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Production, purification and application of antibiotics in decontamination of biodeteriorated cultural heritage objects

Akmal Sakr¹ and Mohamed F. Ghaly²

¹National Museum of Egyptian Civilization (NMEC), Egypt

²Zagazig University, Egypt

Statement of the Problem: Cultural heritage objects are subjected to biodeterioration process either due to sensitivity of materials such as textile, papyrus, leather, wood etc.. or due to availability of biodeterioration agents reducing the historical value of these colonized objects. Biocides are toxic for conservator and harmful for the treated objects and biodeterioration agents gained resistance to applied biocides, so the new trend is using eco friendly methods such as antibiotics. Streptomyces are the most important antibiotics producers, produce more than 90% of available antibiotics; these antibiotics have antimicrobial activity against a broad range of microorganisms deteriorating cultural heritage objects of fungi, bacteria, yeasts and other strains of Streptomyces. These antibiotics could be used alone or in combination with other physical methods such as DBD plasma or gamma irradiation due to the synergetic effects. Production of antibiotics should depend on different factors: Carbone source, nitrogen source, phosphorus source, temperature, shaking condition and age of Streptomyces isolates, it was found that increasing of antibiotics production increased with increasing the age of Streptomyces. Efficacy of produced antibiotics could be estimated using inhibition zone according to Cooper's equation; the diameter of inhibition zones indicated the efficacy of antibiotic against certain indicator microorganisms. The lethal effect of antibiotics on microorganisms may be attributed to several mechanisms such as blocking of DNA synthesis; it was reported that rifampicin and streptomycin blocked RNA synthesis in the treated fungi and blocked the incorporation of labelled precursors into macromolecules, and this mode of action was appeared in SDS-PAGE profile. In addition, antibiotics produced by Streptomyces proofed efficacy in modification of polymers used in consolidation of paintings and stones, in particular Primal AC 33 used with medium of water, so this polymer is susceptible to biodeterioration in particular if the this polymer or treated objects are stored in humid environment.

Findings: Streptomyces produce macrolide polyene antibiotics (ascosin, candidin, endomycin, filipin, fradycin, nystatin, nimocidin and trichomycin) are effective in killing most of microorganisms deteriorating cultural heritage objects.

Recommendations: macrolide antibiotics produced by Streptomyces could be used in decontamination of microorganisms deteriorating cultural heritage objects as an eco friendly method.