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

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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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