

VALIDATION OF THE DIFFUSIVE SAMPLER RADIELLO FOR THE MEASUREMENT OF FORMIC AND ACETIC ACID IN MUSEAL ENVIRONMENTS

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ABSTRACT

The assessment of potential damages to indoor cultural heritage, due to some airborne pollutants, is a major and growing concern for curators and conservators. The aim of our research is the assessment of threshold values, above which such damages are likely to be observed, in environments where air quality and microclimatic anomalies have been characterised.

Since a few years objects of art in museums have been placed in showcases. Besides security reasons this is mainly done to protect these objects against contamination by dust particles and deterioration by gaseous pollutants, a field of growing interest for conservators. Recently, also formic acid and acetic acid are assumed to be harmful for several objects of art, containing e. g. copper or lead. Measurements inside museum showcases via SPME technique showed that these acids can accumulate and reach high concentrations. Most of the showcases are made of wood and/or composite materials as MDF (Medium Density Fiberboard), considered as sources for organic volatiles with low molecular weight. Hence, the named organic acids can be emitted directly into the showcase.

Therefore, a monitoring technique based on diffusive sampling of formic and acetic acid is under test, in order to evaluate its feasibility for measuring air concentrations up to several hundred ppb inside the showcases. The radiello® samplers provide validated methods for the diffusive sampling and the analysis of various gaseous pollutants, such as ozone, nitrogen dioxide, sulphur dioxide, VOCs, etc. To evaluate and validate the applicability of the diffusive sampling of the gaseous acetic and formic acid and to optimize the analytical method for the determination of the actual concentrations, a radiello diffusive sampler, containing chemiadsorbing cartridges impregnated with triethanolamine (TEA) were tested in a dynamic exposure chamber. The test atmosphere was generated by means of capillary injection of an aqueous mixture in a nitrogen stream, followed by a further gaseous dilution. The test conditions covered a range of concentration between 50 and 500 ppb of each compound, for a 7-day exposure time. The environmental conditions were set to 25 °C and 50 % relative humidity. The analytical procedure includes water extraction and ion chromatography, using a