nk, close by, or
vay.
ey Lonewilled ca
with 1
ome 0
hen 1
you m
ead, h
to (
sotpath a
oint; do n

otbridge. Thais southern







ak, close by, or
vay.
ey Lonewilled ca
with 1
ome 0
hen 1
you m
ead, h
to (
sotpath a
oint; do n

otbridge. Thais southern





### Acknowledgment

This catalog could not have been possible without the valuable contribution of the following individuals who have shared with us their resources: the Zamboanga Research Center - Non-food Product Development Division, Philippine Coconut Authority - Trade Information and Relations Division, BF Industries, Inc./Philips Carbon Inc., Agrisolutions Philippines and Swiss National Science Foundation (SNSF); and other individuals who have given their time and knowledge for the completion of this catalog.

Glory and honor be unto God who gave us strength and wisdom to complete the work.

#### Foreword

Most of us grew up with coconuts as one of the most abundant plants around us and probably the most popular crop supporting the livelihood of many. Millions of farmers rely on the coconut for their livelihood, a complete source of life support in many countries and islands in the world. It is beyond question: Coconut is part of our culture. It is one of the unique plants of its kind, a crop of opportunities, and a botanical wonder. It is our precious natural treasure owing to its various derivative products with thousands of uses. New products continue to evolve along with technology development, consumer preferences, and environmental protection requirements for conservation and preservation.

The Authority intends to unleash the valuable facts about what the coconut can offer. There are a lot of books that talk about coconut as food but not much about the numerous non-food products.

In addition to the globally popular coconut oil, not everyone knows that coconut is a major component of pharmaceuticals. It is a very important sustainable source of oleochemicals and activated carbons that the world needs. Further, the coconut also plays a very important role in the country's food and energy security because of its continuous production of biomass that supports soil fertility and potential renewable energy generation.

This catalog presents a variety of non-food value-added products and serves as a guide for interested consumers, agridevelopment organizations, business enterprises, and institutions to familiarize themselves with the non-food uses of the coconut.

In the next few pages, we will unveil the numerous uses and benefits of non-food coconut products derived from different parts of the palm. Such should widen your horizon on the endless opportunities coconut offers and discover new menu of products for your business endeavors.

ROEL M ROSALES Deputy Administrator, Operations Branch Philippine Coconut Authority











Page

İİ

З

# Coconut Shell





coconut shell powder

The coconut shell is the hard portion between the husk and the kernel. After the meat is obtained, the coconut farmers can process the shells into charcoal or sell to artisans to make handcrafted novelties and accessories, or to processors in powdered form as a filler in resin glues and adhesives. It is also the same material used in the manufacture of insect repellent coils.

Coconut shells can be used to make home decors, kitchen utensils, mugs and pots, dish trays and bowls, accessories like necklace, bracelet, and bags, and even instruments like maracas and guitar.



coconut shells OF OF ICC //euse Before switch voltage is in line with the voltage specified on the case of the device. The power cord is supplied with roolug": insert it into the s

Before switching on m of water, food

. that the or ges and does no



mala



coconut shell

coconut shell buttons ESU OF 113

#### **Coconut Shell** Charcoal & Briquettes





nigh attin a



coconut shell charcoal briquettes

lack

ome

cooking with coconut shell charcoal briquettes



**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 may be sold as is in its raw form, or may be granulated into different sizes for the production of activated carbon. The powder produced during granulation is then agglomerated with a binder to form charcoal briquettes. The shapes of the briquettes would vary depending on the molders, e.g., cylindrical, hexagonal, pillow-shaped, and more.

Coconut shell charcoal is traditionally used as fuel for cooking such as boiling stew meat and vegetable, direct heat grilling, or indirect barbecuing.

Recently, coconut shell charcoal is used as raw material for the manufacture of activated carbon. It is used as a base along with other biomass such as coco peat before the grass are planted in golf course development.

Charcoal briquettes 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.





coconut shell charcoal briquettes



barbecuing



briquettes for child brooding

### Activated Carbon



activated

kiln for steam activation



alth ne of some lackt ay, watch bigne y he for he Activated carbon is made from coconut shell charcoal that underwent steam activation at around 1,000°C. Its extremely small pores give it great absorption abilities. Compared to other based carbons, coconut shell activated carbon has higher ash purity. Activated carbon is black in color, and comes in powder, granules, pellets, extruded, and fiber forms.

Granular activated carbon is most famous for its filtration, purifying and, deodorizing abilities.

For liquids, it is used to purify drinking or processed water, treat wastewater and effluents, decolorize sugar and monosodium glutamate (MSG), and even remove contaminants in fats, oils, food, and drinks. It can be used in mining and mineral processing, as well, especially in mercury and gold recovery.

For gases, it is used in cigarette filters, air filters, gas masks, in recovering solvent vapor, desulfurization of fuel gas, industrial gas, and more.



activated carbon for pharmaceuticals, film coating, electronics, and gold recovery

Powder activated carbon is used in pharmaceuticals, electroplating, film coating and in manufacturing dry batteries and capacitors. It can also be used in purifying drinking/processed water.

These days, activated carbon is also used as an ingredient in desserts, beauty and health & wellness products such as detoxifying patches and more.

#### Coconut Husk & Coconut Fiberboard



**Coconut husk** is the fibrous part between the outer layer of the coconut and the shell. It is obtained by dehusking a coconut fruit.

It is naturally used by farmers as fuel in copra making, or sold directly as husk, or further chopped or chipped for horticultural or industrial applications. It is also generally used as mulching material for weed control and moisture conservation for plant growth.

For wide commercial use, it serves as a base or raw material for many valuable products, such as coir mattresses, cocopallets, coir twines, coconets or geonets, cocologs or fascines, and coco peat. It can also be turned into home decors, baskets, plant pots, fiber baskets and rugs, caps and hats, and also bags and wallets.



#### Coconut fiberboard, a potential high value product,

is a low or medium density fiberboard (LDF &MDF) manufactured from 100% milled coconut husk and bonded with organic agent or formaldehyde-free adhesive (tannin). It is eco-friendly, highly resistant to wood destroying organisms and fire-resistant. It can be used as a panel or insulator in houses.

## Coir & Coir Twine





coir and coir twine pots

coir twine umbrella holder

out

ay. atch

-pla

atin

ne y

tens

some

lackt

**Coir** is the natural fiber extracted from coconut husk. It is light to dark brown in color depending on the maturity of the coconut. It is obtained from the outer shell of a coconut by defibering or decorticating.

It is renewable, biodegradable, and durable, making it versatile and eco-friendly. Water can also get past through it because of its permeable, porous, and hygroscopic textures.

Coir is used as a material for coir twines, coir mattresses, thermal insulation, packaging materials, geotextiles, carbon filter, and in the treatment of toxic factory liquid wastes. It's being used to control oil spills in the ocean, too, because of its buoyancy and resistance to salt water.

**Coir twine** is a string made of coir strands mechanically and/or manually twisted together.

It can be used as is, but can also be made into geonets, cordages, cocologs, vegetable or flower pots, baskets, mini poles and trellis, brushes, tufted mats, woven doormats, and handmade papers.



#### Coconet & Cocolog or Fascine



OUIT

**Coconet** is made from mechanically and/or manually spun coir twine woven into blankets of different density and size. This all-natural product is chemical-free, weather-proof, longlasting and biodegradable.

**Cocolog or fascine** is a tubular structure of coir fiber blankets of different diameters filled with coir and coco peat.

They are widely used in bio-engineering and geotechnical purposes. It performs well in stabilizing slopes, riverbanks, and shorelines, and in controlling soil erosion, waterways, and water flow velocity. Coconets are also being used as underlays for road shoulders, landscaping, beautification and even in wasteland rehabilitation. Fascines are also used for orchids and mangroves seedling growing.



#### Coco Peat & Coco Peat-Based Fertilizer





coco peat



night ne of high ne of high ne of high ne high

**Coco peat** is a fine, spongy material left after the extraction of the coir from the coconut husk. It contains up to 85% of organic matter, which can improve soil structure. It has high lignin content which promotes the development of good microorganisms and makes it resistant to bacteria and fungi. Its high cation exchange capacity also helps it store and release nutrients to plant for an extended period of time. These are necessary for soil nutrient availability and plant growth. Coco peat can be compressed to a ratio of 8:1 and can hold water up to 11 times its weight.

Coco peat is mainly used as a raw material of composts, soil conditioner, organic fertilizers, potting mixes and grow bags and plant supplements. On top of the benefits mentioned above, It has good oxygenation properties which promote healthy root development and it can provide just the right amount of pH level that most crops need, making it good for vegetable, strawberry, banana tissue culture, and cutflower production. It makes a good material for animal bedding, as well, because of its high bulk density, moisture absorption capacity, and biodegradability when mixed with soil. Coco peat is also used in rainwater saving and biofiltration.



#### Copra, Copra Meal & Crude Coconut Oil



crude coconut oil (CNO)



copra meal

**Copra** is the dried meat or kernel of a coconut which serves as basic raw material for the extraction of coconut oil. Moisture is reduced to about 6% by solar or sun drying or hot air drying.

**Crude coconut oil** is the raw oil extracted from copra by pressing or milling. At least 63% of oil can be extracted depending on the pressing efficiency. It is either further refined, bleached, and deodorized for food applications, or fractionated into various fatty acids and oleochemicals for industrial and pharmaceutical uses.

**Copra meal** is the residue left after the extraction of oil. It has at least 18% crude protein, up to 12% crude fat, and up to 10% crude fiber, which are essential for animals' growth and strength.

Copra meal is used as an animal feed ingredient, usually mixed with other animal feeds like starter, layer, and broiler compositions.



good quality copra



crude coconut oil (CNO)



copra meal

#### Coconut Methyl Ester (CME)







CME-diesel fuel refilling

**Coconut methyl ester (CME)** is derived from coconut oil through transesterification with methyl alcohol. It is a biodiesel known as cocodiesel. It is generally a renewable and biodegradable fuel and has varying percentage of alkyl groups ranging from C8 to C18–suitable for compression engines and other similar types (DPNS/DOE QS 002:2013).

CME can be used as substitute to diesel fuels, or additive to improve the engine's performance.



It promotes fuel security for the Philippines. It can power utilities in the event of global oil shortage. By using cocodiesel, a vehicle will emit less smoke, and will reduce diesel particulates and carcinogenic compounds in the air. And because of the increased torque power which increases the mileage, fuel expenses are lower, too. Engine maintenance will cost less, as well, because cocodiesel is relatively cleaner than the usual fuels.

#### Other Coconut Oil Derivatives



**Coconut value-added derivatives** consists of a wide range of products, both food and non-food. These derivatives are **coco chemicals** which are the oleochemicals derived from coconut oil. They are one of the biggest contributors in the oleochemical industry because of the high levels of fatty acids in the coconut oil. These fatty acids are primary sources and basic materials for many uses, and are turned to more valuable products. In addition, coconut oil fatty acid-derived oleochemicals are biodegradable and less toxic with low environment impact.

The high value derivatives from coconut oil are: fatty acids, methyl esters, fatty alcohols, glycerine, monoalkyl phosphates, alkanolamides, surfactants and tertiary amines.

Coco chemicals are most in demand in making soaps and detergents, as surfactants made from coconut has various minerals and nutrients that are good for the skin and moisturizing for the hair.



They are also used in the production of cosmetics, plasticizers and lubricants, and other chemical products.

## Coconut Wood



coco wood plate and bowl



**Coconut wood** is obtained from old (60 years old and above) coconut palm trunks sawn or cut appropriately in recommended patterns for density uniformity, then dried and treated for preservation. The processed trunks are then categorized into three according to density: high, medium, and low.

High and medium density coconut wood, are often used for construction purposes be it for beams, rafters, floors, ceilings, doors, windows, and shingles. The unique texture and color of coconut wood makes it perfect for making furniture and decors. Low density coco lumber, meanwhile, can be used in making furniture like tables, chairs, beds, and cabinets. It's also used in making home decors, kitchen utensils, and more.

Coconut wood can be made into beads for various accessories and cut into various shapes and sizes as components for tablewares, utensils, furniture, and interior wall panels.







coco wood desk and chair

#### Handcrafted Novelties & Accessories



Handcrafted novelties and accessories can be made from either the trunk, husk, shells, leaves, midribs, sheath, spikelets, inflorescence or coir.

As mentioned in the previous pages, the **shell** and **husk** or **coir**, which are both obtained from the fruit, and **coco wood** are good materials for making decorations and accessories.

The **leaves**, which are commonly used to wrap sticky rice snacks, their **midribs** and the **sheath**, are used to make baskets, various decors, costumes, hand fans and many more.

Its **spikelets** and **inflorescence** make great decorations, too, for their unique looks.



#### Other Potential Value-Added Products

nei





out

n R some lackt ay. ay. nigh wigh bigbigbigbigbigbigtrain bigtrain bigtrain bigtrain **Coco ethyl alcohol** is obtained from the fermented coconut sap. This can be used as anti-bacterial hand sanitizer. Further, this can be used as base material for perfumes just like oil along with other essential oils.

**Coconut wound dressing** is a moist wound dressing made from coco cellulose (Nata de Coco) fiber impregnated with monolaurin. Monolaurin is a monoester formed from virgin coconut oil's lauric acid which is antibacterial, antiviral and antifungal.

**Coco tannin** is a natural organic extract or resin from coco peat and other coconut biomass. It can be used in the production of natural dyes and as a substitute adhesives for Urea-formaldehyde (UF) in the manufacture of boards.

**Handmade Coco Paper** is made with pulp extracted from various materials from the coconut tree, such as coconut husks, leaves, fronds, sheathe and leaflets.

**Non-load bearing hollow blocks** are concrete hollow blocks which utilize coir, coconut shell or coco peat as alternate or substitute partial coarse aggregate (6-25%). It can be used in making fences, dividers and walls.



cut keehi



# References

0

Bureau of Product Standards. 2009. Philippine National Standard (PNS/BAFPS 43:2009) - Industrial Crops - Coconut (Copra)

Bureau of Product Standards. 2009. Philippine National Standard (PNS/BAFPS 44:2009) - Code of practice for the prevention and reduction of aflatoxin contamination in copra

Bureau of Product Standards. 2015. Philippine National Standard (PNS/BAFS 163:2015) - Animal feed ingredients

Bureau of Product Standards. 2018. Philippine National Standard (PNS/BAFS 21:2018) - Coconut fiber (coir) - Grading and classification

Bureau of Product Standards. 2018. Philippine National Standard (PNS/BAFS 74:2018) - Coco peat - Grading and classification

Department of Public Works and Highways. Department Order No. 142 Series of 2016 - DPWH Standard Specification for Item 622 - Coconet Bioengineering Technology

United Coconut Association of the Philippines, Philippine Coconut Research & Development Foundation. (n.d.). Coconut Technical Handbook Value-Added Derivatives of Coconut, (pp. 36-95).



#### MARKET RESEARCH AND PROMOTIONS DIVISION

Trade and Market Development Department Philippine Coconut Authority Elliptical Road, Diliman, Quezon City Website: https://pca.gov.ph Tel. No.: (02) 8928-4501 loc. 512 E-mail Address: mrpd@pca.gov.ph/ tmdd@pca.gov.ph