CULTURAL HERITAGE AND CLIMATE CHANGE: CHARACTERIZATION OF PHOTOTROPHIC BIFILMS DETERIORATING STONE MONUMENTS SUBJECT TO DIFFERENT ENVIRONMENTAL CONDITIONS AND DEVELOPMENT OF ECO-SUSTAINABLE CONTROL SYSTEM

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The biodeterioration of historical archeological sites is a well-known phenomenon due to the development of microorganisms on stone surfaces, that is revealed both in confined sites and in outdoor environments [1-2]. The presence of these colored biofilms causes the discoloration of the artworks and often chemical and structural damages to the substrates [3]. The growth of these microorganisms is strictly correlated with abiotic environmental factors and thus must be considered in view of the acceleration of climate change in order to develop long term strategies for the conservation and management of cultural heritage. Moreover, there is the need to research and develop new sustainable and restoration strategies: despite the use of biocides being state regulated by (UE) n.528/2012 [4], some toxic substances are still widely used by conservators due to the low cost and the short time required for the application. For these reasons, in recent years there has been an increase in the requests for natural biocides, safe for human health and the environment [5-7].

In this contest the research project will be focused on: i) the morphological and molecular identification of biofilm-forming microorganisms that induce biodeterioration of historical archeological sites, selected from those exposed to climate change; ii) the study of biofilms formation when exposed at different environmental parameters; iii) the development of safe and innovative green biocides, efficacy at low doses against a mixture of biofilm-forming microorganisms, such as essential oils and other phytoderivatives. Finally, a specific easy-to-apply protocol will be designed and employed for the *in situ* application of the newly developed biocides to test their efficacy and their effects on the substrate, in short and long term. This step is of utmost importance because it will allow to evaluate the effect of the biocide *in situ*, subject to the natural phenomenon, such as in the Colosseum and the Domus Aurea and in Catacombs of SS. Marcellino and Pietro, thanks to the collaboration with the Archaeological Park of the Colosseum and the "Pontificia Commissione di Archeologia Sacra", respectively. An interdisciplinary approach will be used in collaboration with the Physical and Chemical Sciences Department of University of l'Aquila, the Territorial and Production Systems Sustainability Department of ENEA Casaccia RC and the Institut d'Etudes Avancees of University of Cergy-Paris (France).

The results will allow the adoption of green alternative solutions that will help in the process of ecological transition, in respect of the Sustainable Development Goals.

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