



COIR IN A NUTSHELL

Produced by Gero Leson for Fiber Futures

Picture coir as a naturally-made reinforcement fiber designed to cushion the blow when coconuts drop. Serving as the protective husk, coir [koi(-&)r] or coconut fiber is the coarse, stiff outside fiber extracted from the husk of coconuts. Measured by global production and trade volume by the Food and Agriculture Organization of the UN (FAO), coir by far dominates other “hard fibers”, such as sisal and abaca.

In the husk, coir weighs about 300 grams and is interwoven with the soft, peat moss-like coir pith in a 1:2 weight ratio; the resulting “cushion” is covered by a thin glossy skin. Coir stands apart from other natural fibers in several ways:

- It is the thickest, stiffest and most resilient of all commercial natural fibers,
- Its cellular structure makes it weaker and more elastic than other natural fibers,
- The cell walls of fiber and pith contain more lignin than any other commercially relevant natural fiber, including wood. Lignin is a natural polymer, which adds strength and elasticity to the cellulose-based fiber walls. Since lignin resists biodegradation, a high lignin content also imparts longevity to outdoor applications.



Coir's properties have made it the fiber of choice for several uses:

- General-purpose **twine and rope** in producing countries, where these products are a common sight in roadside stalls. In importing countries they are used in home gardening and commercial horticulture, e.g., in the hops growing regions of the U.S.
- **Brooms and brushes**: from hand brushes to the metal wire twisted tawashi brushes used in the kitchen, this sector is another area where the stiffness and durability of coir make it a natural choice with limited competition, even by synthetics.
- Indestructible, scrubby, and increasingly stylish **doormats** and a wide range of designs of durable **rugs**. No other natural fiber makes better doormats yet synthetics always loom as a competitor. On the interior front, rugs from pure coir are losing ground, because of their very scrubbiness. Manufacturers try to maintain a role for coir by offering softer rugs made from blends of coir and other tropical fibers, such as sisal and jute, in a range of designs.
- **Mattresses, upholstery**, car seats, often as non-woven mats sprayed with natural latex (rubberized coir). Much of this market was lost in Western countries once the more consistent and lighter expanded foams became widely available. In India and China, particularly the demand for more "sleeping comfort" has reignited that market and car-seat covers are still found in several high-end European car models. Rubberized coir is also making inroads as durable flowerpots.

Coir's properties and the global trend towards natural fibers in technical applications has created other uses: slowly degradable erosion control blankets and nets for slope protection as well as stuffed coir logs for bank support. Several European firms are testing whether coir can play a role in the growing automotive market for "biocomposites" or as thermal insulation in home construction. Since the early 1990s, coir pith, which used to be an annoying waste, is emerging in horticulture as a durable, highly water sorbent and environmentally friendly replacement for peat moss. These trends in existing and emerging markets are indicators that

the global coir industry has the potential to achieve sustainable growth – with the resulting local and global benefits.

Global Trade of Coir

Currently, the global annual production of coir fiber is about 350,000 metric tons (MT). Yet, even in the world's top two producers, India and Sri Lanka, which account for about 90% of global coir fiber production, combined, this renewable resource is underutilized; local coir mills process only a fraction of the available husks, which accrue more or less year round as a waste during coconut processing.

Traditional uses for the resilient and durable coir fiber include rope and twine, brooms and brushes, doormats, rugs, mattresses and other upholstery, often in the form of rubberized coir pads. In the 1980s and 90s, global exports of coir fiber fell by almost half, as Western consumers shifted to synthetic foam and fibers. Then, since 1990, rapidly growing domestic demand in India more than doubled global production benefiting exclusively the Indian coir industry. Finally, since 2001, a rising Chinese demand for coir, an expanding market for coir-based erosion control products, and the spread of coir pith as a peat moss substitute in horticulture has further pushed up global production and prices. In turn, other coconut growing countries, including Philippines, Thailand and Vietnam are now expanding their production and export of coir fiber.

These changes are also reflected in the international trade in coir. Historically, Sri Lanka had been the world's largest exporter of various fiber grades, whereas India exports largely value added products – yarn, mats, and rugs. While in 1990 about 80% of global production was exported, growth of the Indian domestic market dropped that rate to below 40%. Global trade volume for coir fiber, value added products – yarn, mats, rugs – and coir pith now stands at about \$140 million per year with India and Sri Lanka respectively accounting for about \$70 and \$60 million of that amount.

This may not seem much but in the coconut regions of producing countries coir is an important economic factor. In Sri Lanka, coir related exports account for 6% of agricultural exports, over 1% of all exports and 0.35% of GDP. Moreover, coir milling and value addition, mostly spinning and weaving, are important regional employers, particularly in rural Southern India and coastal Sri Lanka. They give work to 500,000+ people, many of them women working part-time. Yet, working conditions and productivity are generally poor. The challenge for industry is to sustainably expand markets for this versatile renewable resource while maintaining its role as employer for the rural poor. This may require producers to innovate production, improve product consistency, and in particular develop novel applications – jointly with their customers in importing countries. Businesses, public agencies and research institutes are now addressing this challenge in multilateral projects worldwide – setting examples that global trade can be beneficial to all parties involved.

Production and Processing: Small-scale rural industry



From picking and dehusking of the coconut through fiber extraction to rug weaving and mattress production: coir production and processing is a complex process and, with current technology, most steps are labor intensive. Nut pickers climb trees or use bamboo picks, the nuts are dehusked manually, using a metal spike. At the fiber mills, the half-husks are soaked with water or “retted” in a pond or backwaters for weeks or even months to soften the fiber through bacterial action. Next, one of several methods is used to clean the fiber from adhering pith and husk pieces. The husk may be beaten with a mallet, although this method is rarely used anymore, held against rotating needle drums, or mechanically cleaned in decorticators or defibrators. Each method produces various grades of fiber, with “mattress fiber” being the most common and least valuable grade. The cleaner “bristle fiber”, which comes in the parallel hanks needed for brooms and brushes, requires even more steps and also fetches a considerable premium. Formerly a waste stream, coir pith is now also collected, dried and pressed into bricks and bales as valuable horticultural product.



The cleaned fiber is screened, spread out in the mill yard to dry, picked up, baled, and shipped. Next, the fiber is spun by hand or machine into yarn and twine. Some fiber is also twisted

mechanically into strands; this twisted fiber is used in rubberized coir products, such as car seats and mattresses. Yarns are then woven or tufted into rugs and mats. Much of that work is done in small cottage operations near homes or coops. Some mats, rugs, and geotextiles are made on semi-automatic looms in factories, while rubberized coir pads and coir pith bricks and bales are virtually always made in factories or mills. At the end of the value chain are usually integrated manufacturers/exporters, which control quality, package and ship fiber, and finished goods.

A typical coir mill may employ 20-40 people working 1-2 shifts. Mills are usually family owned and in close proximity to coconut estates, i.e., in rural settings. Labor comes from nearby, many are women augmenting family income through part-time work, sometimes bringing their children with them. Fiber mills are dusty places with little to no environmental controls and safety measures. Finding younger male workers for the poorly paid work becomes increasingly difficult. Yet, for many rural poor, working in coir is the only employment option close to home. And while jobs in apparel factories, if accessible, may pay better wages, offer uniforms, sometimes even air-conditioning, many women who work in mills or spin, weave and tuft in cooperatives seem to prefer jobs at coir processing facilities because of the flexible schedules and relaxed pace.



Opportunities and Challenges

The future of coir as a renewable resource, which provides work to the rural poor and important export revenue, depends on numerous factors. Booming economies in China and elsewhere, which strain petroleum and mineral resources, also seem to grow the demand for coir. Since China does not have a coir industry to speak of, established producers in India and Sri Lanka and newcomers in other Asian countries stand to benefit. The trend in the West towards natural fibers in adapted technical applications, where they provide technical, economic, and environmental advantages also offers market opportunities. In all relevant producer countries, industry is forming associations and, with the support from their governments and international organizations, conducts joint product and market research on coir – a key to growing the market. One example is the coir R&D projects co-funded by the Common Fund for Commodities (<http://www.common-fund.org/>). The CFC is an autonomous, intergovernmental organization,

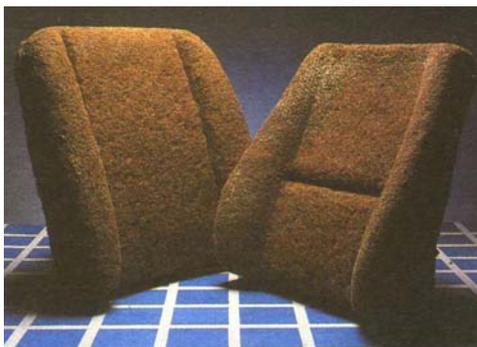
with a mandate to enhance the socio-economic development of commodity producers. It coordinates its coir projects with the FAO's Intergovernmental Group on Hard Fibres, which also periodically provides statistical information on coir, sisal, jute and abaca (http://www.fao.org/es/esc/en/20953/21005/21524/highlight_28807en.html).

Yet, there are numerous challenges to a sustainable growth of the coir industry. Customers increasingly require a more consistent fiber, yarn, and finished product. In some applications, such as high-end car seats, quality and consistency of coir-based products are crucial to the survival over competing synthetic products. However, producing countries are removed from the end user in several respects. Differences in language and communication culture, little direct interaction between producer and user and a lack of understanding of the conditions and needs in the partner country invariably hamper innovation. Most coir mills and even factories are lacking capital to upgrade their equipment. Labor culture in producing countries does generally not encourage participation and innovation by staff. So while the steps that must be taken to grow the coir industry appear obvious, there is much need to also grow cooperation between all parties involved and to implement several priority action items:

- Make fiber milling processes more efficient, controlled and consistent,
- Train staff and provide incentives for participation in process and quality control,
- Enhance cooperation between producing and user countries to resolve quality problems, and develop and test concepts for new products,
- Create visibility for coir and coir pith as beneficial renewable resources, which can be superior to fossil or mineral resources – if processed properly and used imaginatively.

Showcases and Projects

Car Seats and Composites



Rubberized coir used to be the material of choice for car seats, but largely lost out to competition from synthetic foams. Yet, the remaining use of coir in several high-end European car models is an example of how

natural fiber products can stay competitive – and possibly regain ground. Even when compared to high-end foams, seat covers from rubberized coir provide better feel and support. Manufacturing these covers used to be a multi-step labor-intensive process, but in 2000/2001 two major German automotive suppliers jointly developed a novel one step injection process offering shorter cycling times, higher productivity, more consistent quality and, ultimately, lower production cost. The process requires that the used twisted coir fiber is virtually free of husk pieces and very consistent in the weight per length of twisted strand. Achieving this quality has taken much cooperation between the fiber exporters and

users. Development and industrial implementation of this process is a good example of how technological innovation may keep and improve an existing application for natural fibers – possibly extend its benefits to other uses.

Aside from this limited use of coir in car seats, the European automotive industry has become a key user of natural fibers, such as flax and hemp, in composites, where they replace wood or fiberglass. What drives this trend? Natural fiber composites can be lighter and less expensive than their competitors. In accidents, their edges are less prone to injury and their use of a renewable resource provides environmental benefits during production, use, and disposal. So far, coir has not been used in these applications. However, several research and commercial projects are now investigating whether coir's unusual properties – high lignin content and elasticity – combined with its comparatively low price could open up new applications in that growth market.

The return of coir pith



Since the inception of the coir industry in India and Sri Lanka in the 1860s, the corky pith and the finer dust had been considered a nuisance and disposal problem with little beneficial uses. Over the decades, handsome pith mountains gradually grew in the countryside around coir mills. That the

peat moss like material makes a good potting soil ingredient was known since the early 1900s, but only in the late 80s did exporters in tropical countries and customers in Europe realize that this material had desirable horticultural properties and could replace the non-renewable resource peat. Its high compressibility helped since it could be shipped overseas at reasonable cost. Initially, demand for coir pith grew fast and it made inroads into domestic and commercial horticulture. Unfortunately, quality control didn't keep up with demand. While the high salt content in pith had been leached out from the originally "mined" mounds over time, more recent product had high salt content and caused some crop failure. At the same time, low-cost peat from the Baltics and Canada created stiff competition. Through improved quality control and more aggressive marketing, pith exporters are now regaining export volume. At the same time, pith sales have become crucial to the economic survival of many mills since the slow past growth in fiber price were insufficient to balance growing labor cost.

China – not just oil and metals

In recent years, the rapidly growing Chinese economy has shown an enormous appetite for oil and mineral resources, thus pushing up global demand and prices for coir. It is less known that China has also discovered coir as a versatile fiber, which serves a less glamorous need of its population: more comfortable bedding. Since 2001, China has significantly increased its imports of mattress fiber. Much of it gets crudely stuffed into mattresses, but China has also

set up factories to produce the even softer rubberized coir mattresses. As a result, FOB prices for mattress fiber in Sri Lanka have increased by more than 25% since early 2002, after decades of very little increase in nominal prices. This boost has visibly helped Sri Lankan coir mills to improve profitability, invest in advanced processes and allow them to raise wages at least enough to compensate for inflation – a serious concern in many Asian countries.

Will this trend be sustainable? Although difficult to predict, as more Asian countries go into coir production, overcapacity may drag prices down. China may also ultimately develop its own coir industry or follow the example set by the West, i.e., switch to synthetic foams. At least current Chinese demand for coir creates a medium-term opportunity for the rural small-scale coir industries in several Asian countries.

How to buy Coir?

Not all uses of coir are visible to the consumer. Yet, distributors and consumers in Western countries can support the sustainable growth of the global coir industry by purchasing coir-content products where suitable. Here are a few examples:

- **Doormats.** Coir doormats and boot scrapers come in a wide range of designs. They are “natural”, effective and stay visually appealing longer than comparable synthetics products.
- **Rugs and carpets.** Coir-content floor coverings have come a long way from the dull, scratchy hallway rugs of the 1960s. Blends of coir with jute and sisal are softer now and more colorful.
- **Erosion Control Products.** Landscapers, erosion control contractors and land owners can choose from a range of natural products to protect slopes and help establish vegetation. Of all natural fibers in this category, coir provides the maximum durability and drainage in these products. Yet, unlike synthetics it does not leave a messy and unnecessary plastics legacy in the ground.
- **Planting soil.** With a high moisture retention and compressibility and slow degradation, coir pith, also called coco peat, is an increasingly popular ingredient of potting and garden soils and substrate in commercial horticulture. It can replace peat moss, a non-renewable resource. Coco peat is offered in nurseries and gardening stores as bricks or bales.