

## Properties of Natural Fibers

Fiber	Type	Source	Microscopic characteristics	Fiber length	Fiber width (microns)	Strength/flexibility	Appearance	Other characteristics (conductivity, density, moisture)	Deterioration	Use
alpaca	animal	Lama pacos	overlapping scales	8 cm (undercoat)		elastic and strong	soft, lustrous; usually white but may be black or brown			textiles, linings
camel	animal	Camelus bactrianus	overlapping scales: cross section is circular to oval; medulla is narrow and continuous.	30 cm (outer hairs); 2.5-15 cm (undercoat)		strong: Tensile strength = 1.78 g/d ; elongation = 39-40%	lightweight, fine, and soft; tan or brown	poor heat conductor; moisture regain=13%		sweaters, scarves, coats, blankets, brushes
cashmere	animal	Capra hircus	overlapping scales (5-7 per 100 microns)	5.0-12.5 cm (outer); 2.5-9.0 cm (undercoat)	15		soft and fine		damaged by alkalis	shawls, fabrics, dresses, sweaters
horsehair	animal	family Equidae	overlapping scales	mane: 7.5-20 cm; tail: 20-90 cm	mane: 50-150; tail 75-280	stiff and elastic; cannot be spun				upholstery, blankets, stuffing
llama	animal	Lama glama	overlapping scales; medulla is narrow and often pigmented. Cross section is circular to ovoid	30 cm (undercoat)			smooth, long, fine texture			coats, dresses
mohair	animal	Capra angorensis	overlapping scales (about 5 per 100 microns); circular cross section; medulla is normally invisible	250-500 mm		resilient, twice as strong as wool; elongation = 30%	soft, white, silky	resists water; moisture regain=13%	resistant to soiling; susceptible to moths	textiles, upholstery, blankets, draperies, carpets,
vicuña	animal	Vicugna vicugna	overlapping scales	5 cm			soft, lightweight, finer than alpaca or camel			
wool	animal	Caprinae family	overlapping scales	38-125 mm (fine), 65-150 mm (med.), 125-375 mm (long)	17 ( fine), 24-34 (medium); 40 (long)	low tensile strength; good elasticity; elongation = 25-35%		poor heat conductivity; density=1.32-1.34; absorbs water and dries slowly; moisture regain=15-18%	fibers may shrink/felt with high temperatures and friction; susceptible to moths	textiles, blankets, carpets
hemp	bast	Cannabis sativa		1-2 m	9-40	durable and strong but weaker than flax		resistant to wear under water	Damaged by acids and bleaches; resistant to water and alkalis	cordage, ropes, sails
jute	bast	Corchorus capsularis	polygonal cross section (5 or 6 sides); may have discontinuous, fine striations and bundled fibers	1.5-3 m	7-18	weaker than hemp or flax; elongation = 1.7%(dry)		density=1.5; weak when wet; moisture regain=13.75%		cordage, coarse textiles, mats, gunny sacks, carpets
kenaf	bast	Hibiscus cannabinus	polygonal cross section							
linen	bast	Linum usitatissimum	bamboo-like joints	6-65 mm	8-32	stronger than cotton; elongation = 1.8% (dry), 2.2% (wet)	pale yellow	absorbs water but dries quickly; moisture regain=12%	damaged by bleach; not susceptible to biological growth; resistant to alkalis	textiles, lace, thread
ramie	bast	Boehmeria nivea	numerous striations	15-20 cm	12-82	stronger than flax or hemp	lustrous, translucent, stiff, wrinkles easily	moisture regain=12%	Resistant to mildew and insects	textiles (Chinese linen, Canton linen, grass cloth, grass linen)
abaca	leaf	Musa textilis		1-5 m		hard and strong		absorbs moisture readily		cordage
istle	leaf	Agave species								cordage, coarse textiles, mats,
pina	leaf	Ananas comosus	oval cross section	10-20 cm		strong and flexible	translucent and thin with silky luster			textiles, mats, bags
sisal	leaf	Agave sisalana	horseshoe shaped cross section	60-120 cm		weaker and less flexible than hemp	smooth and straight	disintegrates in salt water		ropes, twine, thread
silk	moths	many species, such as Bombyx mori	glass rod; before degumming silk has irregular masses of sericin holding two filaments together	250-750 m		excellent tensile strength; good elasticity; elongation = 20-25% (dry), 30% (wet)	very lustrous when degummed	poor heat conductor; moisture regain=11%	strong soaps cause yellowing; degraded by sunlight; acids cause yellowing; susceptible to carpet beetles	clothing; decorative fabrics
coir	seed hair	Cocos nucifera		12-20 cm		stiff and elastic (like horsehair)	coarse brown fibers	resistant to water		ropes, brushes, mats
cotton	seed hair	Gossypium hirsutum	narrow, twisted ribbon	1.6-6.0 cm		high tensile strength; poor elasticity; elongation = 5-10%	usually white; turns blue when treated with iodine and sulphuric acid	good heat conductivity; poor electrical conductivity; density=1.54-1.56; absorbs water, dries slowly; moisture regain=7.0-8.0%	may mildew, not attacked by moths; degraded by acids, resistant to alkalis	textiles, cordage
kapok	seed hair	Celba pentandra	cross section is oval or circular	20-32 mm	20	resilient, lightweight	silky; turns yellow when treated with iodine and sulphuric acid	resists water, buoyant, fries quickly		stuffing (mattresses, pillows, life preservers)