

CHAPTER 4

Natural Cellulosic Fibers

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NATURAL CELLULOSIC FIBERS

- ⊙ Classified by portion of the plant from which they are removed.
 - Seed fibers: cotton, coir (coconut), kapok, milkweed
 - Bast fibers: flax, hemp, jute, ramie, kenaf, hibiscus
 - Leaf fibers: abaca, piña, sisal, henequen
 - Other: Spanish moss, cedar bark, rush, sea grass, maize, palm fiber
- ⊙ Cellulose: Glucose, percentage, orientation, and length varies by fiber.

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PROPERTIES COMMON TO ALL CELLULOSIC FIBERS

- ⊙ Absorbent
- ⊙ Good heat conductor
- ⊙ Heat resistant
- ⊙ Low resiliency
- ⊙ Lacks loft
- ⊙ Good electrical conductor
- ⊙ Heavy fibers
- ⊙ Damaged by mineral acids, resists alkalis
- ⊙ Resistant to some insects; damaged by other insects, mold and mildew
- ⊙ Flammable
- ⊙ Moderate sunlight resistance

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COTTON

- ⊙ Natural seed fiber, picked and ginned.
- ⊙ Physical structure
 - Staple fiber (1/2 to 2 inches)
 - Upland: 7/8 to 1 1/4 inch
 - Long: 1 5/16 to 1 1/2 inch
 - Short: less than 3/4 inch

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COTTON

- Parts: cuticle—wax-like film
 - Primary cell wall: outer skin
 - Secondary cell wall
 - Lumen: central canal
- Convolution: ribbon-like twists; cohesive
- Fineness: Varies with maturity and type.
- Color: Creamy white, natural brown, green, etc.

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COTTON CLASSIFICATION

- ⊙ Grading and classification by hand or machine; relates to fiber quality and character.
- ⊙ Quality dependent on length, strength, fineness, convolutions, maturity, color, absence of trash, and dirt.
- ⊙ Character refers to maturity, smoothness, uniformity, etc.

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CHEMICAL COMPOSITION AND MOLECULAR ARRANGEMENT

- 99% cellulose (glucose) in finished fabrics; high degree of polymerization.
- **Hydroxyl units:** React readily with moisture, dyes, and finishes.
- Sensitive to damage by bleaches and acids.
- Modifications with chemical finishes
 - Mercerization
 - Ammoniation

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PROPERTIES OF COTTON

- **Aesthetics:** Many options (fiber maturity, yarn, fabric, & finish).
- **Durability:** Medium strength (30% stronger when wet); moderate abrasion resistance, low elongation.
- **Comfort:** Absorbent, good heat & electrical conductivity; heavy.

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COTTON

- **Effect of chemicals:** Damaged by acids, minimal harm by alkalis; resistant to organic solvents.
- **Appearance retention:** Moderate; low resiliency; shrinks; sags with use.
- **Care:** Washable or dry-cleanable; no special care required, but other components may affect care; store clean and dry.

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COTTON

- **Environmental effects:** Oxidized by sunlight.
- **Environmental impact:** Ag-chemicals; erosion; water use; dyeing/finishing chemicals; bioengineering.
- **Identification:** Burns like cellulosic fibers; convolutions (microscope).

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TYPES OF COTTON

- **Organic cotton:** Produced following state fiber certification standards on land where organic farming practices have been used for at least three years.
- **Transition cotton:** Produced on land where organic farming is practiced for less than the three year minimum.

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TYPES OF COTTON

- **Conventional cotton:** Describes cotton grown & processed by regular mainstream practices.
- **Green cotton:** Washed with mild natural-based soap (no bleach or other chemicals, except possibly dyes).
- **Colored cotton:** Naturally colored as it grows.

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FLAX

- **Uses:** Fashion fabrics for apparel and furnishings.
- **Identification:** Similar to cotton; microscopic appearance; greater fiber length.
- **Center for American Flax Fiber (CAFF):** Goal is to establish U.S. flax industry using short cottonized flax fiber.
- **Masters of Linen:** Promotes use of linen.

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RAMIE (RHEA OR GRASSCLOTH)

- ◎ **Structure:** Irregular fiber; long, lustrous, and fine; heavier than most cellulosic fibers.
- ◎ **Properties**
 - **Aesthetics:** Irregular appearance to fabric.
 - **Durability:** Strong and abrasion resistant; brittle with low elasticity.
 - **Comfort:** Good absorbency, stiff, and rough.
 - **Care:** Poor resiliency, elongation can be a problem.
- ◎ **Uses:** Imported apparel, furnishings, industrial uses.

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OTHER BAST FIBERS

- ◎ **Hemp:** High strength for twine, cord; not pliable or elastic; minor fiber, used in apparel.
- ◎ **Jute:** Weak fiber with poor elasticity & elongation; low sunlight resistance, poor colorfastness. Used for bagging, carpet backing; furnishings, rope, cordage, etc.

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OTHER BAST FIBERS

- ◎ **Kenaf:** Long fiber; used for twine, cordage, and other industrial uses.
- ◎ **Hibiscus:** Stronger than jute, it has good fastness when dyed with direct dyes. Experimental use in bags, rugs, and apparel.

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LEAF FIBERS

- ◎ Long, fairly stiff, poor dye affinity, natural colors; cut from plant and fibers split or pulled from the leaf.
- ◎ **Piña:** Soft, lustrous; white or ivory; susceptible to acids and enzymes; used for apparel, furnishings, and industrial goods.

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LEAF FIBERS

- ◎ **Abaca:** Coarse; very long; off-white to brown; strong, durable, & flexible; used for rope, cordage, floor mats, table linens and clothing.
- ◎ **Sisal and henequen:** Smooth; straight; yellow; used in better ropes, twines, and brush bristles; used in carpets, custom rugs, and wall coverings.

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OTHER CELLULOSIC MATERIALS

- ◎ **Rush, seagrass, or Cornhusks:** Used in furnishings, resistant to dry heat.
- ◎ **Paper yarns** in wall coverings for visual interest and texture.
- ◎ **Wooden slats & grasses** in window treatments.
- ◎ **Wicker furniture:** Twisted paper yarns, rattan, seagrass, abaca, and raffia.
- ◎ **Wall panels & wall coverings:** Shredded straw, bark, and old telephone books.

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