

# Research of discharge radioactive Cs-bearing microparticles from a small forested catchment

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## INTRODUCTION

Vast amount of radioactive cesium (RCs) deposited by the accident of Fukushima Dai-Ichi Nuclear Power Plant (FDNPP). Fate of the RCs in the environments is important since RCs has long half-life. Previous studies estimated annual RCs runoff as about 0.1% or less of the total RCs deposition in the forest. Many previous studies reported concentration of suspended solids and RCs concentrations in water samples had linear correlation. However, there were still some extremely high RCs concentration was observed among water samples. Few studies analyzed such high RCs concentration water samples. Radioactive Cs-microparticles (CsMPs) are one of particulate RCs released from FDNPP. They are about 1-10  $\mu\text{m}$  in size. The matrix is SiO<sub>2</sub> glass which contains Cs and other elements such as iron, zinc and tin. One of the remarkable features of CsMPs is high radioactivity per volume compared with soil particles that absorb RCs. There is a possibility that a water sample showing high radioactivity may contain CsMPs. But few studies focused on CsMPs in suspended solids in river water from forested catchment. The aim of this study is to consider whether there is an outflow of CsMPs from forested catchment focusing CsMPs in suspended matter.

## METHODS

Study site is a small forested catchment in Iitate village, Fukushima prefecture. Catchment area is around 56 ha. Estimated RCs deposition was 1 MBq m<sup>-2</sup>. Water level gauge, a turbidity meter, and automatic water sampler was installed for stream water monitoring and sampling. Water samples were brought to the laboratory and filtered to separate suspended matter and supernatant. RCs radioactivity of suspended matter, and Imaging Plate (IP) images were taken for suspended matter whose radioactivity was higher than the average. When expected microparticles which seemed to be CsMPs was detected on the IP image it was fractionated and isolated from suspended matter. Isolated particles were observed using a scanning transmission electron microscope (SEM, Hitachi S-4500) with an energy-dispersive X-ray detector (EDS, KeveX, SIGMA).

## RESULTS

We isolated two CsMPs from all samples from stream water samples during summer of 2018. SEM image and gamma counter suggested small particles with a diameter of 2.4  $\mu\text{m}$  emitted relatively high radioactivity. As a result of examining chemical composition of each CsMPs by EDS, such elements as silicon, zinc, and iron which were confirmed in previous research were confirmed. Also, they were isolated from the same sample, and RCs radioactivity of each CsMPs is 2.33 and 2.22 Bq which was about 12%

against total RCs radioactivity of the water sample. On the other hand, approximately, the mass of the two CsMPs were 50 pg which was about  $5.7 \times 10^{-9}$  % against the total mass of the suspended matter in the water sample. It suggests that the contribution of CsMPs to RCs radioactivity of the water sample. From the view of suspended matter concentrations in the stream water sample, the sample from which we isolated CsMPs was collected at relatively frequent intensity rainfall and the out flow of CsMPs can be considered in the future.

#### AKNNOWLEDGEMENT

Authors would like to appreciate nonprofit organization Resurrection of Fukushima for their help to install water sampling facilities at litate village. This study was supported by Grants-in-Aid for Scientific Research (15H02467). SEM work was conducted at Advanced Characterization Nanotechnology Platform of the University of Tokyo, supported by "Nanotechnology Platform" of the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan.

Keywords: Fukushima, radioactive Cs-bearing microparticles, stream water monitoring and sampling