Effects of microbiological activity on Hg^0 emission in uncontaminated terrestrial soils

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Despite extensive efforts to mitigate its toxic burden on the environment, mercury still poses a serious threat to all kinds of ecosystems, be it aquatic or terrestrial (UNEP 2002). Understanding the exchange processes of mercury between soil and atmosphere and identifying the mechanisms responsible for its transformation within soils is crucial to assess mercury's impact on terrestrial ecosystems.

It is known that direct biotic reduction of Hg^{2+} to Hg^0 (elemental mercury) occurs in wetland soils and soils contaminated with mercury; a process which leads to substantial Hg^0 emissions to the atmosphere (Schlüter 2000; Zhand & Lindberg 1999). Further research of terrestrial, uncontaminated soils identified abiotic reduction of Hg^{2+} to Hg^0 to be an important driver of Hg^0 emission (Schlüter 2000; Zhand & Lindberg 1999). An emerging question is therefore if biotic processes are also important for Hg^0 (re)emission from uncontaminated, terrestrial soils.

We manipulated microbiological activity of soil samples and recorded the resulting Hg^0 emission. Any influence of temperature and soil moisture was studied in separate experiments by comparing the Hg^0 emission of sterilized and intact soil samples. All experiments were carried out under laboratory conditions with a Tekran 2537A for Hg^0 analysis and a LI-COR 6262 for CO_2 analysis as proxy for microbiological activity.

The performed experiments revealed that Hg^0 emission was parallel to microbiological activity, i.e. increased with stimulated activity and decreased with inhibited activity. Similar patterns were observed after dried soils were moistened again. We concluded that Hg^0 emission from uncontaminated terrestrial soils is at least partly controlled by biotic processes. However, it is still unclear if Hg^0 emission is caused by direct biotic reduction of Hg^{2+} or indirectly by abiotic reduction – induced by products of microbiological degradation, e.g. humic acids.

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