Physical and aesthetic decay of built heritage from biological films developed on joint mortars

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Porous stone materials can be affected by litobiontic communities' colonization responsible for physical-chemical processes that give rise to their biodeterioration, also contributing to the loss in aesthetic value of built heritage. Thus, in urban areas with high levels of atmospheric pollution, in the aesthetic decay that occurs in façades due to soiling by particulate matter deposition, the development of biological films that in many cases have an intense dark color must be taken into account.

This paper focuses on biodeterioration processes affecting the joint mortar used on the limestone façades of the Formerly Workers Hospital of Maudes (Madrid, Spain). This type of material is very susceptible to biodeterioration processes, because of its high porosity. The mortar is characterized by Polarization Optical Microscopy, X-ray Diffraction and Mercury Intrusion Porosimetry, and special attention to the interaction with colonizing microorganisms by means of SEM-BSE technique (Scanning Electron Microscopy with backscattered electrons *in situ*) is given. Besides, how the joint mortar biological colonization contributes to limestones façades soling is quantified, through the comparative analysis of the chromatic parameters of the limestone with respect to the mortar by means of Spectrophotometry.

The study reveals that lichen thalli are directly involved in the material disruption, leading to the decohesion of its components. They also contribute significantly to the degree of darkening that the building façades show. While the limestone soling is very heterogeneous and responds to its interaction with air pollutants, for the joint mortar it is much more homogeneous and, in areas of higher humidity and with no direct pollution exposure is due to a biofilm development. In all other areas where joint mortar show darkening, this is mainly due to its interaction with air pollutants.

This paper provides information on the effect of biological colonization in mortars, entailing the implementation of the SEM-BSE technique in such materials, widely used in built heritage.