

Randa Deraz

University of Ljubljana,
Faculty of Chemistry and Chemical
Technology
randa.deraz@fkkt.uni-lj.si

Abdelrazek Elnaggar

University of Ljubljana,
Faculty of Chemistry and Chemical
Technology

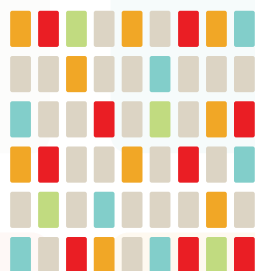
Matija Strlič

University of Ljubljana,
Faculty of Chemistry and Chemical
Technology
University College London,
UCL Institute for Sustainable Heritage

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Lecture

Reassessing the Risk of VOC Emissions from Archival Storage Boxes

The long-term preservation of paper-based heritage collections depends not only on environmental control but also on the chemical safety of storage materials. Volatile organic compounds (VOCs), particularly acetic acid, emitted from archival boxes are often cited as a preservation risk (Menart, de Bruin, & Strlič, 2014), yet their actual impact under realistic conditions remains poorly quantified.

In this study, we assessed VOC emissions from archival storage materials including polypropylene, coated and uncoated cardboards, recycled and speciality papers, naturally aged and lignin-based boards. Emissions were analysed using thermal desorption-gas chromatography-mass spectrometry (TD-GC-MS) and ion chromatography (IC). Paper and metal Oddy tests were applied to assess potential preservation risks, while equilibrium acetic and formic acid concentrations in boxes were modelled at room temperature using measured emission rates and realistic air-exchange rates (Novak, Grau-Bové, De Stefani, Kraševac, & Strlič, 2024; Ramalho, Dupont, Egasse, & Lattuati-Derieux, 2009).

Results showed that polypropylene and archival-quality cardboards primarily emitted inert hydrocarbons with low levels of organic acids, yielding neutral or even preservative outcomes in Oddy tests. Conversely, aged lignin-based and coated cardboards released higher levels of volatile acids and showed more severe Oddy test responses. Yet, equilibrium modelling demonstrated that even the highest-emitting materials did not generate acid concentrations exceeding the 100 ppb threshold generally regarded as harmful for paper. Importantly, elevated concentrations measured in practice are more attributable to emissions from the stored paper itself rather than from the enclosures.

These findings indicate that accelerated Oddy tests overestimate the risks posed by packaging materials. Room-temperature emission assessments combined with ventilation modelling provide a more reliable framework for evaluating preservation risk. Archival box suitability should therefore be judged primarily on mechanical stability and humidity-buffering performance rather than VOC emissions. Overall, VOCs from box materials-including acetic and formic acids-are not a significant concern under typical storage conditions, supporting a more evidence-based approach to preventive conservation (Deraz, Di Gianvincenzo, Malešič, Kralj Cigić, Elnaggar, & Strlič, 2025).

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