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TREATMENT, CONSERVATION AND RESTORATION OF THE BEDOUIN DYED TEXTILES IN THE MUSEUM OF JORDANIAN HERITAGE

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ABSTRACT

This study aims to establish and design effective methods to conserve two Bedouin dyed textile objects selected from the museum of Jordanian heritage and to improve the physical and environmental conditions in which items are kept to optimize their long-term chances of survival. The conservation processes that were used in conservation of the selected objects can be used a guide for conservators to conserve other similar textile objects. Investigations and analysis were used to identify the fibers and the extent of deterioration by using noninvasive methods. Transmitted Light Microscopy (TLM) and Scanning Electron Microscopy associated with EDAX (SEM–EDAX) were used for identifying the fibers and the deterioration. The results showed that the textile artifacts studied were very dirty, had white spots occupying cavities and holes, wrinkles and creases, fiber damages. Previous damage may due to the improper display methods in the museum or due to the incompatible environmental conditions surrounded the artifacts during exhibition such as: light, temperature, relative humidity, pollutants and microorganisms. For these reasons, the textile objects were cleaned using wet cleaning methods that improved the physical and mechanical properties of textile objects and returned them to their original shape as much as possible. Then the textile objects were mounted and supported by stitching on to backing fabric stretched on wooden frames. Finally, and according to the requirements of the museum, the objects were displayed temporarily inside showcases in an aesthetically pleasing manner.

KEYWORDS: Dyed Bedouin Textiles, Museum of Jordanian Heritage, SEM, Deterioration, Fungi, Disinfection, Conservation Methods, Cleaning

INTRODUCTION

Since prehistoric times, textiles have played a rich part in the life and traditions of people of all cultures. They have been constructed using varied materials and techniques, and they have been commonly made from natural fibres (The textile institute, 1985, Landi, 1998, Timar-Balazsy and Eastop, 2002, Abdel-Kareem, 2002). Textiles are considered to be sensitive materials because they deteriorate by light, heat, pollutions and microorganisms. They are extremely vulnerable to damage when stored or displayed in inappropriate environmental conditions (Fahey, 2007). Identifying the properties of a textile object can greatly aid in its caring and conservation (Landi, 1998). The aim of the conservation is to improve the properties of textile objects and enhancing their long term stability (Abdel-Kareem, 2005). Also conservation aims to slow down the rate of the further deterioration of textile artifacts as much as possible.

Conservation processes include cleaning disinfection, consolidation, display and storage processes (Abdel-Kareem, 2002). Cleaning is an irreversible process, so that assessing the possible advantages and disadvantages of any cleaning treatment is an important task in textile conservation. Any material that is suggested for cleaning should be tested and laboratory evaluated before any cleaning treatment is undertaken (Eastop and Brooks, 1996, Shashoua, 1996, Timar-Balazsy and Eastop, 2002).

The Museum of Jordanian Heritage contains an important textile collection which describes the Jordan heritage in different historical periods. Rugs and tapestries, woman's belts, bags, customs and dresses are included in the Collection. Bedouin textiles are the most numerous textile objects in the Museum of Jordanian Heritage. Bedouin textiles describe the Bedouin settle and their lifestyle changes. This type of textile is still being produced in Jordan (Hilden, 2004). The key to the survival of these textile objects for future generations is the success in achieving an acceptable conservation processes suitable to preserve the historical, cultural and aesthetic values of these textile artefacts. Therefore, the current research should be helpful for conservators and interested scientists in Jordan to insure that these collections are available for future generations. This study describes conservation processes for two selected Bedouin flat textile objects in the museum of Jordanian Heritage. The conservation processes that were used in conservation of the selected objects can be used a guide for Jordanian conservators to conserve other textile objects.

DESCRIPTION AND CONDITION

Historical Context

Two long Bedouin woman's belts are made of wool (object A and object B). Object A is 302 cm long by 8 cm wide with the most obvious colors being red, black, dark blue and orange (see figure 1 A). The object B is 349 cm long by 8.5 cm wide; its shape and color are similar to that of object A. The most obvious colors of object B are red, black, dark blue and orange (figure 1B). Both object A and object B are Jordanian and are dated to the first half of the twentieth century. They are produced by hand using a simple manual loom. The belt was called "Shwehya". It was used by women around their waist to fasten their dresses during working and farming. Documentation drawings were made prior to conservation on transparent flexible polyethylene sheets with waterproof resistant colored markers with scale (1/1). Then the drawings were transferred again

on sheets of a transparent paper. The drawing included the general object form, specific details and all deteriorated parts (see figure 1C, 1D).

Figure 1: The general form-and specific details - of object A and object B before any treatments. A and B are the photographic documentation, C and D are the drawing documentation.

Technical Investigation

Technical investigation shows that both of objects A and B were made from a tapestry technique. The number of warps and wefts in the object A, in 1 cm^2 is 6 yarns in the warp and 5 yarns in the weft. The number of warps and wefts in the object B in 1 cm^2 is 6 yarns in the warp and 8 yarns in the weft. This result indicates that the woolen yarns of both of object A and B are very thick.

Visual Investigation

The initial visual examinations showed both objects A and B are weak and dirty (see Figure 2). There were dust and soil over the whole surface of the objects and a few spots of heavy stains. The obvious white spots associated with holes and cavities distributed along the objects area were expected to be microorganism growth. In general both of objects A and B suffered from intensive surface damage

which resulted in fiber- deformation, missing parts and holes especially along the object's edges. The terminal fringes of the objects were weak suffered from abrasive damage and tearing.

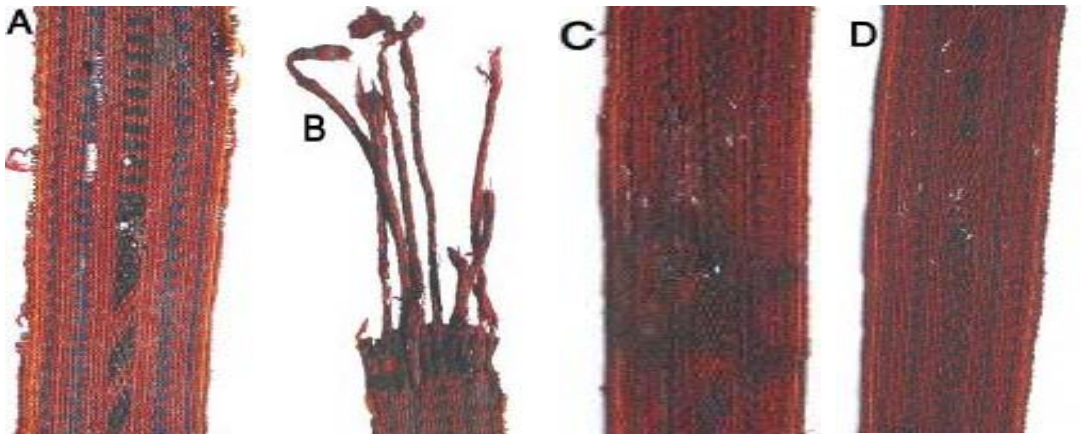

Figure 2: some details of the deteriorated parts in both object A and object B, figures A and B belong to the object A and figures C and D belong to object B.

INVESTIGATIONS

Transmitted Optical Light Microscopy (TLM)

Textile fibers were identified under Transmitted Optical Light Microscopy and viewed through a video microscope system (Nikon H- III). Fibers from warp and weft yarns of each object were examined in longitudinal views at magnifications 400 X. The results showed that both warp and weft yarns for both objects were composed of wool fibers. The characterizations of the wool fibers were that of coarse wool due to their characteristics of regularity in diameters with slightly projecting scales and the central fragmented medulla (The Textile Institute, 1985). The threads used to fasten the terminal fringes of the two objects are cotton.

Scanning Electron Microscopy (SEM)

FEI Quanta 200 Netherlands Scanning Electron Microscopy equipped with EDAX for x-ray microanalysis was used to study the surface morphology of the textile fibers. Samples were mounted on aluminum stubs by double sided sticky tabs, then gold coated with a 20 nm thick by sputtering method using vacuum coating (Polaron E6100, UK). Coated samples were examined to detect possible morphological indications of degradation, splitting and dirt. In addition it was used to assess the ability of microorganisms especially fungi to deteriorate textile artifacts and to identify fungal growth directly (Abdel-Kareem, 1999). EDAX was used to identify the types of dirt and other foreign materials present and, thus, for understanding deterioration.

The results of SEM of both of objects A and B show that warp and weft yarns of the two objects are wool fibers (see figure 3). The typical appearance of wool fibers with overlapping scales of the cuticle was observed (see Figure 3A, 3D).

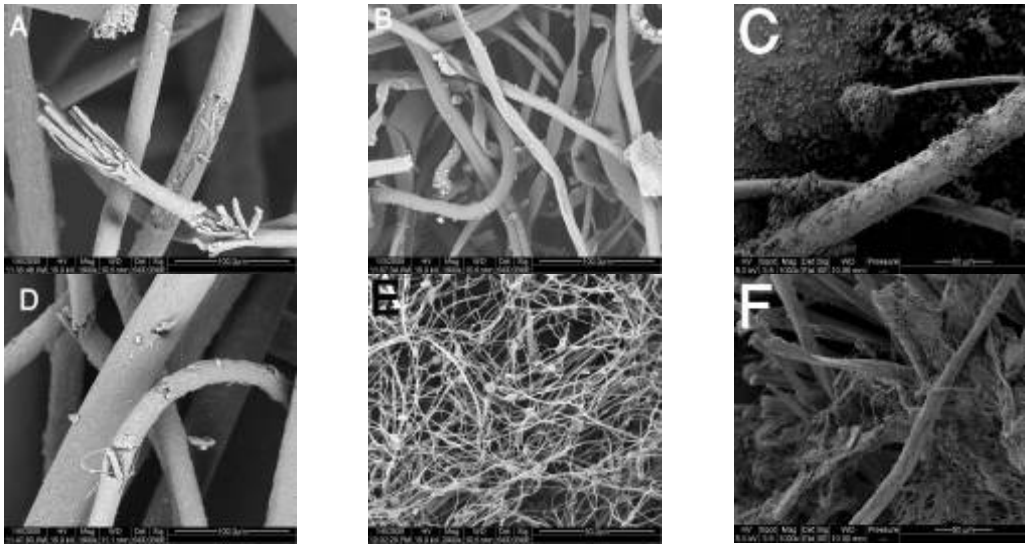

Figure 3: SEM photographs of the deterioration - of both of object A and object B: figures A, B and C belong to object A and figures D, E and F belong to object B.

It is noticed that there is a difference in wool fiber thickness. The changes in fiber surface morphology evident in the SEM images show strong indication of the effects of various degradation influences light, relative humidity and soiling. The results also show that the threads used to fasten the fringes of the two objects are cotton fibers with convoluted flattened fibers (see figure 3B). Wool fibers appear severely damaged with broken ends 'Brush end' appearance and many transverse cracks and longitudinal splits, consistent with loss of scale structure. Also the fibers appear very dirty. SEM photographs indicate that wool fibers are biodeteriorated with several fungi species such as *Aspeigillus sp.* (see figure 3C) and *Chaetomium sp.* (see figure 3E). The mycelia and spores cover the surface of some fibers making them opaque, pitted and rough causing loss of definition of the fabric surface. There are two main reasons for the vulnerability of historical textile to biodeterioration; firstly, their constituent materials and later accretions provide sources of many nutrients for microorganism; secondly, many textiles in museum collections remain undisturbed for many months or even years, and therefore, infestations can remain undetected for significant lengths of time. In this way, textiles can provide an undisturbed habitat and food source. Other factors encourage microorganism growth such as high humidity and high temperature, pH value, darkness, poor air circulation and air pollution. Unfortunately most of these factors which encourage microorganism growth are found in the museum of Jordanian Heritage. There was obvious damage in the textile materials. Fungi excrete enzymes that allow them to digest protieneous and cellulosic materials - altering and weakening these materials. In addition, fungi may contain colored substances that can cause stains and spots on textiles and decrease the strength of the fabric. Fungi can be dangerous to people and in some cases can pose a major health hazard

The results of EDAX analysis exhibit that there are various contamination ele-

ments that are characterized in the composition of dirt in the Museum of Jordanian Heritage (see figure 4). These elements are Si, Ca, Mg, Al and Na, indicating that the fibers were covered with dust and dirt. The high percentages of the contaminations confirm that the surfaces of wool fibers are very dirty.

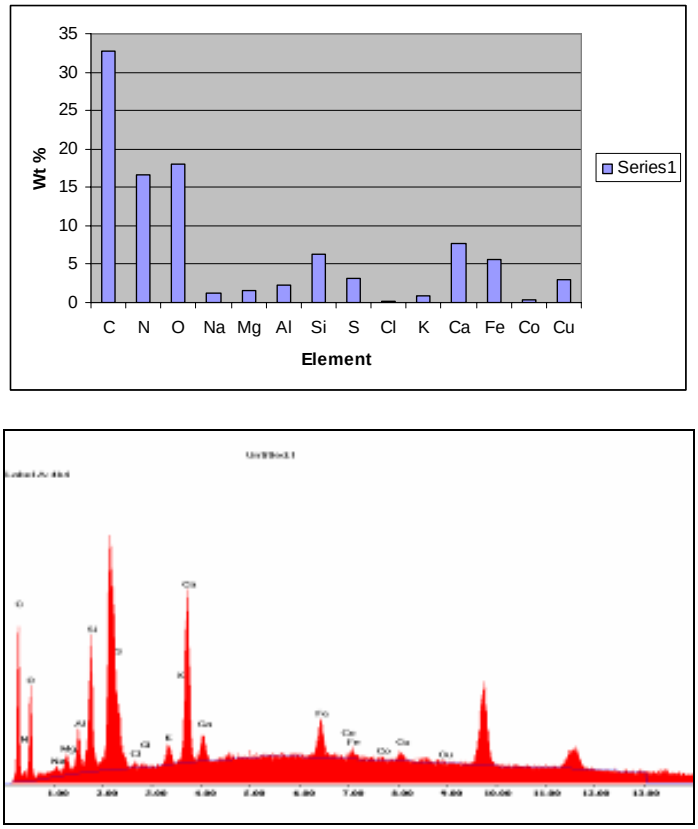

Figure 4: EDAX analysis of the contamination elements on the wool surface of the object A: figure A shows EDAX of the identified elements and figure B shows the percent of the identified elements.

CONSERVATION PROCESSES

Based on the evaluation of the present condition of the two objects the treatment procedures were designed. The study proposed treatment each object, which are summarized as following: temporary support for cleaning purposes, disinfection, cleaning, drying and -and supporting and reinforcement of the objects.

Temporary Support for Cleaning

Prior to any cleaning action each textile was supported temporarily between two layers of fine nylon tulle in a temporary wooden frame (sandwich method). This holds the object in its place and protects the textile from the risk of handling during the cleaning process. A very thin needle and cotton thread was used for stitching using a running stitch. During stitching the needle was passed in between the yarns in the weave, not through them to avoid any damage to the weakened fibers. It is important to keep the tension of the stitches fairly loose. The running stitches were sewn with overlapped rows 1 cm apart starting at the each end of the object and continuing through to the center. The stitches were evenly spaced above and below the textile.

This allows for even weight distribution across several yarns for each stitch. This stitching was repeated all through the whole object to hold it securely between the two layers tulle.

Disinfection

Disinfection refers to the destruction of microorganisms particularly fungi. Because the current objects suffer from fungal deterioration, it was necessity to disinfect the objects before any conservation processes. Preventol was used for disinfecting the textile objects, wooden frames and lining fabric Abdel-Kareem, 2008. This fungicide dissolves well in water. In addition, there is another type of Preventol that dissolves in alcohol so it is recommended for use with all types of dyes. Also the previous study confirmed that it is safe and acceptable for the long term on dyed textile objects.

Cleaning

The belts were very dirty and stained so it was necessary to clean them to remove the dirt to ensure long term survival. The objects had fiber damage which meant they could not tolerate any mechanical vibrations. Wet cleaning, particularly immersion cleaning, was considered to be the best choice for cleaning. Wet cleaning will remove many types of dirt and stains, and it has the potential to soften and relax the fibers. This results in reduced creasing and also improves the chemical properties of the treated objects. The detergent chosen for cleaning the objects was: Orvus WA (sodium dodecyl sulfate) from FLUKA. It is an anionic, neutral surfactant recommended for cleaning dirty textiles (Timar-Balazsy and Eastop, 2002, Long, 2000, Martz, 1998, Eastaugh, 1987). The prepared washing solution was composed of surfactant, sodium dodecyl sulfate (concentration 1 g / L), and a Soil Carrier, sodium carboxymethyl cellulose (SCMC) (concentration 0.1 g / L), dissolved in deionized water. Prior to wet cleaning, the effect of this washing solution on each of the objects was tested to ensure its effectiveness without any side effects. The washing solution was tested on a small spot of each belt before the belt was immersed. In a similar manner testing for dye sensitivity was carried out. A small corner area of each belt was placed between two inert white cotton and wool fabrics with some drops of washing solution. After right hand pressure on the wetted test areas the cotton and wool fabrics were checked for fabric discoloration or dyes bleeding. Fortunately, no discoloration was observed and the wash solution was safe for our objects. There is no suction table available for cleaning processes in the conservation laboratory in the Museum of Jordanian heritage. To clean these long belts a rectangular wash tank was made from four wooden frames which was large enough to suit the object dimensions. The tank was covered with a polyethylene sheet to form the tank base (see Figure 5).

Figure 5: Cleaning process of object A

This technique is an effective and easy technique for cleaning ancient textiles (Abdel- Kareem, 2002). The washing tank was filled with prepared washing solution to a level of 5 cm above the object. The belt was carefully inserted into the bath, in the supporting tulle and allowed to become properly saturated. It was immersed for about 20 minutes. Twenty minutes is an ideal time to prevent too much swelling or hydrolysis of degraded fibers (Shashoua, 1999). To assist the distribution of washing solution inside the tank, water was gently agitated the water by hand until there were signs of movement of dirt and discoloration. The object was removed from the tank. Then the dirty water was drained away by tilting the washing surface on one side. After the washing, the rinsing process was carried out on the washed object. The rinsing process was repeated again with deionized distilled water for 3 to 4 times until the water seemed clear and all signs of detergent had disappeared. This is an important step to ensure that there is no residual detergent present on the fibers that may be harmful for the treated textile in the future. It is clear from washing solutions that too much dirt and soils were removed from the object. After cleaning there was an obvious improvement in the surface of after the belts. The effectiveness of cleaning was affirmed in the SEM photos which indicated clean and smooth surfaces free from dirt.

Drying and Laying out

The drying of wet textiles can present an opportunity to realign distorted fibers. The straightening of the yarns can be achieved with minimum risk to the textile when it is in a film of water that acts as a lubricant and thereby reduces stress on the fibers. Thus, blocking and drying is considered as a crucial part of wet cleaning (Timar-Balazsy, 1999). The drying process should be done quickly over a clean and flat surface to prevent microorganism growth. It is necessary to remove excess water by poultices or filter paper and the same time to checking the weaves. Straightening may be difficult, but is a most important process in connection with washing. It is only when the object is wet that we have a chance of restoring it to its original shape.

After cleaning the belts were transferred onto a flat horizontal, clean and smooth surface. The stitching and protective tulle net were removed. Absorbent drying cotton fabric was used as a poultice and pressed lightly to the surface of the belts to remove all excessive water. Carefully hand pressing on the surface of the object is an important step to check the orientation of the weave. Finally the belts were left to dry overnight with the flat, right side uppermost. A heater and drier were used to assist and hasten drying due to the cool room temperature (see Figure 6).

Figure (6): The drying process of the belts

Supporting and Reinforcement

The most effective support of a weak textile is to line it with a suitable fabric. Mounting the object on a new support fabric will give additional stabilization. This step includes laying the object on a suitable mounting fabric for exhibition purposes. Landi (1998) recommends an inert natural linen fabric as the best choice. The support fabric was attached to a wooden frame from back with tacks. The aim of this mount is to give enough strength to an object to withstand the condition of storage and display prevailing at the time. Just as these conditions can vary from place to place, so may the necessary degree of support is required.

In the case of the Jordanian belts we were concerned with the prevention of future microbiological damage. The wooden frames were treated with preventol 1% in ethyl alcohol and varnished carefully with a brush and left to dry. This fungicide is very good for the prevention of fungal deterioration in textiles museums (Abdel- Kareem, 2008). The frames were varnished completely again with paraloid B72 (with a concentration of 10 % in acetone) to ensure good coating and isolation against various environmental conditions. For mounting the belts on the frames, un-dyed linen backing fabric had been washed to remove all sizing and finishes. The linen was treated with biocide with a concentrate 1% to prevent any future microorganism attack. The backing fabric was laid over the treated timber frame and stretch. Then the textile object was placed carefully over the fabric.

An important factor in a successful mounting is the choice of materials needles, threads, to give the maximum visual satisfaction and assurance of future stability, without risk of adverse effects (Landi, 1998). Likewise, the conservation of a textile by stitching requires delicacy and accuracy. Threads and needles should be durable, thin, good quality and compatible with the object. We used thin stainless needles choice. Landi (1998) recommends silk threads to be as the best choice, then cotton, viscose rayon or polyester, depending on availability. We chose to stitch the belts temporarily with fine thread, differing in color from object's colors. Thus we chose white cotton thread as a guide for the final stitching. The final supporting and stitching adjacent to the primary stitching is made with fine silk threads with colors compatible with each area's color (Landi, 1998). Any type of stitches used in textile conservation must be applied with precision and discretion. To support our objects, two stitches were used. An overcast stitch was used to support the edges of the objects over and a running stitch was used to support the internal areas adjacent to primary stitches and damaged areas.

The choice of framing a textile artifact is a fundamental choice to prevent any further damage during exhibition. The stitching of the textile to the support fabric on the frame is a means to display textiles safely. For this reason with our belts very small running stitches were applied adjacent to the primary stitches to stitch the objects to the backing supports. A running stitch is worked by passing the needle in and out of the fabric. The belts' edges were the weakest places, so an over-casting or whipping stitch was used. Also a long diagonal stitch was used over the edges to tide thread edges of the belts and prevent raveling and reduce further fiber damage. The diagonal stitch was worked from the inside of the belt to outside edge. Natural silk, threads in compatible colors in were used for stitching. The stitches ensured the mounted textile was not strained, but

were tight enough so that it would not move or abrade on the mounting. This type of framing ensures good support for the belts and will reduce future handling to a minimum.

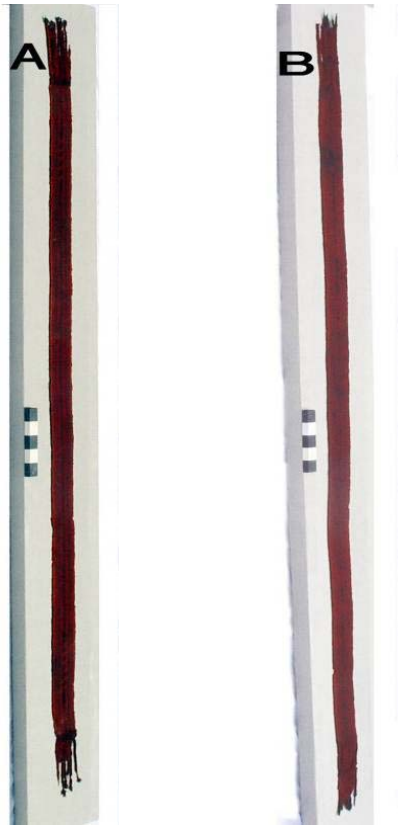

Figure 7: The appearance of the objects A and B after the treatments

DISCUSSION AND CONCLUSION

Most of textile objects in the museum of Jordanian Heritage are composed of wool fibers. In addition, the objects suffer from fiber damage and abrasion especially at the edges and terminal fringes, wrinkles and folds particularly at corners, dirt and stains, white spots associated with holes, some burnt areas and some improper previous repairs. There is intense accumulation of dust and dirt on the surface of objects which may cause mechanical damage and affected the appearance of the objects, giving a dull grey and opaque tone.

The appearance of the belts after all treatments show that there is an improvement in the integrity of the objects. The belts are aesthetically pleasing and are free from dirt and damage (see figure 7).

Two types of fungal species appeared on the studied textiles artifacts: *Chaetomium sp.* and *Aspergillus sp.* These species are very dangerous because they belong to class *Deuteromycetes*, which is capable of rapid growth when the environmental conditions are favorable, and which are also able to survive under unfavorable conditions (Abdel-Kareem, and Szostak-Kotowa, 2003). Inappropriate environmental conditions (such as high relative humidity, temperature and pollutants) of the Museum of Jordanian Heritage promote fungal growth. These results are in agreement with results obtained by Abdel-Kareem (2008) who confirmed that textile objects in display area in Museum of Jordanian Heritage suffer from extensive fungal deterioration. He has identified three genera of fungi: *Aspergillus sp., Chaetomium sp.* and *Pencillium sp.* The most dominant fungi are *Aspergillus sp.* and *Chaetomium sp.* To control and prevention of fungal growth the study recommends using effective types of fungicides as part of conservation processes such as Preventol.

The study confirms that it is necessary to conserve textile objects in the museum. Conservation processes improved the appearance of the belts due to improved physical and mechanical properties of the objects which will lengthen their survival and thus to insure that these collections are available for future generations. The study affirms that there is a lack in facilities and equipments in the conservation laboratories, which may due to the lack of awareness of the importance of to preserving our cultural textile artifacts in the mu-

seum of Jordanian Heritage. The usual method of cleaning textile objects by immersion in an aqueous solution (wet cleaning) was the most suitable for the belts in this study. This study used the available facilities for cleaning by using accessible and inexpensive materials to make the wash tank instead of an expensive suction table. The chosen detergent Orvus WA was considered an excellent surfactant for the cleaning project. After cleaning the belts appeared softer and wrinkles and folds were less obvious. There was extensive removal of particulate soil.

The support method of stitching the belts to an inert linen fabric stretched over a wooden frame is recommended to minimize damage in handling, display and storage. The framing materials are inexpensive and readily available. This method was simple and uncomplicated. The showcases of the museum were used to exhibit our artifacts in an attractive way.

In conclusion, we can say that this study encourages the improvements of the physical and environmental conditions in which textiles are kept to optimize their long-term chances of survival.

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