

Anaerobic Bacteria Oxidize and Methylate Elemental Mercury

Contact: Baohua Gu (gub1@ornl.gov, 865-574-7286)
DOE/Office of Science/Biological & Environmental Research

Objective

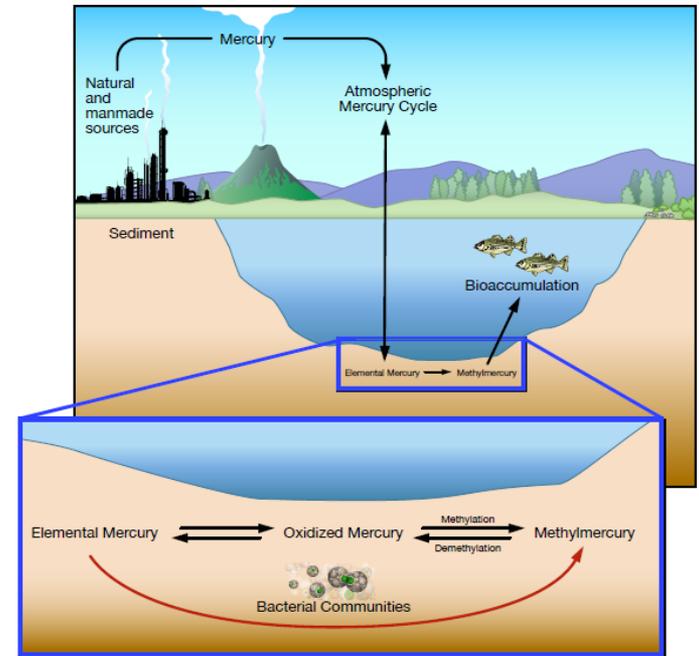
- Determine if different strains of anaerobic bacteria can oxidize and convert elemental mercury (Hg) to neurotoxic methylmercury as a potential pathway in mercury cycling.

Approach

- Compare mercury methylators and non-methylators in their abilities to oxidize and methylate elemental mercury under dark, anaerobic conditions.

Results/Impact

- The abilities of microbes to oxidize and methylate mercury is strain-specific; some can both oxidize and methylate elemental mercury; some can only do one of them, or none.
- Contrary to expectation, reduction of Hg(II) to Hg(0) does not necessarily prevent Hg uptake and microbial methylation.
- Methylating and non-methylating bacteria may together enhance the formation of methylmercury in anoxic environments.



Hu, H., H. Lin, W. Zheng, S.J. Tomanicek, A. Johs, X. Feng, D.A. Elias, L. Liang, and B. Gu. 2013. Oxidation and methylation of dissolved elemental mercury by anaerobic bacteria. *Nature Geosci.* 6:751-754 (doi:10.1038/ngeo1894).

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Methylmercury is a neurotoxin that poses significant health risks to humans. Some anaerobic sulfate- and iron-reducing bacteria (SRB and IRB) can methylate oxidized forms of mercury, generating methylmercury. One strain of SRB, *Desulfovibrio desulfuricans* ND132, can also methylate elemental mercury, Hg(0). The prevalence of this trait among different bacterial strains and species remains unclear. Here, we compare the ability of two strains of the SRB *Desulfovibrio* and one strain of the IRB *Geobacter* to oxidize and methylate Hg(0) in a series of laboratory incubations. Experiments were carried out under dark, anaerobic conditions, in the presence of Hg(0). We report differences in the ability of these organisms to oxidize and methylate Hg(0). In line with recent findings, we show that *D. desulfuricans* ND132 can both oxidize and methylate Hg(0). We find that rate of methylation of Hg(0) is about one-third the rate of methylation of Hg(II). We also show that *Desulfovibrio alaskensis* G20 can oxidize, but not methylate, Hg(0). *Geobacter sulfurreducens* PCA is able to oxidize and methylate Hg(0) in the presence of cysteine. We suggest that methylating and non-methylating bacteria may together enhance the formation of methylmercury in anaerobic environments.

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