

Textile

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A **textile**^[1] or **cloth**^[2] is a flexible material consisting of a network of natural or artificial fibres (yarn or thread). Yarn is produced by spinning raw fibres of wool, flax, cotton, or other material to produce long strands.^[3] Textiles are formed by weaving, knitting, crocheting, knotting, or felting.

The words *fabric* and *cloth* are used in textile assembly trades (such as tailoring and dressmaking) as synonyms for *textile*. However, there are subtle differences in these terms in specialized usage. *Textile* refers to any material made of interlacing fibres. A *fabric* is a material made through weaving, knitting, spreading, crocheting, or bonding that may be used in production of further goods (garments, etc.). *Cloth* may be used synonymously with *fabric* but is often a finished piece of fabric used for a specific purpose (e.g., *table cloth*).

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Etymology

The word 'textile' is from Latin, from the adjective *textilis*, meaning 'woven', from *textus*, the past participle of the verb *texere*, 'to weave'.^[4]

The word 'fabric' also derives from Latin, most recently from the Middle French *fabrique*, or 'building, thing made', and earlier as the Latin *fabrica* 'workshop; an art, trade; a skilful production, structure, fabric', which is from the Latin *faber*, or 'artisan who works in hard materials', from PIE *dhabh-*, meaning 'to fit together'.^[5]

The word 'cloth' derives from the Old English *clað*, meaning a *cloth, woven or felted material to wrap around one*, from Proto-Germanic *kalithaz* (compare O.Frisian 'klath', Middle Dutch 'cleet', Dutch 'kleed', Middle High German 'kleit', and German 'kleid', all meaning "garment").^[6]



Sunday textile market on the sidewalks of Karachi, Pakistan



Simple textile (magnified)



A small fabric shop in canal town Al-Mukalla, Yemen



Late antique textile, Egyptian, now in the Dumbarton Oaks collection

History

The discovery of dyed flax fibres in a cave in the Republic of Georgia dated to 34,000 BCE suggests textile-like materials were made even in prehistoric times.^{[7][8]}

The production of textiles is a craft whose speed and scale of production has been altered almost beyond recognition by industrialization and the introduction of modern manufacturing techniques. However, for the main types of textiles, plain weave, twill, or satin weave, there is little difference between the ancient and modern methods.

Uses

Textiles have an assortment of uses, the most common of which are for clothing and for containers such as bags and baskets. In the household they are used in carpeting, upholstered furnishings, window shades, towels, coverings for tables, beds, and other flat surfaces, and in art. In the workplace they are used in industrial and scientific processes such as filtering. Miscellaneous uses include flags, backpacks, tents, nets, handkerchiefs, cleaning rags, transportation devices such as balloons, kites, sails, and parachutes; textiles are also used to provide strengthening in composite materials such as fibreglass and industrial geotextiles. Textiles are used in many traditional crafts such as sewing, quilting and embroidery.

Textiles for industrial purposes, and chosen for characteristics other than their appearance, are commonly referred to as *technical textiles*. Technical textiles include textile structures for automotive applications, medical textiles (e.g. implants), geotextiles (reinforcement of embankments), agrotextiles (textiles for crop protection), protective clothing (e.g. against heat and radiation for fire fighter clothing, against molten metals for welders, stab protection, and bullet proof vests). In all these applications stringent performance requirements must be met. Woven of threads coated with zinc oxide nanowires, laboratory fabric has been shown capable of "self-powering nanosystems" using vibrations created by everyday actions like wind or body movements.^{[9][10]}

Fashion and textile designers

Fashion designers commonly rely on textile designs to set their fashion collections apart from others. Armani, the late Gianni Versace, and Emilio Pucci can be easily recognized by their signature print driven designs.

Sources and types

Textiles can be made from many materials. These materials come from four main sources: animal (wool, silk), plant (cotton, flax, jute), mineral (asbestos, glass fibre), and synthetic (nylon, polyester, acrylic). In the past, all textiles were made from natural fibres, including plant, animal, and mineral sources. In the 20th century, these were supplemented by artificial fibres made from petroleum.

Textiles are made in various strengths and degrees of durability, from the finest gossamer to the sturdiest canvas. Microfibre refers to fibres made of strands thinner than one denier.



Mrs. Condé Nast wearing one of the famous Fortuny tea gowns. This one has no tunic but is finely pleated, in the Fortuny manner, and falls in long lines, closely following the figure, to the floor.



Traditional Romanian table cloth, Maramureș



Alpaca textile at the Otavalo Artisan Market in the Andes Mountains, Ecuador

Animal textiles

Animal textiles are commonly made from hair, fur, skin or silk (in the silkworms case).

Wool refers to the hair of the domestic goat or sheep, which is distinguished from other types of animal hair in that the individual strands are coated with scales and tightly crimped, and the wool as a whole is coated with a wax mixture known as lanolin (sometimes called wool grease), which is waterproof and dirtproof. Woollen refers to a bulkier yarn produced from carded, non-parallel fibre, while worsted refers to a finer yarn spun from longer fibres which have been combed to be parallel. Wool is commonly used for warm clothing. Cashmere, the hair of the Indian cashmere goat, and mohair, the hair of the North African angora goat, are types of wool known for their softness.

Other animal textiles which are made from hair or fur are alpaca wool, vicuña wool, llama wool, and camel hair, generally used in the production of coats, jackets, ponchos, blankets, and other warm coverings. Angora refers to the long, thick, soft hair of the angora rabbit. Qiviut is the fine inner wool of the muskox.

Wadmal is a coarse cloth made of wool, produced in Scandinavia, mostly 1000~1500 CE.

Silk is an animal textile made from the fibres of the cocoon of the Chinese silkworm which is spun into a smooth fabric prized for its softness. There are two main types of the silk: 'mulberry silk' produced by the *Bombyx Mori*, and 'wild silk' such as Tussah silk. Silkworm larvae produce the first type if cultivated in habitats with fresh mulberry leaves for consumption, while Tussah silk is produced by silkworms feeding purely on oak leaves. Around four-fifths of the world's silk production consists of cultivated silk.^[11]

Plant textiles

Grass, rush, hemp, and sisal are all used in making rope. In the first two, the entire plant is used for this purpose, while in the last two, only fibres from the plant are utilized. Coir (coconut fibre) is used in making twine, and also in floormats, doormats, brushes, mattresses, floor tiles, and sacking.

Straw and bamboo are both used to make hats. Straw, a dried form of grass, is also used for stuffing, as is kapok.

Fibres from pulpwood trees, cotton, rice, hemp, and nettle are used in making paper.

Cotton, flax, jute, hemp, modal and even bamboo fibre are all used in clothing. Piña (pineapple fibre) and ramie are also fibres used in clothing, generally with a blend of other fibres such as cotton. Nettles have also been used to make a fibre and fabric very similar to hemp or flax. The use of milkweed stalk fibre has also been reported, but it tends to be somewhat weaker than other fibres like hemp or flax.

The inner bark of the lacebark tree is a fine netting that has been used to make clothing and accessories as well as utilitarian articles such as rope.

Acetate is used to increase the shininess of certain fabrics such as silks, velvets, and taffetas.

Seaweed is used in the production of textiles: a water-soluble fibre known as alginate is produced and is used as a holding fibre; when the cloth is finished, the alginate is dissolved, leaving an open area.

Lyocell is a synthetic fabric derived from wood pulp. It is often described as a synthetic silk equivalent; it is a tough fabric that is often blended with other fabrics – cotton, for example.

Fibres from the stalks of plants, such as hemp, flax, and nettles, are also known as 'bast' fibres.

Mineral textiles



Textile machinery at the Cambrian Factory, Llanwrtyd, Wales in the 1940s.

Asbestos and basalt fibre are used for vinyl tiles, sheeting and adhesives, "transite" panels and siding, acoustical ceilings, stage curtains, and fire blankets.

Glass fibre is used in the production of ironing board and mattress covers, ropes and cables, reinforcement fibre for composite materials, insect netting, flame-retardant and protective fabric, soundproof, fireproof, and insulating fibres. Glass fibres are woven and coated with Teflon to produce beta cloth, a virtually fireproof fabric which replaced nylon in the outer layer of United States space suits since 1968.

Metal fibre, metal foil, and metal wire have a variety of uses, including the production of cloth-of-gold and jewellery. Hardware cloth (US term only) is a coarse woven mesh of steel wire, used in construction. It is much like standard window screening, but heavier and with a more open weave. It is sometimes used together with screening on the lower part of screen doors, to resist scratching by dogs. It serves similar purposes as chicken wire, such as fences for poultry and traps for animal control.

Synthetic textiles

All synthetic textiles are used primarily in the production of clothing.

Polyester fibre is used in all types of clothing, either alone or blended with fibres such as cotton.

Aramid fibre (e.g. Twaron) is used for flame-retardant clothing, cut-protection, and armour.

Acrylic is a fibre used to imitate wools, including cashmere, and is often used in replacement of them.

Nylon is a fibre used to imitate silk; it is used in the production of pantyhose. Thicker nylon fibres are used in rope and outdoor clothing.

Spandex (trade name *Lycra*) is a polyurethane product that can be made tight-fitting without impeding movement. It is used to make activewear, bras, and swimsuits.

Olefin fibre is a fibre used in activewear, linings, and warm clothing. Olefins are hydrophobic, allowing them to dry quickly. A sintered felt of olefin fibres is sold under the trade name Tyvek.

Ingeo is a polylactide fibre blended with other fibres such as cotton and used in clothing. It is more hydrophilic than most other synthetics, allowing it to wick away perspiration.

Lurex is a metallic fibre used in clothing embellishment.

Milk proteins have also been used to create synthetic fabric. Milk or casein fibre cloth was developed during World War I in Germany, and further developed in Italy and America during the 1930s.^[13] Milk fibre fabric is not very durable and wrinkles easily, but has a pH similar to human skin and possesses anti-bacterial properties. It is marketed as a biodegradable, renewable synthetic fibre.^[14]

Carbon fibre is mostly used in composite materials, together with resin, such as carbon fibre reinforced plastic. The fibres are made from polymer fibres through carbonization.

Production methods

Weaving is a textile production method which involves interlacing a set of longer threads (called the warp) with a set of crossing threads (called the weft). This is done on a frame or machine known as a loom, of which there are a number of types. Some weaving is still done by hand, but the vast majority is mechanized.



A variety of contemporary fabrics. From the left: evenweave cotton, velvet, printed cotton, calico, felt, satin, silk, hessian, polycotton.



Woven tartan of Clan Campbell, Scotland.

Knitting and crocheting involve interlacing loops of yarn, which are formed either on a knitting needle or on a crochet hook, together in a line. The two processes are different in that knitting has several active loops at one time, on the knitting needle waiting to interlock with another loop, while crocheting never has more than one active loop on the needle. Knitting can be performed by machine, but crochet can only be performed by hand.

Spread Tow is a production method where the yarn are spread into thin tapes, and then the tapes are woven as warp and weft. This method is mostly used for composite materials; spread tow fabrics can be made in carbon, aramide, etc.

Braiding or plaiting involves twisting threads together into cloth. Knotting involves tying threads together and is used in making macrame.

Lace is made by interlocking threads together independently, using a backing and any of the methods described above, to create a fine fabric with open holes in the work. Lace can be made by either hand or machine.

Carpets, rugs, velvet, velour, and velveteen are made by interlacing a secondary yarn through woven cloth, creating a tufted layer known as a nap or pile.

Top five exporters of textiles—2013 (\$ billion)	
China	274
India	40
Italy	36
Germany	35
Bangladesh	28
<i>Source</i> . ^[15]	

Felting involves pressing a mat of fibres together, and working them together until they become tangled. A liquid, such as soapy water, is usually added to lubricate the fibres, and to open up the microscopic scales on strands of wool.

Nonwoven textiles are manufactured by the bonding of fibres to make fabric. Bonding may be thermal or mechanical, or adhesives can be used.

Bark cloth is made by pounding bark until it is soft and flat.

Treatments

Textiles are often dyed, with fabrics available in almost every colour. The dyeing process often requires several dozen gallons of water for each pound of clothing.^[16] Coloured designs in textiles can be created by weaving together fibres of different colours (tartan or Uzbek Ikat), adding coloured stitches to finished fabric (embroidery), creating patterns by resist dyeing methods, tying off areas of cloth and dyeing the rest (tie-dyeing), or drawing wax designs on cloth and dyeing in between them (batik), or using various printing processes on finished fabric. Woodblock printing, still used in India and elsewhere today, is the oldest of these dating back to at least 220 CE in China. Textiles are also sometimes bleached, making the textile pale or white.

Textiles are sometimes finished by chemical processes to change their characteristics. In the 19th century and early 20th century starching was commonly used to make clothing more resistant to stains and wrinkles.

Eisengarn, meaning "iron yarn" in English, is a light-reflecting, strong material invented in Germany in the 19th century. It is made by soaking cotton threads in a starch and paraffin wax solution. The threads are then stretched and polished by steel rollers and brushes. The end result of the process is a lustrous, tear-resistant yarn which is extremely hardwearing.

^{[17][18]}



Embroidered skirts by the Alfaro-Núñez family of Cochas, Peru, using traditional Peruvian embroidery methods.^[12]



A. C. Lawrence Leather Co. c. 1910
Peabody, Massachusetts, US

Since the 1990s, with advances in technologies such as permanent press process, finishing agents have been used to strengthen fabrics and make them wrinkle free.^[19] More recently, nanomaterials research has led to additional advancements, with companies such as Nano-Tex and NanoHorizons developing permanent treatments based on metallic nanoparticles for making textiles more resistant to things such as water, stains, wrinkles, and pathogens such as bacteria and fungi.^[20]

More so today than ever before, textiles receive a range of treatments before they reach the end-user. From formaldehyde finishes (to improve crease-resistance) to biocidal finishes and from flame retardants to dyeing of many types of fabric, the possibilities are almost endless. However, many of these finishes may also have detrimental effects on the end user. A number of disperse, acid and reactive dyes (for example) have been shown to be allergenic to sensitive individuals.^[21] Further to this, specific dyes within this group have also been shown to induce purpuric contact dermatitis.^[22]

Although formaldehyde levels in clothing are unlikely to be at levels high enough to cause an allergic reaction,^[23] due to the presence of such a chemical, quality control and testing are of utmost importance. Flame retardants (mainly in the brominated form) are also of concern where the environment, and their potential toxicity, are concerned.^[24] Testing for these additives is possible at a number of commercial laboratories, it is also possible to have textiles tested for according to the Oeko-tex certification standard which contains limits levels for the use of certain chemicals in textiles products.



Brilliantly dyed traditional woven textiles of Guatemala, and woman weaving on a backstrap loom.

See also

- Bangladesh University of Textiles
- Bangladesh textile industry
- Bettsometer
- List of textile fibres
- Maya textiles
- Fibre art
- Quipu
- Realia (library science)
- Smart textiles
- Textile arts
- Textile manufacturing (terminology)
- Textile preservation
- Textile printing
- Textile recycling
- Textile Research Centre, Leiden, the Netherlands
- Textiles of Lampung / Mexico / Oaxaca
- Timeline of clothing and textiles technology
- Units of textile measurement
- List of fabric names

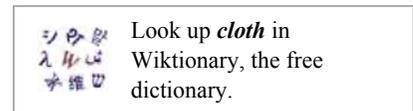
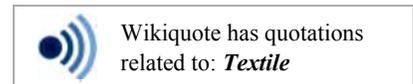
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