

Complexation of Inorganic Mercury and the Distribution of Complexing Ligands Along a Stream Transect

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The toxicity and speciation of mercury in aquatic systems is substantially influenced by complexation with natural ligands. A technique employing competitive ligand exchange followed by solid phase extraction (CLE-SPE) was used to characterize the concentration and binding strengths of ligands in natural freshwaters which complex inorganic mercury, Hg(II). Samples were collected from six locations along a 15 kilometer transect of Alamitos Creek, a mercury impacted stream which drains part of the historic New Almaden mercury mining district in California. Sampling was designed to evaluate the role of wetlands, seasonally anoxic lakes, and other reducing environments as potential sources of ligands. Sample sites bracketed a stratified reservoir with a seasonally anoxic hypolimnion, wetlands, an aerated lake, and a suburban area with non-point source runoff. Water samples from each site were filtered using 0.45 μm and 0.03 μm filters and characterized by the CLE-SPE method to assess the importance of colloidal organic matter and particles in the complexation of inorganic mercury. The concentration, stability, and transport of these complexes, and their possible effects on the methylation and mobility of mercury, was examined.

Results support the hypothesis that dissolved Hg(II) speciation is dominated by complexation with reduced sulfur ligands, such as thiols, sulfide, or polysulfides. Independent measurements of thiol and sulfide concentrations were similar to natural ligand concentrations calculated from the CLE-SPE results.