

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, CO2 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*)
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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
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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*)

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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*)

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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
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Pests and Diseases
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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*)
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Harvesting and Yield
Retting
Washing and Stripping
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Cleaning and Dressing
Grading
Cost of Production
Sunn Hemp in Ceylon
Properties and Uses of Sunn Hemp
Trade and Prices
Spanish Broom (*Spartium Junceum*)
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8. STERCULIA FAMILY (STERCULIACEAE)

Abroma Augusta
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9. THE MECHANIZED PRODUCTION OF STEM FIBRES

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

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10. AGAVE FAMILY (AGAVACEAE)

Agave Species
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Sisal (Agave Sislana)
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Trade
Cantala (Agave Cantala)
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Uses
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Agave Letonae
Fibres from other Agave species

11. NARCISSUS FAMILY (AMARYLLIDACEAE)

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Mauritius Hemp (Furcrea Gigantea Var. Willemettiana)
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Uses of the Fibre in Mauritius
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Furcraea Cabuya
Furcraea Macrophylla
Furcraea Andina
Furcraea Humboldtiana
Furcraea Cubensis
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12. LILY FAMILY (LILIACEAE)

New Zealand Flax (Phorium Tenax)
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Washing & Bleaching
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Baling and Grading
Advantages and Disadvantages of Phormium Production
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Sansevieria Species
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Lily Family (Liliaceae)
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Yucca And Some Relatives

13. PINEAPPLE FAMILY (BROMELIACEAE)

Pineapple Fibre (Ananas Comosus)
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Pita Fibre or Silk Grass (Aechmea magdalenae)
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Caroa Fibre (Neoglazovia variegata)
Fibre From Other Members of the Bromeliaceae

14. BANANA FAMILY (MUSACEAE)

Abaca or Manila Hemp (Musa Textilis)

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Diseases and Pests
Harvesting
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Grading of the Fibre in the Philippines
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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

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Dyeing of Coir Fibre

Mattress Fibre and Combings

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Crin Vegetal (*Chamaerops humilis*)

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The Industry in Morocco

Extraction of the Fibre

Uses of the Fibre

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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

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Esparto Grass

Collection from Wild Plants in North Africa

Production in Spain

Treatment and Uses

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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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