Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


MAG35-P10 Room:Convention Hall Time:May 21 18:15-19:30

# Mat-forming cyanobacteria effectively decontaminate radioactive cesium

Atsushi Yamamoto[1*], YOSHIDA, Shigeru[1], YAMANISHI, Hirokuni[2], ITOH, Tetsuo[2], FURUKAWA, Michio[3]

[1]Department of Life Science, Kinki University, [2]Atomic Energy Research Institute, Kinki University, [3]Mayor of Kawamata-Machi, Fukushima

The accident at the Fukushima I Nuclear Power Plant released radioactive cesium around the plant. The cesium was trapped in fine surface soil (< 0.125 mm in diameter); particularly, the soil from the ground surface to a 1 cm depth was seriously polluted (Yamanishi *et al*., 2012; Inagaki *et al*., 2012). The following three points are thought to be important for decontamination of the cesium: 1) fixation of the polluted soil to its original area, 2) removal of the soil and 3) continuation of decontamination. From a Geological perspective, bacterial mat formation often sustains sedimentary structure. So, we aimed to develop a decontamination technique by artificial formation of bacterial mats, specifically cyanobacterial mats. In this study, we formed artificial cyanobacterial mats and measured $^{137}$Cs concentration of the mats and the residue of soil separated from the mat. The used soil was gathered from the Planned Evacuation Area in Kawamata, Fukushima. The soil was divided to fine (< 0.125 mm) and coarse (0.125 ? 1 mm). We placed both types of soil with a depth of about 5 mm on the dish and tried to form a cyanobacterial mat on the soil. We used three filamentous cyanobacteria. The incubation was carried out at 25 degree centigrade, dark : light = 12 h : 12 h cycle. The formed mat was dried and peeled from the soil, was washed by distilled water to the extent that the soil did not separate from the mat, dried it again and then measured $^{137}$Cs concentration using a germanium semiconductor detector in Kinki University Atomic Energy Research Institute. The residue soil of the final wash was also measured.

After a 2-month cultivation, we got cyanobacterial mats of 1 - 2 mm thickness. The mat covered the entire surface of the dish soil. The strength of the peeled mats differed between cyanobacterial strains. Measured $^{137}$Cs concentration was very high in all samples: 180 ? 380 Bq/g in the fine soil and 70 ? 600Bq/g in the coarse. The $^{137}$Cs concentration of the residue soils was 90 ? 240 Bq/g in the fine and 5 ? 19 in the coarse. As for almost all the residue soils, the $^{137}$Cs concentration was decreased from the control soil. $^{137}$Cs removal ratios, calculated from the $^{137}$Cs concentration of the control soil and residue soils were 45 - 54 % on the fine soil and 30 ? 50 % on the coarse. Both $^{137}$Cs concentration and removal ratios differed between cyanobacterial strains. In comparison with all measured ratios, the removal ratios were significantly higher with the fine soil compared with the coarse, for the ratios were thought to depend on the surface size of the particles of the soil. The $^{137}$Cs concentration ratios calculated from $^{137}$Cs concentrations of the mats and the residue soils were 1.3 ? 53. These ratios were equal to or higher than the ratios reported from higher plants (Dushenkov *et al.*, 1999). Thus, our results demonstrate that cyanobacteria efficiently decontaminated radioactive cesium. Particularly, the efficiency of the fine soil decontamination should be effective in the phytoremediation of the paddy fields.

Keywords: cyanobacteria, phytoremediation, radiocesium, decontamination, bacteria mat, Fukushima I NPP