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PRODUCTION PROCESS OF COIR AND COIR PRODUCTS

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ABSTRACT

Coir or Cocos - Nature's wonder fibre is extracted from the protective husk of the coconut. This golden fibre is spun in a breath - taking range of textured yarn and woven into a spectrum of colorful floor covering.

The husks separated from the nuts are retted in lagoons up to ten months. The retted husks are then beaten with wooden mallets manually to produce the golden fibre. The fibre is later spun into yarn on traditional spinning wheels called "Ratts", ready for dyeing and weaving into myriad shades of floor coverings. A score of varieties/grades of coir yarn are produced and each variety is associated with certain specific characteristics, used for industrial, agricultural and domestic applications.

KEYWORDS: Coir Industry, Golden Fibre, Management

INTRODUCTION

The starting point of the industry is the process of de-husking after harvesting of the mature coconut crop. Coir fibers are extracted from the husks surrounding the coconut.

In most areas coir is a by-product of copra production, and the husks are left on the fields as mulch or used as fertilizer due to high potash content.

For production of light colored fibre of spinnable quality green husk of 10 to 12 months old coconuts is ideally suitable. India and Sri Lanka are the main areas where the fibres from the husk (termed 'coir') are extracted by traditional methods for the commercial production of a variety of products (brushes and brooms, ropes and yarns for nets and bags and mats and padding for mattresses). However, worldwide, only a small part of the fibres available are currently used for these purposes.

Coir

What is commonly called a coconut, as found in grocery stores, is actually only the single seed of a fruit of the coconut palm tree (Cocosnucifera). Before being shipped to market, the seed is stripped of an external leathery skin and a 2-3 in (5-8 cm) thick intermediate layer of fibrous pulp. Fibers recovered from that pulp are called coir. The fibers range from sturdy strands suitable for brush bristles to filaments that can be spun into coarse, durable yarn. In the United States, the most popular uses for coir are bristly door mats, agricultural twine, and geotextiles (blankets that are laid on bare soil to control erosion and promote the growth of protective ground covers).

Coir fibers are categorized in two ways. One distinction is based on whether they are recovered from ripe or immature coconut husks. The husks of fully ripened coconuts yield brown coir. Strong and highly resistant to abrasion, its method of processing also protects it from the damaging ultraviolet component of sunlight. Dark brown in colour, it is used

primarily in brushes, floor mats, and upholstery padding. On the other hand, white coir comes from the husks of coconuts harvested shortly before they ripen. Actually light brown or white in color, this fiber is softer and less strong than brown coir. It is usually spun into yarn, which may be woven into mats or twisted into twine or rope.

The other method of categorization is based on fiber length. Both brown and white coir consist of fibers ranging in length from 4-12 in (10-30 cm). Those that are at least 8 in (20 cm) long are called bristle fiber. Shorter fibers, which are also finer in texture, are called mattress fiber. A 10-oz (300-g) coconut husk yields about 3 oz (80 g) of fiber, one-third of which is bristle fiber.

The only natural fiber resistant to salt water, coir is used to make nets for shellfish harvesting and ropes for marine applications. Highly resistant to abrasion, coir fibers are used to make durable floor mats and brushes. Strong and nearly impervious to the weather, coir twine is the material hops growers in the United States prefer for tying their vines to supports. Coir is becoming a popular choice for making geotextiles because of its durability, eventual biodegrade-ability, ability to hold water, and hairy texture (which helps it cling to seeds and soil).

History

Palm trees belong to one of the world's oldest plant families, and coconut palms have been cultivated for at least 4,000 years. In Sanskrit, the precursor of the modern languages of Hindi and Urdu, the coconut palm was called "the tree that provides all the necessities of life." In fact, it is one of the world's most useful trees, providing food, drink, fibers, fuel, and building material. Coconut fruits are very hardy; they can even float in the ocean for great distances and still remain viable.

About A.D. 60, a Greek sailor wrote about a coconut-producing East African village, probably on the coast of present-day Tanzania, whose boats were made of planks sewn together with fibers. By the eleventh century, Arab traders (whose route stretched from China to Madagascar off the south-eastern shore of Africa) were teaching residents of what are now Sri Lanka and India how to extract and process coconut fibers. During the thirteenth century, Marco Polo—while visiting the port of Hormuz on the Persian Gulf—discovered that the masterful Arab seamen built their ships without nails, sewing them together with coconut fiber. In China, Polo found that the Chinese had been using coconut fiber for 500 years.

Halfway around the world, coir also played a significant role in the exploration of Micronesia and Polynesia, where the product is commonly called sennit. For example, early settlers of Hawaii arrived from the Marquesas Islands around the fifth century in a large, double-hulled canoe lashed together with coconut fiber. In fact, sennit lashings were the primary mechanism for connecting pieces to construct boats, buildings, weapons, and tools until European explorers brought iron nails to the region in the late eighteenth century.

Coir production changed little until efforts to mechanize it began in the middle of the twentieth century. In India, a defibering machine was invented in 1950. Coir processing is an important economic activity in India, where it provides jobs for more than 500,000 people. Because mechanization would eliminate a significant number of those jobs, it is being introduced gradually. In 1980, the primary producing countries of India and Sri Lanka began an ongoing effort to identify and correct technological limitations on coir production.

Raw Materials

Coconut palms flower monthly. Because it takes a year for the fruit to ripen, a tree always contains fruits at 12 stages of maturity. Harvesting usually take place on a 45-60 day cycle, with each tree yielding 50-100 coconuts per year.

Fresh water is used to process brown coir, while sea water and fresh water are both used in the production of white coir. In 2000, researchers announced that adding a broth containing a certain combination of 10 anaerobic (living without oxygen) bacteria to salt water can dramatically hasten the fiber extraction process without seriously degrading product quality.

In Europe and Asia, brown coir mats may be sprayed with latex rubber for use as padding in mattresses or automobile upholstery.

MANUFACTURING PROCESS

Harvesting and Husking

- 1 Coconuts that have ripened and fallen from the tree may simply be picked up offthe ground. Coconuts still clinging to the 40-100 ft (12-30 m) tall trees are harvested by human climbers. If the climber picks the fruit by hand, he can harvest fruits from about 25 trees in a day. If the climber uses a bamboo pole with a knife attached to the end to reach through the treetop vegetation and cut selected coconuts loose, he can harvest 250 trees per day. (A third harvesting technique, in which trained monkeys climb trees to pick ripe coconuts, is used only in countries that produce little commercial coir.)
- 2 ripe coconuts are husked immediately, but unripe coconuts may be seasoned for a month by spreading them in a single layer on the ground and keeping them dry. To remove the fruit from the seed, the coconut is impaled on a steel-tipped spike to split the husk. The pulp layer is easily peeled off. A skilled husker can manually split and peel about 2,000 coconuts per day. Modern husking machines can process 2,000 coconuts per hour.

Retting

Retting is a curing process during which the husks are kept in an environment that encourages the action of naturally occurring microbes. This action partially decomposes the husk's pulp, allowing it to be separated into coir fibers and a residue called coir pith. Freshwater retting is used for fully ripe coconut husks, and saltwater retting is used for green husks.

- For freshwater retting, ripe husks are buried in pits dug along riverbanks, immersed in water-filled concrete tanks, or suspended by nets in a river and weighted to keep them submerged. The husks typically soak at least six months.
- For saltwater retting, green husks are soaked in seawater or artificially salinated fresh water. Often this is accomplished by placing them in pits along riverbanks near the ocean, where tidal action alternately covers them with sea water and rinses them with river water. Saltwater retting usually takes eight to 10 months, although adding the proper bacteria to the water can shorten the retting period to a few days.
- Mechanical techniques have recently been developed to hasten or eliminate retting. Ripe husks can be processed in crushing machines after being retted for only seven to 10 days. Immature husks can be dry milled without any

retting. After passing through the crushing machine, these green husks need only be dampened with water or soaked one to two days before proceeding to the defibering step. Dry milling produces only mattress fiber.

Defibering

- Traditionally, workers beat the retted pulp with wooden mallets to separate the fibers from the pith and the outer skin. In recent years, motorized machines have been developed with flat beater arms operating inside steel drums. Separation of the bristle fibers is accomplished by hand or in a machine consisting of a rotating drum fitted with steel spikes.
- Separation of the mattress fibers from the pith is completed by washing the residue from the defibering process and combing through it by hand or tumbling it in a perforated drum or sieve. (Saltwater retting produces only mattress fibers.)
- The clean fibers are spread loosely on the ground to dry in the sun.

Finishing

- Bristle fibers that will not immediately be further processed are rolled and tied into loose bundles for storage or shipment. More mechanized producers may use a hydraulic press to create compact bales.
- Similarly, mattress fibers may simply be baled with a hydraulic press. However, if more processing is desired, the fibers are combed with mechanical or manual carding tools, then loosely twisted into a thick yarn (wick), and wound into bundles. Later, the wick can be re-spun into a finer yarn. Techniques vary from simple hand spinning to use of a hand-operated spinning wheel or a fully automated spinning machine.
- Depending on its intended final use, the yarn may be shipped to customers, or multiple strands may be twisted into twine and bundled for shipment. Both traditional manual techniques and newer mechanical methods are used to braid twine into rope and to weave yarn into mats or nets.
- For some uses, such as upholstery padding, bristle fiber is loosely spun into yarn and allowed to rest. Then the fibers, which have become curly, are separated. These fibers are lightly felted into mats that are sprayed with latex rubber, dried, and vulcanized (heat treated with sulphur).

Type of Coir Products Production Process

Coir Fibre

Coir seed-hair fibre obtained from the outer shell, or husk, of the coconut with orwithout retting. The processed fibres, ranging from about 4 to 12 inches (10 to 30 centimetres) in length, are light in weight, brittle, strong, and elastic, with a tendency to curl. They are resistant to abrasion and can be dyed. They are used to make brushes, are woven into matting, and are spun into yarns for marine cordage and fishnets.

Coir Yarn

Coir Yarn is generally of 2 ply, spun from coir fibre by hand as well as with the help of traditional rates, fully automatic spinning machines etc. Coir yarn is the raw material for the manufacture of a whole range of coir products. Today coir yarn is available in a range of colours that make them ideal for use in versatile applications.

Coir Ropes

Coir rope-making is a common cottage industry in India. The Coconut fibre is attached to hooks on a wheel that is turned by hand. This twists the coir while more is added. It forms a strong rope that doesn't unwind or break. Among the natural fibre, coir has some unique characteristic particularly its rigidity, durability and friction.

The number of strands required for a strand of rope is determined by the diameter of the strand and the fineness of the yarn used. The diameter of the strand is in turn determined by the diameter of the rope and number of the strands constituting the rope. Therefore, by varying the number of yarns in the strand and the number of the strands, rope of any size can be made.

Coir Mats

Coir Mats are made on handlooms, power looms or frames and with or without brush. It is available in a range of colours, sizes and designs. The brushing qualities of coir doormats and their ability to keep the dirt away make the product a unique one. Mats are available in plain, natural and bleached, available with woven or stencilled designs and bevelled patterns for use in interior or exterior door fronts.

Coir Matting

Coir Matting is primarily used as a floor furnishing material. It is widely used in exhibition and fairs as a temporary but neat and elegant floor coverings. Because of its sound deadening characteristics, it is being used on a large scale for furnishing stairs, corridors, and auditorium and cinema halls. A wide range of attractive designs and colours as well as quality makes it a favourite item for interior decorators.

Coir Tiles

Mattings are cut, rubberised and finished with narrow straight edges, enabling it to be laid together to form tiles. Coir Tiles have inherent strength for durability and strength as it is made out of the strong fibres of coconut husks. Strong and eco-friendly Coir Tiles come in innovative designs so that it can make the floors look classy.

Coir Mattings for Cricket Pitches

The coir mattings for cricket pitches are special type of matting. It may be provided with canvas or leather bindings at the 2 ends. It is used to cover the Pitch to protect it from the adverse effects of Rain, Moisture, Storm and other Natural Factors. It is durable and requires low maintenance.

Coir Rugs

Coir Mattings cut to specified length, and suitably finished are marketed as ‘Coir Rugs’. Coir rugs are available in plain natural colour of the fibre, or in different shades, in woven patterns or printed designs. Rugs of various sizes with attractive designs are specially produced for overseas markets.

Coir Mourzouk

A carpet in coir trade is called as mourzouk. Coir Mourzouks are usually manufactured in a variety of sizes and patterns. They are mostly used for furnishing a selected area either at the centre of the room or any part of where generally the other portion might have furnished by other type of furnishing materials. They are also used for all-round furnishing.

Coir Belts

Coir belts are mainly used for driving machines and as conveyer belts.

Coir Mattings for Roof Surface Cooling

Cooling of buildings by Roof Surface Evaporation is an established technology. It is an effective, simple, economical and environment friendly method of improving the indoor thermal conditions and reducing the capital and running cost of air-conditioning in the order of 60% and 30% respectively, under hot-Dry conditions.

Acoustic Barriers

Coir is being used as a noise prevention solution in homes located along highways and other high-traffic roads, in offices and around sporting arenas in Netherlands. This is also used for making stylish compound walls and garden landscaping.

Coir Geotextiles

Coir geotextile is a permeable textile fabric in geotechnical engineering to prevent the soil from migrating while maintaining the water flow. Its role is to protect and promote vegetarian cover during its formative period after which it degrades over a period of time and mixes with the soil providing for valuable nutrients.

Cocologs

They are non-woven, made from coir fibre bunches under pressed condition in tubular enclosures of knotted coir yarn. Cocologs are mainly used for vulnerable streams, rivers or Lake Bank to protect scour. For high embankment areas with a variable water level, several Cocolog can be applied as stack.

Coir Fibre Beds (Coco-Beds)

Coco-beds are made from coir fibre and coir geo textiles. Coir fibre is sand witched between two coir geo textiles and stitched together to form a bed or pouch. Steep stream banks can be covered with pre planted Coco-beds. Sediments will be collected and held in Coco-beds, which will help plant growth and purify water to a certain extent.

Coir Composite Boards

Coir composites Panels can be made using coir as reinforcing material with or without plantation timber (veneers like rubber, bamboo, jute, glass) in between as a secondary reinforcement and then infused with polymeric matrix material like phenolic, polyester, epoxy, etc., and then processed under controlled temperature and pressure. Coir fibre composites has several advantages such as light weight, unbreakable, non-corrosive, water resistant, durable and affordable. Coir composites are highly suitable for building and construction for door, window panelling, furniture and other joinery work and transportation application for cost-effective replacement to wood and timber.

Coir Fenders

Coir fenders are commonly made in spherical, cylindrical or ring shapes. Fenders are made in the required shape from coir yarn, rope, or fibre tied together tightly. Coir rope knotted to form the outer shell by traditional knotting technique available in different diameters.

CONCLUSIONS

Although some additional mechanisation has been introduced for fibre extraction, and novel accelerated retting technologies have recently been shown to offer substantial improvements over existing practices, the general approach to existing systems of production remain unchanged. Retting continues to pollute surface waters, and working conditions for people remain unhealthy. Existing mechanical defibration procedures and equipment are extremely dangerous, even for skilled workers, and fingers and hands continue to be lost. People, however, continue to work with this equipment within antiquated industrial systems.

Costs of alternative technologies are high, and have generally not been introduced. R&D costs are equally high, and funds are difficult to raise for this traditional fibre commodity, since earnings from fibre production remain marginal. The majority of fibre producers operate on a small-scale at a village level and are unable to contribute towards the costs of

R&D programmes. The public sector may need to provide for industrial continuity, and also to encourage traders and others to develop and exploit novel markets that could provide a measure of security for smallholders and small-scale processors.

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