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- VOLUME 3 -

Sistemas e Técnicas de Tratamento e Disposição de Resíduos Sólidos

&

Reaproveitamento ou Reutilização de Resíduos Sólidos para geração de novos Produtos e Materiais

Organizadores
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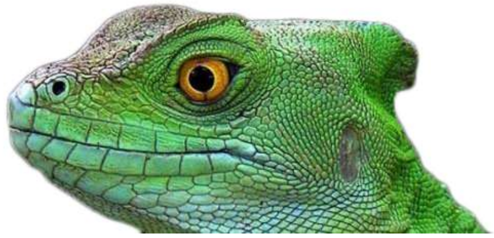


COCOS NUCIFERA L. A REVIEW OF THEIR BIOMASS IN BRAZIL

| ID 15717 |

1Lucas Santos Azevedo, 2Simone Ramires
Federal University of Rio Grande do Sul, e-mail:radialistalucasazevedo@outlook.com; Federal University of Rio Grande do Sul, e-mail: simone.ramires@ufrgs.br

| ABSTRACT |

The biomass generated by the production of coconut is a big problem. The residues of the coconut industry reach 47% of the production of coconut, being represented mainly by Shell and post the bark. In coastal cities, the husks representing up to 80% of the garbage collected. The tank is inappropriate for this residue can cause bad smell, degrade the landscape, putting at risk the environment and contribute to the proliferation of mosquitoes other transmitters of disease. If burned without the proper control produces substances polluting the environment.
The cost of the provision of this type of material in landfills varies from R$ 60.00 to R$ 130.00 per tonne.
Some researchers, as well as organs, are studying ways to employ the biomass of green coconut (epicarp, mesocarp and endocarp) in the correct way, without harming the environment.
The objective is to make a general review of biomass of coconut from its origin to the domestication, wild production to alternatives for reuse of residue to the circular economy of same.
Used for the construction of this work theoretical research to scientific papers by means of digital servers, such as 'Google Scholar'and 'cielo'.
Inconclusividade observed as the wild origin of coconut, because the findings scattered around the world, being the oldest finding found in Colombia dating from the middle to the end of the Paleocene (65 - 55 million years ago). Since its introduction in Brazil in the period after the Portuguese colonization, it was spread throughout the Brazilian territory, focusing mainly in coastal regions, North and Northeast. Morphologically is divided into Giants, dwarves and hybrids. Currently, Brazil is the largest producer per hectare in the world and the fourth in the ranking of total production, bit the top of Sri Lanka.
There are several works in the literature describing different ways of using the residues of coconut, with options ranging from the production of artisan objects, Making memories, use of natural fiber filters, renewable energy production, manufacture of briquettes, cooling of photovoltaic plates, among others, thereby demonstrating sustainable reuse alternatives for their biomass.
The main obstacle to biorrefinária de coco is the logistics required to manage and allocate coconut waste to the place of its reuse of an economically viable form, which can be addressed by supporting nFederal Law 12,305 of 2010 with the implementation of an ERP platform for a reverse logistics more sustainable and economically viable.

Palavras-chave: Cocos núcifera L.; strategic basic research; production engineering.

| INTRODUCTION |

Coconut Tree grows best at altitudes below 1000 m and near the coastal regions, where the average temperature is between 23-34°C, with the absence of temperatures below 15°C and relative humidity between 60 and 90%. The annual precipitation must be greater than 1500mm, preferably distributed throughout the year. You can have growing in a variety of soils, provided that the soil has a good drainage (Carr, 2011).

Correct Summerhayes (2018), the coco was a major food crops of ancient populations of the western Pacific. Although fundamental to the success of colonization and sustainability of the peoples of the Pacific, its history is little known, and their presence recorded by only a handful of archaeologists.

Cocos nucifera L., long was exploited by people from the western Pacific, provided food, drink, oils, medicines and materials used for daily life for the manufacture of houses, kitchen utensils, carpets, canoes, sails for boats, ropes fans and baskets, just to mention some of their uses.

Considered a plant of multiple features, especially the range of products that can be exploited, has worldwide recognition as a vegetable resource vital for all humanity. It is pervasive in virtually all continents, being found between parallels 23°N and 23°S in over 200 different countries (FOALE; HARRIES, 2009) apud (MARTINS; JUNIOR, 2014).

Since its introduction in Brazil in the period after the Portuguese colonization, it was spread throughout the Brazilian territory, focusing mainly in coastal regions, North and Northeast. Currently, Brazil is the largest producer per hectare in the world and the fourth in the ranking of total production, bit the top of Sri Lanka.

Approximately 90% of the production of coconut in the world comes from small farmers with areas of up to 5 hectares, being practically, that this production is consumed internally, in producer countries. In Brazil, approximately 70% of the holding of coconut tree runs in properties up to 10 ha (SIQUEIRA; Aragon; TUPINAMBÁ, 2002) and MARTINS; JUNIOR, 2014).

The residual biomass generated by the production of coconut is a big problem, because the waste from the coco reaches 47% of production, represented primarily by the bark and bark powder (BACONGUIS, 2007). In coastal cities husks representing up to 80% of the garbage collected. Improper tank of this residue can cause bad smell, degrade the landscape, risk to the environment and contribute to the proliferation of insects and other transmitters of disease, and is burned without the proper control produces substances polluting the environment.

There are several works in the literature describing different ways of using the residues of coconut. It seeks through this a revision on the origin, production and alternatives for the use of residues of the coconut in the future projects.

| Materials and Methods |

This study is a survey of strategic basis, conducted through surveys of academic articles, by means of digital servers such as 'Google Scholar' and 'Scielo'.

Origins of wild coconut

The origin of the coco has left many perplexed, since Europeans first observed its presence of Madagascar to South America.

De Candolle, in his publication of 1885 Origin Of Fruits Plants discusses the arguments of the time, about a probable origin American or Asian. Argues that previously thought that the arguments in favor of Western Europe were the strongest. However, he said: 'Now, with more information and greater experience in similar issues, I am inclined to the idea of an origin in the Indian Archipelago'.

Carl Sauer in 1952 pointed out the debate regarding the origin and identification of coconut in Agricultural Origins and Dispersals. In 1968 at a symposium focused on pre-colubianos contacts, publishing later in 1971 in Man Across the Sea, Carl Sauer apud Summerhayes (2018) defends a multiple origin for the coconut, based on identification of multiple centers of geographical distribution of the plant through time. The identification of biogeographical centers was in fashion during this period and was based on the temporal and spatial distribution of species. These studies date back to the Russian botanist Vavilov in 1926 and his classic Studies on the Origins of Fruits Plants apud Summerhayes (2018) argued that the roots of a plant (domestic and wild) was where was the greatest genetic diversity of this. As School (2017), however, the area of origin is debate because the coconut trees have existed for a long time. Fossilized remnants dating back to the Miocene (23 - 5.3 million years ago) were found in the North Island, New Zealand, and small coconuts-type nuts in other areas of New Zealand dating to the eocene (56 - 36 million years ago), and Oligocene (36 - 26 million years ago). School in The Coconut: Treatment, Origins and Spread, also reports cocos-type nuts fossilized in India dating to the Late Cretaceous Period (76 - 62 million years ago). J.F. Rigby apud Summerhayes (2018), shows fossil deposits of coco-type fruit was identified in the city of chinchila, Australia, dating from the late Pliocene/ beginning of the

Pleistocene (5 - 1.5 million years), even as School (2017),the other was found in Colombia dating from the middle to the end of the Paleocene (65 - 55 million years ago).In accordance with Harries (1990 and 1991), the problem is that there is no continuous records of these findings. Harries, analyzing wild species, and taking the basis of biogeography, archeology and biology proposes its origin as being from somewhere in the southwest Pacific in fragmented continent of Lord Howe Rise to the complex of Norfolk Ridge, which has been submerged for 15 million years ago, and points to the origin of the coco households belonging to Malaysia- in the islands between the Southwest Asia and the western Pacific. As School (2017), others prefer an African origin/western Indian Ocean. Id. Chapter 8, discusses in detail the various stories give 'origin' of the coconut. Definitely, there is no consensus about the origin of the coconut, which were used for different types of data such as morphology and genetics.

Origin and genetics of domestic coconut

There is little doubt that the coco tamed was derived from the wild form by human selection before spread across the Pacific. The wild form can float and disperse over large areas, and the float to an island, they focus on the edge around the watermark. The mesocarp fibrous and thick of wild form allows you to float and a longer germination. Harris in 'the evolution' notes that these coconuts may germinate after 110 days 'floating (even more than 200 days)'. The issue of natural dispersal is influenced by how the coco is brought to the beach because the coconut will only survive if the seedling growth. (Allaby 2011) In Genes, Language and Culture History in the Southwest Pacific, observes that the wild form is adapted to the dispersion around the Oceania. Correct (HARRIES; BAUDOUIN; Gasthof Rössle, 2004), Harries (1978) and Allaby (2007) the domesticated form would be the result of human selection of shapes with thinner bark for later planting in the interior.

What is interesting is the idea of greater varieties in the remote islands of Oceania where what is called 'introgressiva HYBRIDIZATION" occurs when the domesticated form is brought to a group of islands containing only the wild form.

The genetic analysis of coconut adds a different dimension to the assessment of the origins of the coconut. Of interest is the observation of school in the coconut that says that the majority of more than 20 studies conducted at coco using techniques of molecular biology, were made, more in the nature of the test the suitability of various techniques and establish the priority of the author in using a particular technique.

Many different molecular techniques have been applied from RFLP (length polymorphism of restriction fragment polymorphism), AFLP (amplified fragment length) and microsatellite (SSR marked by sequence) for more advanced sequencing DNA, once it became more accessible. To Allaby in Origins of Plant Exploitation, up to the moment, molecular research is inconclusive, although they note that 'marcadores that distinguish varieties tonganesa FIJIAN and the rest of the Pacific, as well as specific markers for Papua New Guinea (PNG) using AFLP and simple sequence repeats. Allaby argues that 'the current genetic evidence generally favors an origin of Southwest Asia to the domesticated form of coconut', while acknowledging that the situation has become more complex as more 'phylogenetic-based techniques' were used. (Lebrun et al., 1998) and Allaby (2007) This actually proved to be the case. Although the first rflp data have been used to distinguish groups of African/ Pacific Ocean, this technique does not differentiate between the Oceania Next and Malaysia. Gunn, Baudouin and Olsen (2011) points out that more recent advances in DNA sequencing, with everything, confirms the thesis of two separate populations or subpopulations genetic:

The Pacific Ocean.

Indian and Atlantic ocean basins

Reports on the analysis of DNA from 1322 accessions of coco home (with unique identifiers within a database of DNA sequence) arising out of coconuts collected to represent the geographical and phenotypic diversity.

The results argue for two separate genetic subpopulations, indicating independent origins of cultivation of coconut. They observed that the coconut Pacific has 'ubestrutura', while 'the genetic traits that are more clearly associated with the selection under the human cultivation (habit of dwarf, pollination, and morphology of the fruit nui will)' emerged only in the Pacific. Of importance is the observation that those coconuts as 'mistura genetics' between the two subpopulations (Pacific And Indo-Atlântico) are found in the southwest Indian Ocean. They interpret this as 'consistent with human introductions of cocos Pacific along the ancient trade route linking austronésica Madagascar and Southwest Asia'. From this, then propose two geographic origins of cultivation of coco: Island of Southwest Asia and the margins of Africa in the Indian subcontinent.

As Summerhayes (2018), the problem with this interpretation is common to the majority of genetic data or DNA which were presented by scientists: the problem of 'equifinalidade', i.e., the possibility that two behaviors or different processes could lead to the same result. The term also has implications for the historians when different historical processes result in a similar outcome or social formation. The pattern shown by the DNA can be explained also by using other behavioral models. DNA data, when combined with archaeological data and palinológicos, empirically demonstrated the first evidence of the domestication of coconut in the western Pacific, with subsequent mixing with wild populations in other places. The oldest evidence, as demonstrated for any coco of south Asia is from the holocene medium (approximately 6 thousand years) in comparison with more than 20 thousand years to those found in the western Pacific.

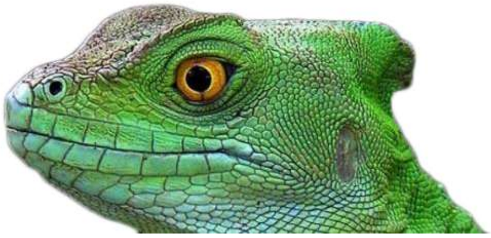
Acoording the Pereira et al. (2003) studying the extent of genetic diversity and genetic relationships between populations / 94 varieties of coco (51 43 Giants and dwarfs), representing the entire range of geographic distribution / cultivation of coconut, evaluates 12 pairs of microsatellite primers of coconut. observing a high level of genetic diversity in the collection with the genetic diversity average of 0.647 ± 0.139, with the average genetic diversity of Giants 0.703±0.125 and 0.374±0.204 of dwarves. The phenetic tree based on genetic distances of DAD regrouped all the 94 varieties / populations in two main groups, with one group comprising all the giants of South-East Asia, Pacific, west coast of Panama, and all the Dwarves and the other giants of South Asia, Africa and the Indian Ocean coast in Thailand. The distribution of alleles of dwarves highlighted a unique position of dwarf palm trees of the Philippines showing as much variation as the giant group. The grouping of all the Dwarves representing all the geographical distribution of the culture, with giants of East Asia and the Pacific, and the distribution of alleles among the giants and Dwarfs, suggest that the Dwarves originated from the giant forms, and also that of the giants of East Asia and the Pacific. Giants of the Pacific Islands registered the highest level of genetic diversity (0.6±0.26) with the largest number of alleles among all regions.

Cultivation in Brazil

The coconut palm does not exist in Brazil When discovered by the Portuguese in 1500. And the first references appear in the "Treaty Descriptive of Brazil," written by Gabriel Soares de Souza in 1587, which says: ''The palm trees that give the coconuts if you do well in Bahia, better than in India, because getting into a coconut beneath the earth, the palm tree that it is born gives coco at five and six years, and in India did not give these plants, fruits in twenty years" (Bondar, 1955) apud (SIQUEIRA; Aragon; TUPINAMBÁ, 2002).

Second Candolle (1885), 'the nut and coconut is abundant on the coast of hot regions of Asia, the islands south of the continent and in similar regions of Africa and America; but it can be said that she date in Brazil, in the West Indies and the west coast of Africa from an introduction that occurred approximately three centuries'. Floor And Marcgrafl seem to admit that the species is foreign to the Brazil without saying this so positive. Of Martius, who published a very important job on the PALMACEAE and travelled through the provinces of Bahia, Pernambuco and others, says: 'where the cocoa nourishes, does not say that it is wild.'

The coconut tree was introduced in Brazil in 1953 through the state of Bahia, hence the name coco-of-bay, with material from the island of Cape Verde. It is likely that has origin in India or Sri Lanka, which were introduced in Mozambique. After a few years, new introductions of coconut trees were carried out in countries such as Malaysia, Ivory Coast and others. From Bahia, the coconut trees spread along the coast of the Northeast, particularly by being a fruitful typical of tropical climate where found favorable conditions for cultivation, and subsequently ended up bringing in other regions of the country. In 1990, the cultivation of coconut was restricted to the Northern and Northeastern regions. In the present day, what is seen is the cultivation of coconut trees in almost all the Brazilian territory (MARTINS; JUNIOR, 2014).



Introduction of hybrid coconut palm in Brazil

As Siqueira, Aragon and Tupinambá (2002), hybridization is the intersection between genetically distinct individuals, and the choice of the parents, is made from the objectives of the activity to be developed.

From May 1938 to November 1951, José Pereira de Miranda Room has developed the first breeding program with coconut trees in Brazil, conducting surveys, autopolinizações and junctions, besides studying the floral biology and characterization of fruit.

Other crossing programs were and are being made from here in Brazil. We adopted worldwide methods of obtaining hybrids, based on combining ability among individuals and phenotypic selection for characters with high heritability. The process of hybridisation may be described as follows:

a) Introductions are made to obtain the maximum genetic variability;

b) Hybrids with different varieties and ecotypes are produced and evaluated in comparative tests. The best ones are reproduced for seed production.

Morphology and form

Based on the shape/morphology of coconut, HARRIES Disseminations in the evolution and Classification of EOLIAN NUCIFERA, in 1978, divided the coconuts in two types:

- The NIU kafa, comprising 'oblong fruits, triangular, with a large proportion of fibrous bark'.
- The NIU will, composed of rounded fruit, 'many times colored, with a large proportion of endosperm liquid'.

The use of the term niu to separate the two forms of coconut is defined by Harris based on linguistic diversity. Niu and its variations are argued Harris, the AUSTRONESIAN words for the coconut of Mali and to all areas of the Pacific. He noted that in isolated islands of rennell, Rotuma and Wallis, a variety of coco with high core and containing 600 - 700g of water was called niu will. The same name was used in a Toga, and Samoa. It was this variety that was used by the polynesians on their long journeys, almost certainly because the liquid content was greater than the niu kafa crumb, and the largest provided more sustenance. The variety niu kafa, on the other hand, he observed, was more resistant and thick. This bark, when prepared was ideal for uniting the canoes and ropes, because there rotted easily in sea water. On land, the braided rope of niu kafa connected the woods of homes and day be used for construction of fish traps, helmets and body armor. Harris says that the coconut naturally developed is the niu kafa and the 'coconut selected under cultivation' is the niu is going. (GUNN; BAUDOUIN; Olsen, 2011) the form niu kafa is seen as 'the most ancestral morphology reflecting the natural selection of oceanic dispersal', while the form niu vai is argued as the reflex 'da selection under the human cultivation'. Thus, it was domesticated coconut shell with its thinner and round, and with the largest fruit which was transported by humans in its colonization of the Oceania Remote.

Correct Gunn, Baudouin and Olsen (2011), the coconuts also have traditionally been classified in varieties "dwarf" and "gigantees" based on the habit of trees. 'Goblins' represent approximately 5% of coconut trees and are cultivated throughout the world; they are typically found near human habitation and feature traces closely associated to human selection: slow growth of the trunk, pollination and fruit production niu goes. The coconuts ' Giants ' Most common are crossing and growing faster than the 'Goblins', resulting in greater height in reproductive maturity. Many 'giants' are grown for the production of copra for extraction of oil and coconut fiber; although actively cultivated, these varieties do not have obvious traits of domestication of dwarves self-pollinators.

As Peace, Pedroza and Oliveira (2017) and other authors, the different species of domestic coconut, the coconut palm giant, the dwarf coconut and the hybrid has its aracterísticas distinct.

The hybrid, fruit of esspécies suparacitadas is characterized by the production of large fruits with higher production of water and pulp, producing early on average from the third year.

The giant coconut begins to florecer and produces fruit from the sixth year, and may reach up to 18 meters and fruit with varying sizes. Its cross pollination is, being a plant of easy adaptation to possess a period of reproduction that can last up to 60 years and with an annual production of 50 to 80 fruits.

The dwarf coconut grows about 10 m, is a plant pest, suscetivel suffers from lack of water, but possesses a large fruit with a greater quantity of pulp and water, with economic productivity of 40 years, production of 100 to 120 fruits per autopolimização annual and fertilization.

The species *Cocos nucifera L.*, common name California, presents the root system fasciculated characteristic of Monocotiledônias plants, has roots in primary, secondary and terceárias in a radius of 1m and depth of 0.2 to 0.6m. Being that the roots tercerárias produce radícolas with diameter of 1 to 3 mm, its stem type is not branched stipe, and resistant that secures their leaves protecting the terminal bud.

The bark of the green coconut and parts described as:

- Epicarp: outer layer("shell" of the fruit).
- The mesocarp: layer located between the epicarp and endocarp, part rich in fibers.
- The endocarp: (layer petraea) most internal that the epicarp, is the heckling dura that surrounds the seed possess carpelos where form the embryo.
- Albumen: (endosperm) nutritive tissue in the seed.

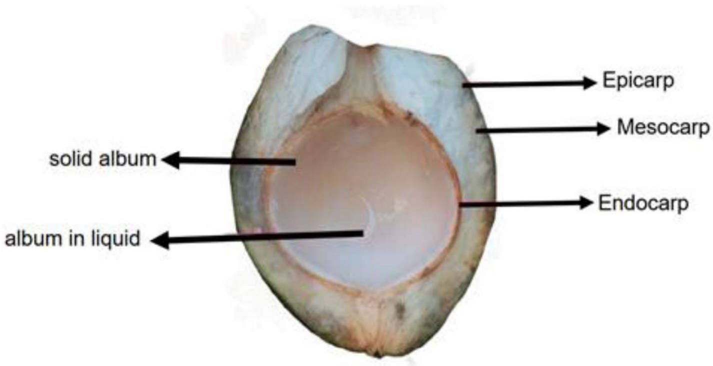


Figura 1: longitudinal coco, illustrating the respective parties

The fruit of coqueíro is composed of albumen liquid (coconut water), albumen, solid or almond, endorcarpo popularly known as "quengas" and the bark. The carbonized represents on average 57% of the fruit being composed by the mesocarp (fiber and dust) and epicarp (most external layer).

The ALBUMEN liquid is formed after 2 months of the inflorescence, reaching a volume of 300 to 600 ml and the with the ripening of the fruit occurs the formation of albumen, solid and liquid volume decreases.

The mesocarp is the fibrous material of fruit, which presents high elasticity and resistance to moisture and high climatic variations being formed of lignin and cellulose degradation slow.

Production of green coconut in the world and in Brazil

According to Martins and Junior (2014), its commercial exploitation that has occurred in approximately 90 countries, where are the largest plantations and best cultivation conditions such as soils, intense solar radiation, good humidity and rainfall well distributed. The coconut palm is considered a plant of multiple features, especially the range of products that can be exploited, gaining worldwide recognition as a vegetable resource vital for all humanity. It is pervasive in virtually all continents, being found between parallels 23°N and 23°S in over 200 different countries (FOALE; HARRIES, 2009) apud (MARTINS; JUNIOR, 2014).

The coconut is a culture typically tropical. Approximately 84% of the area planted with coconut trees in the world lies in tropical Asia, and the remaining 16% are in African countries, Latin America, Oceania and the Caribbean. The data in table 3 show the production of green coconut in major producing countries

Table 1: main producing countries.

Country	Cultivated Area (ha)	Production (t)	Yield (kg/ha)
Indonesia	3,260,015	18,983,378	58,231
Philippines	3,612,304	14,049,131	38,892
INDIA	2,081,000	11,469,837	55,117
Brazil	234,012	2,649,246	**108.629**
Sri Lanka	409,224	2,575,230	62,930
Vietnam	148,106	1,499,228	101,227
Papua New Guinea	204,763	1,202,792	58,741
Mexico	183,794	1,158,978	63,059
Thailand	119.00	895,000	46,615

Adapted from Faostat (2017)

Approximately 90% of the production of coconut in the world comes from small farmers with areas of up to 5 hectares, being that this production is almost consumed internally, in producer countries. In Brazil, approximately 70% of the holding of coconut tree runs in properties up to 10 ha (SIQUEIRA; Aragon; TUPINAMBÁ, 2002) and MARTINS; JUNIOR, 2014).

Brazil currently occupies the fourth position in the world ranking of production of green coconut, producing approximately 2.343 million tons in a harvested area a little higher to 215.6 thousand hectares (FAOSTAT, 2017).

The Brazilian production of coco is highlighted in the states of the northeast region. Table 4 brings the largest Brazilian producers according to the Indíce Brasileiro de Geografia e Estatísticas (Municipal Agricultural Production, 2014)

In total, were produced in Brazil 1,946,073 tonnes (WFP, 2014) in the year 2014 and 2,649,246 tons (FAOSTA, 2017). The state of Bahia is responsible for the greatest national production, contributing to more than 28% of national production. The state of Ceará is in second place, with almost 13% of national production. The brazilian northeast figure as a geopolitical region with greater production, totaling about 70% of production in Brazil.

According to Rosa et al (2002), 80% to 85% of the gross weight of the coconut is represented by shell, the remainder being the usable portion, understood by the albumen and coconut water. Comparing this data with the production of coconut for the year 2017 (FAOSTA, 2017), it can be estimated that are produced annually more than 50 million tonnes of waste (biomass). This is a huge amount of waste generated and should be administered in the correct way and with a view to energy production and conservation of the environment.

Import and export in Brazil

Although Brazil import predominantly dry coconut syrup, there are some initiatives of export of coconut, both fresh coconut water. In accordance with KIN (2010), from 2002 until 2006, there was an increase of 19% in exports of fresh coconut. The behavior of Brazilian export market over the years demonstrates a float. Situation also notes with the countries of destination of exports of Brazilian coconut, where the main ones are the Netherlands, Portugal Spain and the United States. The average for the period of 2005 to 2013 there is a volume of fruit exported around 200 thousand pounds of coco exported (Martins and Junior 2014).

Commercial use of the fruit

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Problems generated by biomass of coconut

The biomass generated by the production of coconut is a big problem and for Baconguis (2007), emphasizes that the waste industry of coco reaches the 47% of the production of coconut, being represented mainly by Shell and post the bark. In coastal cities, in accordance with Bitencourt & Pedrotti (2008), cited by Mota et al. (2015), the husks representing up to 80% of the garbage collected. Silveira (2008) mentions that the tank is inappropriate for this residue can cause bad smell, degrade the landscape, putting at risk the environment and contribute to the proliferation of mosquitoes other transmitters of disease. If burned without the proper control produces substances polluting the environment.

In accordance with the standard Agência Brasileira de Normas Técnicas (NBR 10004/1996), which provides for the classification of waste, the coconut husk (main solid waste generated in the production chain of coconut) fits as a residue class II (non inert waste, biodegradable or fuel). The cost of the provision of this type of material in landfills varies from R$ 60.00 to R$ 130.00 per tonne (FIESP, 2011).

Characterization of residual biomass

The fruit of the coconut tree is composed of albumen liquid (water-coconut), albumen, solid or almond, endocarp (popularly known as "quenga") and bark.

According to Rosa et al (2002), 80% to 85% of the gross weight of the coconut is represented by shell, the remainder being the usable portion, understood by the albumen and coconut water. The bark is composed of the mesocarp (fiber and dust) and epicarp (most external layer of husk) (ANEEL, 2002). The mesocarp of the fruit, consisting of approximately 30 % fiber and 70 % of powder, basically consists of lignin and cellulose of slow degradation, taking from eight to ten years to decomporem in nature. The EPICARP is generally used in the manufacture of jewelry, handbags and handicrafts (NUNES; SAINTS; SANTOS, 2007)

The coconut fiber is a lignocellulosic fiber obtained from the fibrous mesocarp of coconut, fruit of coconut (Cocos nucifera) grown extensively in the tropics (Ishizaki et al., 2006). The coconut fibers are composed mainly by Celulose (44%), hemicelluloses (12%) lignin (33%) and extractive (6%), 3 which makes this material an interesting raw material for the production of chemicals and/or biofuel of high added value, in the context of the call of lignocellulose biorefinery (RENCORET et al., 2013).

The lignin is an aromatic macromolecule, highly irregular in its constitution, amorphous, has elemental composition of carbon, hydrogen and oxygen. It is a polymer complex responsible for the formation of cell wall that has a high molecular weight and structural basis units phenyl-propane and is probably linked to the polysaccharides (polioses) of wood. The lignin has an important role in the transport of water, nutrients and metabolic disorders, being responsible for the mechanical resistance in plants. Cellulose is a polysaccharide of fibrous characteristic, located within the cells of plants. Presents empirical molecular formula (C6H11O).

The hemicellulose is composed of polymers of different units of sugars that form branched chains and short. It is responsible for about 25 to 35% of the composition of biomass and features numerous applications from bio-materials (films, fibers, biocompósitos), chemical products such as chemical additives to pharmaceutical products for the treatment of epidermal lesions, Peace, Pedroza and Oliveira (2017).

The following table provides a comparison between different types of lignocellulosic biomass:

Table 2: Chemical composition of different biomass.

Lignocellulosic Biomass	% Cellulose	% Hemicelluloses	% Lignin
Sugarcane Straw	40-44	30-32	22-25
Sugarcane Bagasse	32-48	19-24	23-32
Hardwood	43-47	25-35	16-24
Softwood	40-44	25-29	25-31
CornStalk	35	25	35
CornCob	45	35	15
Cotton	95	2	0,3
WheatStraw	30	50	15
Sisal	73,1	14,2	11
Rice Straw	43,3	26,4	16,3
CornStover	38-40	28	jul/21
CoconutFiber	36-43	0,15-0,25	41-45
Banana TreeFiber	60-65	06/ago	05/out
BarleyStraw	31-45	27-38	14-19
coconut fiber	44	11	33

Adapted Santos (2013).

Alternatives for the use of residues of coco

A circular economy is based on the principles of designing waste and pollution, keep products and materials in use and regenerate natural systems (FOUNDATION, 2020), thus to rethink the economic practices of the present society inspired by the functioning of nature itself. It is inseparable from innovation and design of products and systems. It includes a framework for sustainable development based on the principle of "close the life cycle" of products, allowing a reduction in the consumption of raw materials, energy and water. Promotes the development of new relations between the companies, which are to be both consumers and suppliers of materials that are re-incorporated into the productive cycle (LEITÃO, 2015).

In Brazil, the law No 594 of 24 December 1948 grants incentives to the use of coconut fiber. Any business legally established for industrial exploitation of fiber, with the use of national raw material, has exemption from import tax and customs duties. To enjoy the benefits, companies will be obliged to undergo prior to examination and approval by the Ministry of Labor, Industry and Commerce all plans, allow the visits of students of certain courses, when accompanied by teachers and does not entail disruption of service among other obligations.

Some researchers, as well as organs, are studying ways to employ the biomass of green coconut (epicarp, mesocarp and endocarp) in the correct way, without harming the environment.

There are several ways to reuse this residue, by means of grinding the bark for the removal of dust and fiber, which can be used in the manufacture of various industrial byproducts, agricultural, craft and even generate energy, adding value and reducing the accumulation of cocos discarded (GONÇALVES, 2019), the options ranging from the production of artisan objects, Making memories, use of natural fiber filters, renewable energy production, manufacture of briquettes, among others (Mota et al., 2015).

The following table provides various possibilities of using this residue considering its parts:

Table 3. Possibilities for use of waste.

Part of the biomass	Destination for biomass	Bibliographic reference
The endocarp	Material of pyrolysis for charcoal production	Andrade et al (2004)
The mesocarp	Removal of reactive dye gray BF-2R	Rocha et al (2012)
Fiber	Agricultural substrate	Carrijo, Liz & makishima (2002)
	Material of pyrolysis for charcoal production	Andrade et al (2004)
	Application in composite materials	Leo (2012)
	Activated charcoal	Macedo (2005)
	Use in asphaltic mix	Vale (2007)
	Production of screens and webs	
	Soil protection	
	Production of paper	
	Environmentally sound materials for civil construction	
	Cooling of photovoltaic plates	(Rajasekar, Prasannaa and Mario, 2019)
	Complementation of animal feed	Vale (2007)
Shell	Production of bio-oil	Mota et al. (2015)
	Charcoal	
	Fuel gas	
	Charcoal	Vale; Barroso; quirinius (2004)
	Chips or chips	Lopes; Brito; Moura (2016)
	Coal	Baconguis (2007)
	Ethanol from 2ªgeração	(RAMALHO; GUARIEIRO; VIEIRA, 2016)
Bark powder	Sorbent material for the detoxification of industrial effluents	Pin (2005)
Bark powder	Bio-oil	Figueiredo (2011)
Bark powder	Agricultural substrate	Rosa et al (2002)
Bark powder	Bioadsorbente material of low cost for treatment of industrial effluents contaminated with toxic metals	Sousa et al (2007)

| FINAL COMMENTS |

Logistics being seen as the flow of materials from production to consumption, there is a need for reverse logistics of consumption for reuse. After reaching the final consumer, the product may move up to three different destinations:

- Go to a safe disposal, such as location of sanitary landfill and specific deposits.
- A destination insecure, being discarded in nature (polluting the environment).
- Or, return to a reverse distribution chain (faé et al., 2006).

Reverse logistics of the shell of coconut is not new. The coconut producing families in small properties dry the residue and place them on the inside of the stove the firewood to produce energy. Business opportunities are promoted through creative projects to ensure best use of resources that are consumed (GONÇALVES, 2019). The main obstacle to biorrefinária de coco is the logistics required to manage and allocate coconut waste on a large scale to the place of its reuse of an economically viable (BECKER et al., 2016); (LOPES, 2018). However, Federal Law 12,305 of 2010, provides for the restructuring of the management systems and management of municipal solid waste, implementing technologies for recovery and treatment of waste. However, the Brazilian federal law no. 12,305, of 2010, provides for the restructuring of the management systems and solid waste management, implementing technologies for recovery and treatment of waste. In this case, to support the restructuring of the management of waste, in particular the solid waste from coconut, the need and possibility of implementation of collection is required for the solid waste collection may occur correct and separately (at least in two fractions: wet and dry) according to their characteristics (BECKER et al., 2016). Lim (2011), discusses the viability of employing with empirical evidence (ERP) for the practice of a logistics and supply chain more sustainable, in an effort to reduce the environmental impact and, at the same time, reduce logistics costs and the costs of production, noting that companies can gain a competitive advantage with the use of ERP platform, with a better management of the resources of the company. Enterprise Resource Planning (ERP) is presented as a solution for a cleaner and more sustainable in terms of logistics strategy and supply chain management through the integration of all business functions together with the help of ICT (Information and Communication Technologies) for a more transparent and efficient exchange of data and instructions. It is therefore concluded that the logistical challenge of redirecting the residual biomass in Brazil can be addressed by implementing strategies supported in federal law 12,305 together with a logistics platform ERP, developing a system more sustainable.

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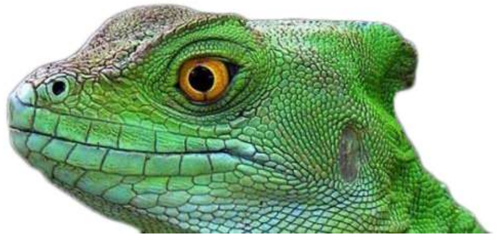

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