Response of mercury biomethylation to flooding and manure addition in a polluted agricultural floodplain.

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Methylmercury (MeHg) is an organometallic compound that is more mobile and more toxic than inorganic mercury (Hg). The mechanism responsible for the formation of MeHg is called biomethylation and it occurs mostly under anoxic conditions. This mechanisms is fairly well studied in aquatic environments and we know that it is influenced by organic matter supply and temperature. In terrestrial soils, however, there has been considerably less research on biomethylation.

In this study, we investigated the presence and formation of MeHg in soils of a Hg-polluted agricultural floodplain near the Rhone River in the Canton of Valais in Switzerland. Our aim was to i) validate a new extraction and quantification method for MeHg using selective extraction and HPLC-ICP-MS analysis, ii) determine MeHg concentrations in the contaminated fields and iii) estimate the influence of manure addition (as an example of a typical local agricultural practice), and flooding (expected to occur increasingly frequently with climate change) on the biomethylation of Hg.

The MeHg extraction method we developed further is based on the work of Brombach *et al* [1]. It is followed by a HPLC-ICP-MS analysis for quantification. We could show that this novel method is not as sensitive as usual methods such as derivatization and GC-ICP-MS. However, it is less time intensive, more user friendly and can be made more cost effective by using HPLC-AFS. We found that MeHg was present in most of the soils we investigated.

Furthermore, soil from three highly Hg-contaminated fields was incubated under flooded conditions in triplicate with or without addition of organic matter (2% cow dung) in microcosms. Inorganic Hg was released into the pore water within 24-48 hours after flooding paralleling the release of dissolved organic carbon. No MeHg could be found in the pore water. However, after 11 days of incubations, the microcosms containing manure saw their soil MeHg concentration multiplied by up to 5.5.

[1] Brombach *et al*.(2015). Anal.Bioanal.Chem **407**, 973-998. A.M. acknowledges funding from the IEF MCA of the EU's FP7/2007-2013/ n° [326736]: BIOMETA.