

## 12. The Science Behind Kalamkari Art: “Traditional Art and Modern Chemistry

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### **ABSTRACT:**

This paper offers a detailed examination of the complex chemical processes involved in the Indian heritage textile art of Kalamkari, essentially recasting the culturally rich but obscure 23-step method in a rigorous chemical framework. Kalamkari paintings were made with the use of natural dyes, and they were picturing mythological stories, floral designs, the tree of life, birds, and animals, among other things. The painters took their inspiration from the temples and nature, along with the stunning mountains and the abundant natural resources of Andhra Pradesh. At one point, painted temple cloths were a major feature of the temple tradition; however, the art of painted temple cloths has faced problems in maintaining its lifespan. The art might have gone down the drain if it had not been rescued in 1957. After its revival, the practice became popular as a means of decorating fabrics and thus evolved into a craft that has both ornamental and utilitarian value. This change of Kalamkari has allowed it to develop as a potentially eco-friendly textile craft. The study looks at its present position in the Indian textile market through the accounts of the artists who practice and sell their works for different uses in the apparel and interior accessories industries.

**KEYWORDS:** Kalamkari, natural dyes, mordants, textile art, pH, sustainable dyes, traditional process.

**INTRODUCTION:** Kalamkari is an old and complex traditional fabric art that features Indian culture. It is an extremely detailed, either hand-painted or block-printed piece of art on the fabric using natural dyes. Kalamkari is a unique combination of fabric art and storytelling from Indian mythology and has been influenced by Persia as well. The word "Kalamkari" comes from the two words "Kalam" and "Kari", where a lavish motif is made by a pen. This nomenclature was established by the Mughals, who patronised the craft in the Deccan region.

It is an age-old handicraft of over three thousand years, which came from Telangana and Andhra Pradesh. The small towns of Kalahasti, Machilipatnam, and the other interior regions of Andhra Pradesh are the places where most of the rural craftsmen and women produce the Kalamkari works, which is a household occupation passed from generation to generation as heritage. The Srikalahasti style, produced in the Tirupati district, is a temple-going painting style that is entirely done by freehand drawing with a tamarind pen on the walls (kalam) and shows temples on large panels. These temples depict the Hindu epics, such as the Ramayana and Mahabharata and religious symbolism. On the other hand, the Machilipatnam style, which is in Machilipatnam, is a vegetable-dyed block-printed style that has evolved under the influence of the Mughal Dynasty and the Golconda Sultanate, and as a result, the style has Persian artistic influences kalamkars created creepers and peacocks. Both the styles take a lot of time and are very difficult, which is the main reason these styles go through a complex and systematic sequence of up to twenty-three individual steps, which includes preparation, dyeing, washing and drying that finally ensure the brightness and the durability of the finished fabric.

Kalamkari art is an expression of nature through the use of mostly indigo, mustard, rust, black, and green. All the dyes used in the production of Kalamkari art are natural and very pure as they

are directly obtained from organic sources without the addition of any chemicals or synthetic materials. For example, the black colour, which is mostly used for the outlining of the designs, is made by the artisans by mixing jaggery, water, and iron filings. Thus, mustard or yellow is from the boiling of pomegranate peels, while the reds are from the bark of madder or algerin. In other words, the blue comes from indigo and the green from mixing yellow with blue.

Even though the colour range in Kalamkari is quite small, the different tones used only make the art more enchanting. Traditionally, the technique has been used on cotton fabrics however, a few pieces of crepe and silk are also getting decorated with Kalamkari these days. More and more people all over the globe are raising their voices against the use of poisonous chemicals in the production and manufacturing processes. Against this backdrop, Kalamkari is the most suitable handloom that doesn't use any artificial chemicals but still produces coloured fabrics.

## **METHODOLOGY**

The method of printing Kalamkari designs was quite complicated and involved several stages. First, the fabric was dipped in a mixture of buffalo milk and cow dung for a few hours, and then washed in a pond or under running water. Next, the fabric was treated with a Myrobalan (*Terminalia chebula*) solution to get rid of the odour of buffalo milk. A cloth pen, 'kalam', is used to put an iron acetate solution, but a wooden block may also be used. Parts to be reddened are dipped with the help of the alum as a mordant. The fabric is allowed to rest for a day before being washed under running water. Red dye is obtained by boiling the fabric with red colouring agents. Parts that have to be kept away from the blue are covered with wax and then dipped in an indigo solution. After the wax is removed by boiling the fabric in water, it is allowed to dry. If the design requires yellow, it is painted on the fabric and then washed. Earlier, indigo dye was extracted from *Indigofera tinctoria* for blue colouring. Cotton easily takes ochre, but for other colours, the fabric has to be treated with mordants to start the necessary chemical reactions with the dye. A resist method was used to protect the colours from going into the other areas, which were made of gum, mud, and wax. If madder is used for the red dye, the cotton has to be dipped into a tannin solution. After that, mordants are applied, and alum is the mordant for red. They create coordination complexes with dye molecules, thus increasing the colour brightness and colour fastness. One instance is when aluminium ions from alum unite with hydroxyl groups in dye compounds, thus forming the bond between the dye molecules and cellulose fibers in cotton. Practicing the mordanting step is both an art and a chemical reaction. The pH level, temperature, and time are the factors that determine the final colour. Alum produces brilliant reds and yellows, while iron results in dark shades. The result of combining madder with alum is the colour red. Fabrics that were painted and printed in Gujarat have been found in Fustat, Egypt, dating from the 12th to the 16th centuries. The designs were repetitive, and blocks were used for the application of mordant. Narrative panels made for temples used brushes on fine cotton cloth woven in the Andhra region and served both as a mordant and a resist. The main resist material was beeswax. The choice of brush or block method depended on the design and motif. The cotton fabrics of Kalamkari are initially treated with myrobalan to make the dye more absorbent. The tannins in myrobalan serve as natural mordants thus, they generate more binding sites on the cellulose framework. After that, the dye molecules are held firmly by hydrogen bonding and van der Waals forces, which are responsible for the durability and wash-fastness of the colours.

## **DISCUSSION:**

Several deep-rooted issues restrict the economy and the energy of going big with Kalamkari and other natural dyeing crafts at the local and regional levels. The main problem of all is making the colour even, a colour that can be predicted and received every time again. Natural dyes have no standardisation, the final chemical composition and the colour obtained from the dye for the plant source vary depending on the plant, which comes from different places, for the conditions in which it grew, for the way it is extracted, and for the complicated coexistence of the multiple chromophores. Because of this intrinsic variability, it is difficult to reproduce standard shades and, therefore, it is in stark contrast to the synthetic dyes, which offer predictable uniformity.

The second part of the story is that the production itself is a pretty expensive and economically demanding process. The traditional way, which can take up to 23 steps, is still very much labour-intensive, water-consuming, and time-consuming the complete dyeing process may take about a month. The high production cost that results from this complexity is far lower than that of mass-produced synthetic textiles, and so, on occasions, craftsmen are forced to choose a cheaper and more readily available artificial dye for quick production. In addition, the traditional knowledge of hundreds of dye recipes was "closely guarded secrets," and the decline of the craft has led to the disappearance of many techniques and the loss of many plants for colours.

## **CONCLUSION:**

Kalamkari is recognized as a scientifically advanced one of the oldest chemo-mechanical textile arts. The complicated process of decorating the cellulose substrate is delicately managed through an essential, multi-step pre-treatment that binds natural tannins and buffalo milk to the fiber to make it more substantive. The outstanding colour longevity and brightness come from the complicated coordination chemistry of the mordants with the plant-based chromophores mainly, the stable chelation of Anthraquinone (Red) structures and the establishment of the sturdy Ferrous Tannate complex (Black).

Iron is used as a mordant for the black outlines, and the reason is quite clear chemically, as its high coordination number allows for maximum colour saturation and fixation strength. Generally, washing and rubbing fastness are good however, the inherent lightfastness still remains a considerable technical issue.

The hand-made Kalamkari method is the living cultural heritage that the past has left to us, and it is a historical example of eco-friendly production that uses renewable raw materials and very few mechanical inputs. However, the sustainability of this art in the long run is, in fact, determined by only a few factors from inside and outside the sphere. From the outside, the climate-dependent nature of raw material acquisition and the reliance on certain water sources cause production to be very unstable. From the inside, the use of metal mordants, especially iron and perhaps copper, makes the process less environmentally friendly than it is thought to be due to the toxification of the effluent.

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