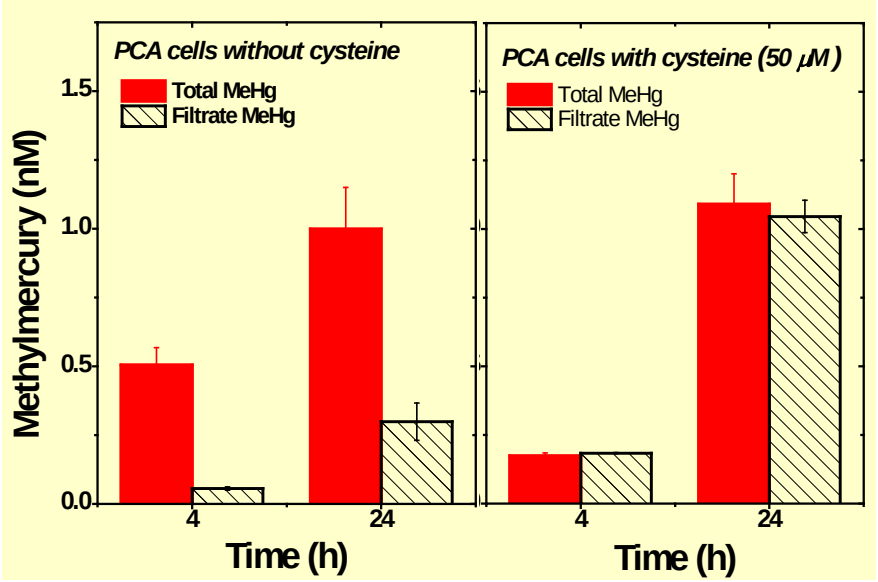
Cell methylmercury export is more complicated than previously thought

Contact: Baohua Gu (GuB1@ornl.gov, 865-574-7286)

DOE Office of Science/Biological & Environmental Research

Objective

- Determine if the biosynthesized MeHg can be effectively exported by the cells and what factors affect MeHg mobilization.



New Science

- Mechanisms of MeHg sorption and export by certain methylating bacteria are unclear.
- MeHg export is found to be bacteria-specific and thiol concentration dependent.
- In the absence of thiol ligands, MeHg strongly sorbs onto *G. sulfurreducens* cells, but not on *D. desulfuricans* ND132 cells.
- Thiols such as cysteine can greatly facilitate MeHg desorption and export by cells.

Significance

- MeHg is not exported instantaneously, as previously thought. Complexing ligands, such as cysteine and natural organic matter, play an important role in cell MeHg export and mobilization in the environment.

Lin, H., X. Lu, L. Liang, and B. Gu. Thiol-facilitated cell export and desorption of methylmercury by anaerobic bacteria. Environ. Sci. Technol. Lett. 2015, 2, 292–296. DOI: 10.1021/acs.estlett.5b00209..

OAK RIDGE National Laboratory

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Methylmercury (MeHg) toxin, formed by anaerobic bacteria, is rapidly excreted from cells, but the mechanism of this process is unclear. We studied the factors affecting MeHg export and its distribution in cells, on cell surfaces, and in solution by two known mercury methylators, *Geobacter sulfurreducens* PCA and *Desulfovibrio desulfuricans* ND132. Thiols, such as cysteine, were found to greatly facilitate desorption and export of MeHg, particularly by PCA cells. In cysteine-free assays (4 h), <10% of the synthesized MeHg was found in solution, >90% was associated with PCA, of which ~73% was sorbed on the cell surface and 19% remained inside the cells. In comparison, 77% MeHg was in solution, leaving ~13% of the MeHg sorbed and ~10% inside the ND132 cells. Our results demonstrate that MeHg export is bacteria-specific, time dependent, and is influenced by thiols, implicating important roles of ligands, such as natural organic matter, in MeHg production and mobilization in the environment.

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