

Original article

IDENTIFICATION AND CONSERVATION OF A RARE ISLAMIC TEXTILE
DECORATED WITH METALLIC YARNS

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Abstract

A rare Islamic textile decorated with two types of metallic yarns date back to 1327 Hijri. This object is from the textiles collection of Sheikh Yusuf Jameel museum in Saudi Arabia. These collections are housed in uncontrolled storage, in terms of variation and fluctuation humidity, temperature and air pollution throughout the year. These storage conditions have had a passive effect on the metallic and natural yarns causing damage. The nature of the surface metals and the nature of the corrosion products were studied by scanning electron microscopy with energy-dispersive X-ray microanalysis (SEM/EDS). A close examination of the textile was followed by various analyses in order to develop a plan for conservation treatment. This research shows the practical strategies which have to be followed in maintaining and conserving textiles in uncontrolled storage. The effects of cleaning materials on the natural dyes were tested, including different types of solvents used to remove the corrosion layer on the metallic yarns. The process of maintenance and restoration has been recorded beginning with the historical record of the textile to the present cleaning process. A new mounting system for display as in Sheikh Yusuf Jameel museum is described.

Keywords: *Metallic yarns, Corrosion, Cleaning, SEM, Natural dyes, Mounting.*

1. Introduction

The Ottoman period provided a rich treasure of different types of textiles. Many of these textiles contain metal yarns as decorations, usually made from gilded silver, silver, or brass. Decorative metals have been incorporated into textiles for thousands of years. Embroideries were one of the most sumptuous kinds of textiles produced in sixteenth-century Europe, and among these costly goods, gold embroideries were the most precious. Metal yarns deteriorate over time and corrode due to chemical attack by different corrosive factors such as high and fluctuating

relative humidity, air pollutants and elevated temperatures [1] [2] [3] [4] [5] [6] [7] [8] [9]. Textiles employing metal are generally in poorer condition than those that do not contain metal, because of extra stresses from the high mass of the fabric and the multiplicity of degradation processes. The condition of the textile containing metal yarns depends on various factors related to the quality of the materials from which the yarns made, their manufacturing techniques, and the surrounding environmental factors. These types of objects, which are formed of composite

materials of different origin and nature, pose a major conservation challenge [10] [11] [4] [12] [7] [8] [9]. For effective restoration, conservation planning and treatment of such composite objects, it is necessary to carry out a diagnosis of the materials that constitute the object. For this type of composite object, many studies have focused on investigating the technology and types of materials for

1.1. Description of the object

This object dates back to the late Ottoman era as it was manufactured in 1327 Hijri. The object was made in Egypt. It contains different types of decorative motifs such as floral, geometric and writing. In the decorations using two types of metal yarns (black and yellow yarns), the structure of metal

metal yarns [4] [13]. The corrosion products of metal are mainly crystalline materials: oxides, hydroxides and simple or basic metallic salts. The metals used to make metal yarns found in or historical textiles are compounds containing covalent bonds with varying degrees of ionic covalent compounds of water solubility [1].

yarns is a solid metal wire. The object is contains the different colors such as black and red color. A visual inspection showed the object to have accumulated dust and dirt mainly due to many years of poor storage under unsuitable and uncontrolled environment, fig. (1-a, b, c, d).



Figure (1) Ottoman textile object from the front and behind showing the decorations, colors, and some damaging forms

2. Examination of metal threads

Scanning electron microscopy with energy-dispersive X-ray microanalysis (SEM/EDS) is the most frequently used

analytical technique for determining of the composition of metal yarns. Where, the energy-dispersive system (EDS),

giving qualitative and quantitative information. Furthermore, SEM images provide a characteristic surface morphology and are useful for judging the surface structure of the investigated

sample, fibers identification and the damaging aspects. [14] [15] [16]. The morphology of the surface of the fibers was investigated using (Joel- Scanning Electron Microscope).

3. Results

The results of SEM investigations proved that the object was made of cotton fibers. The SEM images show that the embroidery or metal yarn are fragile and in very poor condition. It also contains a black stain as shown previously in fig (1). Furthermore, the images show that there

is a corrosion layer on the surface of the metal yarn, fig. (2-a, b, c). On the other hand, EDX results show that the metal yarns in sample one were manufactured from different type of elements such as copper (Cu), zinc (Zn) as shown in fig. (3-a, b, c).

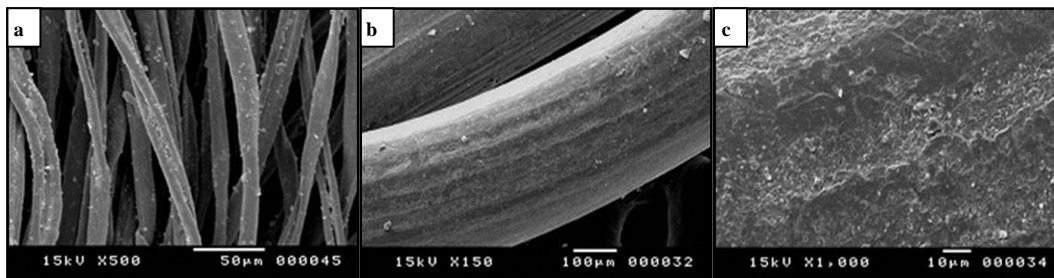


Figure (2) SEM images **a** natural cotton, dust and other abrasive of damage, **b** & **c** showing the metal yarn and we can see the corrosion on the yarn.

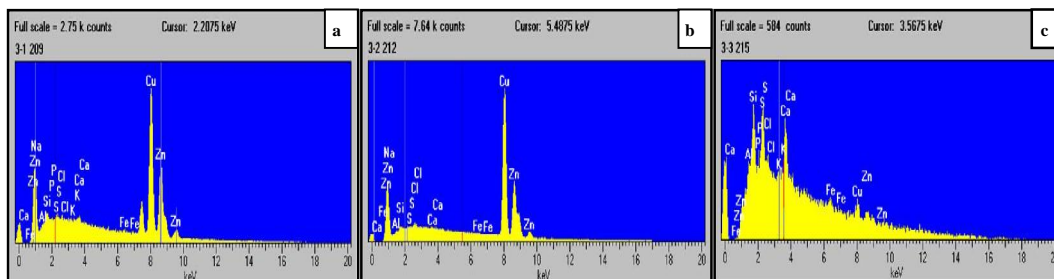


Figure (3) EDX patterns **a** yellow metal yarn, **b** black metal yarn & **c** natural fiber

4. Conservation Procedures

4.1. Testing the stability of dyes

To test the stability of the natural dyes to wet cleaning, green canvas lining was removed, the object showed severe dryness. A piece of cotton wrapped round a wooden stick was immersed into the cleaning solutions

and placed in contact with the colorful parts of the embroiderers. Each color was individually tested. It was found that all the dyes were stable and did not bleed with the wet cleaning solution.

4.2. Mechanical cleaning

The aim of conservation cleaning is to remove harmful soils, which may be disfiguring or causing physical or chemical damage to a textile. Selection of the appropriate cleaning method depends on the nature of the soil present, and on the materials, structure, and condition of the textile. Thorough testing should

always be carried out first to determine the response of the textile to cleaning agents and to identify the most suitable method [17] [4] [5] [12] [7] [8] [9]. Various types of fine brushes are used to remove free dust and dirt from the upper layers of the fabric. Surface dust was removed by using a vacuum cleaner [2].

4.3. Removing the corrosion

Different types of solvents such as acetone, carbon tetrachloride and methanol were used in order to remove the corrosion from the metal yarn. A piece of cotton wrapped round a wooden stick was immersed into the solvent

4.4. Coating and isolated the metallic threads

After removing of old background fabric and cleaning the metal yarn, it was coated with Paraloid B-82 10% (*ethyl methacrylate/methyl acrylate copolymer*). This process was done to isolate and

solutions and placed it in contact with the surface of the metal yarn. Then, the cotton swab was gently rubbed on the surface of the yarns. Different types of brushes were used to remove all the corrosion products.

protect the metallic yarn from the effects of the relative humidity during storage or when the artifact is displayed in the museum, all of these steps are shown in fig. (4-a, b, c, d).



Figure (4) **a** removing of old background fabric, **b** & **c** cleaning process of metal yarn by solvents **d** protection of metal yarn by using Paraloid B- 82

4.5. Wet cleaning procedure

A temporary wash bath was built by using four wooden tires and, lining the bath by polyethylene. This cleaning procedure used water with other detergent agents, to assist the cleaning process. The ratio was one part detergent Synperonic N to 100 parts of distilled water. The water was agitated for 15 minutes to allow it to penetrate between

the fibers to release the dirt particles. The bath temperature was 30 °C. A second cleaning bath using only distilled water was applied for 10 minutes with agitation, and a third bath followed with distilled water for 10 minutes. The wet cleaning reduced the soiling, relaxed the fibers, removed the creasing and brightened the colors [18] [19]

4.6. Drying process

To dry the object without distortion, we experimented with a Japanese tissue sandwich using different tissues (usugami or gampi) applied cross-grain or parallel-grain to the textile with varying amounts of pressure. Then the

object was left uncovered to complete drying at ambient conditions as shown in Fig. 5. When air drying, the process can be shifted towards evaporation in several ways: by ensuring that the wet textile is in a place (i.e. workroom) that is

sufficiently large in comparison to the size and surface area of the drying textile; and by ensuring that water vapor is removed as soon as it is formed with the

help of dehumidifiers, fans and/or effective ventilation [20] [1], these steps are shown in fig. (5-a, b, c).



Figure (5) **a**, **b** & **c** steps of, cleaning process of the textile in temporary bath and. drying process after cleaning

4.7. The final support process

A new linen support fabric was prepared and washed to remove chemical residues and prevent shrinkage at a later time due to humidity changes. The new linen fabric was ironed to remove creases. The new support was three layers adhered together by stitching (non woven textile between two layers of linen). The edges of the support fabric were perforated and the holes were reinforced by metallic rings. A wooden frame was used for mounting. The rings were fixed for easy stretching on the wooden frame. Thick cotton thread was used for fixing the linen support on the wooden frame, fig. (6-a, b). The textile was positioned

on the mount using tacking stitches with a very fine needle and fine silk thread. The edges of the object were attached by sewing around the perimeter of the object with a small stitch technique (blanket stitch). Then the edges of the missing or vulnerable parts were attached by small stitches. Small stitches were used to attach the interior of the textile to the backing. After completing the cleaning process and mounting the textile, it could be displayed in a suitable manner according to the museum requirements [21]. The object in the final stage is shown in fig. (7).

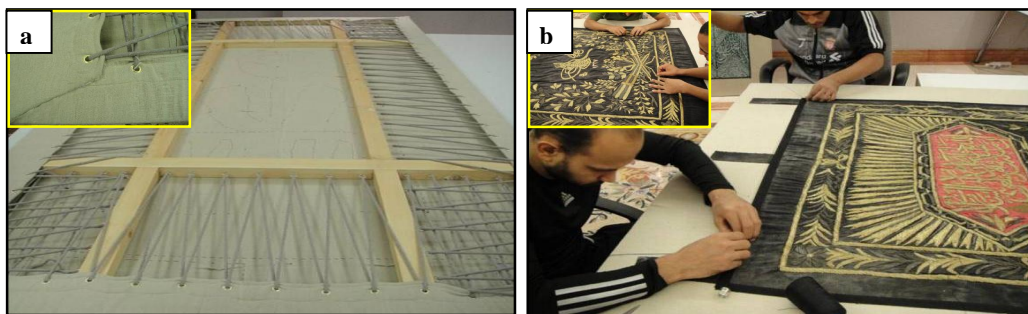


Figure (6) **a** preparing new linen support and attaching the textile on the support, **b** metal yarn before cleaning and after cleaning in the red box



Figure (7) textile after cleaning, mounted on new linen support after completion of the conservation treatment

5. Discussion

The investigation of the metal yarn surface using Scanning Electron Microscopy (SEM) shows that all the metal yarn is the typical structure of historical metal yarns, which is solid metal wire. Microscopic examination shows the layers of corrosion resulting from the impact of weather conditions in the uncontrolled storage environment. The results show that the metal yarn in sample was manufactured from different type of elements such as copper (Cu), and zinc (Zn). The results show that the main components of the sample are copper (Cu) average 53%, zinc (Zn) average 37% which are the fundamental structure of the alloy. Furthermore, the EDX show other elements such as (Cl) average 1%, and (Na) average 5%. Also results show Carbon (C) and Oxygen (O). It is caused by the presence of corrosion compounds on the surface of metal yarn. The solvents such as acetone, carbon tetrachloride show effectiveness to remove the corrosion from the metal yarn more than ethanol.

6. Conclusion

The present article described the analysis and conservation treatment of a historic textile decorated with metal yarns. The textile is dated from the late Ottoman period. Analysis by SEM has shown that the textile was made of cotton decorated with metal yarns. The surface of the textile had an accumulation of dust and dirt affecting the mechanical properties and the appearance of the object, giving it a dull grey and opaque tone. The conservation treatment, which included the removal of corrosion and cleaning and mounting in a proper support, has increased the stability of the textile. Although there was a noticeable improvement of the appearance and integrity of the object after conservation, there was one type of dirt that could not be removed by wet or dry cleaning. After the cleaning and mounting, the textile is free from dirt, has become softer and it is aesthetically more pleasing. Physically, the wrinkles and folds are much less obvious. It is recommended that the textiles should be moved to museum storage as soon as possible for safe keeping of the pieces. It is also recommended that further research should be carried out to study the materials used in the manufacture of the textile, specifically the metallic yarn, the natural dyes and mordents.

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