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Intercomparison of instruments to measure OVOCs: assessment of performance under different relevant controlled conditions (EUPHORE chambers)

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Polyfunctional oxygenated organic volatile compounds (OVOCs) are produced as secondary species of anthropogenic and biogenic sources, biomass burning, etc. They are of interest because of their key role in atmospheric processes that affect the air quality and the health. Indeed, they lead to the formation of radicals and tropospheric ozone and to the production of organic aerosols, which indirectly also influence the Earth's climate.

A variety of methods are used to quantify OVOCs, some of them used in long-term measurements. The reliability of a technique or the analysis of different atmospheric pollutants or their degradation products can be best verified by comparison with other techniques under controlled conditions. With this purpose, simulation chambers provide an ideal tool for inter-comparison campaigns. They allow multiple instruments to measure the same sample while varying parameters that could affect measurement performance over atmospherically relevant ranges with the aim of assessing performance and exploring analytical limitations and cross sensitivities.

This work presents an inter-comparison campaign of 16 on-line and off-line techniques and methodologies for measuring small OVOCs at the EUPHORE high volume simulation chambers. The suite of techniques included PTR-ToF-MS (Proton Transfer Reaction Time-of-Flight Mass Spectrometer), SIFT-MS (Selected Ion Flow Tube Mass Spectrometer), different cartridges both commercial and home-made and with or without derivatization agent analyzed by gas/liquid mass spectrometry, optical systems and SPME-MS (Solid Phase Micro-Extraction). The experiments were also modeled. Typical semi-urban and degradation products from biogenic compound environments were simulated as well as scenarios to specifically test the performance of the instruments under contrasting and relevant conditions and in the presence of potential interferences.

The campaign was carried out within the frame of the EUROCHAMP-2020 project which integrates the most important atmospheric simulation chambers in Europe aiming at investigating the processes that control atmospheric composition, air quality and climate, as well as the impact of air pollution on health and cultural heritage.

An overview of the experimental design is given. Good correlations were found in general. Results are discussed as well as the importance of the calibration process itself and the need of calibrating and characterizing the instruments under key interferences, e.g. in the presence of different humidity conditions, to ensure a better quality and comparability of the measurements.

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