

Cryotrapping-Cryofocussing-GC-ICP-MS (CT-CF-GC-ICP-MS) analysis of microbial volatilized selenium sorbed on soil minerals

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Selenium has major nutritional and biological function but the range between essential and toxic concentration is very small. The more toxic Se(IV) and Se(VI) are water soluble and hence bioavailable. The iron oxide and clay content of soils can affect the bioavailability through adsorption reactions, whereby Se(IV) is stronger adsorbed than Se(VI) (1). Microbial methylation is the most reliable natural attenuation process of enriched Se in the environment (2).

In order to investigate the alkylation / methylation process, *Alternaria alternata*, known as a Se resistant and active methylating saprophytic fungus (3), was used for incubation studies. First we observed the alkylation of dissolved inorganic selenium (SeO_3^{2-} , SeO_4^{2-}) and found different alkylated species over a wide pH range. Then, different selenium enriched materials, e.g. goethite enriched by SeO_3^{2-} or SeO_4^{2-} adsorption, were incubated with *A. alternata* inoculums to study the dependence of solid selenium binding on alkylation reactions. For Se speciation studies we used different analytical tools. Volatile selenium species were measured with a cryotrapping / cryofocussing gaschromatographic system coupled with ICP-MS. Beside the dominantly occurring dimethyl selenide (DMSe) and dimethyl diselenide (DMDSe) we found also other alkylated species like diethyl selenide (DESe) and diethyl diselenide, especially in dissolved selenium experiments. In adsorption experiments the aqueous inorganic selenium species were measured by hydride generation – atomic absorption spectroscopy. In incubation experiments we used a hyphenated HPLC-ICP-MS to separate the dissolved selenium species.

In our incubation studies we found different patterns of alkylation of dissolved and adsorbed selenium. For dissolved Se, Se(IV) were alkylated in higher amounts and we found more volatile species than for Se(VI) caused by a lacking reduction step in the methylation mechanism (4). In the opposite we found a higher methylation for Se(VI) than for Se(IV) adsorbed on soil minerals because of different kinds of adsorption (5).

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