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Design of artificial anaerobic microbial community for bioremediation

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Microbial remediation is one of the promising technologies for treating contaminated environment, especially anaerobic technology for the aquifer and sediments. Anaerobic microbial remediation does not require the soil excavation and/or aeration of aquifer, therefore, it is less expensive and energy saving. However, microorganisms tend to have a narrow range of degradation spectrum of toxic substances, although the polluted sites often contain multiple toxic substances. To this shortcoming of microbial capacity of detoxification of multiple toxic substances, we have conducted the study on a synthetic microbial community to widen the microbial spectrum in the degradation of toxic substances. In this study, we have combined the halogenated aromatics-respiring anaerobe (*Dehalobacter*), halogenated aliphatics-respiring anaerobe (*Geobacter*), aromactics-oxidizing anaerobe (*Desulfatiglans*) and hydrogen-producing anaerobe (*Clostridium*). The synthetic community was also conducted using multiple enriched cultures including these anaerobes. The experiments suggested that the combination of different microbial strains/community is successfully carried out to widen the degrading spectrum. Toxic metabolites from one anaerobe, hydrogen sulfide from sulfate-reducing anaerobe, caused the inhibitory effect on other members in synthetic anaerobe community. In the case of synthetic anaerobic community applied to the plug-flow reactor, pentachlorophenol, the examined pollutant was completely mineralized. All the microbial strains distributed into the narrow upstream area in the reactor based on the detection of functional genes. These results suggested that the design and construction of synthetic anaerobic community would be useful and important for the successful bioremediation.

Biography

Arata Katayama has completed his PhD from Tokyo Institute of Technology and worked as Postdoctoral fellow at University of California, Institute of Toxic Substances Research. Presently, he teaches Sanitary Engineering for undergraduate course and Ecotoxicology for graduate course as a Professor of Department of Civil and Environmental Engineering, Nagoya University, Japan. He also serves many governmental committees on environmental pollution, polychlorinated biphenyl remediation and monitoring of environmental quality.

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