PH-109:

Genomic adaptation of the thermophilic hydrogenogenic carboxydotrophic bacterium from marine sediment, *Calderihabitans maritimus* KKC1, driven by carbon monoxide dehydrogenases

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A novel thermophile *Calderihabitans maritimus* KKC1 (KKC1) isolated from a submerged marine caldera (Kikai caldera) can grow on carbon monoxide (CO) (carboxydotrophic) and produce hydrogen as a byproduct (hydrogenogenic). KKC1 was phylogenetically related to thermophiles of the genus *Moorella*, one of which produces acetate in carboxydotrophic growth. In this study, we determined the genome sequence of KKC1 and compared it with two genomes from different strains of *Moorella*, in order to reveal the relationships between the genomic contents and the variations of carboxydotrophy. By genome-wide phylogenetic analysis, it was strongly suggested that KKC1 and *Moorella* strains evolved from a common ancestor. KKC1 shared genes related to information process and basic metabolism with *Moorella* strains. On the other hand, many genes involved in energy production and conversion were found only in KKC1 genome. In particular, KKC1 genome harbored six genes encoding catalytic subunit (CooS) of [Ni,Fe]-carbon monoxide dehydrogenase ([Ni,Fe]-CODH) that are the key enzymes for carboxydotrophic growth, while *Moorella* strains had only two. Both *Moorella* strains possessed the well characterized *cooS* within acetyl-CoA synthase gene clusters, and each strain had additional CooS genes adjacent to either the well-studied energy-converting hydrogenase gene cluster or the gene encoding cysteine synthase. KKC1 conserved all these types of CooS genes. Additionally, KKC1 had one previously reported *cooS* clustered with nitrite reductase and ferredoxin genes, and two CooS genes in novel genomic contexts which had never been reported; They were adjacent to 1) 2-oxoglutarate:ferredoxin oxidoreductase and ferredoxin genes, 2) 4-hydroxy-3-methylbut-2-enyl diphosphate reductase gene, respectively. These suggest KKC1 can couple CO oxidation to TCA cycle and isoprenoid synthesis. Compared to *Moorella* strains, KKC1 might have flexible CO metabolism and adapt to high concentration of CO.

keywords:carbon monoxide,carboxydotroph,hydrogenogen,acetogen,CODH