

PHILIPPINE NATIONAL STANDARD

Recommended Code of Practice (RCP) for the Processing and Handling of Peanut Butter

Foreword

The Philippine National Standard on the Recommended Code of Practice for the Processing of Peanut Butter was crafted in conjunction with the Philippine National Standard for Peanut Butter—Specifications (PNS Code) by the Industrial Technology Development Institute (ITDI). The recommended code of practice details the production practices of local peanut butter manufacturers, with modification to assure the production of safe and quality finished products.

The code of practice for peanut butter processing was established by conducting plant visits and documentation of the current practices of our local peanut butter manufacturers. It was reviewed by a Technical Working Group (TWG), and revised accordingly based on their comments and recommendations. The TWG was created through the ITDI Special Order No. 229 s. 2021 and its amendment, ITDI Special Order No. 217 s. 2022. It is composed of experts from the Agricultural Machinery Testing and Evaluation Center (AMTEC), Bureau of Philippine Standards (BPS), DOST-National Capital Region (DOST-NCR) Regional Office, Food Development Center (FDC), Food and Drug Administration (FDA), Food and Nutrition Research Institute (FNRI), National Association of Consumers, Inc. (NACI), Philippine Association of Food Technologists, Inc. (PAFT), Polytechnic University of the Philippines (PUP), and the University of the Philippines (UP). Several local peanut butter manufacturers were also part of the TWG and involved in the crafting of the code of practice. The creation of the Recommended Code of Practice for the Processing of Peanut Butter was made possible through a grants-in-aid project funded by the Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD).

1. Scope

This Code of Practice is a set of recommended procedures for the processing and handling of peanut butter to conform to the PNS/FDA xxx:XXXX Standard for Peanut Butter, and is applicable to peanut butter products for commercial retail and distribution in the Philippines.

This document specifies guidelines in the production, storage and handling of peanut butter, starting from raw materials and ingredients up to product distribution. It also includes the minimum hygiene requirements necessary to maintain the safety and quality of the product.

2. Normative Reference

The following referenced documents are indispensable for the application of this document. The latest edition of the referenced document (including any amendments) applies.

Bureau of Agriculture and Fisheries Standards (BAFS). (2012) PNS/BAFS 107:2012 Philippine National Standards for Peanuts – Classification and Grading

Bureau of Agriculture and Fisheries Standards (BAFS). (2018) PNS/BAFS 82:2018 Philippine National Standard for White Sugar – Specification

Department of Health (DOH). (2004) Administrative Order No. 153 s. 2004 Revised Guidelines on Current Good Manufacturing Practice in Manufacturing, Packing, Repacking, or Holding Food

Department of Health (DOH). (2014) Administrative Order No. 2014-0030 Revised Rules and Regulations Governing the Labeling of Prepackaged Food Products Further Amending Certain Provisions of Administrative Order No. 88-B s. 1984 of the “Rules and Regulations Governing the Labeling of Pre-packaged Food Products Distributed in the Philippines”

Department of Health (DOH). (2006) Bureau Circular No. 2006-016 Updated List of Food Additives

Food and Agriculture Organizations of the United Nations/World Health Organization (FAO/WHO). (2004) CXG 50-2004 General Guidelines on Sampling

Food and Agriculture Organizations of the United Nations/World Health Organization (FAO/WHO). (2012) CXS 150-1985 Standard for Food Grade Salt

Food and Agriculture Organizations of the United Nations/World Health Organization (FAO/WHO). (2018) CXS 1-1985 Codex General Standard for the Labelling of Prepackaged Foods

Food and Agriculture Organizations of the United Nations/World Health Organization (FAO/WHO). (2019) CXS 212-1999 Standard for Sugars

Food and Agriculture Organizations of the United Nations/World Health Organization (FAO/WHO). (2020) CXC 1-1696 General Principles of Food Hygiene

Food and Agriculture Organizations of the United Nations/World Health Organization (FAO/WHO). (2021) CXS 234-1999 Recommended Methods of Analysis and Sampling

Food and Agriculture Organizations of the United Nations/World Health Organization (FAO/WHO). (2021) CXS 192-1995 General Standard for Food Additives

Republic Act No. 8172 s. 1995 An Act for Salt Iodization Nationwide (ASIN), 10th Congress, First Regular Session. (1995) (enacted).

U.S. Food and Drug Administration Bacteriological Analytical Manual (BAM) Online. (2021) Chapter 3: Aerobic Plate Count.

U.S. Food and Drug Administration Bacteriological Analytical Manual (BAM) Online. (2020) Chapter 4: Enumeration of Escherichia coli and the Coliform Bacteria

U.S. Food and Drug Administration Bacteriological Analytical Manual (BAM) Online. (2022) Chapter 5: Salmonella

U.S. Food and Drug Administration Bacteriological Analytical Manual (BAM) Online. (2017) Chapter 18: Yeasts, Molds, and Mycotoxins

3. Definition of Terms

For the purpose of this document, the following terms and definitions apply.

3.1

Container

any form of packaging material, which completely or partially encloses the food (including wrappers). A container may enclose the food as a single item or several units or types of prepackaged food when such is presented for sale to the consumer (FDA AO 2014-0030).

3.2

Dry blanching

the process of initially subjecting peanuts to a mild heat treatment, followed by mechanical removal of the skin (Schirack *et al.*, 2006).

3.3

Food

any substance or product whether processed, partially processed or unprocessed that is intended for human consumption. It includes drinks, chewing gum, water and other substances which are intentionally incorporated into the food during its manufacture, preparation and treatment (RA 10611).

3.4**Food additive**

any substance not normally consumed as a food by itself and not normally used as a typical ingredient of the food, whether or not it has nutritive value, the intentional addition of which to food for a technological (including organoleptic) purpose in the manufacture, processing, preparation, treatment, packing, packaging, transport or holding of such food results, or may be reasonably expected to result (directly or indirectly), in it or its by-products becoming a component of or otherwise affecting the characteristics of such foods. The term does not include contaminants or substances added to food for maintaining or improving nutritional qualities (CXS 192-1995).

3.5**Ingredient**

any substance including food additives, used as a component in the manufacture or preparation of a food and present in the final product in its original or modified form (FDA AO 153 s. 2004).

3.6**Label**

a display of written, printed, or graphic matter upon the immediate container of any article and a requirement made by or under authority of existing law that any word statement or other information appearing on the label shall not be considered to be complied with unless such word, statement, or other information also appears on the outside container or wrapper of the retail package of such article or is easily legible to the outside container or wrapper (FDA AO 2014-0030).

3.7**Lot**

food produced during a period of time and under more or less the same manufacturing conditions as indicated by a specific code (FDA AO 2014-0030).

3.8**Maximum use level**

is the highest concentration of the additive determined to be functionally effective in a food or food category and agreed to be safe by the Codex Alimentarius Commission. It is generally expressed as mg additive/kg of food (CXS 192-1995).

3.9**Packaging**

the process of packing that is part of the production cycle applied to a bulk product to obtain the finished product. Any material, including painted material, employed in the packaging of a product including any outer packaging used for transportation of shipment. Packaging materials are referred to as primary or secondary according to whether or not they are intended to be in direct contact with the product (FDA AO 153 s. 2004).

3.10

Peanut butter

a light to medium brown colored food product with a uniformly smooth or crunchy texture and a nutty-characteristic flavor. It is spreadable, and may or may not have noticeable oil separation. It shall have a minimum peanut content of at least 75% (PNS for Peanut Butter).

3.11

Roasting

a cooking method which subjects the food to dry heat. Whether from an open flame, oven, or other heat source causing physico-chemical changes such as browning, caramelization, flavor development, and moisture reduction (PNS/FDA 28:2010).

3.12

Skin

the commonly used term to refer to the seedcoat or testa, which is the light brown to brownish papery covering of a kernel (PNS/FDA 28:2010).

3.13

Sorting

the automatic or manual removal of highly contaminated peanut kernels such as discolored, broken, shriveled, insect damaged or mechanically broken kernels (Chalwe et al., 2019)

4. INGREDIENTS AND PACKAGING MATERIAL REQUIREMENTS

4.1 Ingredients

4.1.1 Basic Ingredients

4.1.1.1.1 Peanut - shall be any acceptable peanut variety (*Arachis hypogaea* L.), presented as kernels that are sound, wholesome, mature, and fit for human consumption. The peanut used shall meet the minimum requirements stated in PNS/BAFS 107:2012 Philippine National Standard for Peanuts—Classification and Grading, and/or other applicable standards. Varieties of peanuts that can be used are listed, but not limited, in Annex A of PNS/BAFS 107:2012.

4.1.1.1.2 Sugar - shall be food grade sugar that conforms to CXS 212-1999 Standard for Sugar, PNS/BAFS 82:2018 Philippine National Standard for Sugar—Specification, and/or other applicable standards.

4.1.1.1.3 Iodized salt-shall be food grade salt that conforms to CXS 150-1985 Standard for Food Grade Salt, RA No. 8172 s. 1995 An Act for Salt Iodization Nationwide (ASIN), and/or other applicable standards.

4.1.2 Optional Ingredients

Optional ingredients may include oils, sweetening agents, and food additives. These ingredients shall be of food grade quality, and must conform to all applicable standards. Food additives, when used, shall be in accordance with the regulations prescribed in the FDA Bureau Circular No. 016, s. 2006 Updated List of Food Additives, and CXS 192-1995 General Standard for Food Additives, and/or their future amendments. The food additives listed, but not limited, to those in Annex A may be used for the manufacture of peanut butter.

4.2 Packaging Materials

Packaging materials shall be appropriate for peanut butter, and for the expected conditions of handling during distribution and storage. These shall provide adequate protection from contamination, and shall be sufficiently durable to withstand mechanical, chemical and thermal stresses encountered during processing and normal distribution.

All packaging materials shall be clean and free from defects that may affect the product or package integrity, and shall be stored in a clean and sanitary manner. A plastic overwrap is recommended for securing packaging materials in bulk during storage.

5. HYGIENE

It is recommended that the product covered by the provisions of this code of practice be prepared and handled in accordance with the appropriate sections of the CXC 1-1969 General Principles of Food Hygiene, the FDA A.O. No. 153 s. 2004 Revised Guidelines on Current Good Manufacturing Practice in Manufacturing, Packing, Repacking, or Holding Food, and/or their future amendments, covering the plant facilities and operations requirement including the construction and layout of processing plant, hygienic facilities, equipment, utensils and working surfaces.

6. PREPARATION AND PROCESSING

The production of peanut butter is described from receipt of raw materials up to product storage. The production process shall be supervised by personnel with adequate technical training and experience.

6.1 Acceptance and Inspection

6.1.1 Raw materials and ingredients

Prior to entry to the processing line, raw materials and ingredients shall be inspected and sorted as required to remove unfit materials. Such operations shall be carried out in a clean and sanitary manner.

The basic and optional ingredients for peanut butter shall conform to the requirements of Subsection 4.1 Ingredients, and shall be properly packed in appropriate packaging materials. Ingredients with indications of deterioration, decomposition or contamination to an extent which renders them unfit for human consumption, shall not be used for processing. Whenever applicable, Certificate of Analysis (COA) from raw materials and ingredient suppliers shall be secured to confirm their suitability for processing.

Stored stocks of ingredients shall be used on a first in-first out (FIFO) or first to expire-first out (FEFO) basis.

6.1.2 Packaging materials

6.1.2.1 Glass jars and caps

Glass jars shall be closely inspected to ensure the absence of chipped finishes, glass fragments, and other glass defects.

If cleaning is necessary, glass jars and caps can be manually washed using appropriate detergent, and rinsed with potable water. A final rinse with water containing appropriate sanitizer is recommended. The jars can be dried upside down on racks or trays. For mechanical washing using suitable cleaning equipment, jars are arranged in an inverted position from which they are cleaned with hot water jets or sprays, and then allowed to dry.

6.1.2.2 Plastic jars and caps

Plastic jars shall be checked for dents, cracks, punctures, and other abnormalities. It shall not impart objectionable odor and flavor to the product when used. Cleaning and sanitation, if needed, shall be done similarly as that of glass jars.

6.1.2.3 Flexible pouches

Preformed containers such as flexible pouches shall be checked for pinholes, delamination (film separation), scratches, blisters, and gross closure defects that may affect the integrity of the package. The seal area must be free from product and foreign matter contamination, and wrinkles; and shall provide a hermetic seal upon closure.

6.2 Processing Operations

The general flow of peanut butter processing is presented in Figure 1. Peanut kernels with or without skin can be used for peanut butter production.

6.2.1 Preparation of raw materials and ingredients

6.2.1.1 Peanut

6.2.1.1.1 Peanut with skin

6.2.1.1.1.a Roasting

Peanuts with skin are initially prepared by dry blanching to separate the skin from the kernel. The skin can be removed manually, or mechanically by using a peeling machine. Peeled kernels are then fully roasted using standard time and temperature combinations, and/or until the desired color and odor are achieved. Roasted peanuts are transferred into tubs for cooling via manual or mechanical means, and weighed accordingly prior to mixing with other ingredients

6.2.1.1.1.b Oil frying

Oil is initially heated in a large vat or kettle. Once the oil is hot, peanuts are added and are continuously stirred during frying. Frying is done when the desired color and odor of peanuts are achieved. Right after frying, the oil is drained off, and fried peanuts are transferred into tubs for cooling via manual or mechanical means. Fried peanuts are weighed accordingly prior to mixing with other ingredients.

6.2.1.1.2 Peanut without skin

Raw peanuts are initially sorted to remove discolored, infested, and/or damaged kernels. Once sorted out, good quality kernels are roasted or oil-fried using standard time and temperature combinations, and/or until the desired color and odor are achieved. After roasting or oil-frying, the kernels are transferred into cooling tubs and allowed to cool by manual or mechanical means. Roasted or oil-fried peanuts are weighed accordingly prior to mixing with other ingredients.

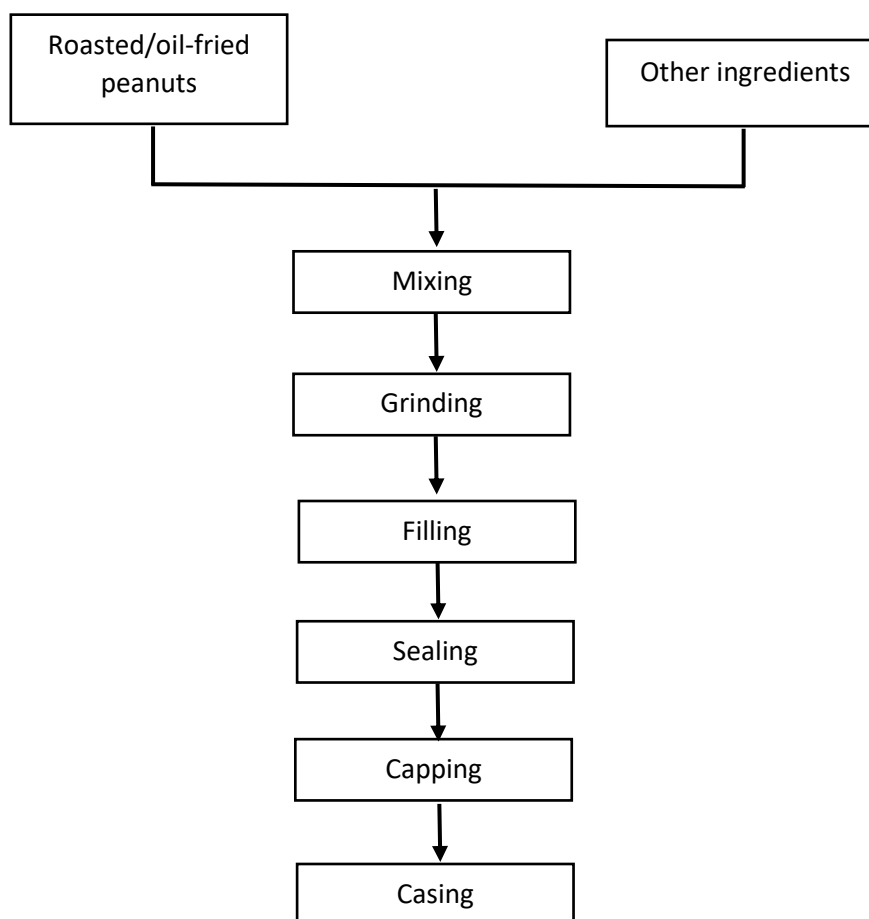


Figure 1. General process flow for peanut butter processing.

6.2.1.2 Other Ingredients

Other ingredients including sugar, salt, and optional ingredients are separately weighed. Ingredients in dry form can be pulverized if desired.

6.2.2 Mixing

Roasted or oil-fried peanuts is added together with other ingredients. All ingredients are thoroughly mixed by manual or mechanical means.

6.2.3 Grinding

The peanut mixture is passed through a grinding machine. The number of passes through the grinding machine depends on the desired consistency of the end product.

6.2.4 Filling, Sealing, and Capping

The peanut butter mixture is filled into suitable containers by manual filling or using appropriate filling machines. The filled containers are sealed and capped by manual sealing or using appropriate sealing or closing machines. In automatic filling machines, the sealing or capping step is done immediately after filling.

Glass and plastic jars shall be well-filled with the product, occupying not less than 90% (minus any necessary head space according to good manufacturing practices) of the water capacity of the container. The water capacity of the container is the volume of distilled water at 20°C which the sealed container can hold when completely filled.

Flexible containers shall be filled as full as commercially practicable.

7. LABELING

Peanut butter shall be inspected before labeling and casing. All containers of packaged products shall be properly labeled following the minimum mandatory information indicated in the provisions of the CXS 1-1985 General Standard for the Labeling of Prepackaged Foods, and the FDA A.O. No. 2014-0030 Revised Rules and Regulations Governing the Labeling of Prepackaged Food Products Further Amending Certain Provisions of Administrative Order No. 88-B s. 1984 of the "Rules and Regulations Governing the Labeling of Pre-packaged Food Products Distributed in the Philippines," and for Other Purposes, and their future amendments. The label shall contain the following information:

- 7.1 Product Name/ Name of the Food
- 7.2 Use of Brand Name and/or Trademark
- 7.3 Complete List of Ingredients
- 7.4 Net contents
- 7.5 Name and address of the manufacturer, re-packer, packer, importer, trader, distributor
- 7.6 Lot identification
- 7.7 Storage condition
- 7.8 Expiry or Expiration date/ Use-by-date/ Consume Before Date (Recommended last consumption date)
- 7.9 Food Allergen Information
- 7.10 Direction/Instruction(s) for Use
- 7.11 Nutrition facts/ Nutrition Information/ Nutritive Value

8. QUALITY ASSURANCE

8.1 Inspection of Finished Products

Peanut butter products shall be inspected, and shall pass the quality criteria prescribed in Section 5.2 of the PNS/FDA xxx:XXXX Standards for Peanut Butter and the type of defects in the lot examined, as defined in Subsection 7, must not exceed the acceptable number based on the appropriate sampling plan in accordance with CXS 234-1999 Recommended Methods of Analysis and Sampling (Annex B).

8.2 Record Keeping

Permanent and legible dated records of production batches, code marks and other pertinent details shall be kept. Written records of all package examinations shall specify the lot, date of package inspections, measurements obtained, and all corrective actions taken.

Records identifying initial distribution of finished product to facilitate the segregation of specific food lots that may have been contaminated or otherwise unfit for intended use, if necessary, shall be kept and maintained.

All process deviations, involving failure to satisfy the minimum requirements of the process, shall be recorded detailing those deviations and the actions taken.

9. STORAGE AND TRANSPORT OF FINISHED PRODUCT

Storage and transport conditions (temperature, relative humidity, etc.) of peanut butter shall ensure that the integrity of the product container and its seal are maintained, and the safety and quality of the product are not compromised.

Cases and cartons must be completely dry. They must be of correct size to ensure proper fit of individual containers, and prevent damage caused by movement within the case. They must be strong enough to cushion and withstand the impacts of normal transport and distribution conditions. Stacking of cases and cartons during storage and transport should also follow the recommended stacking height specific to the type and size of packaging material.

10. LABORATORY CONTROL PROCEDURES

Each food processing establishment should have access to laboratory analyses. Laboratory procedures for quality control of finished product must follow recognized or standard methods for easy interpretation and recognition of results.

Representative samples of each lot or batch should be randomly tested to assess the safety and quality of the product. All food ingredients and finished products declared unfit for human consumption by the laboratory shall be rejected.

11. END PRODUCT SPECIFICATIONS

Appropriate methods shall be used for sampling and analyses of peanut butter to meet the following specifications as stated in PNS/FDA xxx:XXXX Standard for Peanut Butter:

- 11.1 To the extent possible in good manufacturing practices, the product shall be free from any objectionable matter;
- 11.2 The product shall be free from aflatoxin in amounts that may be hazardous to health and shall conform to the quality parameters of peanut butter as described in Section 5.2.1 Chemical Properties;
- 11.3 The product shall be free from microorganisms in amounts harmful to humans as prescribed in Section 5.2.2 Microbiological Properties; and
- 11.4 The product shall comply with the requirements set forth by the Food and Drug Administration (FDA) and the Codex Alimentarius Commission on Food Additives.

ANNEX A

Table 1. Food additives for peanut butter in accordance with the regulations of the FDA Philippines and the CODEX General Standard for Food Additives.

FUNCTIONAL CLASS	FOOD ADDITIVE	MAXIMUM USE LEVEL
Artificial sweetener	Acesulfame potassium*	1000 mg/kg
	Aspartame*	1000 mg/kg
	Neotame*	33 mg/kg
	Steviol glycosides*	330 mg/kg
	Sucralose*	400 mg/kg
	Saccharins*	160 mg/kg
Emulsifiers and stabilizers	Polydimethylsiloxane*	10 mg/kg
	Phosphates*	2200 mg/kg
Antioxidants	Butylated Hydroxyanisole**	200 mg/kg
	Butylated Hydroxytoluene**	200 mg/kg
	Tocopherols*	300 mg/kg
	Ethylene Diamine Tetra Acetates*	250 mg/kg
Preservatives	Benzoates*	1000 mg/kg
	Hydroxybenzoates, para-*	1000 mg/kg
	Sorbates*	1000 mg/kg
	Sulfites*	500 mg/kg

*Based on the Food Category System No. 04.2.2.5. Vegetable (including mushrooms and fungi, roots and tubers, pulses and legumes, and aloe vera), seaweed, and nut and seed purees and spreads (e.g., peanut butter) (CXS 192-1995)

**Based on the Food Category System No. 04.2.2.5. Vegetable, and nut and seed purees and spreads (e.g. peanut butter) (DOH-FDA Circular No. 2006-016)

Annex B
Sampling Plan

SAMPLING PLAN 1
(Inspection Level I, AQL = 6.5)

NET WEIGHT IS EQUAL TO OR LESS THAN 1 KG (2.2LB)

Lot Size (N)	Sample Size (n)	Acceptance Number (c)
4,800 or less	6	1
4,801 - 24,000	13	2
24,001 - 48,000	21	3
48,001 - 84,000	29	4
84,001 - 144,000	38	5
144,001 - 240,000	48	6
more than 240,000	60	7

NET WEIGHT IS GREATER THAN 1 KG (2.2LB) BUT NOT MORE THAN 4.5 KG (10LB)

Lot Size (N)	Sample Size (n)	Acceptance Number (c)
2,400 or less	6	1
2,401 - 15,000	13	2
15,001 - 24,000	21	3
24,001 - 42,000	29	4
42,001 - 72,000	38	5
72,001 - 120,000	48	6
more than 120,000	60	7

NET WEIGHT GREATER THAN 4.5 KG (10 LB)

Lot Size (N)	Sample Size (n)	Acceptance Number (c)
600 or less	6	1
601 - 2,000	13	2
2,001 - 7,200	21	3
7,201 - 15,000	29	4
15,001 - 24,000	38	5
24,001 - 42,000	48	6
more than 42,000	60	7

SAMPLING PLAN 2**(Inspection Level II, AQL = 6.5)****NET WEIGHT IS EQUAL TO OR LESS THAN 1 KG (2.2 LB)**

Lot Size (N)	Sample Size (n)	Acceptance Number (c)
4,800 or less	13	2
4,801 - 24,000	21	3
24,001 - 48,000	29	4
48,001 - 84,000	38	5
84,001 - 144,000	48	6
144,001 - 240,000	60	7
more than 240,000	72	8

NET WEGHT IS GREATER THAN 1 KG (2.2 LB) BUT NOT MORE THAN 4.5 KG (10 LB)

Lot Size (N)	Sample Size (n)	Acceptance Number (c)
2,400 or less	13	2

PHILIPPINE NATIONAL STANDARD	PNS/FDA	
Recommended Code of Practice (RCP) for the Processing and Handling of Peanut Butter	ICS	

2,401 - 15,000	21	3
15,001 - 24,000	29	4
24,001 - 42,000	38	5
42,001 - 72,000	48	6
72,001 - 120,000	60	7
more than 120,000	72	8

NET WEIGHT GREATER THAN 4.5 KG (10 LB)

Lot Size (N)	Sample Size (n)	Acceptance Number (c)
600 or less	13	2
601 - 2,000	21	3
2,001 - 7,200	29	4
7,201 - 15,000	38	5
15,001 - 24,000	48	6
24,001 - 42,000	60	7
more than 42,000	72	8

Reference:

Food and Agriculture Organizations of the United Nations/World Health Organization (FAO/WHO). (2021) CXS 234-1999 Recommended Methods of Analysis and Sampling

References

- Bureau of Agriculture and Fisheries Standards (BAFS) – Department of Agriculture (DA). (2010). Philippine National Standard (PNS) on Processed Pili Nut Products – Specification (PNS/BAFPS 28:2010). Retrieved from <https://archive.org/details/pns.28.2010/page/n1/mode/2up>.
- Bureau of Agriculture and Fisheries Standards (BAFS) – Department of Agriculture (DA). (2010). Philippine National Standard (PNS) on Dried Tropical Products – Specification (PNS/BAFPS 16:2007). Retrieved from https://archive.org/stream/pns.16.2007/pns.16.2007_djvu.txt.
- Department of Health – Food and Drug Administration (DOH-FDA). (2013). An Act to Strengthen the Food Safety Regulatory System in the Country to Protect Consumer Health and Facilitate Market Access of Local Foods and Food Products, and other Purposes (RA No. 10611 or Food Safety Act). Retrieved from <https://www.officialgazette.gov.ph/2013/08/23/republic-act-no-10611/>.
- International Organization for Standardization (ISO). (2017). Animal and vegetable fats and oils-Determination of peroxide value-Iodometric (visual) endpoint determination. Retrieved from <https://www.iso.org/obp/ui/#iso:std:iso:3960:ed-5:v1:en>.
- National Institute of Standards and Technology (NIST) Handbook 133. (2019). Checking the Net Contents of Packaged Goods. Retrieved from <chrome-extension://efaidnbnmnnibpcajpcglclefindmkaj/https://nvlpubs.nist.gov/nistpubs/hb/2020/NIST.HB.133-2020.pdf>.
- Vasconcelos, A. L. S., Franca, A. S., Glória, M. B. A., & Mendonça, J. C. F. (2007). A comparative study of chemical attributes and levels of amines in defective green and roasted coffee beans. *Food Chemistry*, 101(1), 26–32. <https://doi.org/10.1016/j.foodchem.2005.12.049>
- Young, C.T. & Schadel, W.E. (1990). Microstructure of Peanut Seed: A Review. *Food Structure*, Volume 9 (No. 4), pp. 317 – 328. Retrieved from https://digitalcommons.usu.edu%2Ffoodmicrostructure%2Fvol9%2Fiss4%2F3&utm_medium=PDF&utm_campaign=PDFCoverPages.