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FIRST PILOT STUDY OF SELECTED ION FLOW TUBE-MASS SPECTROMETRY (SIFT-MS) IN HERITAGE SCIENCE: CHARACTERIZATION OF NATURAL AND SYNTHETIC PAINT VARNISHES BY PORTABLE MASS SPECTROMETRY

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The identification at molecular level of organic materials in heritage objects as paintings requires in most cases the collection of micro-samples followed by micro-destructive analysis. In this study, we explore for the first time the possibility to characterize natural and synthetic resins used as paint varnishes by mean of non-invasive analysis of released volatile organic compounds (VOCs) through selected ion flow tube-mass spectrometry (SIFT-MS). SIFT-MS is a portable direct mass spectrometric technique that achieves the analysis of VOCs at trace levels in real time, by controlled ultra-soft chemical ionization using different chemical ionization agents. We tested the portable instrumentation on different reference resins used as paint varnishes, both natural (mastic, dammar, and colophony) and synthetic (Paraloid B67, MS2A, Regalrez 1094, and polyvinyl acetate), to evaluate the possibility to obtain qualitative data for the identification of these materials in heritage objects avoiding any sampling. This new analytical approach was validated by comparison with the traditional approach for VOCs analysis based on SPME-GC/MS analysis.

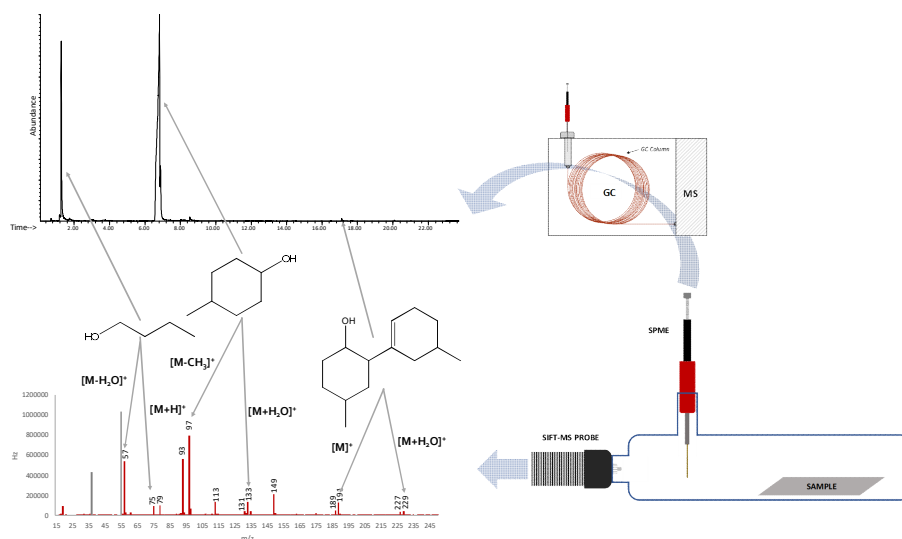


Figure 1. Exposure chamber used for the SPME-GC/MS and SIFT-MS analysis

The promising results obtained in this survey represent the first step in the development of a completely new analytical approach for the non-invasive/non-destructive characterization of

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organic materials. The advantages in the use of this instrumentation, such as the low limits of detection, the high selectivity, and the possibility to perform in situ analysis, could be extremely relevant within cultural heritage where the characterization of organic materials requires novel analytical approaches not needing invasive approaches.

The possibility to interface this portable SIFT-MS instrumentation to microclimate frames could be a powerful combination for the characterization of the organic materials through the analysis of the VOC profile. Moreover, the development of exposure chambers with different dimensions suitable for specific artworks or archaeological objects allows a wider range of applications, including the non-invasive identification of archaeological organic residues.