

Methylmercury production by *Desulfovibrio desulfuricans* ND132: Influences of natural organic matter and growth stage

ABIR BISWAS¹, SCOTT BROOKS^{1*}, CARRIE MILLER¹, GEORGE SOUTHWORTH¹, JENNIFER MOSHER¹, MEGHAN DRAKE¹, XIANGPING YIN¹

¹Oak Ridge National Laboratory, Environmental Sciences Division, Oak Ridge, TN (brookssc@ornl.gov)

Mercury (Hg) is a widely distributed pollutant that can be methylated by sulfate-reducing bacteria (SRB) in sedimentary environments to form the neurotoxin methylmercury (MeHg) that can bioaccumulate up aquatic foodwebs. Studies of MeHg production have indicated that total Hg is not directly correlated to total MeHg in many aquatic systems [1], which has stimulated interest in variables controlling Hg uptake by bacterial cells (eg. Hg speciation [2,3]) and controls on bacterial metabolic processes that could affect rates of Hg methylation. Natural organic matter (NOM) is a ubiquitous environmental variable that can strongly complex with Hg in natural systems and whose effect on Hg methylation has been understudied.

Cultures of the known methylating SRB *Desulfovibrio desulfuricans* ND-132 were grown under respirative conditions (sulfate-free media with pyruvate and fumarate added) and spiked with inorganic Hg or Hg pre-equilibrated with Suwanee River (SR-)NOM. Sacrificial samples collected at mid-log, late-log, and late stationary phases were sampled for MeHg, filter-passing (0.2 μm) and filter-retained total Hg, organic acids, and cell enumeration. Methylmercury produced by ND132, expressed as picograms MeHg per 10^6 cells (pg/Mcell), was not influenced by the presence of SRNOM at any sampling time, though ND132 did grow faster in the presence of SRNOM. MeHg increased from 0.058 pg/Mcell at mid-log phase to 0.09 pg/Mcell at late stationary phase. The addition of Hg or Hg-SRNOM to a late stationary phase culture (~98% of the pyruvate and fumarate had been consumed) produced a 4X increase in MeHg production (0.35 pg/Mcell, equivalent to 70% methylation; samples collected 48 hours after Hg addition) and suggests that ND132 in this stressed condition may be a more active methylator. Results offer a first step toward a better understanding of controls on MeHg production under natural environmental conditions.

[1] Benoit et al. (2002) *ACS Symposium Series* **835**, 262–297. [2] Schaefer & Morel (2009) *Nat. Geosci.* **2**, 123-126. [3] Lin & Jay (2007) *ES&T* **41**, 6691-6697.