Macadamia Kernel Product Standard

May 2024

Certified HACCP system

Each processor must have a 3rd party certified HACCP system in place. The system must be certified by a registered accredited certification body.

Approved supplier program

It is best practice for nut-in-shell (NIS) suppliers of certified processors to have in place a food safety based approved supplier program that is at least 2nd party audited.

Country of origin

All macadamia nuts sold must be labelled with the country of origin in which they were grown.

Nut-in-shell storage and handling

- Prior to being dried to the moisture level for cracking, NIS must be stored by the processor in conditions that provide forced ventilation.
- NIS should be dried to less than 7.5% NIS moisture within 14 days following intake (by processor or other drying facility).
- NIS held in ambient conditions should be processed within 90 days.
- NIS held for longer than 90 days must be stored in a temperature-controlled environment at <15°C and, if possible, a relative humidity not exceeding 70% for up to 270 days.

An alternative validated process may also be used, as long as it does not adversely affect kernel quality

Kernel product classification and labelling

Standard description format

This standard requires that the product be descriptively labelled using the following terminology or abbreviation:

- Wholes (W), Halves (H), Pieces (P), Natural (N), Diced (D)
- Minimum % wholes, with wholes always being the first stated in a blend of wholes and halves
- Size range in mm

Wholes – kernels which are not split into halves, nor with more than 1/4 of the kernel missing, provided that the kernel contour is not materially affected by the missing portion.

Halves – means that approximately half of a whole kernel, with not more than 1/8 of its mass missing.

Pieces – pieces can be naturally broken or diced with the size specifications listed in Table 1.

Unless otherwise defined, the size ranges stated will be understood to indicate that product will pass over a smaller round screen (with size expressed in mm diameter) and pass through a larger round screen (with size expressed in mm diameter). Alternative sizing methods may be used but must obtain equivalent sizing to that achieved by passing over a round screen. Size range in mm with a 10% tolerance for over or under-sized kernels.

The three different grades are defined as:

Premium kernel

Defined as kernel that is fully mature kernel free from significant defects. Must be free from off odours and flavours.

Commercial grade kernel

Defined as kernel that exhibits minor visual defects, such as surface discolouration and immaturity. The kernel must be free from off odours and flavours. This kernel is suitable for food usage but is usually further processed by dicing and/or coating.

Reject kernel

Defined as kernel that contains defects such as insect damage, mould, pitted centre, internal discolouration, pink and/or blue staining and major defects for disorders such as basal discolouration, immaturity, discoloured crest, adhered skin or if the kernel exhibits off-odour or off-taste.

Different quality grades of product should use the following abbreviations:

Premium ..... PREM
Commercial ..... COM

The standard terminology and abbreviation for roasted product is as follows:

Dry Roasted (unsalted) ..... DR
Dry Roasted & Salted ..... DRS
Oil Roasted (unsalted) ..... OR
Oil Roasted & Salted ..... ORS
Raw ..... RAW

Non-standard kernel styles must incorporate the prefix “SP” to indicate a special (non-standard) specification. SP ‘styles’ should use “SP” and the closest standard style that they represent.

An example of the descriptive labelling convention, for a special blend of 70% whole kernel and 30% half kernel of the size range 17-20mm, which is deemed closest to Style 1, and has been dry roasted and salted would be labelled as follows:

PREM STYLE SP 1 70%W 17-20mm DRS

An example of the descriptive labelling convention, for an in-specification Style 1, with 90% whole kernel and size range 16-20mm which has been dry roasted and salted would be labelled as follows:

PREM STYLE 1 90%W 16-20mm DRS

Style conventions

“Style” is to define the various kernel sizes and blends.

Table 1. Accepted definitions for labelling

Style 0	Min 95% whole kernel	>20mm
Style 1	Min 90% whole kernel	16-20mm
Style 1S	Min 90% whole kernel	13-18mm
Style 2	Min 50% whole kernel	>13mm
Style 3	Min 15% whole kernel	>13mm
Style 4L	Min 80% halves	>13mm
Style 4S	Min 50% halves	10-14mm
Style 5	Pieces	8-12mm
Style 6	Pieces	5-9mm
Style 7	Pieces	3-6mm
Style 8	Fines or Meal	<3mm

The style convention in Table 1 is also applicable for commercial grade kernel but must use the prefix of COM as follows:

COM Style 2 50%W >13mm DRS

Final kernel product testing

Microbiological standards

Table 2. Microbiological testing requirements and limits

Organism	Max limits raw kernel	Max limits roasted kernel	Test method
E-coli	Not detected <3	Not detected <3	ISO16649 OR internationally accredited test method, including: /g (AS 5013.15 – 2006)
Salmonella	N.D.	N.D.	Sample size minimum 250g ISO6579 OR internationally accredited test method, including: /g (AS 5013.10 – 2009)
Standard plate count	<30,000 cfu	<3,000 cfu	/g (AOAC 990.12) or (AS 5013.1)
Yeasts and moulds	<20,000 cfu	<2,000 cfu	/g (AS1766.2.2 – 2009

Chemical standards

Table 3. Chemical testing requirements and limits (at time of packing)

Chemical	Maximum limits	Test method
Total aflatoxin (µg/kg)	Must meet consuming country's limits	HPLC/LCMS
B1 (µg/kg)	Must meet consuming country's limits	HPLC/LCMS
Free fatty acid	0.5%	(AOCS Ca-5a-40)
Peroxide value	≤2 meq/kg (2 years shelf-life)	(AOCS Cd-8b-90)
Peroxide value	Between 2 and 3 meq/kg (1 year shelf-life)	(AOCS Cd-8b-90)

Sampling for microbiological and chemical analysis

Sampling should follow the guidelines of ISO 3951-4:2011:

"Sampling procedures for inspection by variables — Part 4: Procedures for assessment of declared quality levels" or the following sampling prescriptions as a minimum procedure to ensure representative sampling of the lot:

- All products must be sampled and tested at the minimum rate of not less than 1.0kg for each production lot (or batch) of kernel. A 1.0kg test sample must be collected using a minimum of 20 sub-samples, taken representatively throughout the production of the lot.
- Lot size for this purpose must not exceed 20 tonnes of kernel.
- If a validated pasteurisation process is used, lot sizes may be increased to 30 tonnes.
- Samples must represent each style produced and are to be collected at the point of kernel packing.

Laboratory accreditation

All laboratories undertaking microbiological and chemical analysis must be accredited by NATA or an ISO17025 Accredited or another equivalent Food Physico-Chemical and Microbiological analytical laboratory.

Kernel retention samples

Retention samples for microbiological and chemical analysis must be retained for each batch of product at a minimum rate of 400g per lot (lot size must not exceed the defined limits) under the recommended storage conditions of the finished product and for the shelf-life of the product in packaging that will protect the integrity of the product for the intended test purpose.

Physical kernel specifications at the point of packing

Macadamia kernel sold as premium grade must meet the acceptable limits for kernel moisture, appearance, taste, foreign material, shell, and defective kernel as set out in Table 4 or meet agreed customer specifications.

All products must be representatively sampled and tested. Lot size for this purpose shall not exceed 1 tonne of kernel for each test. Samples are to represent each style produced and are to be collected prior to or at the point of kernel packing.

Table 4. Physical kernel specifications

	Premium grade
	Raw
Kernel moisture content	Not to exceed 1.8%
Appearance and taste	White/cream in colour or as specified for roasted product
	Free from excessive dust or oil.
	Crunchy texture (excluding meal) with a typical macadamia flavour
	Free from off odours and flavours
	Each style must be reasonably uniform in shape, colour and size.
Foreign matter*	Target nil
Loose shell**	Style 0-4: max 1 piece per 10kg
	Style 5-8: max 3 pieces per 10kg
Impacted shell***	Not more than 1% of kernels by weight
Unsound kernel (reject plus commercial grade kernel)	Not more than a combined total of 3% unsound kernel by weight, of which reject grade kernel must not exceed 2% by weight
Wholes, halves, piece count	Must meet specification per Table 1 and/or as per customer requirements

Definitions

* Foreign matter includes any product that is not kernel and/or shell.

** Loose shell is defined as pieces of shell that cannot pass through a 3mm round hole.

*** Impacted shell is defined as shell that is embedded in the kernel and cannot pass through a 2mm round hole

Agrichemical residue testing

All products must conform to importing country's maximum residue levels (MRL) for agricultural chemicals.

Bulk packaging specifications for kernel

All macadamia kernel sold must be packaged in a form and manner appropriate to the claimed shelf-life. To claim the optimal shelf-life, product must be packed in a modified atmospheric packaging (MAP).

The recommended structure of the liner is 12µm PET / 9µm Foil / 120µm LLDPE with packs to be nitrogen or carbon dioxide flushed and vacuum-sealed with a residual oxygen level of less than 2%. The target transmission rates are specified in Table 5.

Table 5. Bulk packaging transmission rate specifications

O2 Barrier	H2O Barrier
<0.10cc / m2 / 24h (at 25°C, 75% RH, 1 atm)	<0.25gm / m2 / 24h

All packers should implement a process for ensuring the integrity of the inner and outer packaging is maintained

Packing and labelling of finished kernel product

All bulk packaging must comply with regulatory standards and display the following information:

- Packer or seller's name, address, and contact details
- Country of origin
- Product style code
- Lot code or unique code
- Net weight
- Shelf-life (either by best before date or pack date and shelf-life statement)

It is recommended that all bulk packaging display the following information:

- Pack date
- Best before date
- Recommended storage conditions

Final product storage

Storage should be in conditions that preserve quality and prevent insect infestation.

It is recommended that finished product be stored under suitable climate-controlled conditions prior to dispatch to the customer. The recommended maximum temperature for storage of macadamia kernel is 12°C.

Kernel product specification sheets

Processors must have a product specification sheet for each product sold under the WMO Global Product Standard which must contain the following:

- Product code
- Product size details
- Description of acceptable taste and aroma
- Maximum acceptable moisture content
- Maximum levels of defective kernel, impacted shell and foreign material
- Maximum microbiological levels for salmonella, E-coli, standard plate count, yeasts and moulds
- Maximum levels for aflatoxin, peroxide value and free fatty acid
- Description of the pack date, shelf-life and/or best before date
- Recommended storage conditions

Reprocessing and blending of finished material

When product is blended from batches of different production dates then the blended lot shall use the shelf-life of the oldest component.

In order for an extended shelf-life to be claimed, the finished product must be tested and show chemical and microbiological results consistent with that extended shelf-life.

All production and re-processing activities are to be conducted in a manner which is consistent with the delivery of high-quality outcomes to customers throughout the supply chain.

Product traceability

All finished product must have forward and backwards traceability.

Pasteurisation/ready to eat

If macadamias are sold as ready to eat it is recommended that kernel be pasteurised in a system that has been validated to provide a 5-log reduction in salmonella using the Almond Board of California Guidelines for Process Validation Using Enterococcus faecium NRRL B-235.