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Mercury in suspended particulate matter of rivers in Germany

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Mercury (Hg) contamination of rivers is a long-term problem. Even after the implementation of effective measures to reduce Hg emissions at local and global scales in the framework of the Minamata Convention, remobilization of legacy Hg from contaminated river sediments and floodplain soils will likely prevent decreasing Hg levels in many riverine ecosystems over long time scales. Remediation actions are often not feasible due to the spatial extent of the contaminated river area. Moreover, existing management practices in waterways (e.g., dredging) may potentially facilitate Hg remobilization and transport to downstream areas. The chemical status of all large rivers in Germany is classified as “not good”, mostly due to the exceedance of the EU environmental quality standard of Hg in fish. Riverine Hg transport is dominated by Hg bound to suspended particulate matter (SPM) while dissolved Hg concentrations are usually low. Thus, a thorough understanding of Hg binding to SPM is critical for the investigation of Hg transport processes in riverine ecosystems and ultimately for assessing the risk of Hg accumulation in aquatic food webs.

Here, we present preliminary results from a project aiming to characterize Hg binding to SPM from large rivers (waterways) in Germany. A first goal was the evaluation of sampling and pretreatment methods. SPM was collected from sedimentation boxes at eight locations along German rivers (Elbe, Rhine, Saale, Mulde). One aliquot was frozen on-site with liquid nitrogen, while two other aliquots were transported without cooling to the lab followed by drying at 40°C and 105°C, respectively. THg determined by a direct Hg analyzer ranged from 230 ng g^{-1} (Rhine) to 2792 ng g^{-1} (Saale). Drying at 105°C resulted in THg losses of on average 12%, but with a large variability between sites. Pyrolytic thermodesorption analyses exhibited maximum Hg release peaks at ~200-300°C, indicating a dominance of matrix-bound Hg(II) species. Drying at 40°C caused peak broadening and shifts to lower release temperatures, an effect that was even more pronounced after drying at 105°C. Ongoing work using an optimized sampling protocol focuses on the elucidation of spatial and seasonal variations of Hg binding forms in riverine SPM.