant	Syringa Syr v 3	81	14423847	7
Syringa vulgaris	Lilac	Syr v 1.0101	Aero Plant	Syringa Syr v I	145	631911	7
Syringa vulgaris	Lilac	Syr v 1.0102	Aero Plant	Syringa Syr v I	145	631912	7
Syringa vulgaris	Lilac	Syr v 1.0103	Aero Plant	Syringa Syr v I	145	631913	7
Tabanus yao	Horse Fly	Tab y 1.0101	Venom or Salivary	Tabanus Tab y 1 Apyrase	554	323473390	12
Tabanus yao	Horse Fly	Tab y 2.0101	Venom or Salivary	Tabanus Tab y 2 Hyaluronidase	349	304273371	12
Tabanus yao	Horse Fly	Tab y 5.0101	Venom or Salivary	Tabanus Tab y 5	256	304273369	12
Thaumetopoea pityocampa	Pine moth	Tha p 1.0101	Contact	Thaumetopoea Tha p 1 full length	126	301030229	12
Thaumetopoea pityocampa	Pine moth	Tha p 2.0101	Contact	Thaumetopoea Tha p 2	115	408387552	14
Theragra chalcogramma	Alaska pollock	Unassigned	Food Animal	Theragra parvalbumin	109	14531020	7
Theragra chalcogramma	Alaska pollock	Unassigned	Food Animal	Theragra parvalbumin	109	14531018	7
Thunnus albacares	Yellowfin tuna	Thu a 2.0101	Food Animal	Thunnus Thu a 2 enolase	432	385145178	13
Thunnus albacares	Yellowfin tuna	Unassigned	Food Animal	Thunnus Thu a 2 enolase	12	576011132	15
Thunnus albacares	Yellowfin tuna	Unassigned	Food Animal	Thunnus Thu a 3 aldolase	364	291195949	12
Thunnus albacares	Yellowfin tuna	Thu a 3.0101	Food Animal	Thunnus Thu a 3 aldolase	37	576011088	15

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Todarodes pacificus	Japanese flying squid	Unassigned	Food Animal	Todarodes Tod p 1	284	83715932	7
Trachurus japonicus	Japanese horse mackerel	Unassigned	Food Animal	Trachurus parvalbumin	107	77799800	7
Tresus keenae	clam	Unassigned	Food Animal	Tresus tropomyosin	284	219806600	10
Triatoma protracta	Western conenose	Tria p 1	Venom or Salivary	Triatoma Tria p 1	169	15426413	7
Trichophyton rubrum	Fungus	Tri r 2	Contact	Trichophyton (Arthroderma) Tri r 2	412	5813790	7
Trichophyton rubrum	Fungus	Tri r 4	Contact	Trichophyton tri 4 allergen (Arthroderma)	726	5813788	7
Trichophyton schoenleinii	Fungus	Unassigned	Contact	Trichophyton (Arthroderma) Tri r 2	405	74663809	12
Trichophyton schoenleinii	Fungus	Unassigned	Contact	Trichophyton tri 4 allergen (Arthroderma)	726	23894227	7
Triticum aestivum	Wheat	Unassigned	Aero Plant	Triticum Tri a 14 LTP_amylase inhibitor	113	417370	11
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum 5a2 protein	94	66840998	7
Triticum aestivum	Wheat	Unassigned	Aero Plant	Triticum aAI CM16_17	143	195957140	10
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum aAI CM16_17	143	21711	7
Triticum aestivum	Wheat	Unassigned	Aero Plant	Triticum aestivum Tri a 41	60	827354845	16
Triticum aestivum	Wheat	Unassigned	Aero Plant	Triticum aestivum Tri a 42	76	827354790	16
Triticum aestivum	Wheat	Unassigned	Aero Plant	Triticum aestivum Tri a 43	108	827354822	16
Triticum aestivum	Wheat	Unassigned	Aero Plant	Triticum aestivum Tri a 44	107	827354912	16
Triticum aestivum	Wheat	Unassigned	Aero Plant	Triticum aestivum Tri a 45	89	827354784	16
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum alpha/beta gliadin	286	21755	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum alpha/beta gliadin	307	21673	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum alpha/beta gliadin	296	21757	7

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum alpha/beta gliadin	286	21761	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum alpha/beta gliadin	313	21765	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum alpha/beta gliadin	318	170710	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum alpha/beta gliadin	291	170712	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum alpha/beta gliadin	313	170718	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum alpha/beta gliadin	286	170720	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum alpha/beta gliadin	262	170722	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum alpha/beta gliadin	297	170724	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum alpha/beta gliadin	282	170726	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum alpha/beta gliadin	186	170728	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum alpha/beta gliadin	259	1304264	7
Triticum aestivum	Wheat	Unassigned	Aero Plant	Triticum Bakers asthma allergen #4	27	3913017	7
Triticum aestivum	Wheat	Unassigned	Aero Plant	Triticum flour Glutathione Transferase	222	190684057	11
Triticum aestivum	Wheat	Tri a 19.0101	Food Plant	Triticum omega-5 gliadin Tri a 19	439	73912496	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum omega-5 gliadin Tri a 19	359	208605344	10
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum omega-5 gliadin Tri a 19	272	208605346	10
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum omega-5 gliadin Tri a 19	346	208605348	10
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum omega-5 gliadin Tri a 19	366	508732623	15
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum putative leucine-rich repeat protein	137	66840996	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum serine carboxypeptidase II	260	66840994	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum serine carboxypeptidase II	444	125987805	10
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Thaumatin-like	173	135917	12
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 12	131	190684061	11
Triticum aestivum	Wheat	Tri a 12.0103	Food Plant	Triticum Tri a 12	131	548948852	14
Triticum aestivum	Wheat	Tri a 12.0101	Gliadin	Triticum Tri a 12	131	548948848	15

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Triticum aestivum	Wheat	Tri a 12.0102	Gliadin	Triticum Tri a 12	131	548948850	15
Triticum aestivum	Wheat	Tri a 12.0104	Gliadin	Triticum Tri a 12	131	207366248	15
Triticum aestivum	Wheat	Tri a 15.0101	Gliadin	Triticum Tri a 15	121	283465829	11
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum Tri a 20	302	170702	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum Tri a 20	291	170708	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum Tri a 20	251	170736	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum Tri a 20	327	170738	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum Tri a 20	279	1063270	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum Tri a 20	285	62484809	7
Triticum aestivum	Wheat	Tri a 20.0101	Gliadin	Triticum Tri a 20	279	508732621	15
Triticum aestivum	Wheat	Tri a 21.0101	Gliadin	Triticum Tri a 21 alpha, beta-gliadin	281	283476402	11
Triticum aestivum	Wheat	Tri a 25.0101	Gliadin	Triticum Tri a 25	125	8980491	15
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 26	830	21743	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 26	648	21751	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 26	660	21779	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 26	39	21793	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 26	705	22090	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 26	815	170743	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 26	838	736319	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 26	101	897811	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum Tri a 26	794	508732625	15
Triticum aestivum	Wheat	Tri a 26.0101	Gliadin	Triticum Tri a 26	848	288860106	15
Triticum aestivum	Wheat	Tri a 26.0201	Gliadin	Triticum Tri a 26	795	71084277	15
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 27.0101 Thiol reductase	203	30793446	7
Triticum aestivum	Wheat	Tri a 28.0101	Gliadin	Triticum Tri a 28	119	66841026	7
Triticum aestivum	Wheat	Tri a 29.0101	Aero Plant	Triticum Tri a 29	120	253783731	11

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Triticum aestivum	Wheat	Tri a 29.0201	Aero Plant	Triticum Tri a 29	120	283465827	11
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 29	145	21701	7
Triticum aestivum	Wheat	Tri a 30.0101	Food Plant	Triticum Tri a 30	168	21713	7
Triticum aestivum	Wheat	Tri a 31.0101	Food Plant	Triticum Tri a 31	253	11124572	7
Triticum aestivum	Wheat	Unassigned	Aero Plant	Triticum Tri a 32 Peroxiredoxin	218	190684059	11
Triticum aestivum	Wheat	Tri a 32.0101	Aero Plant	Triticum Tri a 32 Peroxiredoxin	218	75324900	14
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 33 Serine protease inhibitor	399	1885350	7
Triticum aestivum	Wheat	Tri a 33.0101	Gliadin	Triticum Tri a 33 Serine protease inhibitor	398	5734506	15
Triticum aestivum	Wheat	Tri a 34.0101	Gliadin	Triticum Tri a 34 GAPDH	337	253783729	11
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 36	307	21773	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 36	356	21783	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 36	373	75317968	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 36	229	886963	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 36	261	886965	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 36	276	886967	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 36	285	75219081	7
Triticum aestivum	Wheat	Unassigned	Food Plant	Triticum Tri a 36	326	62550933	7
Triticum aestivum	Wheat	Tri a 36.0101	Food Plant	Triticum Tri a 36	369	335331566	12
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum Tri a 36	304	170730	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum Tri a 36	323	170732	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum Tri a 36	244	170734	7
Triticum aestivum	Wheat	Unassigned	Gliadin	Triticum Tri a 36	283	508732627	15
Triticum aestivum	Wheat	Tri a 37.0101	Food Plant	Triticum Tri a 37 alpha purothionin	137	4007850	14
Triticum aestivum	Wheat	Unassigned	Aero Plant	Triticum Tri a 39 serine proteinase inhibitor-lik	84	154101366	10

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Triticum aestivum	Wheat	Unassigned	Aero Plant	Triticum Tri a 39 serine proteinase inhibitor-lik	84	122065237	11
Triticum aestivum	Wheat	Tri a 39.0101	Aero Plant	Triticum Tri a 39 serine proteinase inhibitor-lik	84	403213259	14
Triticum turgidum subsp. durum	Wheat	Unassigned	Food Plant	Triticum aAI CM16_17	143	21916	7
Triticum turgidum subsp. durum	Wheat	Unassigned	Food Plant	Triticum Tri a 29	145	21920	7
Triticum turgidum subsp. durum	Wheat	Unassigned	Food Plant	Triticum Tri a 36	295	21926	7
Triticum turgidum subsp. durum	Wheat	Unassigned	Food Plant	Triticum Tri a 36	285	21930	7
Triticum urartu	Wheat	Unassigned	Food Plant	Triticum alpha/beta gliadin	296	170740	7
Tyrophagus putrescentiae	Dust mite	Unassigned	Aero Mite	Tyrophagus Tyr p 10 tropomyosin	284	148615631	9
Tyrophagus putrescentiae	Dust mite	Unassigned	Aero Mite	Tyrophagus Tyr p 10 tropomyosin	201	156938915	9
Tyrophagus putrescentiae	Dust mite	Tyr p 10.0101	Aero Mite	Tyrophagus Tyr p 10 tropomyosin	284	48249227	9
Tyrophagus putrescentiae	Dust mite	Tyr p 13	Aero Mite	Tyrophagus Tyr p 13	131	51860756	7
Tyrophagus putrescentiae	Dust mite	Unassigned	Aero Mite	Tyrophagus Tyr p 13	130	121296500	9
Tyrophagus putrescentiae	Dust mite	Unassigned	Aero Mite	Tyrophagus Tyr p 13	131	156938917	9
Tyrophagus putrescentiae	Dust mite	Tyr p 2	Aero Mite	Tyrophagus Tyr p 2	141	2182106	7
Tyrophagus putrescentiae	Dust mite	Tyr p 24.0101	Aero Mite	Tyrophagus Tyr p 24 Troponin C	153	219815476	11
Tyrophagus putrescentiae	Dust mite	Tyr p 3.0101	Aero Mite	Tyrophagus Tyr p 3	285	167540622	11
Tyrophagus putrescentiae	Dust mite	Unassigned	Aero Mite	Tyrophagus Tyr p 8	218	452215228	14
Venerupis philippinarum	Clam	Unassigned	Food Animal	Venerupis tropomyosin	284	219806573	10
Vespa affinis	Lesser banded hornet	Unassigned	Food Animal	Vespa affinis Phospholipase A1	334	576011175	15

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Vespa affinis	Lesser banded hornet	Unassigned	Food Animal	Vespa affinis Phospholipase A1	334	576011171	15
Vespa crabro	European hornet	Unassigned	Venom or Salivary	Vespa Vesp c 1 phospholipase	301	313471397	12
Vespa crabro	European hornet	Vesp c 5.0101	Venom or Salivary	Vespa Vesp c 5	202	549184	7
Vespa crabro	European hornet	Vesp c 5.0102	Venom or Salivary	Vespa Vesp c 5	202	549185	7
Vespa magnifica	Hornet	Unassigned	Venom or Salivary	Vespa magnifica Vesp ma 2 hyaluronidase	357	315133295	12
Vespa magnifica	Hornet	Unassigned	Venom or Salivary	Vespa magnifica Vesp ma 5	225	319801357	12
Vespa mandarinia	Wasp	Vesp m 5.0101	Venom or Salivary	Vespa Vesp c 5	202	6136165	7
Vespula flavopilosa	Wasp	Ves f 5.0101	Venom or Salivary	Vespula Ves f 5	204	549189	7
Vespula germanica	Wasp	Unassigned	Venom or Salivary	Vespula Phospholipase A1- Ves m/v 1	300	74035843	7
Vespula germanica	Wasp	Ves g 5.0101	Venom or Salivary	Vespula Ves f 5	204	549190	7
Vespula germanica	Wasp	Unassigned	Venom or Salivary	Vespula Ves f 5	204	74035841	7
Vespula germanica	Wasp	Unassigned	Venom or Salivary	Vespula Ves v 2	331	116174180	8
Vespula germanica	Wasp	Unassigned	Venom or Salivary	Vespula Ves v 2	323	116174182	8
Vespula maculifrons	Wasp	Ves m 1.0101	Venom or Salivary	Vespula Phospholipase A1- Ves m/v 1	300	1709545	8
Vespula maculifrons	Wasp	Ves m 5.0101	Venom or	Vespula Ves f 5	204	549191	7

			Salivary				
Species	**Common**	**IUIS Allergen**	**Type**	**Group**	**Length**	**GI#**	**Version**
Vespula maculifrons	Wasp	Unassigned	Venom or Salivary	Vespula Ves f 5	227	85681830	7
Vespula maculifrons	Wasp	Unassigned	Venom or Salivary	Vespula Ves m 2 Hyaluronidase	31	313118253	12
Vespula pensylvanica	Wasp	Ves p 5.0101	Venom or Salivary	Vespula Ves f 5	204	549192	7
Vespula squamosa	Wasp	Ves s 5.0101	Venom or Salivary	Vespula Ves f 5	205	549193	7
Vespula squamosa	Wasp	Unassigned	Venom or Salivary	Vespula Ves s 1 phospholipase	298	313471398	12
Vespula vidua	Wasp	Ves vi 5.0101	Venom or Salivary	Vespula Ves f 5	206	549194	7
Vespula vulgaris	Wasp	Ves v 1.0101	Venom or Salivary	Vespula Phospholipase A1- Ves m/v 1	336	897647	7
Vespula vulgaris	Wasp	Ves v 5.0101	Venom or Salivary	Vespula Ves f 5	227	162551	7
Vespula vulgaris	Wasp	Ves v 5	Venom or Salivary	Vespula Ves f 5	204	4826574	7
Vespula vulgaris	Wasp	Ves v 5	Venom or Salivary	Vespula Ves f 5	209	11514279	7
Vespula vulgaris	Wasp	Ves v 2	Venom or Salivary	Vespula Ves v 2	331	1346323	7
Vespula vulgaris	Wasp	Ves v 2.0101	Venom or Salivary	Vespula Ves v 2	340	62147665	7
Vespula vulgaris	Wasp	Unassigned	Venom or Salivary	Vespula Ves v 2	331	109157163	8
Vespula vulgaris	Wasp	Ves v 3.0101	Venom or Salivary	Vespula Ves v 3 dipeptidylpeptidase IV	776	167782086	9

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Vigna radiata	mung bean	Vig r 1.0101	Food Plant	Vigna Vig r 1 PR 10	155	60418924	7
Vigna radiata	mung bean	Vig r 2.0101	Food Plant	Vigna Vig r 2	453	108743976	15
Vigna radiata	mung bean	Vig r 2.0201	Food Plant	Vigna Vig r 2	454	158251953	15
Vigna radiata	mung bean	Vig r 6.0101	Food Plant	Vigna Vig r 6 Cytokinin-specific binding protein	155	4190976	14
Vigna radiata var. radiata	mung bean	Vig r 4.0101	Food Plant	Vigna Vig r 4	272	1000708	15
Vitis sp.	Grape	Unassigned	Food Plant	Vitis Lipid transfer protein P3	91	145559502	8
Vitis sp.	Grape	Vit v 1	Food Plant	Vitis Vit v 1 LTP	37	462719	7
Vitis sp.	Grape	Unassigned	Food Plant	Vitis Vit v 1 LTP	38	462717	7
Xiphias gladius	Swordfish	Xip g 1.0101	Food Animal	Xiphias Xip g 1 beta-parvalbumin	109	222352960	10
Zea mays	Corn	Unassigned	Aero Plant	Zea group 13 pollen allergen	410	89892725	7
Zea mays	Corn	Unassigned	Aero Plant	Zea group 13 pollen allergen	404	89892727	7
Zea mays	Corn	Unassigned	Aero Plant	Zea group 13 pollen allergen	411	89892729	7
Zea mays	Corn	Unassigned	Aero Plant	Zea pollen specific protein	170	1588669	7
Zea mays	Corn	Zea m 1.0101	Aero Plant	Zea Zea m 1 beta-expansin	269	28630919	7
Zea mays	Corn	Unassigned	Aero Plant	Zea Zea m 1 beta-expansin	269	28630923	7
Zea mays	Corn	Unassigned	Aero Plant	Zea Zea m 1 beta-expansin	269	14193761	8
Zea mays	Corn	Unassigned	Aero Plant	Zea Zea m 1 beta-expansin	245	114794319	8
Zea mays	Corn	Unassigned	Aero Plant	Zea Zea m 1 isoform	263	89892721	7
Zea mays	Corn	Unassigned	Aero Plant	Zea Zea m 1 isoform	252	89892723	7
Zea mays	Corn	Unassigned	Aero Plant	Zea Zea m 1 isoform	99	105969543	8
Zea mays	Corn	Unassigned	Aero Plant	Zea Zea m 1 isoform	269	105969545	8
Zea mays	Corn	Unassigned	Aero Plant	Zea Zea m 1 isoform	270	115502167	9
Zea mays	Corn	Unassigned	Aero Plant	Zea Zea m 1 isoform	269	115502168	9
Zea mays	Corn	Zea m 12.0104	Food Plant	Zea Zea m 12 profilin	131	2642324	7

AllergenOnline version 16
27 January, 2016

Species	Common	IUIS Allergen	Type	Group	Length	GI#	Version
Zea mays	Corn	Unassigned	Food Plant	Zea Zea m 12 profilin	131	110644952	8
Zea mays	Corn	Unassigned	Food Plant	Zea Zea m 12 profilin	131	110644954	8
Zea mays	Corn	Unassigned	Food Plant	Zea Zea m 12 profilin	131	110644956	8
Zea mays	Corn	Unassigned	Food Plant	Zea Zea m 12 profilin	131	110644958	8
Zea mays	Corn	Unassigned	Food Plant	Zea Zea m 12 profilin	131	110644960	8
Zea mays	Corn	Unassigned	Food Plant	Zea Zea m 12 profilin	131	110644962	8
Zea mays	Corn	Unassigned	Food Plant	Zea Zea m 12 profilin	130	110644964	8
Zea mays	Corn	Zea m 12.0101	Food Plant	Zea Zea m 12 profilin	131	313138	15
Zea mays	Corn	Zea m 12.0102	Food Plant	Zea Zea m 12 profilin	137	313140	15
Zea mays	Corn	Zea m 12.0103	Food Plant	Zea Zea m 12 profilin	131	313142	15
Zea mays	Corn	Zea m 12.0105	Food Plant	Zea Zea m 12 profilin	131	11493677	15
Zea mays	Corn	Zea m 14.0101	Food Plant	Zea Zea m 14	120	168576	15
Zea mays	Corn	Zea m 14.0102	Food Plant	Zea Zea m 14	99	168578	15
Zea mays	Corn	Unassigned	Aero Plant	Zea Zea m 25 thioredoxin	128	66841002	7
Ziziphus mauritiana	Chinese-date	Ziz m 1.0101	Food Plant	Ziziphus Ziz m 1	330	61225281	7

Appendix 12
Amino Acid Analysis
RPI90

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Analytical report

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DSM Food Specialties BV
For the attention of
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NEDERLAND

Email Leon.Coulier@dsm.com

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Sample code Nr. 890-2015-00004741 **Report Date** 21/01/2016
Analytical Report Nr. AR-16-RM-001268-01 / 890-2015-00004741

Your contact for Customer Service : Elze Noordzij

Our reference :	890-2015-00004741/ AR-16-RM-001268-01		
Client reference :	**RPI-1549-01-G**		
Sample described as :			
Sample reception date :	18/12/2015	**Analysis starting date :**	18/12/2015
Analyses requested :	PDJ02: Amino-acids profile (with tryptophan) RMK00: Crude Fibre RMA00: Base rate per sample (chemistry) RMK08: Trypsin Inh bitor Activity (TIA) DJCLG: Glucosinolater QD495: Phytic Acid RMA05: Project handling		
Project name	DIC/PoFu	**Sample description**	Rapeseed protein isolate

			Results (uncertainty)
QD495	**QD**	**Phytic Acid Method : Analytical Biochemistry Vol. 77:536-539 (1977)**	
		Phytic Acid	< 0.14 %
RMK08	**RM**	**Trypsin Inhibitor Activity (TIA) Method : EN-ISO 14902:2001; AOCS Ba 12-75**	
		Trypsin inhibitor	21.9 mg/g

DIETARY FIBERS			Results (uncertainty)
RMK00	**RM**	**Crude Fibre Content Method : ISO 6865-M; EC Method 152/2009 app. III-M**	
		Crude fiber	<0.6 % (w/w)

CHEMICAL ANALYSIS			Results (uncertainty)
DI004	**DJ**	**Amino acids (acid hydrolysis) Method : ISO 13903:2005; EU 152/2009 (F)**	
	(Q)	Alanine	4.22 (± 0.25) g/100 g
	(Q)	Arginine	6.47 (± 0.39) g/100 g
	(Q)	Aspartic acid	5.62 (± 0.34) g/100 g
	(Q)	Glutamic acid	23.2 (± 1.6) g/100 g
	(Q)	Glycine	4.90 (± 0.34) g/100 g
	(Q)	Histidine	3.17 (± 0.32) g/100 g
	(Q)	Hydroxyproline	<0.05 (LOQ) g/100 g
	(Q)	Isoleucine	3.55 (± 0.28) g/100 g
	(Q)	Leucine	7.02 (± 0.56) g/100 g
	(Q)	Lysine	6.24 (± 0.50) g/100 g
	(Q)	Ornithine	<0.05 (LOQ) g/100 g
	(Q)	Phenylalanine	3.72 (± 0.22) g/100 g
	(Q)	Proline	6.85 (± 0.55) g/100 g
	(Q)	Serine	4.07 (± 0.28) g/100 g
	(Q)	Threonine	3.77 (± 0.23) g/100 g
	(Q)	Tyrosine	1.98 (± 0.22) g/100 g
	(Q)	Valine	4.79 (± 0.38) g/100 g
DJ011	**DJ**	**Cystine, methionine (oxidative) Method : ISO 13903:2005; EU 152/2009 (F)**	
	(Q)	Cystein +Cystine	3.50 (± 0.35) g/100 g

Sample code Nr.	890-2015-00004741	Report Date	21/01/2016	Page 2/2
Analytical Report Nr.	AR-16-RM-001268-01 / 890-2015-00004741			

CHEMICAL ANALYSIS			Results (uncertainty)
DJ011	**DJ**	**Cystine, methionine (oxidative) Method : ISO 13903:2005; EU 152/2009 (F)**	
	(Q)	Methionine	2.09 (± 0.21) g/100 g
DJCLG	**DJ**	**Glucosinolater Method : Reg. (EEC) No 1864/90**	
		4-Hydroxyglucobrassicin	<0.1 (LOQ) µmol/g
		Glucoalyssin	<0.1 (LOQ) µmol/g
		Glucobrassicanapin	<0.1 (LOQ) µmol/g
		Glucobrassicin	<0.1 (LOQ) µmol/g
		Gluconapin	<0.1 (LOQ) µmol/g
		Gluconapoleiferin	<0.1 (LOQ) µmol/g
		Glucoraphanin	<0.1 (LOQ) µmol/g
		Progoitrin	<0.1 (LOQ) µmol/g
		Total glucosinolates	<0.1 (LOQ) µmol/g
DJ009	**DJ**	**Tryptophane Method : EU 152/2009**	
	(Q)	Tryptophan (Total)	1.39 (± 0.11) g/100 g

SIGNATURE

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Reports without stamp are not valid.

(b) (6)

Mirjam Kortekaas
Business Unit Manager

Report electronically validated by Vince Leeuwestein

EXPLANATORY NOTE

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DIAAS Calculation

Memo

DSM Food Specialties B.V.

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Date
2 September 2016

From
Maaike Bruins

To
Anneke Boot
Mohrmann, Lisette

cc
Gertjan Smolders

Summary
The digestibility of DSM rapeseed protein isolate can be expected to be moderate, 87%, based on digestibility in humans reported by Deglaire et al. [1]. DSM rapeseed protein isolate has relatively high levels of indispensable amino acids. Based on a scoring pattern for a 0.5-3 year-old child, the DIAAS of DSM rapeseed protein isolate was estimated to be 95%, which is comparable to estimated DIAAS for soy protein isolate. A protein with a DIAAS between 75%-99% is considered a good source of protein according to FAO recommendations [2]. The amino acids of rapeseed protein isolate are relatively well absorbed [3] and utilized [4].

Amino acid composition
The protein content of protein isolates typically contain 90% of protein or more. Rapeseed protein isolate exceeds 90% on dry matter basis in all products. Minerals (ash), lipids, and small amounts of carbohydrates make up for the remaining 10%. Crude fibre is typically not present in measurable amounts.

Amino acid scores of DSM's rapeseed protein isolate as measured by Eurofins (The Netherlands) were used. The amino acid content (g/100 g of total protein) of the three batches are shown in Table 1:
1543-02, 1543-03, 1549-02. Also two average amino acid compositions of other rapeseed protein isolates are shown in Table 1 (Vitalexx® and Isolexx®).

As the amino acid composition in Table 1 shows, DSM rapeseed protein isolates contain all essential amino acids in comparable amounts. The rapeseed protein isolates Vitalexx® and Isolexx® have relatively low lysine as compared to DSM rapeseed protein isolate.

Digestibility in animal studies
Based on results of nitrogen balance studies in rats, rapeseed protein isolate was reported to have a high true protein digestibility of 95% [5]. Also, in another digestibility study in rats, the true protein digestibility of rapeseed protein isolate was reported to be 93.3% [6]. The true protein digestibility of Isolexx® rapeseed protein isolate tested in rats was reported to be 93%, 95%, and 91%, at levels of 7.5, 15 and 30% dietary protein fed, respectively.

Digestibility in human studies

Bos et al. [4] reported in a human feeding study that *B. napus* rapeseed protein isolate had an ileal digestibility value of 84%. This value was low compared to cereal proteins but high compared to legumes such as lupin. In a later publication the authors reported a digestibility value of 87% for this rapeseed protein isolate, which was obtained by removing one outlier [1]. A subcommittee of FAO also reported this value of 87% in a review of ileal amino acid and protein digestibility of foods [7]. The isolate contained 0.9:1 cruceferin:napin ratio (36.8% cruciferin, 41% napin, 2.7% LTP) [4] comparable to an average ratio of 0.9:1 cruceferin:napin present in DSM rapeseed protein isolate (40.4% cruciferin and 44.6% napin). Considering that napins are less digestible than cruciferins, the digestibility of DSM's rapeseed protein isolate can be expected to be comparable to the digestibility reported for rapeseed protein isolate [1].

DIAAS estimates

The Digestible Indispensable Amino Acid Score (DIAAS) for rapeseed protein isolate was calculated from 1. analysed amino acid content in protein, 2. true ileal digestibility in humans (87% for rapeseed protein isolate [1]) and 3. the amino acid scoring pattern for children 0.5 to 3 yr of age as recommended by FAO for regulatory purposes [2]. Since for rapeseed protein isolate the true ileal digestibility of individual amino acids are not known, the true ileal digestibility of the protein was used to predict digestibility of individual amino acids [2].

Table 2 shows the calculated Digestible Indispensable Amino Acid (IAA) reference ratios of individual amino acids and the DIAAS of total protein isolate based on amino acid scoring patterns for children 0.5-3 yr of age. In Vitalexx® and Isolexx® rapeseed protein isolate, lysine had the lowest Digestible IAA reference ratio (0.85-0.87). In DSM rapeseed protein isolate, leucine had the lowest Digestible IAA reference ratio (0.94-0.96) followed by the aromatic amino acids phenylalanine and tyrosine (0.97-1.00). The estimated DIAAS of DSM rapeseed protein isolate was on average 95% (94%-96%). This is comparable to DIAAS values of soy protein isolate, which would be approximately 89%-93% based on reported protein amino acid profiles and true ileal protein digestibility [8-10].

PDCAAS estimates

Although the Protein Digestibility Corrected Amino Acid Score (PDCAAS) is no longer recommended by FAO for new protein quality assessments, it remains the regulatory standard in the United States of America until an agreed dataset of DIAAS becomes available [2]. Therefore, PDCAAS was calculated for different rapeseed protein isolates for comparison. PDCAAS were calculated from 1. Analysed amino acid content in protein, 2. faecal digestibility in rats (93% [5, 6] for rapeseed protein isolate) and 3. the amino acid scoring pattern for children 2 to 5 yr of age as recommended in 1991 by FAO [11]. The PDCAAS of DSM rapeseed protein isolate were estimated to range from 85% to 89% (Table 3) comparable to Vitalexx® and Isolexx® rapeseed protein isolates.

Amino acid absorption and utilization

The amino acids of rapeseed protein isolate are relatively well absorbed and utilized. On average, after 8-h sampling, 94% of total amino acids from a 12% casein diet fed to pigs had appeared in portal blood, compared with 103% for a 12% rapeseed protein diet [3]. Data from a human study demonstrate that net postprandial protein utilization of rapeseed protein isolate in humans (70.5%) is comparable to that of soy (73.5%) and that rapeseed protein isolate has a postprandial biological value (84%) comparable to that of soy (80%) [4].

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Table 1: Amino acid content (g/100 g protein) of rapeseed and soy protein isolates and indispensable amino acid reference pattern for children 0.5-3 years of age. Indispensable amino acid in bold.

	Reference score	RPI Vitalexx®	RPI Isolexx®	RPI DSM 1543-02	RPI DSM 1543-03	RPI DSM 1549-02
Alanine		5.1	4.7	4.4	4.5	4.4
Arginine		4.8	7.5	6.7	6.7	6.7
Aspartic acid		7.3	8.8	5.7	5.7	6.0
Cysteine		2.4	2.1	4.0	4.1	3.6
Glutamic acid		18.8	19.4	23.8	24.5	23.8
Glycine		5.2	5.2	5.1	5.1	5.1
Histidine	**2.0**	**3.2**	**2.7**	**3.3**	**3.3**	**3.3**
Isoleucine	**3.2**	**4.6**	**4.3**	**3.7**	**3.7**	**3.7**
Leucine	**6.6**	**7.8**	**7.7**	**7.1**	**7.2**	**7.3**
Lysine	**5.7**	**5.7**	**5.6**	**6.6**	**6.6**	**6.5**
Methionine		2.5	2.1	2.2	2.3	2.1
Phenylalanine		4.1	4.5	3.8	3.8	3.9
Proline		6.4	6.7	7.4	6.5	7.0
Serine		6.0	4.7	4.0	3.8	4.2
Threonine	**3.1**	**4.3**	**4.2**	**3.9**	**3.8**	**4.0**
Tryptophan	**0.85**	**1.6**	**1.5**	**1.4**	**1.4**	**1.5**
Tyrosine		4.1	3.4	2.1	2.0	2.1
Valine	**4.3**	**6.0**	**5.3**	**4.9**	**4.9**	**4.9**
Sulfur AA (CYS+MET)	**2.7**	**4.9**	**4.2**	**6.2**	**6.4**	**5.7**
Aromatic AA (PHE+TYR)	**5.2**	**8.2**	**7.9**	**5.8**	**5.8**	**6.0**
		100.0	100.0	100.0	100.0	100.0

Table 2: The Digestible Indispensable Amino Acid reference ratios for individual amino acids and DIAAS for total protein estimated for different rapeseed protein isolates (Vitalexx®, Isolexx® and DSM)

	RPI Vitalexx®	RPI Isolexx®	RPI DSM 14/42	RPI DSM 15/27	RPI DSM 15/43
Histidine	1.39	1.17	1.43	1.43	1.42
Isoleucine	1.25	1.16	1.00	1.01	1.01
Leucine	1.03	1.01	.94	.95	.96
Lysine	.87	.85	1.01	1.01	.99
Threonine	1.21	1.17	1.09	1.07	1.11
Tryptophan	1.64	1.53	1.46	1.47	1.50
Valine	1.22	1.07	1.00	1.00	1.00
Sulfur AA (CYS+MET)	1.58	1.35	2.00	2.06	1.85
Aromatic AA (PHE+TYR)	1.37	1.31	.98	.97	1.00
Total protein	87%	85%	94%	95%	96%

Digestible Indispensable Amino Acid reference ratios were calculated as the ratio amino acid in RPI protein (g/100 g) to amino acid reference pattern for children 0.5-3 years of age multiplied by an estimated RPI ileal digestibility of 87%.

Table 3: The Protein Digestibility Corrected Amino Acid reference ratios for individual amino acids and PDCAAS for total protein based estimated for different rapeseed protein isolates (Vitalexx®, Isolexx® and DSM)

	RPI Vitalexx®	RPI Isolexx®	RPI DSM 14/42	RPI DSM 15/27	RPI DSM 15/43
Histidine	1.00	1.00	1.00	1.00	1.00
Isoleucine	1.00	1.00	1.00	1.00	1.00
Leucine	1.00	1.00	1.00	1.00	1.00
Lysine	.92	.90	1.00	1.00	1.00
Threonine	1.00	1.00	1.00	1.00	1.00
Tryptophan	1.00	1.00	1.00	1.00	1.00
Valine	1.00	1.00	1.00	1.00	1.00
Sulfur AA (CYS+MET)	1.00	1.00	1.00	1.00	1.00
Aromatic AA (PHE+TYR)	1.00	1.00	.87	.85	.89
Total protein	92%	90%	87%	85%	89%

Protein Digestibility Corrected Amino Acid reference ratios were calculated as the ratio amino acid in RPI protein (g/100 g) to amino acid reference pattern for children 2-5 years of age multiplied by an estimated RPI faecal digestibility of 93%.

Appendix 14
Protease Inhibitor Analysis

RPI batch code	TIA [mg/g]	Comment
wk44 (2013)	15.2	heat damaged during process (contact: Jing). Sample code as received
RPI-1418-01-G	19.7	
VKA260813-01	19.2	Sample code as received
VKA140813-01	19.1	Sample code as received
wk33 (2014)	17.8	heat damaged during process (contact: Jing). Sample code as received
RPI-1506-01-G	24.6	
RPI-1506-02-G	19.0	
RPI-1521-01-G	30.0	
RPI-1521-02-G	31.1	
RPI-1527-01-G	16.7	
RPI-1536-01-G	18.5	
RPI-1543-01-P	18.8	
RPI-1543-02-P	22.9	
RPI-1543-03-P	25.5	
RPI-1549-01-P	21.9	
RPI-1549-02-P	24.4	
RPI-1607-1-P	19.8	
RPI-1607-2-P	19.6	
RPI-1607-3-P	24.0	
RPI-1615-01-G	20.08	
RPI-1623-01-G	18.72	
RPI-1627-01-G	19.63	
RPI-1627-02-G	19.51	

Average	21.1
Range	15.2-31.1

SUBMISSION END