

SIMPLIFIED GUIDE

on the Technical Specification, Grades
or Classification of Coconut Products



Virgin Coconut Oil (VCO) for Human Consumption
Coconut Shell Charcoal Briquettes
Coir Twine

INTRODUCTION

As part of the Philippine Coconut Authority's mandate in promoting the rapid integrated development and growth of the coconut and other palm oil industries, the agency is tasked to develop the industry's full potential in line with a new vision of a united, globally competitive, and efficient coconut industry.

The Coconut and Oil Palm Standards (COPS) Guide is a collection of information established through the development of the Philippine National Standards (PNS) in collaboration with the Department of Trade and Industry - Bureau of Philippine Standard (DTI-BPS), Food and Drug Administration (FDA), the Department of Agriculture - Bureau of Agriculture and Fisheries Standard (DA-BAFS), PCA Albay and Zamboanga Research Centers and BF Industries, Inc./Philips Carbon Inc. This is prepared as supplemental reference to several publications on product standards and codes of practice with the goal of helping farmers and processors in their journey to enterprise development and technology users in their decisions and product choices. This will guide them on how to produce products which will conform with the market requirements, i.e., what quality & safety parameters to adhere to, what materials to use, how to package and store them, or how to obtain samples for testing as necessary. Further it will guide technology users on the appropriate applications of the products.

This volume will cover Virgin Coconut Oil (VCO) for human consumption, coir, coir twine, and coconut shell charcoal briquettes.

The process flows in the production of each product are also shown. Lastly, the Philippine Standard Commodity Classification (PSCC) codes, which also indicates the Harmonised System (HS) and ASEAN Harmonised Tariff Nomenclature (AHTN) codes are provided for reference in the trading activities.

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LIST OF ABBREVIATIONS

ASTM	- American Society for Testing and Materials
C	- Celsius
g	- Gram
kg	- Kilogram
kJ	- Kilojoule
kPa	- Kilopascal
m	- Meter
max.	- Maximum
mEq	- Milliequivalent
min.	- Minimum
N	- Newton
nd	- No Data/Not Determined
nm	- Nanometer
UTM	- Universal Testing Machine
wt	- Weight

DEFINITION OF TERMS

Binder

natural adhesive material added to charcoal granules that hold the particles together in a permanent solid mass

Breaking load

force necessary to cause the coir twine to break

Coconut Meat/Kernel

also called endosperm, is the firm white, edible flesh attached to the shell

Fixed carbon

percent carbon remaining after the removal of volatile matter, moisture, and ash from dry coconut shell charcoal briquettes

Food/Dietary Supplement

refers to a processed food product intended to supplement the diet that bears or contains one or more of the following dietary ingredients: vitamin, mineral, amino acids, herb or dietary substance or botanical, animal, artificial or natural origin to increase the total daily intake in amounts conforming to the latest Philippine recommended energy and nutrient intake or internationally agreed minimum requirements

Food-grade root crop

root crop that is safe for human consumption or safe to come into direct contact with food products

Free Fatty Acids (FFA)

fatty acids present in the oil that are not chemically bound, the amount of which is used as indicator of hydrolytic deterioration of the oil

Hank

coir twine coil of specified length

Heating/Calorific Value

a measure of the heat content per unit mass of the briquettes expressed in kilojoules per kilogram (kJ/kg)

Mature Coconut

coconut which exhibits change in husk color from green or yellow or orange to brown or grayish-brown. This occurs from 10 to 12 months after pollination

Moisture content

the amount of water present in dry coconut shell charcoal briquettes expressed in percentage

Non-food-grade root crop

root crop that may not be safe for human consumption nor to come into direct contact with food products

Shatter Index

percentage by weight of a sample of coconut shell charcoal briquettes remaining after the sample has been subjected to a specified dropping test. It is calculated by dividing the weight multiplied by 100

Tensile strength

resistance to breaking under tension

Twist

the number of turns applied per unit length

Volatile matter

percentage loss in mass less than the moisture content, when the coconut shell charcoal briquettes is heated without contact with air under specified conditions

Yarn

single ply

VIGIN COCONUT OIL FOR HUMAN CONSUMPTION

Virgin Coconut Oil is a clear colorless unadulterated oil obtained from the fresh kernel of the mature coconut by mechanical or physical extraction or natural fermentation methods, with or without application of heat, without undergoing chemical refining, bleaching or deodorizing. Below 25°C, VCO solidifies and becomes white in color. To liquefy, warm the VCO containing solids to around 45°C for 15 minutes in a 25 ml test tube, beak or a similar clear container.

It consists mainly of triglycerides with a composition that is predominantly medium chain fatty acids and stable to oxidation even when exposed to high temperatures. Its fatty acid composition is distinct from animal fats, which are composed mainly of long chain fatty acids. Each essential identity characteristics are defined according to fatty acid composition, spectrophotometric measurement (absorbance at 278 nanometer (nm)), iodine value, unsaponifiable matter and organoleptic characteristics values of which are shown in Table 1 below:

Table 1. Identity Characteristics

Parameter	Value
Fatty acid composition	See table 2
Spectrophotometric measurement, absorbance at 278 nm	$A_{278} \leq 1.5$
Iodine value*	4.0 – 12.0
Unsaponifiable matter, wt/wt*	$\leq 0.60\%$
Organoleptic characteristics (aroma, flavor and color)*	VCO should have either nutty, acid or <i>latik</i> aroma and flavor, or combinations of any of these sensory characteristics as described in Table 4

*optional

Fatty acid composition consists of the various medium and long chain fatty acids indicated in Table 2 below:

Table 2. Fatty Acid Composition

Fatty Acids	Range (%FA)
<i>Medium chain fatty acids</i>	
Caproic Acid (C6:0)	nd - 1.0
Caprylic Acid (C8:0)	3.2 - 10
Capric Acid (C10:0)	3.5 - 8.0
Lauric Acid (C12:0)	45.0 - 56.0
<i>Long chain fatty acids</i>	
Myristic Acid (C14:0)	16.0 - 22.3
Palmitic Acid (C16:0)	7.5 - 11.4
Stearic Acid (C18:0)	2.0 - 5.0
Oleic Acid (C18:1)	4.8 - 10.0
Linoleic Acid (C18:02)	0.5 - 2.5
Linolenic Acid (C18:3)	nd - 0.2
Linolenic Acid (\geq C20)	nd - 0.1

As to quality characteristics, the parameters are the odor and taste, color, solidification, insoluble impurities or sediments, moisture, free fatty acids, peroxide value, and additives, with the standard value shown in Table 3.

Table 3. Quality Characteristics

Parameter	Value
Odor and Taste	Should be free from foreign rancid odor and taste
Color	Colorless
Solidification	Below 25 °C, VCO is white solid
Insoluble impurities/ sediments (wt/wt), max.	0.05%
Moisture (wt/wt), max.	0.10%
Peroxide value, (meq/kg), max.	3.0%
Additives	None permitted

Both the identity and quality characteristics shall be identified using the sensory evaluation descriptors as seen the Table 4 below:

Table 4. Descriptive Sensory Evaluation

Descriptor	Definition
Nutty	Aroma/Flavor associated with the 2nd layer of fresh coconut kernel with testa
Latik	Aroma/Flavor associated with cooked, sweet, coagulated coconut milk
Acid	Aroma/Flavor associated with acetic acid solutions
Rancid	Aroma/Flavor associated with old, unpleasant, acrid, and acidic oil

The production process of VCO must adhere to the relevant sections of the FDA Administrative Order No. 153 Series of 2004 entitled "Revised Guidelines on Current Good Manufacturing Practice in Manufacturing, Packing, Repacking, or Holding Food and its Future Amendment" and its future amendment thereof, as well as the Recommended International Code of Practice - General Principles of Food Hygiene recommended by the Codex Alimentarius Commission, RCP 1 – 1969, Rev. 2020) and its most recent revision.

Packaging and Labeling

As for the packaging, VCO should be in any appropriate food-grade container that is resilient to handling, storing, and transit. The packaging must be able to preserve and protect the quality of VCO for the duration of the declared shelf-life. It should also be in compliance with the "Code of Practice for the Storage and Transport of Edible Fats and Oils in Bulk (CXC 36-1987, REV, 1-1999)," if applicable.

The label of each packaging shall have the following information:

- Product Name: “Virgin Coconut Oil”
- Process: “Natural fermentation”, “Centrifuge”, “Expeller” or “Physical”
- Brand Name and /or Trademark
- Allergen Information
- Net volume or Net weight
- Name and address of Manufacturer, Repacker, Packer, Importer, Trader and Distributor
- Nutrition Facts/Nutrition Information
- Storage conditions: “Store away from direct sunlight.”
- Lot Identification Number/Code
- Expiration Date/Use-by-Date/Consume Before Date (Recommended last consumption date) in alphanumeric format (i.e. 10Jan24)
- Manufacturing Date
- Philippine FDA License to Operate (LTO) Number, FDA Food Registration (FR) Number and barcode are optional
- For VCO applied as Food Supplement, the phrase “Food/Dietary Supplement” as part of the product name, and “NO APPROVED THERAPEUTIC CLAIMS” in prescribed format in accordance to Bureau Circular No. 02 s.1999 shall be declared.

It shall also be labeled in accordance with the appropriate sections of FDA Administrative Order 2014-0030 (Revised Rules and Regulations Governing the Labelling of Prepackaged Food Products Distributed in the Philippines).

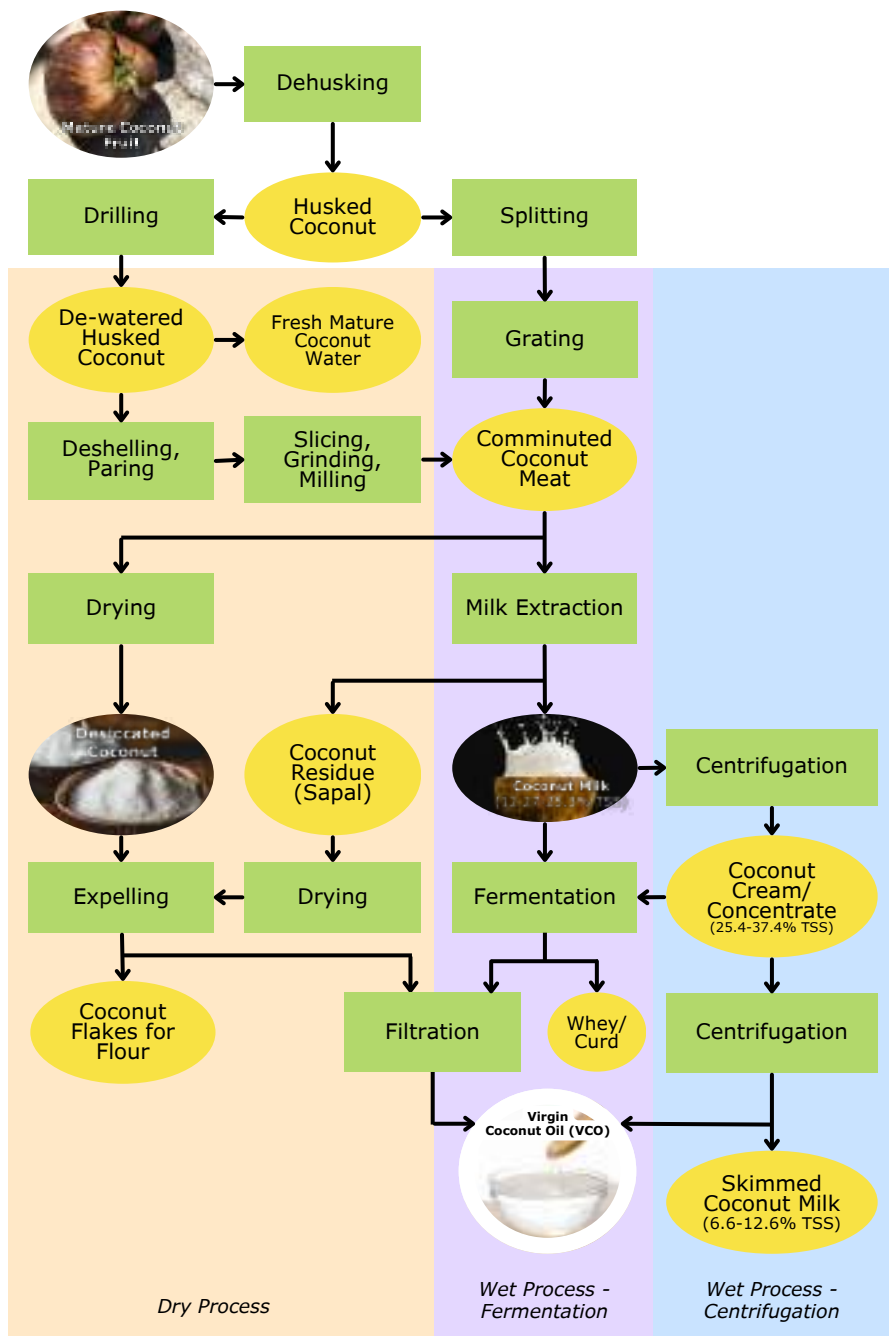


Figure 1. Virgin Coconut Oil Process Flow

PSCC codes

2022 PSCC	Name
1513.11.10-001	Virgin Coconut Oil (VCO) from Dry Process
1513.11.10-002	VCO from Wet Process (Centrifugation)
1513.11.10-003	VCO from Wet Process (Natural Fermentation Method)
1513.11.10-009	Other VCO

COIR TWINE

Coir is a natural fiber extracted by decorticating or defibering the husk of a mature coconut. It is the raw material used for producing coir twine.

Coir Twine is a string made of coir yarns either manually (hand spun) or mechanically twisted together. It is classified according to the grade of coir used, as indicated in the Table below:

Table 5. Types of Coir Twine

Type	Grade of Coir
CT-1	CH-1 and/or CH-2
CT-2	CH-3

As for the coir, it is classified into five (5) grades according to its length, dust and total impurities, which can be seen in Table 6.

Table 6. Grading of Coir

Grade	Name	Length cm	Dust % (weight)	Total Impurities % (weight)
CH-1	Defibered coir	>12	<1	<2
CH-2		>12	<2	<4
CH-3	Decorticated coir	70% > 12 30% < 12	<3	<6
CH-4		60% > 12 40% < 12	<3	<6
CH-5	Decorticated coir waste	40% > 12 60% < 12	>3	>6

5% tolerance level for moisture content, length, dust, and total impurities shall be allowed in all grades of coir.

Coir twines shall have two (2) or three (3) plies or yarns. Other specifications that shall be complied with are its minimum diameter, number of twists, moisture content and tensile strength, as identified in Table 7.

Table 7. Coir Twine Specifications

Characteristics	Requirements
Minimum Diameter	5.0mm ± 1.0mm
Minimum Number of Twists	28 twists for every 30 cm
Moisture Content (MC)	Shall be dried to equilibrium moisture content at the locality
Minimum Tensile Strength	150 Newtons (N)
	15.2 kg

Sampling and Testing

Sampling shall be done in accordance with PNS ASTM D885/D885M. A practical and simple method of measuring the breaking point or tensile strength can be done in the field using the hanging test method. It can be done easily at the coir-twine factory as a quality control measure in lieu of the elaborate mechanical test conducted under strict laboratory-controlled conditions using the UTM.

Materials and apparatus needed for the hanging test are: weighing scale, loads of different weights (e.g., rocks), any container for the weights (e.g., plastic net bags) and tape measure or meter stick.

Test samples shall consist of three (3) coir twine with such length that permits allowance for ties/grips and a clear span of one (1) meter.

Hanging Test Procedure:

- 1.** Tie one end of the coir twine to a fixed beam and tie the other end to the container that holds the weights.
- 2.** Apply an initial load of 15.3 kg and increase it in increments of 0.5 kg until the coir twine breaks. (See Figure 2)

NOTE: If the coir twine breaks at a load of 15.3 kg, the actual breaking load may be determined by using a lighter load for purposes of product improvement.

- 3.** Record the actual maximum weight applied at which the coir twine partially breaks, i.e., when some fibers or portions of the yarn and/or ply are cut into two or more pieces due to the applied weight causing the reduction of the twine diameter
- 4.** Repeat the procedure to get the average breaking load of the three samples. All shall have at least 15.3 kg breaking load to determine compliance with the requirement of 150 N.

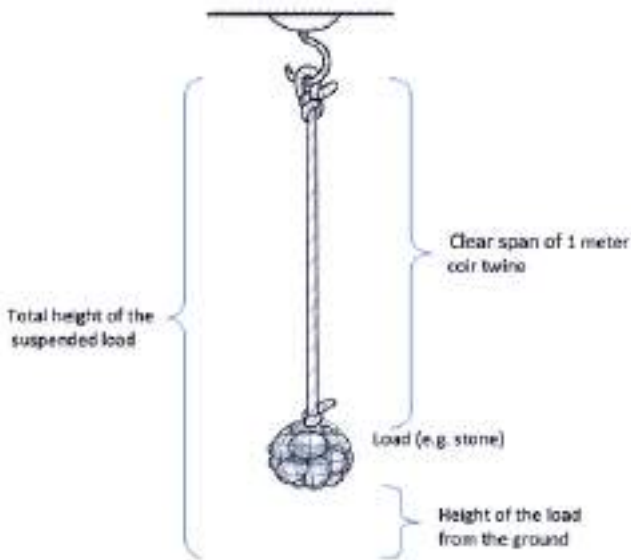


Figure 2. Hanging test for coir twine

Packaging, Labeling and Storage

Coir twine may be packed into specific forms, sizes and weight, like in the following:

- Hand spun coir twine in bundles of 10 hanks with length of 20m or as specified
- Hand spun coir twine in bundles of 100 hanks to form a bale of 160 kg or ball shape with a length of 620 m
- Mechanically spun coir twine in spools or balls with weight as specified by the buyer

If sold in retail, the packaging shall contain the following information:

1. Type of twine and grade of coir used
2. Net weight in kilograms (kg) or length in meters (m)
3. Batch and lot number
4. Name, address and contact details of the manufacturer
5. "Product of the Republic of the Philippines"

It should be stored in a dry and well ventilated storage area protected from hazardous elements and pests. It should not be exposed to rain and direct sunlight for a long period of time.



Figure 3. Bundles of coir twine

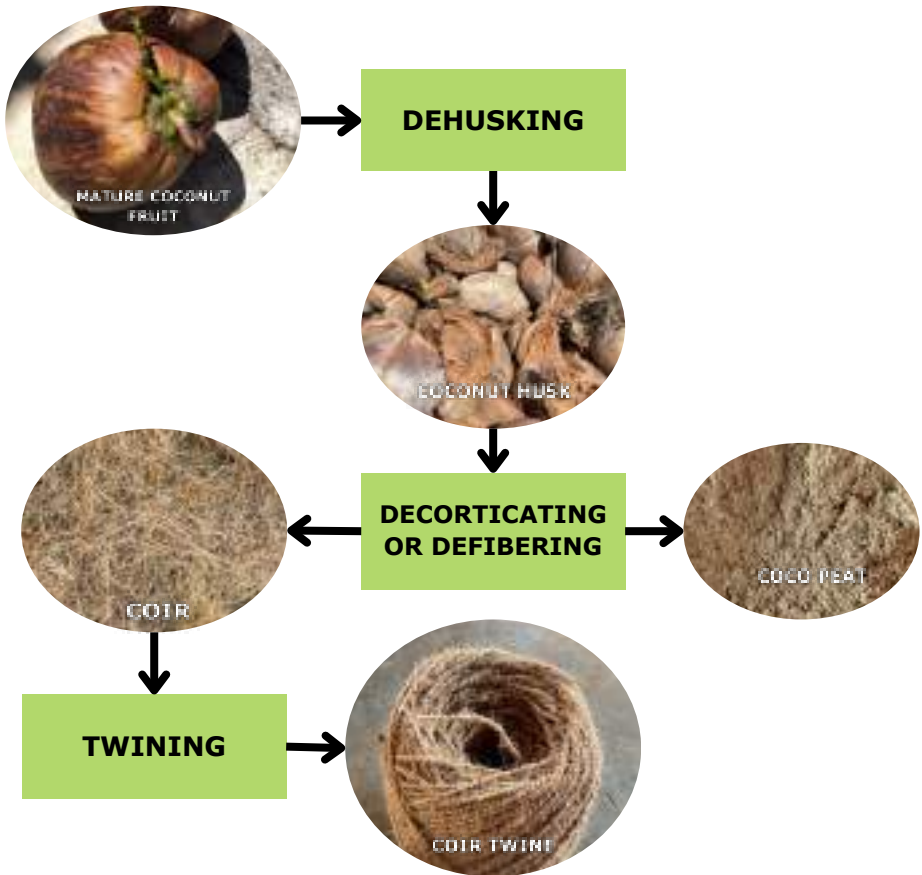


Figure 4. Coir Twine Process Flow

PSCC code

2022 PSCC	Name
5607.90.90-001	Coir Twine, Cordage, Ropes and Cables

COCONUT SHELL CHARCOAL BRIQUETTES

Coconut shell charcoal briquette is the agglomerated coconut shell charcoal powder which is produced during granulation. It is mixed with a binder with water then formed into different shapes & sizes then dried to a 12% moisture content level.

coconut shell charcoal is made with coconut shell through carbonization. It is heated from 300-500°C through drum or kiln method until more or less 70% of its weight is lost. It is traditionally used as fuel for cooking such as boiling stew meat and vegetables, direct heat grilling, or indirect barbecuing.

Charcoal briquettes, on the other hand, are mainly used as alternative material for charcoal in cooking and general heating purposes. It is used in egg hatcheries and brooder houses to provide warmth for young livestock and poultry.

It can have different shapes and mass such as indicated in Table 8.

Table 8. Coconut Shell Charcoal Briquettes Shapes and Mass

Shape	Mass
Shisha (cubic, rectangular, tablet)	10-20 g
Pillow, Hexagon, Cylindrical	21 - 100 g
Honeycomb (cylindrical, cubic and rectangular blocks)	101 - 1000 g



Shisha



Pillow



Cylindrical



Beehive

Figure 5. Sample Shapes of Coconut Shell Charcoal Briquettes

Aside from the abovementioned, there can be other shapes and weights of briquettes in the market. All types shall have a minimum shatter index of 99%.

Its application varies depending on the binder used, i.e., food grade and non-food grade binders. If it's agglomerated using food grade binders, its classifications are:

- **Type I-F** - the binder is food grade cassava or corn starch with a minimum of 5% by weight binder-charcoal ratio.
- **Type II-F** - the binder used is other food grade root crops with a minimum of 5% by weight binder-charcoal ratio.

If it's agglomerated using non-food grade binders, its classifications are:

- **Type I-NF** - the binder used is non-food grade cassava or corn starch with a minimum of 5% by weight binder-charcoal ratio.
- **Type II-F** - the binder used is non-food grade root crops with a minimum of 5% by weight binder-charcoal ratio.
- **Type III-NF** - the binder used is other starch-based materials with a minimum of 5% by weight binder-charcoal ratio.

Sampling and Testing

A minimum of 1 kg for every 1,000 kg of coconut shell charcoal briquettes shall be obtained for sampling. In case the batch is less than 1,000 kg, the minimum sample shall still be 1 kg.

Sampling Procedure:

1. Random sampling shall be done in three (3) locations of the stock: 1/3 shall be drawn from the surface, 1/3 from the fringes, and the remaining 1/3 from the inner portion. The accumulated samples shall constitute the initial sample.

- 2. The total initial sample accumulated shall be placed on clean, dry floor or steel plate or other hard, smooth, non-absorptive surface.
- 3. The initial sample shall be thoroughly mixed by the best and most convenient method possible to achieve a composite sample.

Now to reduce the composite sample to the required weight for testing, the **quartering method** shall be used through the following steps:

- 1. Divide the composite sample in half either by hand or with the aid of a tool through the center of the pile. Similarly, divide each of these halves into two equal parts, thus quartering the sample.
- 2. Combine diagonally opposite quarters of the material to make two samples. Store one of the two samples as a reserve or retention sample for future use. Repeat the entire quartering process, if needed, using the other sample until a 1 kg sample has been obtained.

Samples must be placed in properly labelled and sealed airtight containers.

As for the testing, coconut shell charcoal briquettes shall be tested in accordance with the test methods specified in Table 9:

Table 9. Chemical Composition, Physical and Other Requirements of Coconut Shell Charcoal Briquettes

Property	Requirement	Applicable Test Method
<i>Chemical Requirements</i>		
Volatile Matter (%), max.	20	PNS ASTM D1762
Fixed Carbon (%), min.	60	
Ash Content (%), max.	20	
Moisture Content (%), max.	12	

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Heating/Calorific Value (kilojoule (kJ)/kg), min.	19,000	PNS ASTM D5865/D5865M
Self-heating Temperature, min. (°C)	140	UN Manual of Tests and Criteria – Section 33.4

Physical Requirement

Shatter Index (%), min.	99	PNS ASTM D3038
		Modified Drop Test Method – PNS ASTM D3038

Additional Test Requirements (if requested by buyer)

Resistance to Water Penetration (%)	-	PNS ASTM D870
Bulk Density (kg/m ³)	-	PNS ASTM D6683
Compressive Strength (kPa)	-	PNS ASTM C873

The setup for shatter resistance test should have a smooth solid platform set at 1 meter height from the smooth concrete flooring.

Shatter Resistance Test Procedure:

1. Get the initial weights in grams (W1) of the briquette samples.
2. Drop the briquette test sample at a specific height of 1.0 meter onto a solid base.
3. Collect and weigh the retained fraction of the sample as the final weight in grams (W2) and compute for the weight loss (%) using the formula below:

$$\% \text{ wt. loss} = \frac{W1 - W2}{W1} \times 100$$

Where:

W1 - initial mass in grams (g)

W2 - final mass in grams (g)

% wt. loss - weight loss in %

4. Shatter resistance is calculated by using the formula below:

$$\text{Shatter Resistance (Shatter Index)} = 100 - \% \text{ wt. loss}$$

5. Tabulate the data and compute the average values.

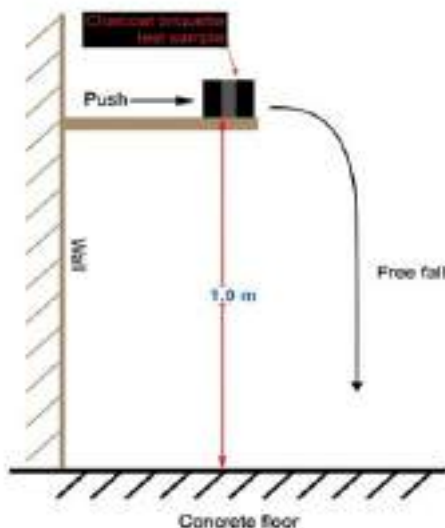


Figure 6. Drop Test for Coconut Shell Charcoal Briquette

Report:

Report the results of each shatter test as follows:

- Percent weight loss (%)
- Shatter resistance (shatter index)
- Initial mass in grams (g)
- Final mass in grams (g)

Table 10 shows test data for some requirements as may be required by buyers.

Table 10. Other Informative Test Data

Properties, (unit)	Value
Bulk Density, (kg/m)	413.78
Density, (kg/m)	0.75
Tumbling Resistance, (%)	78.94
Resistance to Water Penetration, (%)	76.64

Source: PCA-Zamboanga Research Center

Packaging and Labeling

Coconut hell charcoal briquettes may be packed in bags or any suitable primary, secondary or tertiary packaging materials. It shall be in a clean, sound and sealed bag or container appropriate for safe handling, transportation and storage or as may be required.

If in bags, it should be packed not more than 50 kg which may be handled manually. The primary packaging should be plastic liner or film and shall be water-resistant if packed in corrugated paper boxes. Both primary and secondary packaging shall be properly sealed and not torn.

If in shipping containers with primary packaging only, it shall not be more than 600 kg, which shall be handled by mechanical loaders. Packaging shall be water-resistant polypropylene (PP) with liner or high-density polyethylene (PE) bags properly sealed and not torn.

If in shipping containers with multiples packaging, secondary and tertiary packaging shall not be more than 600kg, which shall be handled by mechanical loaders. Primary packaging shall be paper or plastic, properly sealed and not torn. Secondary and/or tertiary packaging should be shrink-wrapped polypropylene (PP) with liner or high-density polyethylene (HDPE) bags and not torn.

Each packaging shall be permanently, clearly and legibly marked with the following:

- 1. Product type and classification (e.g., Type I-F)
- 2. Net weight in kg
- 3. Manufacturing date in the format, mm/dd/yyyy
- 4. Batch and lot number
- 5. Name, address and contact details of the manufacturer
- 6. "Product of the Philippines"
- 7. Warnings:
 - "Use with proper ventilation when indoors"
 - "Keep out of reach of children"
 - "Store in dry place at ambient temperature"

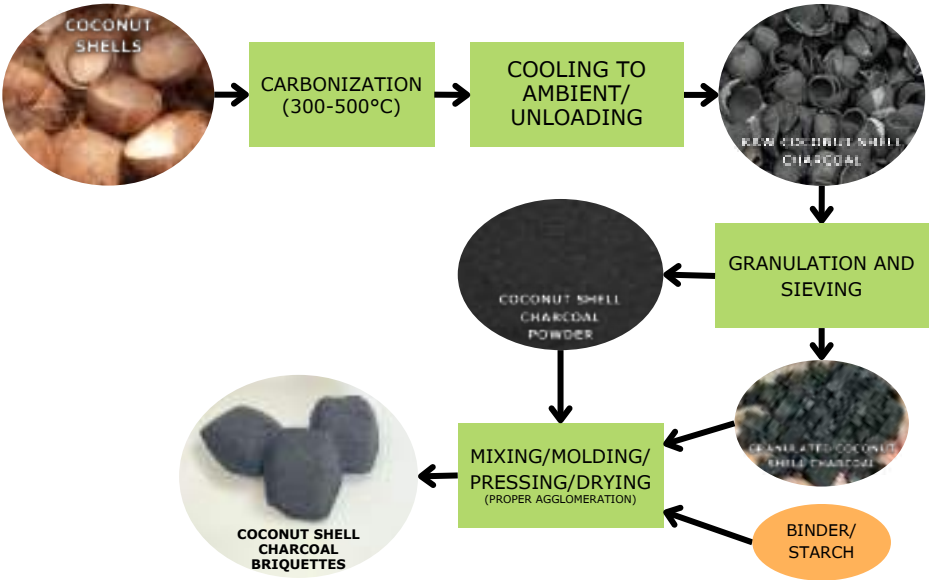


Figure 7. Coconut Shell Charcoal Briquettes Process Flow

PSCC code

2022 PSCC	Name
4402.20.10-004	Briquettes

REFERENCES

Bureau of Philippine Standards. 2022. Philippine National Standard (PNS/FDA 42:2022) - Virgin Coconut Oil (VCO) for Human Consumption

Bureau of Philippine Standards. 2022. Philippine National Standard (DPNS 2149:2022) - Coconut shell charcoal briquettes – Specifications

Bureau of Philippine Standards. 2021. Philippine National Standard (PNS 2151:2021) - Coir twine – Grading and classification

Philippine Statistics Authority. 2022. 2022 Philippine Standard Commodity Classification (PSCC)



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