

# Uses Of Coir Fibre, Its Products & Utilization Of Geo-Coir In India

\* Nagaraja. G  
\*\* Dr. C. Basavaiah

## INTRODUCTION

Coir (From malayam *kayar*, cord) is a coarse Fibre extracted from the fibrous Outer shell of coconut, the fruit of Coconut tree (*Cocos Nucifera L*). This outer layer is called the coconut husk. The husk (exocarp) of the coconut consists of a smooth waterproof outer skin (epicarp) and fibrous zone (mesocarp). The mesocarp comprises of strands of fibro vascular bundles of coir embedded in a non fibrous paranchymatous "corky" connective tissue usually referred to as pith; which ultimately becomes coir dust. Chemically, coir fibre is composed of a highly lignified form of cellulose (cellulose lignin complex), which accounts for its colour, harshness and relative brittleness in comparison with pure cellulose fibre. The bulk of the ground tissue of the husk, on the other hand, is made up of pectin and hemicelluloses. i.e. pectin and hemi cellulose act as a spongy binding material that bind the large fibre cells together to make up the husk. **Coconut coir is in great demand unaccounted of natural resilience, durability, resistance to dampness and other properties.** [3] Grading of coir is based on its fibre length, colour, resilience and general cleanliness in relation to the quantity of pith present. All coir fibre falls into two distinctly different categories, white coir and brown coir -the differences are due to the conditions of husk used, the method of extraction, the physical properties as well as in the uses. Coir obtained from immature green coconut is generally known as white fibre and is finer than the brown fibre obtained from seasoned coconuts, which has lost their green colour (>12 months). Both types of fibre are widely used and each has its own unique distinct type of application. Coconuts are the seed of the palm trees, these palms flower on a monthly basis and the fruit takes 1 year to ripen. A typical palm tree has fruit in every stage of maturity. A mature tree can produce 50-100 coconuts per year. Coconuts can be harvested from the ground once they have ripened and fallen or they can be harvested while still on the tree. A human climber can harvest approximately 25 trees in a day, while a knife attached to a pole can up the number to 250 trees harvested in a day. Monkeys can also be trained to harvest the coconuts, but this practice is less efficient than other methods. Green coconuts, harvested after about six to twelve months on the plant, contain pliable white fibres. Brown fibre is obtained by harvesting fully mature coconuts when the nutritious layer surrounding the seed is ready to be processed into copra and desiccated coconut. The fibrous layer of the fruit is then separated from the hard shell (manually) by driving the fruit down onto a spike to split it (*Dehusking*). A well seasoned husker can manually separate 2,000 coconuts per day. Machines are now available which crush the whole fruit to give the loose fibres. These machines can do up to 2,000 coconuts per hour.

## BROWN FIBRE

The fibrous husks are soaked in pits or in nets in a slow moving body of water to swell and soften the fibres. The long bristle fibres are separated from the shorter mattress fibres underneath the skin of the nut, a process known as *wet-milling*. The mattress fibres are sifted to remove dirt and other rubbish, dried in the sun and packed into bales. Some mattress fibre is allowed to retain more moisture so that it retains its elasticity for 'twisted' fibre production. The coir fibre is elastic enough to twist without breaking and it holds a curl as though permanently waved. Twisting is done by simply making a rope of the hank of fibre and twisting it using a machine or by hand. The longer bristle fibre is washed in clean water and then dried before being tied into bundles or hunks. It may then be cleaned and 'hackled' by steel combs to straighten the fibres and remove any shorter fibre pieces. Coir bristle fibre can also be bleached and dyed to obtain hanks of different colours.

---

\* Assistant Professor, Department of Economics, SVUPG Centre, Kavali, Nellore Dist., Andhra Pradesh-524201.  
E-mail: nagu\_1976@rediffmail.com

\*\* Associate Professor, Department of Economics, SVUPG Centre, Kavali, Nellore Dist., Andhra Pradesh-524201.

## WHITE FIBRE

The immature husks are suspended in a river or water-filled pit for up to ten months. During this time, micro-organisms break down the plant tissues surrounding the fibres to loosen them - a process known as **retting**. Segments of the husk are then beaten by hand to separate out the long fibres which are subsequently dried and cleaned. **Cleaned fibre is ready for spinning into yarn using a simple one-handed system or a spinning wheel.**

## COIR FIBRE PRODUCTION

Production of coir fibre in India in years 2001 to 2006 are indicated in Table 1

**Table: 1**

Year	Brown Fibre	White Fibre	Total
2001-02	2,47,600	121,800	369,400
2002-03	2,41,700	122,000	363,700
2003-04	2,52,000	112,000	364,000
2004-05	2,52,000	92,000	385,000
2005-06	3,14,000	96,000	410,000

Source: Coir Board, Kochi.

Table 1 shows The Coir Fibre Production. It is clear that the Coir Fibre Production has increased over the years. In 2001-02, Total production was 3,96,400 million tonnes and 4,10,000 million tonnes in 2005-06. Brown Fibre production has increased over the year, it was 2,47,600 million tonnes in 2001-02. and 3,14, 000 million tonnes in 2005-06. White Fibre production has decreased over the years, In 2001-02, white fibre production was 1,21,800 million tonnes and in 2005-06, it was 96,000 million ton.

## COIR DUST

**Coir dust or coconut pith is the by-product of the coir fibre industry**, the disposal of which was a problem. It is about 70% of the weight of the coconut husk. It is described as brown spongy particles of low weight, which falls out when the fibre is shredded from the husk. It is rich in lignin and tannin and it also has lignocelluloses bonds, which is resistant to microbiological attack. There is a high demand for coir dust otherwise termed as coir fibre pith or coir peat, in the market as moisture retaining agent in potting mixtures for horticultural and agricultural applications and is also used for producing domestic or industrial fuel, for producing hard boards, thermal insulator, hydro seeding and shotcreting.

## COIR FIBRE PROCESSING

### ✿ FIBRE EXTRACTION

The effectiveness of the wet processes such as bleaching and dyeing of coir, are strongly dependent on the procedures used to extract fibres from the husks and the pre-treatment given the fibres. Both state-of-the art and commonly used technologies for fibre extraction are described below.

### ✿ TRADITIONAL FIBRE EXTRACTION

The traditional production of fibres from the husks is a laborious and time-consuming process. This is highly polluting of surface waters and results in the accumulation of large dumps of pith. After manual separation of the nut from the husk, the husks are processed by various retting techniques, and generally in ponds of brackish waters (for three to six months) or in salt backwaters or lagoons. This requires 10-12 months of anaerobic (bacterial) fermentation. By retting the fibres, they are softened and can be decorticated and extracted by beating, which is usually done by hand. After hackling, washing and drying (in the shade), the fibres are loosened manually and cleaned. The fibre thus obtained is of highest quality and can be used for spinning and weaving purposes. Retted fibres from green husks are most suitable fibers for dyeing and bleaching. For the production of more coarse brown yarns, shorter periods of retting may be applied. Yarn thus obtained can be used extensively in geo-textiles. Alternatively, mechanical process can be applied by using either defibering or decortivating equipment to process the husks which require only five days of immersion

in water tanks. Crushing the husk in a breaker opens the fibres. By using revolving “drums”, the coarse long fibres are separated from the short woody parts and the pith. The stronger fibres are washed, cleaned, dried, hackled and combed. The quality of the fibre is greatly affected by these procedures.

## ❁GREEN DECORTICATIONS AND ENZYME TREATMENTS

New environmentally friendly methods of fibre production are of interest. These can be locally exploited on relative small-scale, and have the potential to produce a more constant quality of fibres. Novel developments by the Central Coir Research Institute (CCRI), Kalavoor using a biotechnological approach with specific microbial enzymes, for example, have substantially reduced the retting time from three to five days. High quality fibre production has been maintained. Similar protocols can be developed to enhance the properties of the fibres with regard to surface properties such as smoothness and porosity. By using specific (microbial) lignolytic enzymes (laccase/phenoloxidase), the fibre surface can be bleached (or activated to react more easily with the dyes). Similar technology has been developed by NOVO-Nordisk to reduce the amounts of chemicals required to produce wood chips or fibreboard.

## FIBRE PROPERTIES

**The different fibre extraction processes yield different qualities of fibres: generally 56-65 per cent long fibres of over 150 mm (up to 350 mm staple length) and 5-8 per cent short fibres of under 50 mm. The fibre fineness varies between 50 and 300  $\mu\text{m}$ . The fibres are composed of individual fibre cells of about 1 mm length and 5-8  $\mu\text{m}$  diameters.** The tensile strength of coir is relatively low when compared to sisal or abaca fibres, but it is less impaired by immersion in water. Coir fibre has the advantage of stretching beyond its elastic limit without rupturing, as well as having the power to take up a permanent stretch. Its resistance to microbial degradation and salt water is unique.

The comparison chemical composition of coir and other plant fibres is given in Table 2. It is observed from Table 1 that brown coir fibres contain relatively low amounts of cellulose (35 per cent) but have high lignin content (32 per cent). This exceptionally high lignin content implies that the available dyeing and bleaching techniques for textile fibres cannot simply be transferred to coir.

**Table 2: Comparison Of Chemical Composition Of Coir With Other Plant Fibres**

Fibre Waxes	Cellulose	Hemi cellulose	Pectin	Lignin	Extractives	Fat & percent of dry weight
Cotton	91.8	6.3	-	-	1.1	0.7
Flax (bast)	71.2	18.5	2.0	2.2	4.3	1.6
Hemp (bast)	78.3	5.4	2.5	2.9	-	-
Jute (bast)	71.5	13.3	0.2	13.1	1.2	0.6
Coir (brown)	35.6	15.4	5.1	32.7	3.0	--
Coir (white)	36.7	15.2	4.7	32.5	3.1	--
Coir pith	19.9	11.9	7.0	53.3	0.3	-
Sisal	73.1	13.3	0.9	11.0	1.3	0.3
Abaca	70.2	21.7	0.6	5.6	1.6	0.2

Source: Coir Board

**Table 3: Physical Properties of Coir Fibre**

Length in inches	6-8
Density (g/cc)	1.40
Tenacity (g/Tex)	10.0
Breaking elongation %	30
Diameter in mm	0.1 to 1.5
Rigidity of Modulus	1.8924 dync/cm <sup>2</sup>
Swelling in water (diameter)	5 percent
Moisture at 65 % RH	10.50 percent

Source: Coir Board

## COIR FIBRE - USES & APPLICATIONS

### 1) TRADITIONAL APPLICATIONS

- ✿ Mattress Filling - *Mattress Fibre*
- ✿ Automobile Upholstery - *Twisted Fibre*
- ✿ Shipping Industry And Fishing - *Coir Ropes*
- ✿ Tube Well Filter - *Coir Twine/Coir Yarn*
- ✿ Hop Industry - *Coir Twine*
- ✿ See Weed Cultivation - *Coir Twine*

### 2) NEWLY DEVELOPED APPLICATIONS

#### EROSION CONTROL

- ✿ Road Embankments
- ✿ Bio Engineering
- ✿ Soil Erosion Control
- ✿ Capping Land Fills
- ✿ Mining And Wastelands
- ✿ Stream Bank Stabilisation
- ✿ Golf Courses
- ✿ Landscaping
- ✿ Ski Slopes And Ski Lift Tracks
- ✿ Re-Vegetation
- ✿ Shoreline stabilization
- ✿ Roof Greening
- ✿ Woven Geotextiles
- ✿ Stitched erosion control blankets-Soil bags
- ✿ Mattress
- ✿ Reed beds
- ✿ Reed beds
- ✿ Coco Gabions

## GEO-COIR

Geo-coir geo-textiles are made of pure coir obtained from the husk of the coconut without adding any synthetic material - a cent percent natural product. This is Geo-coir's most essential, distinctive feature compared to conventional geo-textiles used for soil stabilization, reinforcement, landscaping and erosion control.

As soon as they have accomplished their function as slope protection/erosion control, (10 years depending upon application), Geocoir geo-textiles decompose and fit into the natural ecological cycle, thus fulfilling the claim for indulgent, near-natural landscaping. Apart from decomposing after doing their job, coir fibers have other enormous advantages compared with synthetic fibers. They are highly water absorbent, while retaining their physical properties. They store up water and build an ideal microclimate for the seeds underneath. Of all natural fibers, coir has the greatest tensile strength.

## ADVANTAGES

- ✿ Handles high water velocities.
- ✿ UV resistant vs. synthetics.
- ✿ High tensile strength.
- ✿ Biodegradable after 4-10 years.
- ✿ Water absorbent.
- ✿ Accepts hydro seeding.
- ✿ Plant through fabric.
- ✿ Flexible - easy to handle.

### 3) HORTICULTURAL APPLICATIONS

- 1) Growing medium
- 2) Seed Germination and Root Development
- 3) Soil Conditioner
  - a. Coir Peat/Dust
  - b. Coir Bio Fibres
  - c. Coconut Husk Chips
- 4) Plant Nurseries and Re-vegetation
  - i. Coir pillows
  - ii. Grow Bangs
- 5) Growing Aid For Climbing Plants
- 6) Indoor and Out Door Horticultural Décor
  - ✿ Coco Poles
  - ✿ Coir pots/ Jiffy Pots
  - ✿ Coir Bio Fibre
  - ✿ Coir Peat/Dust
- 7) Root Balling and Transferring
  - Root Balls

### 4) FARM LANDS/CATTLE & HORSE PIGGERIES AND HORSE RACE TRACKS

- ✿ Coir Bio Fibre/Coir Dust

### 5) SOUND BARRIER APPLICATIONS

- ✿ Stitched Blankets
- ✿ Coir Blankets

### 6) FENCES & PARTITIONING

- Coco Pole fences

## USES

- ✿ Stream/river bank stabilization.
- ✿ High altitude - short growing season.
- ✿ Silt fencing.
- ✿ Construct vegetated geo-grids.
- ✿ Re-vegetation projects.
- ✿ Effective on all soil surfaces.
- ✿ Proven effective on 1:1 slopes and those greater than 1:1.

- ✿ Traps sediment-builds deposition Economical to install.
- ✿ Esthetically pleasing.
- ✿ Economical alternative to riprap/ synthetics.
- ✿ Channel re-vegetation.
- ✿ All soil bio-engineering applications.
- ✿ Re-sedimentation.

## CONCLUSION

In India, Coir fibre can be used in every way as mentioned above. We have plenty of coconut trees in coastal areas of India . So, a large amount of coir fibres can be collected, processed & used in India. Government of India and Coir Board can take necessary steps to encourage the use of this fibre and its products especially for stabilization, reinforcement, landscaping and erosion control.

## BIBLIOGRAPHY

1. Banzon and Velasco, (1982), Coconut Production and Utilization, p. 277.
2. Coir Board (2009) Annual Report 2008-09, Coir Board, Ministry of Small and Medium Enterprises, Government of India.
3. Festin, T.F. and W.I. Jose (1979), "Utilization of Waste Coir Dust as a Source of Fuel, Paper presented at the 2<sup>nd</sup> Recycling World Congress, Manila, March 20-22, 1979.
4. Fremond, yan (1968), " The Coconut Palm", Berne: International Potash Institute, George Joseph, K.I (1994) "Coir Geo-textiles" seminar organized by swebecorp at Stockon.
5. Sudhakaran Pillai. M & Christy Fernandez (2000) "Coir-An Effective component for consolidation"-Proceedings Geosynthetics Asia 2000-GA 2000(Kuala Lumpur, 20-31 May 2000) Vol.2 Pg. 207 212.
6. Sudhakaran Pillai. M & R Vasudev (2001) "Applications of coir in Agricultural textiles" Proceeding International Seminar On Technical textiles (Mumbai, India 2-3 June 2001).
7. Woodroof, J.G. (1970). Coconuts: Production, Processing and Products. A VI, Westport, CN.

---

# INDIAN JOURNAL OF MARKETING

Statement about ownership and other particulars about the newspaper "INDIAN JOURNAL OF MARKETING" to be published in the 3<sup>rd</sup> issue every year after the last day of February.

## FORM 1V

(see Rule 18)

- |   |   |                               |
|---|---|-------------------------------|
| 1. Place of Publication                       | : | NEW DELHI                     |
| 2. Periodicity of Publication                 | : | MONTHLY                       |
| 3. 4,5 Printer, Publisher and Editor's Name   | : | S. GILANI                     |
| 4. Nationality                                | : | INDIAN                        |
| 5. Address                                    | : | Y-21,HAUZ KHAS, NEW DELHI-16  |
| 6. Newspaper and Address of individual        | : | ASSOCIATED MANAGEMENT         |
| Who owns the newspaper and partner            | : | CONSULTANTS PRIVATE LIMITED   |
| Of Shareholder holding more than one percent. | : | Y-21, HAUZ KHAS, NEW DELHI-16 |

I, S. Gilani, hereby declare that the particulars given above are true to the best of my knowledge and belief.

Dated : 1<sup>st</sup> March , 2011.

Sd/-

S. Gilani

Signature of Publisher