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This is the author's manuscript

Original Citation:

Availability:

This version is available http://hdl.handle.net/2318/1641083 since 2017-06-07T11:41:15Z

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18 October 2023

Fungal infections and Cultural Heritage: An alternative approach for VOCs analysis applied in indoor environments

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Keywords: Indoor air, VOCs, Fungi, Cultural Heritage

Fungal infections inside libraries and archives are frequent and complex problems to manage, often with severe economic and health implications. Even if indoor environments are climate controlled (18-20 °C, 50-60% relative humidity), some fungal species are still able to grow on materials, preferentially in air-stagnation microenvironments [1, 2].
It is well known that Fungi during their development, even in the early stages, produce several volatile organic compounds (VOCs) that are then suspended in the air or adsorbed on dust particles [3]. The assessment of their nature is needed for a proper assessment of the indoor air quality.
A rapid tool to understand fungal contaminations in indoor environments could be air sampling followed by gas chromatography-mass spectrometry (GC-MS) analysis. For the broad speciation of unknown trace of VOCs we tested evacuated stainless steel canisters (3 Liters of volume) to sample within a few seconds the indoor air [4].
The composition of the indoor air in a deposit of Ca' Foscari University Library affected by an active molds infection was analyzed with the aim of detecting a specific chemical fingerprints of Fungi. Seven canisters were adopted in different areas of the deposit to collect VOCs and subsequent analyzed by GC-MS. Moreover, laboratory experiments were developed to collect VOC production directly from infected books and from the two dominant fungal species isolated from the library by previous sampling (*Eurotium halophilicum* and *Aspergillus penicillioides*). In addition, dedicated sample chambers were realized for the analyses of VOCs emitted by infected books, while specie-specific fungal colonies were grown in culture bottles with proper media and temperature. All the samples were monitored for a period of 1-2 months by weekly analysis of the emitted VOCs. For all the analysis, microscale purge & trap Entech 7100 was adopted as sampling and pre-concentration system directly connected with corresponding sampling devices (canisters, sample chambers, culture bottles) and GC-MS.
Several volatile organic compounds that were detected in the indoor air (i.e. 1,4-pentadiene and 2-butanone) were also found in the emission of the dominant fungal species isolated from materials and in the volatiles released from the infected books. The results suggest a close relationship between the fungal infections and the indoor air quality.

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