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Field chemical characterization and laboratory heterogeneous reactivity of markers of biogenic secondary organic aerosol formation and fate

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Secondary aerosols, whose emissions cannot be regulated, have been the subject of all attention for several years due to their impacts on both climate change and air quality. In this context, the LANDes EXperiment project (LANDEX) focused on the study of biosphere-atmosphere interactions at Salles-Bilos in the Landes forest ecosystem, established as an open-air laboratory. Indeed, this managed-forest is planted almost exclusively with maritime pines, resulting in specific high monoterpene (mostly α- and β-pinene) and poor isoprene emissions. The aim of the LANDEX project was to study the formation and fate of biogenic secondary organic aerosols (BSOAs). In-situ photo-oxidation gas-phase processes involving biogenic volatile organic compounds were recently reported by Mermet et al. (2021). Such multi-oxidation steps are well-known to lead to the formation of secondary aerosols, that may be subject to different aging processes during their transport.

In this work, the chemical composition of atmospheric particles was investigated using liquid chromatography coupled with time-of-flight mass spectrometry (LC-QTOF/MS) to achieve a molecular speciation of major BSOA markers. Their concentrations were determined in the $PM_{2.5}$ and PM_1 fractions for day- and nighttime periods along with the on-line measurements of VOCs (mainly terpenoids), either directly emitted by vegetation or generated through first or second generation oxidation steps (e.g. pinonaldehyde and nopinone).

The complexity of the chemical composition of SOAs, the difficulty to characterize and evaluate their sources and subsequent aging processes, combined with the importance of SOA in terms of impacts, make the need to use reliable atmospheric markers. During air mass transport, markers may undergo (photo-)chemical degradation in either gas or liquid phase but also heterogeneous oxidation. These last processes have been poorly documented for BSOA markers. Therefore, gas-surface reactions of 5 particulate-products arising from the oxidation of α- and β-pinene, respectively terebic acid, terpenylic acid, pinonic acid, pinic acid, and 3-methyl-1,2,3-butanetricarboxylic acid (MBTCA) with the main atmospheric oxidants (OH, O_3, NOx) were investigated using a discharge fast flow tube. The first results will be presented and discussed in the framework of the Landes forest.

Reference : Mermet et *al.* (2021), *Science of The Total Environment*, **756**, 144129.