

Dual functional role of naturally dissolved organic matter (DOM) in redox transformation of contaminant metals and radionuclides (Hg, U, and Tc)

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Naturally dissolved organic matter (DOM) consists of redox reactive but chemically heterogeneous organic substances that exist ubiquitously in aquatic and terrestrial environments. DOM can directly or indirectly participate electron transfer reactions and act as an electron shuttle in enhancing microbial reduction of contaminant metals and radionuclides such as U, Tc, and Hg under reducing conditions. However, under oxidizing conditions, DOM also acts as an electron acceptor and thus significantly enhances oxidation of U and Tc. Even under a strict anoxic environment, we show that DOM can cause oxidation of the elemental Hg(0) to the Hg(II) species via thiol-induced oxidative complexation. This dual role of DOM is expected to strongly influence species transformation of contaminant metals or radionuclides and may thus have important implications on their bioavailability and fate in the environment.

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