ANNATTO AND TURMERIC IN SPANISH 18TH CENTURY FABRICS: IDENTIFICATION AND OPTIMISATION OF DYEING TECHNIQUES

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ABSTRACT: Yellow and orange colourants obtained from annatto seeds and turmeric rhizomes were commonly used in silk dyeing in Spain in the 18th century. Their optimisation, the knowledge from the results of their different dyes, as well as their principle characteristics, are greatly important to know and understand the worked silk textiles produced in Spain during this period.

KEYWORDS: natural dyes, annatto, turmeric, silk, textile dyeing, Spanish fabrics

1. INTRODUCTION

The textiles produced in Spain, above all, Valencian brocaded textiles from the 17th and 18th centuries, never fail to amaze us for their chromatic richness, the range of shades combined with exceptional mastery, and their motifs and designs, most of which accurately represent the typical flora of the region.

The art of silk dyeing in Spain, as explained by Luis Fernández, master silk dyer from the Royal Silk Factory of Valencia, required a very extensive range of colours and shades (Fernández, 1995:39). This situation forced dyers to be constantly on the lookout for and in search of new colours. For this reason, the use of a huge variety of dyes and the constant search for new mixtures and methods were necessary to achieve the brightest and most precious shades of fabric so that they would always be attractive to the consumers’ eyes at that time.

2. SUBJECT

This study focuses on turmeric and annatto. These two natural dyes, especially annatto, were widely used by dyers in Spain during this period as a pure component or in mixtures with other dyes. These practices resulted in a large variety of colours and shades which, according to dyers’ documents from the period, were of the most varied shades and highly valued.

This study aims to show the results of the optimisation of these two natural colourants, which range from the extraction of their dyeing components to the preparation of the dye baths, by reproducing the primitive techniques described in dyers’ documents and treatises on dyeing. It is important to point out that the book “Instructive and practical treatise on the art of dyeing”, from 1778 and the “Dissertation on the true causes preventing the perfection of good silk colours” written in 1785 by Luis Fernández, were the main references on the reproduction of the dyes.

3. HISTORY

The silks produced in Valencia during this period, identified by their floral motifs and sufficiently vibrant and peculiar colours, were worked with dyed threads in a wide variety of natural colours, some from the East, such as turmeric and indigo, and others from the New World (America), like annatto, brazilwood, logwood and others.

Annatto and turmeric are two substantial colourants, dyes which allow a direct use as they do not require the action of a mordant or other chemical agents to set the dyeing component in textile fibres. The colourant components react and set into the fibres irrespectively of the action of a fixer. Among these dyes, the yellows and oranges from the annatto – Bixa orellana L. – plant, whose seeds release a golden orange dye, and the very intense yellow colourant extracted from the rhizome of the turmeric plant – Cúrcuma longa L. – are worth highlighting. Each dye reacts differently on each textile fibre, thus producing different shades of a greater or lesser intensity.

During the 18th century, colourants were classified according to their characteristics and qualities, and separated into two groups. The first group included the colourants considered permanent or good dyes, while the second group included those considered fugitive or false dyes. The latter type were generally used as a load for dyes to achieve certain shades or to lower their cost. At times they were used alone; however, these dyes are considered of a very poor quality. (Roquero, 2006:129).

Both annatto and turmeric were classified as belonging to the group of fugitive dyes. With regard to annatto, in his treatise,
As the golden straw colours return to their first state, and scarlets darken considerably. (Hellot, 1752:452).

On the other hand, master dyer, Luís Fernández, make completely opposing recommendations in his treatise in relation to the use of turmeric. These circumstances have led one to believe that it was not the same colourant cited by Jean Hellot when he stated that, “All of the colours in this Treatise can be dyed, colourfast and permanent, using turmeric. However, after dyeing and making alterations to the samples, they must be treated with lemon or vinegar to complete the dyeing process…” (Fernández, 1995:105).

These two colourants were commonly used in Spanish dyes during the 18th century. They were used separately to produce shades of different colours, depending on the concentrations of the baths, and were also mixed with each other and with other natural dyes. The result is an endless list of colours present in the worked silk textiles produced in Spain during this period.

With regard to the colourant from the turmeric rhizome, Jean Hellot made some recommendations in his treatise on dyeing wools. To the colourant, he attributed characteristics that were not indicated for a good dyeing of this type of fibre. Hellot indicated that turmeric was, in some cases, used in the good dye as the basis for the appreciation and enrichment of yellows and greens as it bestowed them a greater density. On other occasions, it was used to give a golden hue to the golden yellows of the dyer's greenweed, or to tone down or lighten scarlet reds to make them a more orange colour. (Hellot, 1752:451-453). As for this procedure, the dyer next pointed out that “this practice is prohibited because the air soon removes part of the colour from the turmeric, in such a way that...” (Hellot, 1752:452).

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4. EXPERIMENTAL

4.1. Reference Materials

Fabric:
For the study into dyes, one 100% silk fabric with taffeta interlacing was used, commercially known as Ponge, which was supplied by Sodintex, S.L. http://www.sodintex.com. Ponge is a fabric of Chinese or Japanese origin, composed of warp threads and greige silk grain and taffeta interlacing. Its name is derived from Pongée, the French name for the fabric.

Colourants:
Annatto seeds (ref. 37350 - C.I. Natural Orange 4) and turmeric roots (ref. 37230 - C.I. Natural Yellow 3) the colourants used in the study into dyes were acquired from Kremer Pigments.
4.2. Optimisation of the dyes

**Annatto**

Annatto - *Bixa orellana* L. is a shrub of the *Bixaceae* family which reaches an approximate height of 3-6 m and whose seeds provide a highly valued colour dye which ranges from yellow-gold to brick red (Figure 2). It has a distinct smell and a characteristic taste, and was widely used to dye textile fibres in primitive villages throughout Central and South America. It has been used for silk dyeing in Europe since the 17th century (Cardon: 2003:245). Its hermaphrodite, pink flowers are arranged in corymbs with two to four flowers, each with numerous stamens. The fruit is a heart-shaped capsule, first carmine red, then dark brown after drying. It has stiff hairs which stand on end and are dehiscent through two valves. It is grown in warm, humid climates. It produces abundant fruit and its crop requires little care (Figure 3) (Castroviejo:1992:98 and Ferreira:1998:54).

In the same way as other colourants from America, that from the Annatto plant arrived in Europe in the form of pre-prepared cakes and, depending on its place of origin, was mixed with other substances. In this way, treatises on dyeing describe the dyeing method from the pre-extracted colourant.

According to the literature, the method to prepare the annatto colourant varied depending on the region. Thus, to perform the first test, a cold extraction of seeds was chosen, a method cited by the vast majority of the studies done. The method consisted in soaking the same amount of seeds in relation to the dry silk fibres in deionised water for approximately 24 hours. The following day, the seeds were slightly pulverised by hand and then pulverised with a mortar to extract the largest possible amount of colourant. Next, the colourant solution was heated to a maximum temperature of 90°C for 1 hour. The solution was then strained through fine 32-strand nylon, and was left ready for the preparation of the dye bath. The resulting material was a thick solution of a very distinct brick red colourant.
For comparison purposes, a fourth dye test (T0064-08) was performed using calcium carbonate to control the pH. It involved mixing 20% of the product in deionised water and later adding it to the solution. This dye produced a more vivid orange-gold with a higher concentration of red than the previous dye.

To finish, two additional dyeing processes were carried out with the annatto colourant on the samples from the two previous dyeing processes as a dye base for green shades. The first (T0065-07) consisted of using the dye (T0063-08) with a subsequent indigo bath. This dye produced a slightly bluish-green colour. The second (T0066-07) process used the dye solution (T0064-07), which was followed by an indigo bath to result in a shade close to pistachio green.

Turmeric
Turmeric, or Curcuma longa L., is a herbaceous plant of the Zingiberales family which reaches a height of between 100-150 cm., and is very well-known for its yellow rhizomes. From the rhizomes, enormous smooth, oblong leaves of a light green colour develop vertically, culminating at the top. Cylindrical, white flower heads with a pink to light green flushing sprout from the floral trunks. The plant rhizome contains a very intense yellow colourant component, which is highly valued and widely used for different purposes (Figures 4 and 5) (Castroviejo: 1992:101 and Ferreira: 1998:45).
at approximately 60°C, and was then heated at 90°C for 40 minutes. After the solution had cooled, it was filtered using 32-strand nylon. The resulting dye solution was a very concentrated, strong and opaque yellow colour.

Afterwards, sufficient deionised water was added to the dye solution in order to completely immerse the fabric. The first dye test (T-0008-07) with the turmeric colourant was performed using the direct dyeing technique by immersing the previously wet fabric in the bath at approximately 60°C, and was then heated at 90°C for 40 minutes. After the solution had cooled, it was filtered using 32-strand nylon. The resulting dye solution was a very concentrated, strong and opaque yellow colour.

Table 3. Dyeing tests done with Turmeric

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The colourant from the turmeric plant is available on the market as a powder; it is most commonly used as a seasoning and food colouring, or as small pieces of rhizome which is the form of the colourant used for the dyeing tests carried out in this study.

The preparation of the turmeric colourant consisted in grinding the pieces of rhizome in a mortar until they become a fine powder. For the dye, the same amount of powder in relation to the weight of the dry silk fibre was used. Next, the powder was dissolved in hot water, at approximately 60°C, and was then heated at 90°C for 40 minutes. After the solution had cooled, it was filtered using 32-strand nylon. The resulting dye solution was a very concentrated, strong and opaque yellow colour.

Afterwards, sufficient deionised water was added to the dye solution in order to completely immerse the fabric. The first dye test (T-0008-07) with the turmeric colourant was performed using the direct dyeing technique by immersing the previously wet fabric in the bath.
solution and increasing the temperature to 70°C for 45 minutes. Once the procedure had been completed, the resulting dye was a very vivid, bright and deep egg yellow colour.

The second dye test (T0028-08) with turmeric was performed by previously staining the silk with 10% tin chloride, which resulted in a very similar yellow colour to that achieved with direct dyeing, but somewhat more intense. The third dye test (T0055-08) was carried out with a previous staining in 20% alum in relation to the dry silk, and resulted in a very bright, vivid and deep yellow colour.

The fourth dyeing process (T0057-08) involved a previous staining of the silk with 20% alum and a subsequent bath in a 5% sodium carbonate solution which produced a very intense brick red colour.

In the fifth dye test (T0059-08), the turmeric colourant was used as a load, or dye base, to produce a green shade. For this dye, a lower concentration of colourant was used, 70% in relation to the dry fibre, which had been previously stained with alum. This dyeing technique resulted in a luminous, slightly muted colour. In the last dye test (T0060-08), the dye base solution was used (T0059-08) with a subsequent indigo bath. The colour produced was a greenish-blue.

CONCLUSIONS

The optimisation of the dyeing processes has provided the colours and shades reflected in the ancient treatises from the 18th century. The pH values significantly influenced the dyeing of the silk with both natural colourants. Therefore at more basic pHs, annatto tends to produce darker shades, while turmeric tends to produce redder shades.

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Versión española

TITULO: *El Achiote y Rizoma en las fábricas españolas del s.XVIII: identificación y optimización de las técnicas de entintado.*

RESUMEN: Los colorantes amarillos y anaranjados obtenidos de las semillas del achiote y del rizoma de la ciricuma fueron comúnmente empleados en la tintorería sedera de España en el siglo XVIII. Su optimización, conocimiento del resultado de sus distintas tinciones, bien como sus características principales son de gran importancia para el conocimiento y entendimiento de los tejidos en seda labrada producidos en España en el periodo.

PALABRAS CLAVES: tintes naturales, achiote, rizoma, tinta textil, fábricas españolas