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CONSERVATION OF A RARE PAINTED ANCIENT EGYPTIAN TEXTILE OBJECT FROM THE EGYPTIAN MUSEUM IN CAIRO

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This study describes conservation of a painted ancient Egyptian textile object from the collection of Osiris cloths in the Egyptian Museum in Cairo, Egypt. An evaluation of the reactivation consolidation technique to reinforcement of ancient Egyptian painted textiles was performed. Various investigation methods were carried out to identify the fibres, paints, and other materials, which are part of the selected object. The condition of the object was also investigated. Newly prepared painted linen textile samples were artificially deteriorated to be used for evaluation of the suggested reactivation consolidation technique. The aged textile samples were treated with three selected adhesives in three different concentrations and the samples were evaluated. The results show that the tested consolidation technique is suitable to reinforce deteriorated linen textiles. The evaluated consolidation technique is simple, effective and can be applied using simple tools that are common to many conservation labs.

1 Introduction

Many damaged ancient painted Egyptian textile objects are exhibited and stored in the Egyptian Museum in Cairo. This may be a consequence of the fact that most of the textiles have not undergone any conservation treatment since their excavation. The damage may also be a consequence of display and storage practices in the Egyptian Museum, which are far from the accepted standards.[1] Textiles deteriorate naturally due to oxidation, heat, mechanical stress, radiation, moisture and microbiological attack.[2,3] Deterioration of cellulosic textiles causes breakdown of the molecular structure, which in turn results in the loss of strength and general durability, in discolouration, fading and affects the appearance of the material.[4-6]

The conservation of historical textiles always involves a compromise between preservation of evidence and enhancement of the long-term preservation of the constituent materials.[7] We have to compare effective soil removal against the possible damage caused by cleaning.

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Figure 1: The shroud before the treatment.

Chemical Name	Trade Name	Producer
Vinyl acetate / acrylic ester copolymer	Mowilith DM5 (E)	Hoechst
Vinyl acetate / dibutyl maleate copolymer	Mowilith DMC2 (E)	Hoechst
Butyl acrylate / methyl methylacrylate	Lascaux 498 HV (E)	Lascaux Restauro
Methyl hydroxyethyl cellulose	Tylose MH300 (SD)	Hoechst

Table 1: Adhesives used in this study.

The fragility of certain deteriorated textiles has caused particular conservation problems.[7] The problems may be even more complicated in the case of dyed or painted textiles as is the case of the study object. One of the main problems in conservation of fragile painted textiles is difficult reinforcement. Most of the methods that are commonly used for historical textiles are based on needle work, and conservators may prefer consolidation of fragile textiles with polymers and adhesives. Some of them are more commonly used than others.[7-15]

When considering a treatment, it is important to understand the probable consequences it the object remains non-treated, as well as the probable effects of treatments and in addition, any possible side effects.[7] Polymers and adhesives can be applied as liquids directly to the textile, so that fibres become coated and impregnated with the adhesive. In consolidation, adhesive creates a thin film on the surface of fibres, thus keeping the small fragments together. In textile conservation, adhesives are usually applied as liquids and allowed to dry, before they are applied to the textile in its solid state (dry film) using pressure or, heat pressure, to secure adhesion. There are two commonly applied methods. The first one is carried out directly by using the polymer as a liquid. This technique may be irreversible as a complete removal of the polymer from the fragile textile is impossible. The other methods may also have disadvantages, e.g. heat may also cause damage to fragile textiles. Takami has applied reactive consolidation technique to reinforce a Korean painted silk banner.[15]

This study aims at evaluation of a reactivation consolidation technique for the treatment of a painted Egyptian linen object. Using this method the adhesive can be reactivated by liquid solvents.

2 Material and Methods

2.1 Materials

2.1.1 The Object

A painted ancient Egyptian linen textile object (165 x 77 cm) from the Egyptian Museum in Cairo was used for this case study (Fig. 1). This textile object is a mummy shroud excavated by Daressy and Grebaut in 1891 in Elder-Elbahri in Luxor. The shroud dates back the 21st Dynasty from the Pheronic period.[16] The shroud was stored in the third floor of the Egyptian Museum in Cairo (No.14398 special record).

2.1.2 New Fabrics

Scoured unbleached plain linen textile fabric was used in this study to prepare model samples. Two types of support fabrics were tested in this study, silk screen and polyester fabrics.

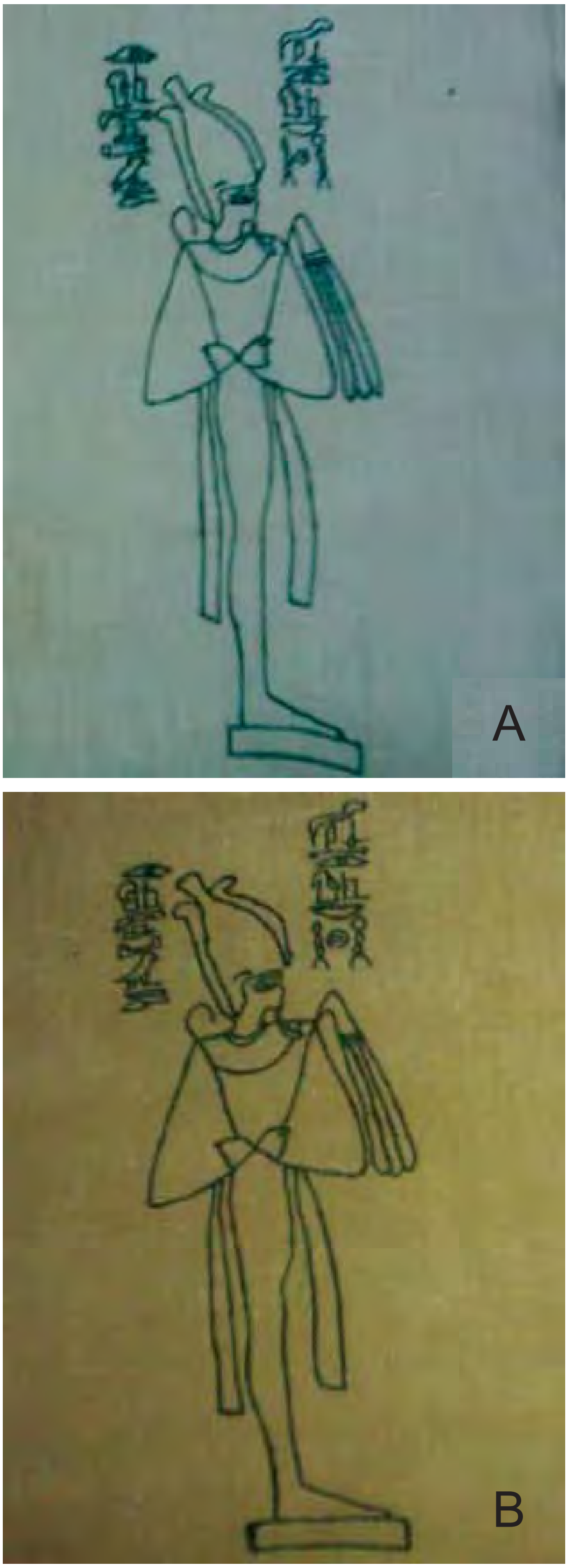

Figure 2: Experimental painted linen textile samples, A) before ageing, B) after ageing.

2.1.3 Adhesives

The adhesives used in this study are listed in Table 1. They were used in three concentrations, 5, 10 and 15%. These polymers are commonly used in consolidation of historical textiles.[7-15,17,18]

2.2 Methods

2.2.1 Methods of Investigation

Various methods were used to identify the materials. The condition of the object was assessed visually. The state and the extent of deterioration of the fibres, structure, and the colour of the object before treatment were evaluated. Also, technical examination of the weaving and fibre type was performed using a stereo microscope. To test pH of the ancient textile object, surface pH tests were performed using non-bleeding Merck indicator strips held against a small area previously wetted with de-ionized water. For optical microscopy, small parts of loose fibres were investigated using a video microscope system (SDL international, UK), at a magnification of 500x. The Scanning Electron Microscope (SEM) investigation was carried out using SEM Philips XL30 equipped with an EDAX Unit. Transmittance FTIR spectra of textile samples were measured using the KBr pellet technique using a Bruker IR Spectrometer at the Micro Analytical Centre, Cairo University.

2.2.2 Evaluation of the Consolidation Method

Scoured unbleached plain linen textile fabric was cut into pieces of 20x15 cm. The prepared pieces were decorated and painted by hand with black paints prepared using ancient materials and methods (Fig. 2).[19] Various types of pigments and dyes have been used to paint and decorate linen textiles in ancient Egypt. Black carbon ink has been used on the object, and the model linen specimens were also painted and decorated with black carbon ink. The binder was prepared from 59 g of gum Arabic, dissolved in 70 ml of warm water and left for 24 h to stand. 40 g of carbon soot were ground well and mixed with the prepared binder. The filtered ink was used for painting the model linen specimens using a fine brush.

Following this, the painted samples were thermally aged at 140 ºC in a convection oven for 72 h according to Kerr et al. [20] This is estimated to be equivalent to about 200 years of ageing under normal conditions.[21] Very degraded textile specimens are produced, which are physically fragile, and thus suited for evaluation of conservation methods using polymers and adhesives. However, these samples may not be representative of the chemical state of the ancient textiles, because of the different deterioration agents (such as heat, light, pollution and microorganisms), which affected the historical object.[22] The tested support fabrics were cut into pieces of 21 x 16 cm. The support fabric samples were treated with adhesives according to the method No. 2 described by Landi.[11]

The aim of this technique is to create a film from the adhesive in which the fabric is embedded. The prepared support fabrics were attached to the artificially aged linen textile specimens according to the following procedure: The working surface on a cleaned table was covered with a Teflon sheet and then coated with a sheet of non-woven polyester as padding. A Teflon sheet was used as covering, to isolate the surface and prevent sticking of the shroud onto the surface. The artificially aged linen textile specimens were placed face down in the centre of the prepared surface. The previously treated support fabrics were put over the back of the aged linen textile specimens, making sure that the warp was correctly aligned. They were put firmly in place, smoothing them out gently but without putting them under tension. A perforated Teflon sheet was used as a covering. Poultice pulp impregnated with a suitable solvent (acetone for Mowilith and Lascaux adhesives, and water for Tylose), was used to coat the perforated Teflon sheet. Another sheet of Teflon was used to cover all items. A wooden board was used as a weight (about 40 kg). After 10 min to ensure that the adhesives were reactivated and attached with the artificially aged linen textile specimens, the wood board and the poultice were removed safely and the artificially aged linen textile specimens were left for 30 min to dry. The specimens were evaluated visually and microscopically.

3 Results and Discussion

3.1 Investigations Prior to Treatment

3.1.1 Condition Assessment

By visual examination it was established that the shroud was very soiled (Fig. 1). The shroud was fragile and stiff as a result of drying out. The fibres were also damaged, which might be a consequence of improper storage in too dry conditions. This damage may also have occurred before excavation or may be a consequence of soiling. There were different additional stains on the shroud. There were big holes and tears in the shroud. The selvedges and edges suffered from wear and tear. The piece exhibited many areas of loss. The linen yarns were brittle and stiff. There was evidence of insect attack, possibly woodworm. Through the warp direction there were strips of more degraded fibres, which were more darkly coloured. The fringed ends were breaking off at the slightest movement. Otherwise, it was possible to handle the object.

3.1.2 Technical Notes

The weave structure and fibre type were analysed. The dimensions of the object are 165 x 77 cm, weave pattern: plain weave (tabby) 1/1, count of warp threads: 12, count of weft threads: 6, warp: linen, weft: linen. There are two fringes: upper and lower. The weave structure of these fringes was the following: weave pattern: plain weave (tabby) 2/2, count of warp threads: 8, count of weft threads: 12, warp: linen, weft: linen. The shroud was painted with hieroglyphs and decorations in the form of a dead person staying as Osiris God with Osiry position. Stereo microscopy was used to establish the painting technique. No ground was visible and the paint appeared to coat the fibres and interstices of the weave with some absorption into the fibres. The decoration was done by hand using a black pigment/dye and brush.

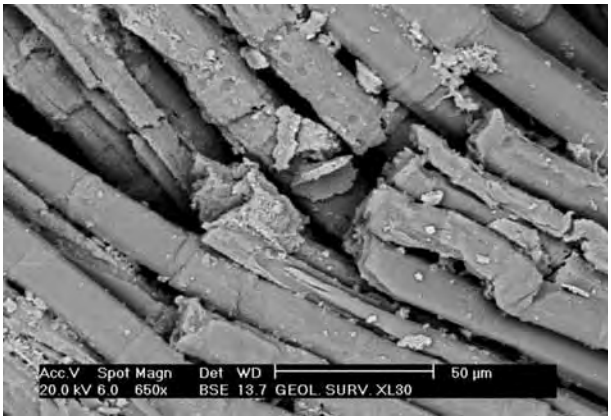

Figure 3: SEM photos showing surface damage.

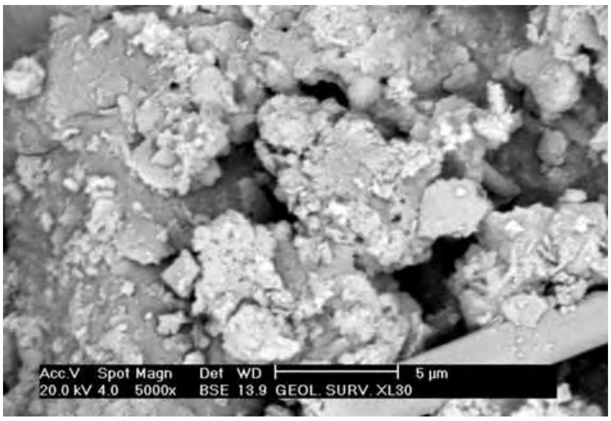

Figure 4: SEM photos showing parts of the coloured shroud surface.

3.1.3 pH Measurement

The surface pH was 4 - 5. This acidity may be due to migration of acids from the wood panel and the lining fabric that were used to support the shroud.

3.1.4 Scanning Electron Microscope

Observation of the surface morphology of fibres collected from the shroud revealed a high degree of degradation and damage. Scanning electron microscopic (SEM) images (Figs. 3-4) show that the linen surface is extremely rough. The damage is evident in the form of scratches, large slights, holes and transverse cracking of fibres, which can be noticed in the photos.

3.1.5 IR Spectroscopy

The results show that the linen fibres are very damaged, indicated by the presence of functional groups typical of deteriorated cellulose. The linen samples are clearly very degraded as the ratio of peaks for carbonyl and carboxyl functional groups is higher than that of new linen without.[23] The results also show that the medium used for ink preparation is gum Arabic.

Figure 5: The shroud before cleaning.

Figure 6: The shroud after cleaning.

3.2 The new reinforcement technique

Visual investigations of the model linen specimens after treatments with adhesives in 5% concentration revealed that the adhesion between the specimens and the tested lining fabrics is not strong enough to provide sufficient reinforcement. The specimens after treatment with adhesives in 15% concentration attached to both tested lining fabrics became stiff. The specimens after treatment with 10% Lascaux 498 and Mowilith on silk screen retained flexibility, while the specimens treated with 10% Tylose on silk screen became stiff. This was also the case of all tested adhesives in 10% concentration on polyester. There is some change in the colour of specimens treated with adhesives in 10% concentration on silk screen and polyester fabrics, the samples became somewhat darker. This was not the case of 10% Lascaux 498 treatment on silk screen. Microscopic examination indicated that the adhesives are still between the lining fabrics and the behind surface of the treated specimens and that there is no penetration of the adhesive into the upper surface of the treated specimens. All previous results show that the new method is safe to be applied to the shroud. Previous results[17] confirm that Lascaux 498 enhances the long-term preservation of linen textiles. The results of this study confirm that Lascaux 498 at a concentration of 10% is the preferred choice from among the tested adhesives. The results show that silk screen is better than polyester support fabric. Further studies should be performed to investigate the long term durability of silk screens in museum environments.

3.3 Treatment of the object

To achieve stabilisation of the object, the treatment included: humidification, cleaning and removal of stains,[24] and reinforcement of the shroud.[7] Finally, the shroud was prepared for display.

3.3.1 Humidification

Humidification was carried out to bring the degraded linen fibres into a relaxed and elastic state.[7] The shroud was humidified in a humidification chamber made of polyethylene piping and sheets. The chamber was large enough to accommodate the shroud placed on a net-covered platform. A tray within the chamber was inserted to hold an ultrasonic humidifier, after which a tray of deionised water placed under the platform.[25]

Figure 7: The shroud after conservation.

3.3.2 Cleaning

The shroud was cleaned locally using a suction table.[26] First, the shroud was put between 2 sheets of polyester crêpe to enable its safe handling. Then, the shroud was cleaned with a 50:50 mixture of ethanol and water using a suction table, locally and by taking care of the decoration.[13] The mixture of ethanol and water was used to relax the fibres sufficiently to soften the creases.[11] Most of the dirt was thus removed (Figs. 5-6).

3.3.2 Reinforcement

The silk screen support was treated with Lascaux at a concentration of 10% as mentioned above. The work surface (cleaned table) was covered with polyethylene and then coated with sheet of non woven polyester as padding to absorb pressure during the work. The prepared surface was covered with a Teflon sheet to prevent sticking of the

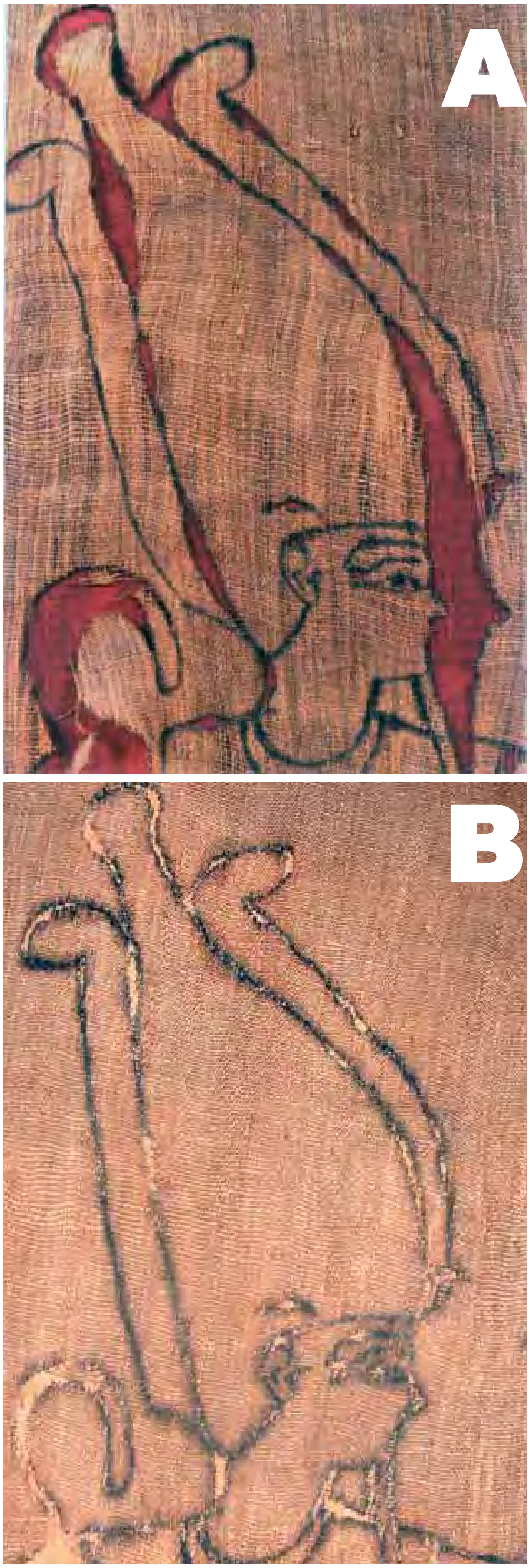

Figure 8: Details of the shroud before and after conservation, A) before B) after.

shroud to the surface. The shroud was placed face down. The previously treated silk screen support was laid over the back of the shroud, making sure that the warp is correctly aligned. It was fixed firmly in place by application of weight over it, smoothing it out as flat as possible but without putting it under tension. A perforated Teflon sheet was placed on top. A pulp paper poultice impregnated with acetone was put over the perforated Teflon sheet and another sheet of polyethylene was used as covering. A wooden board was placed on top and weights were applied. After 10 min, ensuring that the adhesive was reactivated and attached to the shroud, the wooden board and poultices were removed and the shroud was left for half an hour to dry (see Figs. 7-8). The shroud was displayed flattened on a wooden board prepared according to Abdel-Kareem and Schofer.[26] The shroud was covered with Perspex with to provide protection against UV slight and dust.

4 Conclusions

The evaluated reactivation consolidation technique is simple and effective for reinforcement of ancient Egyptian linen objects. This technique can be applied using simple tools that are commonly present in conservation labs. To apply this technique silk screen and Lascaux 498 are suggested. Further investigation should be done to investigate the long term stability of painted linen textiles treated according to this method.

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