

Comparison of cesium-bearing microparticles from marine and terrestrial sources

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Radionuclides including radioactive Cs were released into the environment due to the Fukushima Daiichi Nuclear Power Plant accident in 2011. Two years after the accident, glassy water-resistant particles incorporating radioactive Cs were first reported. Such glassy particles are called cesium-bearing microparticles (CsMPs). CsMPs have been studied because (i) they have information on the condition in the reactor at the time of the accident, and (ii) there is concern about the exposure to the humans and the other organisms.

Several types of CsMPs have been reported, which is assumed to reflect the difference in the accidental progress of each unit. It is also known that CsMPs were transported in the atmospheric plume at the time of emission and therefore have different deposition regions. Type-A CsMPs, are presumed to originate from Unit 2, deposited over a wide area including the Kanto region due to their small size ($\sim 0.1\text{--}10\ \mu\text{m}$). Type-B CsMPs, are presumed to originate from Unit 1, deposited in a limited area in the north direction because of their large size ($50\text{--}400\ \mu\text{m}$). Matrix of Types-A and -B CsMPs is SiO_2 but Type-A CsMPs have higher concentration of volatile elements including Cs than Type-B CsMPs due to the difference in forming process. Type-A CsMPs were formed through gas condensation, whereas Type-B CsMPs were formed through melt solidification.

The presence of CsMPs emitted from Unit 3 in the ocean was confirmed by our research. The plume at the time of the emission of radionuclides from Unit 3 was in the ocean direction, which suggests that many CsMPs from Unit 3 deposited directly into the ocean. We will report the comparison of CsMPs from marine and terrestrial sources. In addition, we reported Type-A CsMPs from suspended particles in rivers and marine samples, such as plankton net and suspended particle samples. This fact suggests that Type-A CsMPs deposited on land and transported to the ocean through rivers. The presence of CsMPs may be the cause of the overestimation of solid-water distribution coefficient for marine sediments and particulate matters and apparent high concentration factor of marine biota of radioactive Cs.

Keywords: radiocesium-bearing microparticle, Fukushima Daiichi Nuclear Power Plant accident, Radioactive cesium