The Majority of Methylmercury in East Fork Poplar Creek is Sub-nanometer in Size

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DOE/Office of Science/Biological & Environmental Research

Objective

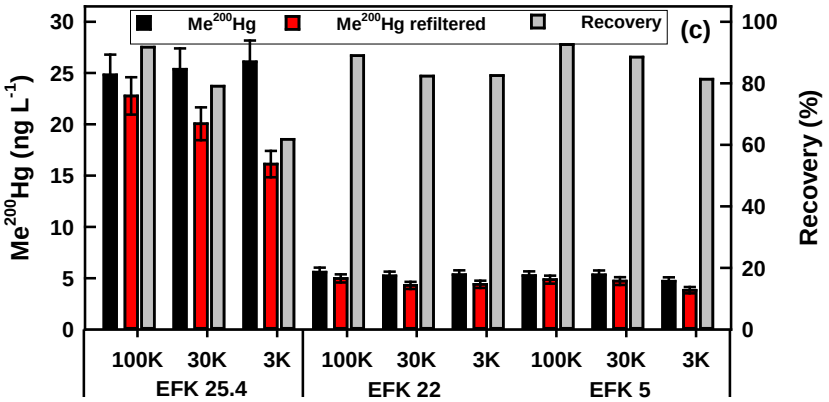
- Quantify mercury (Hg) and methylmercury (MeHg) size-distribution in creek water.

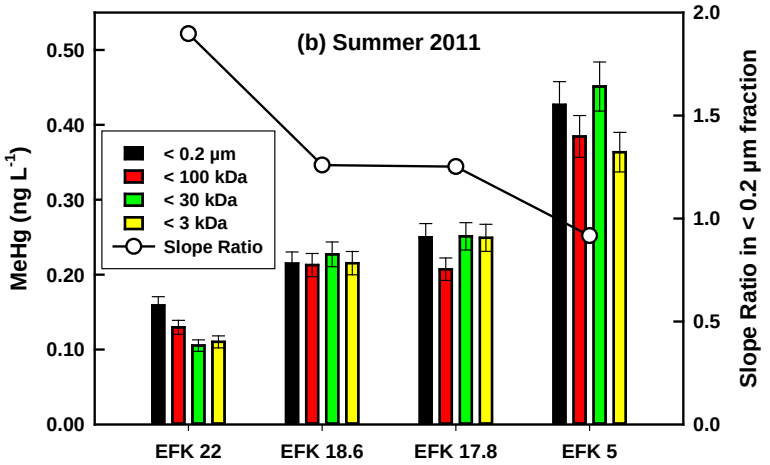
New Science

- Centrifugal ultrafilters can be used to fractionate MeHg but were not reliable for Hg in our system.
- Methylmercury is essentially dissolved, as it passes ~0.4 nm (3-kDa) filter.
- Result was independent of changes in dissolved organic matter quality with distance downstream.

Significance

- We provide the first evaluation of centrifugal ultrafiltion for Hg and MeHg fractionation in freshwater. The majority of methylmercury resides in the sub-nanometer size fraction. This may have implications for methylmercury bioavailability and subsequent biomagnification in the East Fork Poplar Creek system.





Kocman, D., S.C. Brooks, C.L. Miller, and X.L. Yin. 2013. Evaluation of centrifugal ultrafilters for size fractionation of total mercury and methylmercury in freshwaters. Environ. Chem. 10:323-332 (doi: 10.1071/EN12199).

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Amicon Ultra-15 centrifugal filters with nominal molecular weight cut-offs of 100, 30 and 3 kDa, were tested for separating Hg complexes in freshwaters. Experiments used Hg-contaminated water from East Fork Poplar Creek (EFPC) and laboratory-prepared Hg solutions containing Suwannee River natural organic matter (SR-NOM). Investigations focused on Hg and dissolved organic carbon (DOC) blank levels, Hg sorption and leaching, Hg mass balance closure and spike recoveries of inorganic and methylmercury (MeHg). Hg spike recoveries for EFPC samples were low (57 ± 16%, n=30) due to sorption. MeHg recovery averaged 87 ± 9% (n=15) suggesting it was less affected by sorptive losses. SR-NOM samples yielded similar DOM and MeHg size fractionation patterns with ~20% of the MeHg found in the less than 3 kDa fraction. Overall, the distribution of MeHg followed a pattern similar to the DOM, indicating the importance of both sample DOM quantity and quality for MeHg partitioning in aquatic systems. While the use of these ultrafilters for inorganic Hg in freshwater samples is not recommended, they were successfully used for MeHg in EFPC where the majority of MeHg was found to be either dissolved or associated with phases smaller than 3 kDa cutoff filter.

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