Stimulation of natural organohalogen formation by microorganisms

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Halogenated C1 and C2 hydrocarbons contribute to a significant extent to atmospheric ozone destruction. They are emitted among other sources from salt lake sediments [1]. Organohalogens are formed biotically by the catalytic activity of plants, animals and microorganism. Organohalogens can form also abiotically in presence of humic compounds, KCl and Fe(III) minerals. The abiotic formation is greatly enhanced by addition of H_2O_2 suggesting the involvement of radicals [2]. When microorganisms reduce humic substances electrons can be shuttled to Fe(III) minerals and semiquinone radicals are formed [3]. This suggests that organohalogen formation in natural environments could also be stimulated indirectly through the activity of microorganism catalysing Fe- and humic substance-redox transformations. We performed batch experiments with Fe-metabolizing bacteria, Fe minerals and humic compounds and quantified organohalogen formation by GC-MS. In addition, we characterized the microbial communities in sediment samples from South African salt lakes using both cultivation-dependent (MPN counts) and cultivation-independent (DGGE) methods. The aim of this study is to determine how and which microorganisms affect organohalogen formation indirectly through iron or humic substance redox transformations.

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Characterisation of organic compounds in atmospheric aerosols utilising a GCxGC/MS-TOF

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Aerosols consists of various inorganic and organic chemical species, of which only a small fraction of organic compounds have been identified. Current methods give valuable information with regards to the overall chemical composition, oxidation state and reactivity of organic aerosols, but they provide limited information about the actual character of individual organic compounds [1]. Two-dimensional gas chromatography coupled to a time-of-flight mass spectrometer (GCxGC/MS-TOF) is a relatively novel technique that has the potential to measure and characterise organic compounds within complex matrices, such as ambient particulate matter [2]. The main aim of this investigation was therefore to collect and extract organic particulate matter, followed by analyses of the samples with a GCxGC/MS-TOF in order to identify new organic compounds in ambient air.

Samples were collected at Elandsfontein in the Mpumalanga province of South Africa. Elandsfontein is an air quality monitoring station situated between coal-fired power stations in the Mpumalanga Highveld. A high-volume air sampler equipped with a quartz filter and polyurethane filter (PUF) was used.

Two different extraction methods namely: soxhlet extraction and accelerated solvent extraction (ASE) was compared. Different combinations of solvents were used with each of the two different extraction methods in order to extract polar and non-polar organic compounds.

A state-of-the-art LECO Pegasus 4D GCXGC/TOF-MS that was recently procured by the university was used for analyses. Compounds were characterized according to their confirmation- and quantification ions.

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