Novel Perchlorate-Reducing Bacteria Accumulate High Levels of Chlorate

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Perchlorate (ClO_4^-) contamination is found in many potable water sources across the United States. Dissimilatory reduction to chloride by perchlorate-reducing bacteria (PCRB) can be an effective treatment strategy, as perchlorate is a highly energetic electron acceptor and the end product is innocuous. Perchlorate reduction is thought to occur in three steps: perchlorate reduction to chlorate (ClO_3^-), catalyzed by the (per)chlorate reductase enzyme; chlorate reduction to chlorite (ClO_2^-), catalyzed by the same enzyme; and chlorite disproportionation to chloride and oxygen by the chlorite dismutase enzyme. Although chlorate accumulation has not been reported for PCRB, we found that PCRB accumulate trace amounts of chlorate during batch reduction tests, around 1 % of the perchlorate concentration, on a molar basis. This low accumulation may explain why it has not been detected by others. We have found two novel PCRB isolates that display significantly higher levels of chlorate accumulation. *Dechloromonas* sp. HCAB-C and *Dechloromonas* sp. HCAB-1 accumulate chlorate at around 56 % and 28 % of the perchlorate concentration, respectively. Batch experiments suggest the kinetics also are markedly different from other PCRB described in the literature. The distinct kinetic behavior suggests there may be more than one type of (per)chlorate reductase enzyme, and there may be syntrophic relationships among conventional PCRB and high-chlorate-accumulating PCRB with regard to chlorate production and utilization.

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