

Chapter 9

Deterioration Mechanisms: The Role of Science and Technology in the Preservation and Sustainability of Egyptian Historical Textiles – A Case Study

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ABSTRACT

Historical textiles in Egyptian museums are exposed to many different forms of damage, such as biological, chemical, and physicochemical factors. They are also exposed to dirt and various stains. These factors cause damage to historical textiles, including changing the pH, weakening of historical textiles, and increasing fragility. Therefore, modern technology contributes to the maintenance and restoration of historical textiles, which helps in the sustainability of historical textiles in Egyptian museums. In this chapter, the role of various damage factors and their impact on historical Egyptian textiles will be clarified through the writer's practical experience, which spanned more than 20 years in the field of restoration and preservation of historical textiles. Practical experiences of using modern technology and its applications in the field of preserving historical Egyptian textiles will also be presented.

INTRODUCTION

Physicochemical Deterioration of Historical Textiles

The physicochemical factors of damage include both heat and light factors in addition to the moisture factor, which causes non-reversible physical and chemical changes, which eventually lead to the photochemical decomposition of tissue fibers, breaking the chemical bonds between their atoms, and destroying the fibers themselves. There is also damage to natural pigments, change and fading in color tones and fading of their colors in the long term, especially with light-sensitive dyes and pigments. In addition, dust and dirt particles, which at high relative humidity and with the hygroscopic nature of textile fibers absorb

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excessive amounts of them, which lead to their swelling. It works to raise the acidity, which increases the decomposition of the fibers, which results in the occurrence of distortions in the shape and dimensions of the tissue holding in general, with the appearance of tears and cuts. The high humidity, along with the availability of gaseous pollutants in the atmosphere of the industrial cities, leads to the possibility of forming acid solutions that destroy the textile holdings, but in the case of low humidity, this leads to the textile fibers losing their internal moisture content, which results in their dryness and fragility and the emergence of separations and cuts (Tímár-Balázs, & Eastop, 2012; Beecher, 1979; Ahmed, 2002).

Protecting Textiles in Museums from the Effects of Physicochemical Damage

- Calculating and recording the amounts of light in the exhibition halls of textile holdings using light measuring devices
- Use of Cool Beam Lamps such as Dichroic Halogen Lamps which are free from harmful infrared rays with the use of Pollutants Dosimeter Badge 57
- The use of automatic, self-closing lighting systems to reduce exposure times
- The necessity of using central air conditioning systems, the necessity of good monitoring and continuous environmental recordings.
- The use of Buffering Agent has the ability to absorb and give moisture to the surrounding environment inside the display cases of textile holdings until reaching a degree of equilibrium, and also the use of Dehumidifiers (Booth, 1984; Flury- Lemberg & Bern, 1988).

Biological Damage Factors

Biological damage factors include various types of insect infestations such as Varied Cloth Beetle, Black Carpet Beetle, Silver Fish, and Clothes Moth. Where the textile collectibles suffer from the effect of these insects through direct damage (mechanical damage), whether by feeding on the components of the historical textile, which leads to the presence of holes and various corrosions, through indirect damage (chemical damage) due to the excrements left by insects or acidic enzymatic secretions, this is led to changing the pH values. The Biological damage lead resulting in the appearance of color spots, which are attractive to decomposing fungi and all kinds of dirt and dust. Also, historical textiles are affected by the attack of microorganisms such as fungi and bacteria. Researchers have provided a list of fungi that attack historical textiles, the most important of which are *Penicillium*, *Aspergillus*, and *Cladosporium* (Kavkler et al., 2022; Mansour and Ahmed, 2012; Cooper and Phillips, 1999).

PROTECTING TEXTILES FROM BIOLOGICAL DAMAGE

Some guidelines that must be followed to resist biological damage

- Remove the textiles affected by fungal or insect damage from the exhibition halls, put them in airtight bags and transport them to the places designated for treatment.
- Determining the source of the infection and the method of its occurrence with the use of one of the modern methods of inhibitors of insect development, which leads to the death of the insect

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