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Culturable diversity of thermophilic archaera from a hydrothermal vent of Tofua Arc

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Key Word: Hydrothermal vent, thermophilic archaera, diversity, cultivation, Tofua Arc

Hydrothermal vents are interesting ecological spots in the aspects of evolution of life and light-independent ecosystem. Sediment and chimney samples from a hydrothermal vent were obtained from Tofua arc, near the westward bend of the Tonga Trench, which continuously gushes hot and mineral-rich water. Microorganisms surrounding hydrothermal vents support the ecosystems via primary production by chemolithotrophic metabolism retrieving energy from reduced inorganic chemicals. In this study, we attempted to cultivate various trophic levels of thermophilic archaera from the samples under aerobic and anaerobic conditions at 65 °C and 85 °C. Combination of various electron acceptors and donors were tested: electron donor (hydrogen, methane, reduced sulfur and yeast extract); electron acceptor (ferricydrite, elemental sulfur and nitrate). Diversity analysis based on 16S rRNA gene amplification and denaturing gradient gel electrophoresis and morphological observations of archaera in the cultures were performed for targeted isolation of archaenal strains.

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Isolation and characterization of a new thermophilic carboxydotroph from an acidic hot spring

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Key Word: carboxydotroph, carbon monoxide, thermophile

Recent estimates point out a considerable amount (10–20% of total emission) of carbon monoxide (CO) is consumed by CO-oxidizing microorganisms. CO occurs naturally from volcanic gases in many volcanic hot springs, however, a paucity of information regarding diversities, distributions and physiological features of thermophilic CO-oxidizers still veils their ecological role on CO fluxes in hydrothermal ecosystems. Of hydrothermal environments, we focused on an acidic hot spring which has not been reported as an isolation source of CO-oxidizing thermophiles. We isolated a new thermophilic CO-utilizing (carboxydotrophic) bacterium designated strain Ug1 from an acidic hot spring located in Ibusuki, Kagoshima Pref., Japan. Strain Ug1 grew on 100% carbon monoxide (CO) in gas phase as a sole carbon source producing hydrogen and carbon dioxide. The cells were motile rods with a length of 1.0–3.0 μm. The temperature and pH ranges for growth were 50–73 °C (optimum at 65 °C) and 4.6–8.6 (optimum in 6.0–6.5), respectively. Strain Ug1 oxidized CO (100% in gas phase) with ferric citrate, amorphous Fe(III) oxide, 9,10-anthraquinone 2,6-disulfonate (AQDS), elemental sulfur, or thiosulfate as electron acceptors. The phylogenetic analysis based on 16S rRNA gene sequences revealed strain Ug1 belongs to carboxydotrophic genus Carboxydothermus. The highest sequence similarity among these species was found to be 96% with C. hydrogeniformans. Growth on CO with reduction of elemental sulfur or ferric citrate have not been reported in this genus. These data strongly suggest that strain Ug1 is a new species of genus Carboxydothermus.

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