Migration Behavior of Radiocesium Derived from the Fukushima Dai-Ichi Nuclear Power Plant Accident in Natsui River and Tone River

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The accident of Fukushima Dai-ichi Nuclear Power Plant due to the Tohoku earthquake, which occurred on 11 March 2011, has released a large amount of radioactive materials to the atmosphere. This accident resulted contamination of radioactive cesium (¹³⁴Cs and ¹³⁷Cs) on land, rivers and sea around Fukushima Prefecture. Radioactive cesium widely deposited on land and transported from watershed through river system to the ocean. In this study concentration of ¹³⁴Cs and ¹³⁷Cs in river water has been investigated for dissolved and particulate phase. River water sample was collected at a fixed station from the Tone River and the Natsui River at normal and high flow condition during 2018-2019. Suspended solids were separated using continuous flow centrifugation and dissolved cesium were co-precipitated using ammonium molybdophosphate (AMP) method.

The AMP precipitated and suspended solids were dried to determined radioactive cesium concentration using HPGe gamma spectrometry. Investigations of cesium concentration in the rivers have been performed to understand factors controlling transport of radiocesium during different condition. The maximum concentration of ¹³⁴Cs and ¹³⁷Cs at normal condition was 0.7 mBq L⁻¹and 7.9 mBq L⁻¹in the Tone River, and 1.1 mBq L⁻¹and 11 mBq L⁻¹in the Natsui River, respectively. After the rainy events and typhoon, the concentration of ¹³⁴Cs and ¹³⁷Cs in river water was increased. Total concentration of ¹³⁴Cs after the rainy events in the Tone River and the Natsui River was 18 –37 mBq L⁻¹and 40 mBq L⁻¹ respectively, and concentration for ¹³⁷Cs was 211 –411 mBq L⁻¹and 447 mBq L⁻¹espectively. During the study period, 97-100 % of ¹³⁴Cs and ¹³⁷Cs was distributed by suspended solid in the Tone River and 95-100 % of ¹³⁴Cs in the Natsui River after the rainy events. These results indicate that behavior of suspended solids is a main factor controlling variation of concentration of ¹³⁴Cs and ¹³⁷Cs in both rivers.

Keywords: Radioactive Cesium, River water, Suspended solids, Fukushima Dai-ichi Nuclear Power Plant