Summery

This paper deals with **"Study of Technology to the Use of Enzymes in Cleaning of Mural Paintings. Applied, Experimental Study in Treatment and Conservation"**

This Scientific work includes six chapters divided as follows:

Chapter one under title: Enzymes

The chapter contains three main sections focus on nature of enzymes and enzymatic catalysis, as well as methods of division, classification and nomenclature of enzymes, concluding the first chapter with extraction, purification and estimating the activity of enzymes as well as factors affecting the enzyme activity, such as temperature and concentration of enzymes and substrate material., the three main sections of this chapter were divided as follow:

First: a brief history of dealing with the use of enzymes and its denomination.

It explains the nature of the enzymes and the fact that enzyme is complex protein, as well as enzymes are vital Catalysts, This is because biochemical reactions that occur in cells with the assistance of enzymes are carried out under moderate conditions of temperature and hydrogen ion concentration.

Second: classification, division and naming of enzymes, As well as focusing on the different divided ways of these enzymes in multiple ways, including:

Division depending on the installation: the system relies on the naming and division of enzymes to:

A - Enzymes of protein nature only.

B - Enzymes composed of protein and contain Escorts enzyme.

As well as ways to partition and label system according to the International Society for Chemistry, this is divided into six groups of enzymes, namely: Oxido reductases, Transferases, Hydrolases, Lyases, Isomerases, Ligases.

The last part of this section is the numbering of enzymes, followed by International Committee of the enzymes.

Third: It is the last section of the first chapter, which includes the methods of extraction, purification of enzymes, estimating the activity in the enzymatic reactions and the factors affecting the enzyme activity

Chapter Two: applications, of enzymes using and their importance in biological and chemical interactions.

This chapter is divided into three sections:

First: deals with the studying of the role of enzymes in biochemical reactions, dealing the specialty work of enzymes and the fact that turning

various forms of energy, as well as accelerate the speed of chemical reactions without changing the balance of the interaction.

Second: includes the types of enzymes such as protease amylase and lipase etc. and its uses in multiple applications.

Third: the use of enzymes in the treatment and maintenance of archaeological materials, where the enzymes used in the field of restoration and maintenance of materials such as cleaning operations in the archaeological and to remove sediment, dirt , stains , varnishes , the remnants of the old materials removal

Chapter Three: mural paintings and the common types of stains on the surface of mural paintings.

This chapter is divided into three sections are divided as following:

First: Category murals in terms of components of the painted layer and the types of techniques, including Tempera painting style. Where Tempera technique is one of the oldest techniques used in ancient Egypt. Also organic materials used in mural painting.

Second: deals with types of stains found on the surfaces of murals and deterioration phenomena.

These types of stains found on the surfaces of materials, and their effects on murals in particular: varnishes and resins used for coating or reinforcing or insulation, as well as deposits of organic residues and nests of birds, insects and bats, the layers of soot and carbon particles which produce the outputs of industrial pollution, and the remains of materials used in the removal of coverage during the removal the materials of the old fortification casein and gelatin, as well as residues of animal protein such as glue, as well as blood stains bats, oil spills and oily by-product of fingerprints, stains and wax , carbon resulting from burning candles and incense used in some religious rituals.

Third: deals of traditional and modern methods used to clean mural paintings surfaces.Including multiple cleaning methods of mural paintings, such as mechanical, chemical, organic Solvent and cleaning with enzymes.

Chapter Four: This chapter deals with scientific methods of examination and analysis of the wall paintings and stains.

Including the registration and documentation of mural paintings and methods of microscopic examination, methods of analysis using X-ray different PIXE analysis and spectral analysis of infrared In order to identify of organic medium used in mural paintings.

Chapter Five: the experimental study of the use of enzymes.

It is divided into two main sections

First: the production of enzymes, like protease, amylase, etc.from some types of bacteria in the laboratory study, cultural media of bacteria, the solutions and materials used in the measurement of enzyme activity and how to prepare it, as well as steps for enzyme activity measurements of enzymes produced in the lab and the results of these measurements.

Second: this section focus light on the work of experimental models of mural and stains common presence on the surface of mural paintings the experimental mural paintings samples were prepared similar to the original mural paintings and making some of experimental patches similar to those found on the surfaces of mural paintings.

The application of enzymatic cleaning made to get the best results

Then the second study with artificial enzyme and its application for cleaning and removing different stains to get the best results,

Concluding this chapter with the study of the addition of some materials for enzymes to inhibition to choose the most suitable in the application field

Chapter Six: Application studies

this chapter addresses the practical aspects of the use of enzymes to clean mural paintings under study and research.

The best result of previous experimental study has been selected for application in cleaning of the mural paintings

this chapter include a simplified explanation supported by pictures of the models under study and research. Including the operating conditions of the cleaning with enzyme as well as the amount of the used enzyme, the conditions of suitable temperature and pH number, as well as a perfect time for application of enzyme in cleaning processes, and how to select the most appropriate application methods of application. The study was applied on the two mural paintings from the Coptic Museum in Cairo Numeric:

1-number one is (7953) record of the Coptic Museum, which a researcher proved that they belong to the monastery of St. Jeremiah at Saqqara, fifth and sixth century AD. (Qubile 1907, Sqqara excavation)

2-number tow is (11457) records in the Coptic Museum, which dates back to the Church of Abdullah Nubia, the tenth century AD.

3-The Temple of Habu (stains of bats blood).

Finishing this study with the most important results from research and study. As well as some of the recommendations that the researcher see the importance of its application in the field of cleaning of mural paintings.

Attached study with the list of references (Arabic and foreign references.)