

Study Revealed Changes in Mercury Binding Affinity with Dissolved Organic Matter

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Significance

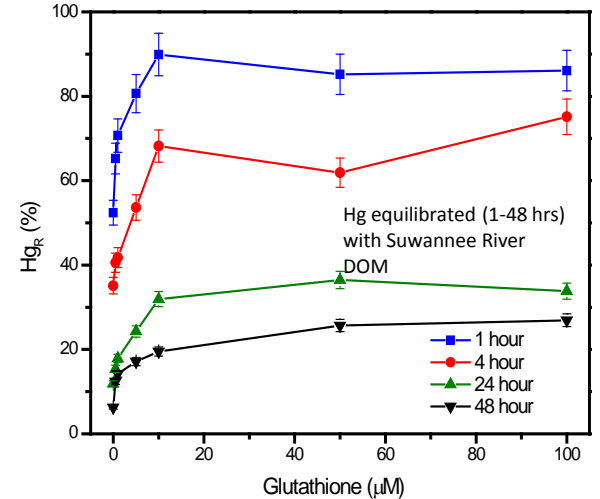
- Naturally dissolved organic matter (DOM) affects transformations of Hg to methylmercury in the environment. Here we show that the strength of the interaction between Hg and DOM is time dependent. Over time, Hg became more tightly bound to DOM, suggesting that it is less reactive and less available for microbial uptake and methylation in aquatic ecosystems.

Objective

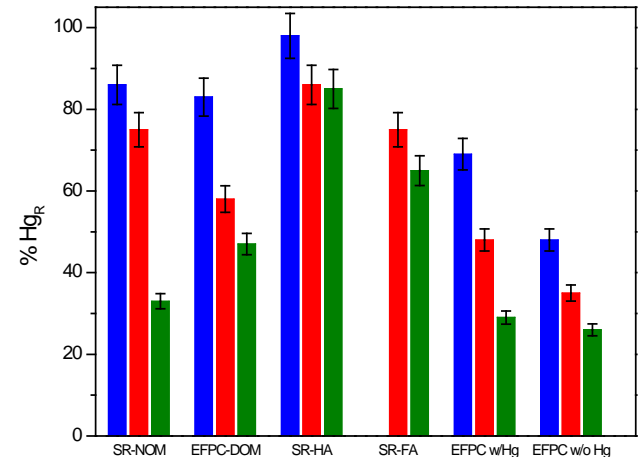
- Examine time dependant changes in the strength of Hg-DOM complexes.

Approach

- Ligand titrations, using glutathione as a competitive ligand, were employed to examine the strength of Hg-DOM complexes in water from a mercury contaminated East Fork Poplar Creek (EFPC) and in solutions prepared with DOM. Stannous reducible Hg (Hg_R) measurements were used to differentiate Hg-DOM (nonreactive) and Hg-glutathione (reactive).



Hg released from DOM as glutathione increased, but over time the DOM-associated Hg became less reactive to glutathione



Decreased reactivity of Hg over time (blue-1hr, red-4hr, green-24hr) is found in EFPC water and in Suwannee River (SR) NOM.

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Mercury (Hg) interactions with dissolved organic matter (DOM) are important in aquatic environments but the kinetics of Hg binding to and repartitioning within the DOM remain poorly understood. We examined changes in Hg-DOM complexes using glutathione titrations, coupled with stannous-reducible Hg measurements during Hg equilibration with DOM. In laboratory prepared DOM solutions and in water from a Hg-contaminated creek, a fraction of the Hg present as Hg-DOM complexes did not react to glutathione addition. This unreactive Hg fraction increased with time from 13% at 1 hour to 74% after 48 hours of equilibration with a Suwannee River DOM. In East Fork Poplar Creek water in Oak Ridge, Tennessee, about 58% of the DOM-complexed Hg was unreactive with glutathione 1 hour after the sample was collected. This time-dependent increase in unreactive Hg suggests that Hg forms stronger complexes with DOM over time. Alternatively the DOM-complexed Hg may become more sterically protected from the ligand exchange reactions, as the binding environment changes within the DOM over time. These results have important implications to understanding Hg transformations in the natural environment, particularly in contaminated aquatic systems due to non-equilibrium interactions between Hg and DOM.

Miller, C.L, L. Liang and B. Gu. 2012. Competitive ligand exchange reveals time dependant changes in the reactivity of Hg-dissolved organic matter complexes. *Environ. Chem.* 9:495-501. (doi: 10.1071/EN12096).