Non-destructive Analysis and Conservation of Greek Papyrus in Egyptian Museum Cairo, Egypt

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ABSTRACT

Papyrus plants were one of the most important sources of writing material in ancient cultures and are first used over 5000 years ago in the Nile Valley Kingdoms. Papyrus number SR.1772, CG.31194 housed in Egyptian Museum, Cairo was selected for this study. Measurements 7.5 x 3.5 cm, it was found in Gebel el Luxor, it is part from document with Demotic line dates back to Ptolemaic era (Fig 1). For many years different kinds of secondary supports have been used such as (gelatin, celluloid film, paper, cardboard, gold beaters skin, Plexiglas and glass) with different kinds of adhesives like (starch, animal glue and waxes) which cause many deterioration aspects to archaeological papyrus.

In this paper, the goal is to use non-destructive analytical techniques in order to provide a deeper understanding of the materials. Moreover, apply appropriate conservation techniques to the papyrus. Different techniques have been applied for investigation and analysis of selected papyrus.

METHODS AND MATERIALS

The object were studied using SEM-EDX, Micro Raman, and Micro FTIR;

1) SEM-EDX: Philips Environmental Scanning Electron Microscope (ESEM) model: XL30 was used to observe the surface morphology, also we analysis sample ink and surface of papyrus to know the components of it.

2) Fourier transform infrared spectroscopy (FTIR): Infrared reflectance spectra was recorded using a Vertex 70V (Bruker Optics) spectrometer. The recording time varied according to the quality of spectra obtained and ranged between 600-4000 scans and spectral resolution was 4 cm⁻¹.

3) Raman spectroscopy: The micro-Raman spectra were obtained using a Rennshaw spectrometer equipped with a CCD. The blue beam of an Ar+(488.0 nm) laser was used for sample investigation. The phonon peaks, attributed in the spectra, were fitted with Lorentzian distributions, for the best possible determination of their frequencies. The instrument was calibrated using the spectrum of a silicon wafer as a reference.

RESULTS and Discussion

The results of the analysis proved that starch adhesive was used to fix archeological papyrus on old paper backing. The IR spectrum of starch sample was described by many absorbance peaks as follow: The peaks at 3334 cm⁻¹ and 2918 cm⁻¹ could be attributed to O−H and C−H bond stretching, respectively, while the peaks at 1423 cm⁻¹ and 1388 cm⁻¹ were attributable to the bending modes of H−C−H, C−H and O−H. The peaks at 1300-1000 cm⁻¹ were attributed to C−O bond stretching. For these peaks (Michele, R et al 1999). Additionally, the comparison between the spectra from the old adhesive and the starch standard yields a good fit as (Fig 4). This finding is agreement with (walker, A. 1988)

Carbon ink was determined as the writing material by using Raman Spectroscopy which revealed through the characteristic strong and broad bands at ~1320 and 1567 cm⁻¹ (Alexis, C. et al 2012) (Fig 2) which confirmed with SEM-EDX. In (Fig 3).

Arabic gum is identified as a binder for the ink in this papyrus by FTIR analysis. The restoration process reveal that hydroxypropyl cellulose (HPC) and Gampi paper achieved great success for lining surface of papyrus during the removal of old paper backing.

CONSERVATION TREATMENT

Papyrus conservation processes included surface cleaning, removing unsuitable secondary paper support by applying surface lining using hydroxypropyl cellulose (HPC) 4% and Gampi paper (Fig 5a). Damping the backing with (ethanol-distilled water) and peel it off, then we dampened the facing lining with a brush impregnated with acetone and remove it (5d, 5e), the treated Papyrus was mounted between two sheets of three-millimeters glass.

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REFERENCES