Fibres And Their Characteristics

Wool

On a price versus quality basis, wool represents the best value of all animal fibres for textile uses, which is why it is traded in the largest volumes. Wool is produced in virtually every nation on earth. Breeds of sheep and quality of breeding vary, which in turn determines the quality of wool produced. Australia is the only nation which breeds sheep purely for wool and, consequently, the best quality of wool emanates from there.

In other nations wool is regarded in varying degrees as a by-product and therefore the quality of wool produced and its value varies. There are hundreds of pure breeds of sheep, to which we can attribute specific breed names and there are also thousands of sheep arising as a result of crossbreeding. The UK alone has about 30 known pure breeds.

Wool has the ability to insulate the body, but also allows the body to breathe and is very ecological in its production. Wool also has the ability to emit latent heat when exposed to damp and cold atmospheres, which is one of the reasons we say it is a ‘warm’ fibre. Wool also has the ability to felt due to its barbed fibre structure, which makes it suited to more varied applications. Being a natural fibre it is easy to dye and it remains relatively colourfast.

Silk

Silk is considered to be a luxury fibre. It accounts for a very small share of world fibre production. This fibre falls into two categories:

**Cultivated silk** (produced by the caterpillar of the Bombyx Mori moth). The fibre is warm and smooth with a soft lustre. It has good drape properties, especially for lightweight fabrics and is a strong fibre. In its raw state the fibre is white in appearance.

**Wild silk** (produced by the silkworm of the Antherea moth) The fibre is irregular throughout its length, which also causes fabrics made from it to have an irregular appearance. Therefore it is not as lustrous as cultivated silk and generally commands a lower value. In its raw state, the fibre has a golden hue.

China and India are the main producers of this fibre, with quality varying between producers. It is a difficult fibre to dye and does not readily accept dye due to its structure.
Alpaca

Alpaca is considered to be a luxury fibre. The Alpaca is a camelid (related to camels) like the Llama. It produces a fairly fine, soft fibre in varying natural hues from white through to fawn, to browns, and grey to black.

This fibre has been used for centuries in woven fabrics and vast amounts were imported to Europe for use in suiting. The main producing area is the mountainous South American countries of Peru, Bolivia and Ecuador, but animals have been successfully bred more recently in other countries, on a smaller scale.

This trend is rising but production is rather limited at present, with no real discernable difference in quality.

The fibre is shorn from the animal. It is a warm fibre and its quality varies from fine to very coarse. It is difficult to dye and does not readily accept dye, particularly in dark colours.

Cashmere

Cashmere, in its de-haired form, is considered to be the most luxurious fibre currently available in commercial quantities, second only to Vicuna and Guanaco.

The Cashmere is a goat, which produces a coat with two distinct layers; a fine body or under hair and a long, strong coarse outer hair, known as guard-hair. The fibre is collected by combing the animal. It is the short fine body hair which is so highly prized, being finer than the finest wool/animal hair, with a very soft handle. This also means difficult care issues when used in garments and must be separated from the coarse outer hair. It is removed from the coarse outer hair commercially in a very fine carding process known as de-hairing. This process is slow and consequently expensive, as is the fibre. So, the yield of usable fibre from each goat is very small.

The fibre properties are very similar to wool and as a result it is found in blends with wool. Due to its very fine nature, it is possible to use the fibre in fine fabrics; however, the only drawback is shortness of fibre length, which does limit its use. It is a highly skilled job to produce fine articles in 100% cashmere. The main producing areas are China, Mongolia, Afghanistan and Iran.
Camelhair

Camelhair is considered to be a luxury fibre in its de-haired form. The Bactrian (two humped) camel produces an undercoat of soft strong fibre and a coarse outer coat of strong fibre. The animal sheds its hair every year and this is collected by the herdsmen. The fibre from the soft undercoat is prized for use in coatings and other fabrics.

This is obtained commercially in a carding process, known as de-hairing. This process is slow and expensive. The resulting fibre can then be used 100% or in blends with wool.

The fibre has similar properties to wool and is warm in cold weather. The fibre is a white to light natural fawn colour in young animals and darker and coarser in adults. It can be lightened by mild bleaching, but this can detract from the soft feel of the fibre. Therefore baby hair is more prized than adult hair and commands a much higher price.

The main producing areas are China, Tibet and Mongolia. Worldwide markets have used this fibre for many years in luxury garments.

Mohair

Mohair is considered to be a luxury fibre. The Angora goat produces a long, lustrous, springy coat and the fibre has very few scales. The animal ranges from kid, through to a young goat, to adult, with fineness decreasing with age.

The biggest source of Mohair was Turkey, until the 19th century when South Africa took over as the main producer. Substantial flocks are also kept in the USA, namely Texas and California with the USA now being the largest producer.

South African mohair is still considered to be the best quality, lustre and colour and commands a slightly higher price.

The coat is shorn from the animal in the same way as wool. The animals are shorn twice a year, as with sheep. Due to its lustrous nature, it produces very attractive fabrics, either used 100% or in blends with wool, although high percentages tend to make articles feel very cool or even cold to the first touch.
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Its high resilience and recovery make it ideal for fabrics where crease resistance is essential, and its lustre also makes it highly suited to pile or velvet fabrics where sheen is required. The dye ability of the fibre is very good and it will accept all colours with good results.

Angora

Angora is considered to be a luxury fibre. The hair of the Angora rabbit is white or coloured, also long and soft, with the rabbits being kept commercially for their fur fibre. Again, the fibre consists of short fine hairs and long spiky hairs. However, in this case the long spiky hairs are considered to be an advantage and produce pleasing effects in yarns and other articles. With the longer hair having a little lustre and taking dye a little differently to the fine hair also adds to the effect.

The hair is combed and clipped every three months and then graded. The clean, long, best grade commands the highest price. White fibre is considered to be the most desirable. This fibre is luxurious being whiter than any other natural fibre.

Care of this fibre is an issue, as it is known to be the most effective fibre for felting and readily felts with little effort. Therefore, if it is not cared for correctly it may result in felted garments.

Main producing areas are China and France with many other nations producing to a lesser extent.

Yak

Yak is struggling to be recognised as a luxury fibre. The fibre is naturally brown to fawn in colour. Lighter colours than this must be produced by bleaching the fibre, which is a little detrimental to its handle.

The soft fine under hair is the desirable element of this animal’s coat and is removed commercially by de-hairing, which separates the soft under hair from the coarse outer hair, known as guard-hair. It sits in between camel and cashmere for quality and is used as a cashmere substitute, largely as a consequence of price.

The fibre has never really appeared in full scale production of any substance. We are not sure why, but it is maybe to do with the fibre’s positioning, in relation to other fibres. Or maybe the name! This should not deter from experimenting with this fibre, which is, in our opinion undervalued.
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**Bamboo Fibre**

Bamboo fibre is a relatively new fibre. The fibre is produced from Bamboo pulp (like viscose pulp) which is obtained through a process of hydrolysis/alkalisation and bleaching of bamboo stems. The resulting pulp is wet spun in the same way as other pulp based fibres. The resulting fibre is white and silky in appearance and is a cool fibre as a result of its high absorbency, due to the fibre being full of cavities.

The fibre is soft to handle with good absorbency and can be used in blends with other fibres or 100%. It also has the unique function of being antibacterial. The main producing country is China.

**Milk Protein (Caesin) Fibre**

Milk protein fibre is a bio-engineered fibre. It was invented in the 1930’s in Italy and America as a fibre to compete with wool. This was produced under several brand names. The fibre has only recently staged a revival, having fallen victim to the second world war. It is considered to be a green product, hence its revival.

Milk is de-watered and skimmed, with the remaining protein fluid spun into a filament, through what is known as a wet-spinning process.

In this process, the fluid is forced through a spinneret and is then drawn to the required denier (finer for cotton articles and coarser for wool articles). The spun fibre is then rinsed, dried and passed through a crimping machine, which adds crimp to the fibre so that it bulks up and then it is cut to the required length. Short for woollen spinning and long for worsted top making.

The fibre is white in appearance and soft, like cashmere and has a silk-like appearance. It has good absorbency and is comfortable to wear in garments. This is a relatively new fibre and is yet to be proven. It is not generally used 100% and is more commonly to be found in blends with other fibres such as cotton, wool and silk. The fibre is dyeable with reactive, acid or cationic dye. China is the largest producer of this fibre today.
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**Soybean Fibre**

Soybean is a new vegetable based fibre. It was invented in 1937 by Henry Ford and was called soy wool. This unique fibre was used in car upholstery at that time, but the fibre became victim to the second world war and also the advent of new man-made fibres, which were cheaper to produce. The fibre was re-invented in 1998 and promoted as an eco-fibre in 2000.

The fibre is complementary in blends with other fibres and is not generally used on its own.

In blends with Cashmere or wool it improves hang and drape qualities, giving a superior lustre to the product and helping to reduce rubbing/pilling. It is possible to use the fibre 100% in yarns. Absorption properties are similar to cotton and so the fibre feels cool. Its ventilation is superior to that of cotton with a silk-like appearance.

The fibre is anti-ultraviolet and therefore, retains dyed colours well and is superior to viscose and silk in this respect. It is stronger than wool, cotton and silk but not polyester. Main producer today is China.

**Corn Fibre (Ingeo)**

Ingeo is a brand name for corn fibres made from Natureworks’ PLA, which is made by Cargill Inc. USA. PLA stands for polylactic acid or polyactide, which is a versatile polymer produced from lactic acid, which is produced when corn is fermented to make a pulp, which is plastic based. This can then be spun to produce fibre.

The fibre produced is white in colour, soft and cool with a similar appearance to silk. The corn used to make the fibre is known as ‘number 2 yellow dent’ maize. It is the most common corn variety grown. The annual production of this fibre is 136,000 metric tons.

The fibre has similar characteristics to polyester staple fibre but is more absorbent than polyester, so fabrics made from this fibre are more comfortable to wear. Its flammability is quite low and fibre recovery is very good, so fabrics have good shape retention and anti-crease. The fibre is dyeable with normal disperse dyes and is unaffected by ultraviolet light and so consequently, retains colour better than other fibres.
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The fibre has a high melt point, good clarity and is strong. The only disadvantage being its frailty, as the fibre is a little too rigid. Country of production is USA.

Cotton

Cotton is the most widely used known fibre. There is evidence that cotton was grown in Egypt about 12000BC and India 3000BC. Cotton was indigenous to North and South America, as well as Asia and Africa, with evidence that fabrics were made from cotton around 2500BC in Peru. There are many countries producing cotton including Russia and America. The word cotton is derived from the Arabic word, quotun or qutun.

The cotton plant is a member of the Mallow family and there are several species. It grows best in hot humid climates, with wet and dry seasons flowering approximately 100 days after being sown from seed.

The pretty flower dies after two days, leaving the seed pod which bursts open 50-80 days after flowering, revealing the fleecy cotton fibres which are ready for picking.

Flowers appear over a long period of time, so there is a long harvesting/picking season. Originally picked by hand, cotton is now harvested mechanically, although some hand picking of high quality cotton still remains. The picked cotton is ginned (passed though a shaker) to separate the cotton fibre from the seed and then classed/graded.

Cotton fibres are white, short, non-lustrous and uniform, more so than other plant fibres. Sea-Island and Egyptian cotton are the longest variety compared to shorter varieties of upland origins. Cotton is used for many purposes and is relatively inexpensive. Care of this fibre is easy. The only real drawbacks are shrinkage and unfortunately, it is highly combustible.

Flax (Linen)

Flax or Linen is considered by many to be the oldest fibre used in the Western world, with fabrics having been found dating back to 10,000BC. It is a fibre whose production was centred round Europe since about 500AD, Irish linen being one of the earliest productions. Therefore the machinery, most suitable for processing flax, was developed in Europe.

Today the Soviet Union produces most of the flax for fibre. Other producers include Belgium, Ireland and other nations of Eastern Europe.
Flax is a bast fibre. In other words, it is obtained from the stem or stalk of the plant, Linum usitatissimum. The climate of Europe is especially suited to growing this plant. Flaxseed is planted in April/May and harvested for fibre before it is mature or left to seed for further planting.

To obtain fibre, the stalk’s outer part must be rotted away in a process called retting. This is accomplished in several ways, all incorporating water in some way, and each taking varying amounts of time. After retting, the stalks are bundled together and squeezed between rollers to separate the fibre from the outer wood. This process is called breaking and scutching. After scutching the fibres are combed (hackled) which is a similar process to carding and combing wool or cotton.

Flax is relatively strong and has a golden colour in its natural state. It can be bleached to produce very white fibre. It is a cool fibre and is relatively easy to care for lending itself to many applications. The fibre has a natural sheen and is irregular due to its plant origin. The fibre does not have good crease recovery, this being its main fault. There is an element of prestige, with this fibre having a high heritage and sentimental value.

**Viscose**

Viscose fibre was discovered in 1891 by English scientists, Cross and Bevan. It was heralded as the new fibre to replace silk and is sometimes called artificial silk. This fibre has been produced widely all over the world, usually in countries which have a plentiful supply of trees, as it is this which provides the raw material for the fibre. The raw material is actually wood pulp, but also short cotton fibre, unusable for spinning, is also a raw material.

The first commercial production in America was opened in 1910 by the American Viscose Company and the fibre became known as viscose rayon, with other producers following suit. The first use for the fibre was in car tyres as reinforcing. Massive volumes for the fibre were never achieved due to the invention of other cheaper fibres, such as Polyester and Nylon.

Wood is pulped into sheets of cellulose and steeped in an alkali solution. After this process the sheets are shredded into cellulose crumbs and treated with carbon disulphide, which changes the chemical structure of the cellulose.

This is then dissolved in a solution of sodium hydroxide, to make a thick solution (hence the name viscose). This solution is then machine forced through spinnerets, to produce viscose fibre in a wet spun process. The resulting fibre is then dried, crimped and cut to the required length.
Viscose fibre can be bleached or dyed using disperse dyes and has many applications, including upholstery, hosiery and woven fabrics. The fibre has good absorbency and is used in many applications where high absorbency and sterile conditions are required. The fibre has a lustrous appearance like silk and can be chemically de-lustred if required, leaving a matt/dull appearance, rather than bright. The fibre is relatively strong but is highly flammable and for some applications it is necessary to flame-proof the fibre or fabric. The fibre has been marketed under various brand names including ‘Tencel’, ‘Fibro’ ‘Visil’, etc.

**Nylon**

Nylon is a man-made fibre of petrochemical origins. Nylon is the brand name of the Dupont Company. This has now become a generic name. Nylon is commonly known as polyamide. The fibre comes in varying molecular structure. The most commonly known ones today are Nylon 6 and Nylon 6.6. Nylon 6.6 is produced using two chemicals; hexamethylene diamine and adipic acid -each containing 6 carbon atoms, hence 6.6. This is obtained from the distillation of benzene or coal tar.

Specific amounts of the two chemicals are combined in solution to form nylon salt. The nylon salt is then polymerised under pressure, with nitrogen to produce a ribbon of polymer, which is then flaked or chipped.

This polymer is then melted and extruded through a spinneret into cool air, where the nylon filaments are formed. After cooling the filaments are stretched to orientate the molecules in the fibre, which develops strength in the fibre. The fibre must be fully drawn to achieve its full strength. This filament is then crimped and cut to length if required.

Nylon is truly a man-made fibre and is relatively expensive to produce compared to other man-made fibres. Therefore, its production has decreased, particularly following the discovery of polyester and polypropylene, which are both cheaper to produce.

Nylon remains in production due to its easy dye-ability and strength, coupled with a high melt-point. The fibre accepts the same dyes as wool and other animal fibres and is therefore perfect for use in blends where added strength, resilience and wear-ability are required. Nylon is still used extensively in carpet manufacture. The fibre is a little lower than wool in absorbency. It is produced and marketed under several brand names.