

Silk Beyond Fashion - The Surprising Uses of Silkworm Silk in Medicine and Industry

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Introduction

Natural fibre known as silk has long been revered for its opulent attributes. Some insects, especially silkworms, create it while they spin their cocoons. The *Bombyx mori* silkworm (Fig. 1), which is native to China and has been domesticated for silk production for more than 5,000 years, produces the most well-known and frequently used variety of silk. The fabric known for its grandeur and elegance in the fashion industry, silk, has recently become a flexible and priceless resource with unanticipated uses in both medical and a number of industrial fields. Here, we examine the numerous applications of silkworm silk and shed light on its outstanding contributions to developments in industry and healthcare.



Fig 1. Silkworm, *Bombyx mori*

The Exceptional Properties of Silkworm Silk

Along with being to being a soft, glossy, and lightweight fabric, silk is a natural miracle with qualities that make it extremely well-suited for a variety of uses. Silk is manufactured by the silkworm *Bombyx mori*. Its incredible strength-to-weight ratio, which surpasses that of steel pound for pound, is one of its most amazing qualities. Due to its excellent strength and low weight, silk is helpful in fields where resilience and durability are crucial.

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Some Key Points About Silk

Historical Significance: Silk was initially found in ancient China, and since then, it has a long and illustrious history. The Chinese Empress Xi Ling Shi is said to have discovered silk when a cocoon accidentally dropped into her tea and she unravelled the delicate strands. Silk manufacture was maintained a carefully guarded secret by the Chinese for many years, and it was an important commodity in commerce along the Silk Road (Fig. 2), which connected Asia to Europe.

Natural Fibre: Silk is a protein-based natural fibre that silkworms generate as pupae. Silk fibres are used to make a protected cocoon, which may then be carefully extracted and used to make fabric.

Luxurious Feel: Silk has a luxurious feel due to its smooth and silky texture. It has a natural shine to it that contributes to its beauty, and it is frequently linked with luxury and refinement. Silk is a popular fabric for high-end clothes, lingerie, and bedding because of its rich texture.

Diverse Uses: Silk is a flexible material with several applications. It is utilised in the manufacture of accessories, home furnishings, and even medical sutures, in addition to garments and textiles. Its lightweight and breathable nature makes it easy to wear in hot weather, while its insulating capabilities keep you warm in cold weather.

Durability: Silk is a delicate material, but it is surprisingly robust. A single silk thread is smaller than a human hair, yet when woven into fabric, it may be fairly strong. Proper care can help it last longer and last longer.

Types of Silk: There are different types of silk produced by various species of silkworms. Besides mulberry silk from the *Bombyx mori* silkworm, other types include tussah silk, muga silk, and eri silk. These silks vary in texture, color, and properties.

Silk Production: Silk production comprises numerous phases, including silkworm rearing, cocoon harvesting, boiling the cocoons to soften the sericin (a protein that links the silk threads), and spinning the softened threads into strands. Finally, the strands are weaved into cloth.

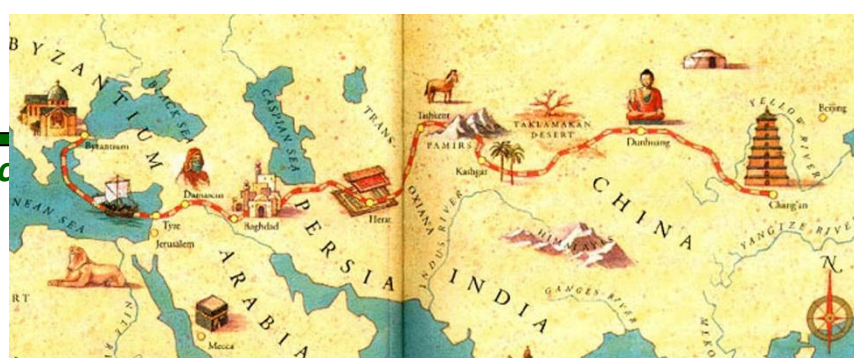


Fig 2. The Silk Road**Silk's Role in Medicine**

Silk has emerged as a transformational instrument in the area of medicine, having the potential to revolutionise patient care and treatment. Silk sutures have been used in surgery for millennia due to its biocompatibility and progressive biodegradability within the

**Fig 3. Silk suture**

body. Silk sutures (Fig.3), as opposed to synthetic sutures, cause minimal tissue irritation and dramatically lower the incidence of problems. Furthermore, the toughness and flexibility of silk make it a perfect material for tissue engineering. Silk-based scaffolds are being investigated by researchers to aid in the regeneration of damaged tissues and organs ranging from skin and bone to blood vessels and neurons. Silk's biodegradable nature provides transient structural stability before giving way to spontaneous tissue regeneration.

Another fascinating medicinal application of silk is in medication delivery systems. Silk nanoparticles may be loaded with a variety of therapeutic agents, including medicines and proteins, and then precisely guided to target cells or tissues. This regulated release mechanism has huge potential for treating a wide range of disorders, from cancer to chronic inflammatory ailments, with fewer side effects and greater effectiveness.

Silk's Contributions to Industry

Silk has beginning to make its mark in a variety of unexpected industrial fields other from medical. Silk fibres' intrinsic strength and lightness have led to their inclusion into industrial processes. Silk, for example, is used to improve the mechanical characteristics of

high-performance composite materials. These materials are used in crucial industries like as aerospace, automotive, and sports equipment manufacture, where weight savings and strength are critical.

Silk's natural ability to repel moisture and fight microbial development has found practical application in extreme-environment fabrics. Outdoor enthusiasts benefit from silk-based clothes (Fig. 4) that provide warmth as well as moisture control without sacrificing comfort. Silk's distinct qualities have also led to its application in filtration systems, where its natural propensity for attaching to different pollutants makes it an incredibly effective filter for water and air purification procedures.

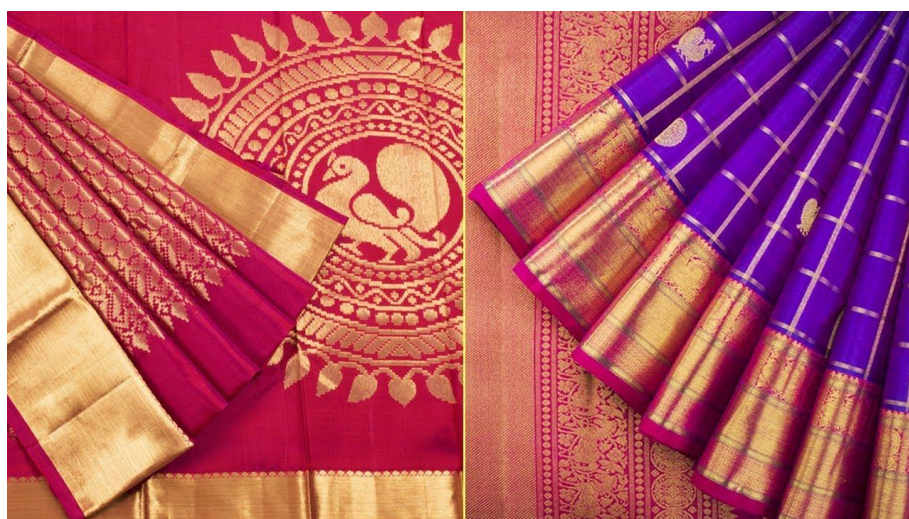


Fig 4. Silk Garments

Furthermore, the versatility of silk has fueled innovation in biology and electronics. Using silk as a substrate, biodegradable electronics have been produced, allowing the fabrication of implanted medical devices that may be safely absorbed by the body once their purpose has been served.

Conclusion

Silkworm silk, long associated with high fashion and luxury, has evolved into a vital and adaptable substance in medicine and a variety of industrial industries. Its unrivalled strength, biocompatibility, and one-of-a-kind qualities have made it a vital asset in tissue engineering, medication delivery, composite materials, filtration systems, textiles, and electronics. Silk is set to change the future of health and industry as scientists continue to harness the full potential of this extraordinary natural resource, delivering new answers to some



of the world's most urgent concerns. Thus, silk exemplifies how beauty extends well beyond fashion, becoming a fundamental component of growth and innovation in our modern society.

