Radioactive cesium-bearing particles in various environmental samples

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Radioactive materials released by the Fukushima Dai-ichi Nuclear Power Plant (FDNPP) accident caused extensive radioactive contamination. Adachi et al. (2013) discovered radioactive Cs-bearing particles (Cs-bearing particles) from air filter in Tsukuba (170 km from FDNPP). This finding is an important, since the particle which is likely to be emitted directly from FDNPP may contain various information on the phenomena occurring in FDNPP during the accident. However, because of the difficulty of separating Cs-bearing particle from environmental sample, comprehensive information on physical and chemical properties of the particles as well as distribution of particles in Fukushima contaminated areas is limited. In this study, the distribution and physical and chemical properties of Cs-containing particles were investigated using various types of environmental samples, such as suspended particles in river and surface seawater, tree leaves, and road dust (noted as black substances).
Radioactive cesium-bearing particle in the sample was separated from other particles by the wet-separation method using a NaI scintillation counter. The separated particle was identified by a scanning electron microscope (SEM) equipped with an energy dispersed X-ray spectrometer (EDS). The activities of ^{134}Cs and ^{137}Cs in the identified particle were measured by non-destructive gamma-ray spectrometry.
Spherical particles with diameters of approximately $< 5\ \mu$m were found in any samples. Particles of this type are similar in terms of chemical composition to those reported so far, and were estimated to be derived from Units 2 or 3 of FDNPP estimated by the ^{134}Cs/^{137}Cs activity ratio. In the dust samples of the northwest direction within 20 km from FDNPP, particles with diameters of several tens to several hundreds of microns were found. This area has been reported to be contaminated with radioactive materials from Unit 1 (Satou et al., 2015). Most of the particles in this region were not uniform in shape. The main components of the particles in this region were Si, Ca, K, and Al derived from Unit 1 from the ^{134}Cs/^{137}Cs activity ratio. In addition, although it is reported that the shape of the particles in this region is not uniform, some spherical particles with a diameter larger than $> 20\ \mu$m were also found.
From the facts above, it was found that three kinds of radioactive particles are widely present in various environmental samples.

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