History of Silk Fiber

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Throughout history in the fashion industry, fibers play a huge role for fabrics. Fibers contain a specific use for a specific purpose. An important natural fiber that comes from a silkworm is called silk. Legend has it that the process for making silk cloth was first invented by the wife of the mythical Yellow Emperor, who was said to have ruled China in about 3000 BC. She is credited with the introduction of silkworm due to her tea time. A cocoon fell into her tea and unraveled. The cocoon is made from a long thread that's both strong and soft. Silk was very expensive and it was only used for those who are wealthy. Now silk is easily accessible for apparel, household, and much more. In this paper we will discuss the history and properties of silk, different dyes used with silk, and the types of silk used in various end use.

The history of silk began in the 27th century BC. Silk fiber originated from China where it remained in sole use until it appeared from China to the Mediterranean Sea. In 130 BC the Silk Road opened and silk started to obtain trade between China and the Far East with the Middle East and Europe. Cultivation of silk spread to Japan somewhere around 300 CE while the Byzantines managed to sneak in silkworm eggs and were able to begin silkworm cultivation of their own. In time the Chinese lost their secret formula of silk to the Koreans and later the Indians. Silk is a protein fiber produced by a silkworm to build their webs from cocoons. Although there are other insects that produce silk, silkworms started to produce silk first for many years. Silk is the only natural fiber to occur in filament form. To elaborate further, *Handbook of Textile and Industrial Dyeing : Principles, Processes and Types of Dyes* by M. Clark states that, “silkworm produces silk in the form of two filaments consisting of fibroin and

glued together by the protein gum sericin" (Clark, 2011, Pg. 53). This is significant because sericin is a hydrophilic protein that can allow the process of separating two silk filaments to degum in water and then unwind the cocoon. An organic silk (Figure 1) can be more than 2000 m long from its individual filaments. Silk filaments can be triangular or elliptical and have a thickness of 15 to 25 um in diameter. This means that the value of silk holds a good amount of strength. Not only is silk valuable with its properties, the relationship between silk and dye is easy because silk can absorb dye very well.

Silk can be dyed with acid dyes, metal-complex dyes, reactive dyes, and direct dyes. Acid dye is a dyeing process that will dye fibers with cationic sites like silk. Acid dyes are used to dye protein fibers such as wool, angora, cashmere, and of course silk. This specific dye is non-toxic. It's named for the mild acid such as vinegar used in the dyeing process, and for the types of bonds they form to the fiber. Acid dyes are easy to apply, and the best part about acid dyes is that they have a wide range of colors. Not only that but some dye selection can have great color fastness properties. The dyes have three categories according to their leveling and fastness properties; Leveling (also known as equalizing) dyes, Milling dyes, and Super-milling dyes.

Metal-complex dyes are mainly applied to wool, silk and nylon to achieve better wash fastness for dyed fabrics. Alternatively the metal is chelated in the dye structure by the manufacturer before application, which is called pre metalised dye. Metal-complex dyes are important to produce bright, wash-fast shades on natural protein. These dyes are often used for dyeing of natural goods like silk to produce fast shades.

Reactive dyes are actually one of the most successful modern synthetic dyes. Their shade and their flexibility in application and good fastness properties get from dyeings produced with reactive dyes on natural fibers like silk. Reactive dyes have many selections of colors, and showcase tons of brightness. They form bonds between their reactive groups and protein that demonstrates wonderful color fastness. The basic application procedure is carried out in three phases: Exhaustion, where the dye is transferred from the dyebath to the fiber. Fixation, where the reaction takes place to fix the dye to the fiber. Post-dye washing, where any excess dye is removed to give acceptable color fastness.

Direct dyes are inexpensive and easy to apply. They have a great variety of hues, but lack brightness. The color fastness properties are not particularly good, especially in darker shades. They show poor to moderate fastness to washing. Direct dyes are used on materials where color fastness is not important. Shades give an effect from metal salts but less so by resins imparting crease resistance. The deeper the dyeing color, the lower the fastness to wet treatments, and the higher fastness to light. When washing the dye can have an effect on light fastness and can change the shade of the original dye.

Pure silk fiber has great absorbency, making silk apparel items cool in the summer. Silk is neither wrinkle or sun resistant, and over-exposure to sunlight will weaken and fade the fabric. For instance *Silk: Properties, Production and Uses* by Pornanong Aramwit states, “Silk is degraded by the UV light emitted by the sun through photolysis: the energy of the photon is

absorbed by the proteins, and if this energy is greater than the bond energy, it will break the chemical bonds and create chain scissions. Silk is the most sensible of all fibers to UV light because of its fineness that allows more radiation to penetrate" (Aramwit, 2015, Pg. 121). This is important because we need to know how to take care of silk. Though silk can be hand-washed, dry-cleaning will increase the life and beauty of the fiber. Clothes made of silk fiber are often expensive and have a high perceived value. When silk fiber is twisted in the weaving process, different silk fabrics are created, such as crepe, shantung and satin.

Silk can be used for a lot of end use products, but there are specific types of silk that can get the job done and correctly. Sometimes silk can be synthesized with other fibers. According to Textiles and Fashion : Materials, Processes and Products by R. Sinclair "Silk fibers have outstanding natural properties that rival the most advanced synthetic polymers, yet their production does not require harsh processing conditions, encouraging widespread research into the possibility of artificially produced silk fibers" (Sinclair, 2014, Pg. 63). It's important to know that silk blended with other fibers can be useful. Synthetics give silk more stability, as well as sun and water spotting resistance. For sports attire, adding cotton or polymer to silk fiber gives strength, stain resistance and body to the fabric. Draperies (Figure 3) and upholstery are also more durable and easy to take care of with synthetic fibers mixed with the silk fibers. Other than synthetics, natural silk like silk chiffon (Figure 2) is a soft and light silk made from a very highly twisted yarn. It's expensive and strong but still very thin used for women's formal dresses. Dupioni is a type of Indian silk suitable for men's shirts or women's dresses. The woven silk fiber makes soft, flowing nightgowns, underwear and robes. Raw silk is often used for men's sport

coats, women's suits and coats. Raw silk is when layers of liquid sericin are left on the silk fiber a rough and coarse silk is produced. Silk can be used for home decor too. Silk chiffon makes flowing curtains and ruffles for pillows and comforters. Matka silk adds texture and thickness to upholstering due to the twist and amount of fibers used in manufacturing. Silk wall coverings give a finishing touch to bedrooms and living rooms. Silk fiber for home furnishings are best used in rooms that receive less traffic and wear as it does water spot and isn't stain resistant. Silk throws and pillows can add colorful additions to your room decor and give a super soft feel to it. Silk bedding gives a relaxing and comfortable night. Woven silk fibers are used for the construction of parachutes and bicycle tires. Silk fibers that undergo a special manufacturing process are used to construct prosthetic arteries. Due to silk's antibacterial properties, it's often used in the medical field for wounds and burns. Many silk fibers are woven into suitable backgrounds for pen and ink drawings and paintings.

Images

1. Silk Cocoon Figure 1

   https://ebookcentral.proquest.com/lib/citytech-ebooks/reader.action?docID=1584442&ppg=77

2. Yohji Yamamoto Silk Chiffon Dress Figure 2

https://www-oxfordartonline-com.citytech.ezproxy.cuny.edu/groveart/view/10.1093/gao/9781884446054.001.0001/oao-9781884446054-e-8000022471?rskey=KLwkai&result=1

Yohji Yamamoto: Dress, multilayered fuchsia, pink and black silk chiffon, Autumn 2005 (New York, The Museum at FIT); photo courtesy of The Museum at FIT

3. Draped Silk Dress Figure 3

   https://www.vogue.co.uk/gallery/silk-fashion-trend

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   Roksanda

   Fashion Trend: Yes, You Can Wear Sumptuous Silk This Winter

   By Ellie Pithers

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