

# Natural Fibers Handbook with Cultivation & Uses

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Natural fibers production, processing and export are vital to the economies of many developing countries and the livelihoods of millions of small scale farmers and low wage workers. Almost all natural fibers are produced by agriculture, and the major part is harvested in the developing world. It is convenient to classify natural fiber in two ways; morphologically, according to the part of plant from which they are obtained and practically according to the uses to which they are put, which in turn depend on their properties. From the view point of the uses vegetable fibers may be classified into following groups; textile fibers, cordage fibers, brush and mat fibers, stuffing and upholstery materials, paper making materials etc. Fibers from the view point of the part are classified as hair fibers, leaf fibers, woody fibers, bast fibers, etc. The use of fibers for paper making differs completely from their use in textiles, in that in papermaking it is ultimate fiber cells which are used; thus in papermaking process consists in breaking down the strands of fiber into the ultimate fibers. Jute, the most important textile fiber apart from cotton, is obtained from two species of corchorus(white jute) and *C. olitorius*L. (tossa jute). Farmers around the world produce a wide variety of natural fibres, planting crops and rearing animals. Plant fibres may be from the plant fruit (e.g. cotton), stems (e.g. flax and jute) or leaf (e.g. sisal). Natural fibres are generally considered more environment friendly than synthetics in their production and disposal. However, there is great variation depending on the fibre and the growing conditions. Many chemicals are used to contain pests and weeds. Chemicals are also used in the processing and dyeing which can lead to water contamination. Processing of some natural fibers can lead to high levels of water pollutants, but they consist mostly of biodegradable compounds, in contrast to the persistent chemicals, including heavy metals, released in the effluent from synthetic fiber processing. Farming and production of natural fibres also plays a significant role in eradicating poverty as an important source of farming income and contribution to food security in developing countries. Demand for natural fiber composites are largely driven by increasing environmental awareness. Due to low cost, low density, acceptable specific properties, ease of separation, enhanced energy recovery, CO<sub>2</sub> neutrality, biodegradability and recyclable properties, natural fiber use in composites is gaining as demand grows for component materials that are durable, reliable, light weight, with mechanical properties better than those of traditional materials. Total global natural fiber composite market expected to grow at 11% CAGR.

Some of the fundamentals of the book are the occurrence and nature of vegetable fibres, conditions necessary for growing flax, mulberry family (moraceae), lime family (titliaceae), experiments on mechanized production of jute, mallow family (malvaceae), kenaf production in various other countries, the use of unretted kenaf ribbons for sack manufacture, pea family (leguminosae), sterculia family (sterculiaceae), agave family (agavaceae), structure of the sisal

industry, narcissus family (amaryllidaceae), lily family (liliaceae), pineapple family (bromeliaceae), fibres from other species of musa and a related genus, brush making fibres, etc.

The book contains process and other parameters for the manufacturing of fibers arrive from natural sources. Due to eco friendly nature there is very good domestic and export potentiality for natural fiber. This is very useful book for new generation entrepreneurs, consultant institutional libraries, and existing units.

## 1. INTRODUCTION

The Occurrence and Nature of Vegetable Fibres

Bast Fibres

Leaf Fibres

Fibre Identification

Testing of Fibres

Chemical Analysis

Fibre Fineness and Commercial Use

## 2. FLAX FAMILY (LINACEAE)

Flax (*Linum Usitatissimum*)

Conditions Necessary for Growing Flax

Varieties

Cultivation

Harvesting

Pulling

Drying

Retting

Dew Retting

Water Retting

Warm Water Retting

Leaching

Double Retting

Aerated Retting

Green Flax

Scutching

Flax in the U.S.S.R

Flax in Belgium

Flax in Other Countries

China

Japan

Egypt

India

Australia

New Zealand

Kenya

Uganda

Grading of Flax

Properties of Flax

Trade

## 3. MULBERRY FAMILY (MORACEAE)

Hemp (*Cannabis Sativa*)

Botany

- Breeding Experiments
- Cultivation
- Harvesting
- Yield
- Retting
- Breaking and Scutching
- Hemp in China
- Hemp in Chile
- Quality of Hemp
- Properties and Uses of Hemp

#### 4. LIME FAMILY (TITLIACEAE)

- Jute (*Corchorus Capsularis* and *C. Olitorius*)
- Cultivation
- Soil
- Preparation of the Soil
- Sowing
- Varieties
- Harvesting
- Retting
- Extraction of Fibre
- Cost of Production
- Jute in Brazil
- Jute in China
- Production in Taiwan
- Experiments on Mechanized Production of Jute
- Varieties
- Cultivation
- Harvesting
- Ribboning
- Scutching
- Retting
- Washing
- Drying and Storage
- Sorting and Grading
- Production of Jute in Other Countries
- Burma
- U.S.S.R
- Borneo
- Malaya
- Philippines
- Thailand
- Nepal
- Vietnam
- Iran
- Peru
- Miscellaneous Countries
- Sorting and Grading of Jute
- Uses of Jute
- The Jute Trade
- Triumfetta* Species
- Honckenya Ficifolia*

Funga Fibre (Cephalonema Polyandrum)

## 5. MALLOW FAMILY (MALVACEAE)

Kenaf (Hibiscus Cannabinus)

Varieties

Sowing

Harvesting

Growth Phases

Retting

Pests and Diseases

Kenaf in India

Kenaf Production in Various Other Countries

Argentina

China

Egypt

Guatemala

Haiti

Italy

Mexico

Mozambique

North Africa

Papua and New Guinea

Peru

Southern Rhodesia

Spain

Thailand

South Africa

Economics of Kenaf

The Use of Unretted Kenaf Ribbons for Sack Manufacture

Properties of Kenaf

Roselle (Hibiscus Sabdariffa)

Fibres From Other Species of Hibiscus

Urena Lobata

Cultivation

Retting

Yields

Distribution

Labour Requirements in Fibre Preparation

Grading of the Fibre

Properties and Uses

Trade

Abutilon Species

Sida Species

Pavonia Species

Thespesia Species

Miscellaneous Fibre Plants of the Malvaceae

## 6. NETTLE FAMILY (URTICACEAE)

Ramie (Boehmeria Nivea and its Var. Tenacissima)

Varieties

Soils and Growing Conditions

Planting

Harvesting

- Yields
- Replanting
- Fibre Extraction
- Degumming
- Problems of Ramie Degumming
- Drying
- Ramie in China
- Varieties in China
- The Ramie Industry in Japan
- Varieties Grown
- Pests and Diseases
- Grading of Ramie in Japan
- Spinning of the Fibre
- Ramie in Taiwan
- Ramie in Brazil
- Ramie in Other Countries
- Uses of Ramie Fibre
- Properties of Ramie
- The Trade in Ramie
- Other Fibre Yielding Plants of the Urticaceae

## 7. PEA FAMILY (LEGUMINOSAE)

- Sunn or Sunn Hemp (*Crotalaria Juncea*)
- Varieties in India
- Growing Conditions
- Harvesting and Yield
- Retting
- Washing and Stripping
- Preparation of Hanks
- Cleaning and Dressing
- Grading
- Cost of Production
- Sunn Hemp in Ceylon
- Properties and Uses of Sunn Hemp
- Trade and Prices
- Spanish Broom (*Spartium Junceum*)
- Sesbanea Aculeata*

## 8. STERCULIA FAMILY (STERCULIACEAE)

- Abroma Augusta*
- Cultivation
- Harvesting
- Yields
- Fibre Extraction
- Properties of the Leaf

## 9. THE MECHANIZED PRODUCTION OF STEM FIBRES

- Large Labour Requirements of Non Mechanized Production
- Advantages of Mechanized Production
- Harvesting Mechanically
- Ribboning Machines
- Problems of Ribboning
- Drying

Retting  
Washing  
Costs of Mechanized Production

## 10. AGAVE FAMILY (AGAVACEAE)

Agave Species

Botany

Fibre Yields of Various Species

Breeding Experiments With Agave Species

Nature of the Fibres in the Agave Leaf

Sisal (Agave Sislana)

Cultivation

Climate and Soil

Preparation of the Land

Planting

Fertilizers

Harvesting

Yields

Decortication and Decorticating Machines

Flume Tow

Structure of the Sisal Industry

Drying

Artificial Drying

Brushing

Grading

Baling

Labour Requirements for Sisal Production

Production in Other Countries

Properties of Sisal

Uses of Sisal

Trade

Henequen (Agave fourcroydes)

Cultivation

Harvesting

Decortication

Drying

Uses

Trade

Cantala (Agave Cantala)

Cultivation

Harvesting

Retting

Uses

Trade

Agave Letonae

Fibres from other Agave species

## 11. NARCISSUS FAMILY (AMARYLLIDACEAE)

Furcrea Species

Mauritius Hemp (Furcrea Gigantea Var. Willemettiana)

Yields

Extraction of the Fibre

Retting

Uses of the Fibre in Mauritius  
Properties of the Fibre  
*Furcraea Gigantea*  
*Furcraea Cabuya*  
*Furcraea Macrophylla*  
*Furcraea Andina*  
*Furcraea Humboldtiana*  
*Furcraea Cubensis*  
*Curculigo* Species

## 12. LILY FAMILY (LILIACEAE)

New Zealand Flax (*Phormium Tenax*)  
Production of *Phormium* in New Zealand  
Varieties  
Propagation  
Cultivation  
Diseases, etc.  
Harvesting  
Stripping  
Washing & Bleaching  
Scutching  
Baling and Grading  
Advantages and Disadvantages of *Phormium* Production  
Production and Costs  
*Phormium Tenax* in Argentina  
*Phormium Tenax* in South Africa  
*Phormium* in Other Countries  
Properties of *Phormium* Fibre  
Trade  
*Sansevieria* Species  
Propagation and Cultivation  
Lily Family (Liliaceae)  
Extraction of the fibre  
Production in Mexico  
Other Countries  
Yield  
Properties  
*Yucca* And Some Relatives

## 13. PINEAPPLE FAMILY (BROMELIACEAE)

Pineapple Fibre (*Ananas Comosus*)  
Cultivation  
Production in the Philippines  
Production in Other Countries  
Extraction by Machine  
Pita Fibre or Silk Grass (*Aechmea magdalenae*)  
Harvesting  
Yield  
Caroa Fibre (*Neoglazovia variegata*)  
Fibre From Other Members of the Bromeliaceae

## 14. BANANA FAMILY (MUSACEAE)

Abaca or Manila Hemp (*Musa Textilis*)

- Varieties
- Cultivation
- Propagation
- Diseases and Pests
- Harvesting
- Extraction of the Fibre
- Grading of the Fibre in the Philippines
- Production of Abaca in Central America
- Cost of Producing Abaca
- Production in Borneo
- Abaca in Malaya
- Canton And Pacol Fibres
- Properties of Abaca
- Uses
- Trade
- Fibres From Other Species of Musa and a Related Genus

#### 15. PALM FAMILY (PALMAE)

- Coir or Coconut Fibre (*Cocos nucifera*)

- Collection of Fruit

- Removal of Husks

- Retting

- Production of Coir Yarn

- Grading of Yarn

- Costs of Production

- Cost of production of Fibre and Yarn

- Matting

- Bristle or Coco Fibre

- Dyeing of Coir Fibre

- Mattress Fibre and Combing

- Production of Coir Fibre in India

- Production in the Philippines

- Machine Extraction of Coir Fibre

- Properties of Coir

- Trade

- Crin Vegetal (*Chamaerops humilis*)

- Botany

- Distribution

- The Industry in Morocco

- Extraction of the Fibre

- Uses of the Fibre

- Technical Characteristics

- Trade

- Tucum Fibre (*Bactris Setosa*)

- Date Palm Fibre (*Phoenix Dactylifera*)

- Doum Fibre (*Hyphaene Thebaica*)

#### 16. BOMBAX FAMILY (BOMBACACEAE)

- Kapok (*Ceiba Pentandra*)

- Soils

- Propagation

- Yields

- Harvesting



Hulling  
Drying  
Removal of Seeds  
Baling  
Kapok in India  
Collection of the Floss  
Preparation  
Grading  
Baling  
Properties of Kapok Fibre  
Uses of Kapok

#### 17. MILKWEED FAMILY (ASCLEPIADACEAE)

Akund Floss (*Calotropis Procera* and *C. Gigantea*)

Yields

Preparation

Grading and Packing

Trade

Uses

Kendyr Fibre (*Apocynum Venetum*)

*Asclepias* Species

#### 18. BRUSH MAKING FIBRES

Fibres Used in Earlier Times

Properties required in Brush Making Fibres

Bahia Piassava (*Attalea funifera*)

Botany and Germination

Collection and Preparation of the Fibre

Properties and Uses

Para Piassava (*Leopoldinia Piassaba*)

West African Piassava (*Raphia Hookeri* and *R. Graolis*)

Madagascar Piassava (*Vonitra Fibrosa*)

Mexican fibre (*Agave lecheguilla*)

Harvesting and Extraction of the Fibre

Cleaning and Grading

Uses

Jaumave Fibre (*Agave Funkiana*)

Coco Fibre (*Cocos Nucifera*)

Palmyra or Bassine Fibre (*Borassus Flabellifer*)

Kitool Fibre (*Caryota Urens*)

Gomuti Fibre (*Arenga Saccharifera*)

Broom Root (*Muhlenbergia Macroura*)

Italian Whisk (*Sorghum Vulgare*)

Palmetto Fibre (*Sabal Palmetto*)

#### 19. PAPER MAKING FIBRES

Properties for Paper Making

Treatment for Conversion into Pulp

Wood

Esparto Grass

Collection from Wild Plants in North Africa

Production in Spain

Treatment and Uses

Straw  
Bamboo  
Bagasse  
Other Materials

## 20. MISCELLANEOUS FIBRES

Toquilla (Carludovica Palmata)

Preparation For Making Panama Hats

Weaving and Bleaching

Alpinia Chinensis

Polygala Gomesiana And Other Sources or Rope, etc.

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