



Methionine as a potential precursor for halogenated compounds by the reaction with iron minerals

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Volatile halogenated compounds (VOX) play an important role in different photochemical reactions within the troposphere and the stratosphere. Soils and sediments seem to act as a major natural source for VOX, but investigations of the reaction mechanisms are rather scarce. To get further information on potential intermediates the reaction of the amino acid methionine with the ferrous and ferric iron minerals pyrite and ferrihydrite as well as solute ferrous sulfate was studied using a gas chromatography-flame ionization detector (GC-FID).

Methionine is an important amino acid in the biosynthesis of plants used as a starting compound for the messenger ethene with aminocyclopropane carboxylic acid as an intermediate product.

This pathway may also occur under abiotic conditions.

Ethene is assumed as precursor for various halogenated C2-compounds like vinyl chloride and dichloroethene. Due to its ubiquity by an average concentration of 10 to 290 ng/g soil and its potential to regenerate in soils and organic litter by microorganisms, methionine may be an important educt for both abiotic and biotic terrestrial halogenation processes.

In laboratory tests methionine was exposed to different iron species like pyrite, iron sulfate or ferrihydrite. The oxidant H_2O_2 was used to start the reaction. Production values of methyl chloride and other halogenated compounds are discussed in the context of methionine as their potential precursor and several Fe-minerals as soil-borne catalysts. Several possible intermediates for the production of VOX have been detected e.g. methane, ethene or propane.

A formation of isobutylene is noteworthy for some cases.

In addition to VOC the production of methyl chloride and dimethyl sulfide (DMS) was observed. Only the DMS bears upon a specific mineral. The samples containing pyrite reveal the highest concentrations.

To get a better assessment of methionine, respectively VOC released from methionine as precursors for halogenated compounds, parallel measurements of the samples on a gas chromatography- electron capture detector (GC-ECD) and gas chromatography- mass spectrometer (GC-MS) are scheduled.