

Indoor/Outdoor Particulate Matter and Bioaerosol Load of a Museum in Mediterranean Climate: The case of the Historical Museum of Crete (Greece).

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Indoor air quality can significantly affect the state of works of art inside museum environments. Especially, particulate matter (PM) deposition can lead to adverse effects including surface alteration, deterioration of the aesthetic appearance, mechanical damage and the transport of harmful absorbed compounds or microbiological agents as well as the structures and substances produced by those microorganisms to the surface of artefacts. Airborne particles mainly come from outside and enter inside the building through different sorts of openings (cracks in the building skeleton, doors, windows) or via the ducts of the ventilation systems. Significant amounts of PM are also transported indoors by the visitors entering the museums. Especially, exhibits made of sensitive organic materials such as wood, leather and paper, present high risk of deterioration of their characteristics, even at low pollutant's concentrations during exposures for long periods of time. Therefore, recording and monitoring of indoor/outdoor aerosols and bioaerosols concentrations is of great importance in order to determine, in cooperation with conservatives and curators, the efficient measures and actions to protect vulnerable works of art.

This work presents selected results of six weekly intensive campaigns conducted at the Historical Museum of Crete, located in Heraklion (Greece) between June and October 2018. PM and bioaerosols indoor and outdoor measurements were performed to evaluate the state of particulate load inside the museum and furthermore, to examine possible short term increases of PM concentration which cannot be observed from routine long-time averaged measurements, common in museums' microenvironments. The measurements included a) continuous data PM mass collection in different size fractions using high time resolution portable aerosol data monitors (Dustrak II and OPS (TSI), b) gravimetric sampling using personal cascade impactors (SKC) c) Bioaerosols sampling using the MAS-100 microbial air sampler (Merck Millipore). The collected aerosol particles in filters were analysed by ion chromatography (IC) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS).

Detailed analysis of the collected data revealed that indoor PM concentrations are affected by the outdoor conditions, the use of air purifiers and the presence of visitors inside the museum. Figure 1 shows the effect of the presence of people inside the El Greco

exhibition room (no air purifiers operating in this room) during visiting hours (OPS measurements). The increase in coarse particle mass concentration is clear and it can be correlated to the resuspension of previously deposited particles and also to the transport from outdoors of soil dust and textile fibers by the visitors (Chatoutsidou et al., 2015). Airborne microbial load of heterotrophic bacteria, fast growing fungi and acid producing bacteria also presented higher values indoors than outdoors and especially in showrooms without air purifiers.

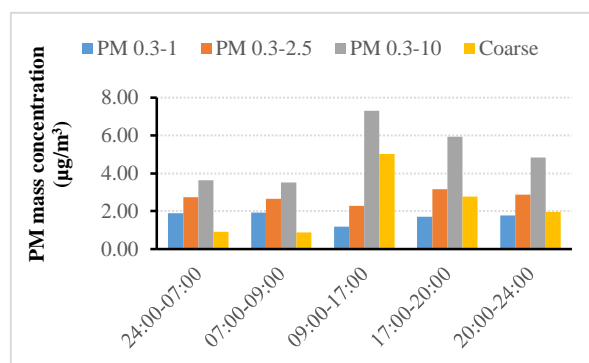


Figure 1: Average PM mass concentrations of different size fractions (OPS data) in the El Greco exhibition room between 28/8/2019 and 04/09/2018. Museum was open to the public between 09:00-17:00.

Although indoor quality is acceptable inside the Historical Museum of Crete, this work showed that further actions are needed to protect vulnerable works of art from the possible destructive capacity of chemical compounds and living organisms transported indoors.

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Chatoutsidou S. E., Maskova L., Odrackova L., Ondracek J., Lazaridis M. and Smolik J. (2015) *Building and Environment*, 89, 253-263.