Effect of bacterial iodide oxidation on iodine mobility in pasture soil

Y. UNNO[1*], K. SHIROYAMA[2], S. AMACHI[2], A. TAKEDA[1]

[1] Institute for Environmental Sciences, Aomori 039-3212, Japan (*correspondence: unno@ies.or.jp, takeda@ies.or.jp)

[2]Chiba university, Chiba 271-8510, Japan (kankankan992@gmail.com, amachi@faculty.chiba-u.jp)

Much attention is paid to long-life radioiodine (^{129}I) that has been emitted from nuclear fuel reprocessing plants, because its behavior in the environment has not sufficiently been clarified yet. The mobility of ^{129}I in the terrestrial environment, especially in soil, is important for understanding its behavior. Although various studies pointed out that iodide (I^-) mobility in soil was affected by I^- oxidizing bacteria which are capable of oxidizing I^- to I_2, the ecology and role in I dynamics of these bacteria under field conditions has been still unclear.

A nuclear fuel reprocessing plant is located in Rokkasho and has been under the final test. In this study, soil core samples from a surface layer down to 50 cm were collected at a pasture in the vicinity of the plant on August, 2014 and studied for their bacterial community structure and distribution of IoxA gene, which is one of the gene code for I^- oxidizing enzyme (IOE). The results were discussed in relation to various chemical and biological characteristics such as I concentration in soil solution, I^- soil-water partitioning coefficients (K_d) and IOE activity.

Amplicon libraries of 16S rRNA gene were constructed for each soil layer, and sequenced by using MiSeq sequencer. Phylogenetic analyses revealed that the decreasing tendency of relative abundance of *Alphaproteobacteria* with depth. IoxA-like sequences were only detected in the surface soil, and its sequences had high similarities to IoxA of *Alphaproteobacteria*.

Concentration of I in the soil solution was relatively high in the surface soil in comparison to that from common field soil under oxic conditions. Although the total I concentration was decreased with depth, organic I and I^- proportion are fairly constant in ranges of 58-74% and 42-26%, respectively, with undetectable IO_3^-. Those results suggested that organic-I and I^- are mobile forms in the soil. In addition, the surface soil showed relatively high IOE activity and low K_d value. All those results are not inconsistent with that bacterial I^- oxidization and subsequent iodination of organic materials played an important role in I mobility in pasture soil.