Resuspension processes of Fukushima radioCs: Could fungal spore play a significant role?

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The authors have studied for atmospheric re-suspension of the radioactive cesium (Cs) originated from the Fukushima Dai-ichi Nuclear Power Plant (FDNPP) accident in contaminated area by the accident to assess the atmospheric effect of the accident. As a result the authors came to know that 1) in summertime, Cs concentration increases (see Fig. 1) in such typical Japanese village-vicinity mountain area and that 2) radioactive particles in summer seem to be dust from its appearance and their optical micrograph, but on the contrary, we realized that most has biological origin from electron-microscopic view (Fig. 2). Taking into consideration the fact that true fungi concentrate Cs due to misidentifying Cs as potassium, we can assume that the fungal spore as the major contributing factor for resuspension.
Supposed that only fungal spore can carry ^{137}Cs, estimating the ^{137}Cs amount per spore under various assumptions; the value would be 5×10^{-10}-3×10^{-7} Bq/fungal spore particle, in that case, the spore needs to be released at a rate of 9×10^{3}-5×10^{5} particle/m^2/sec from forests to support the present ^{137}Cs in the air. This value is surprisingly 1-3 digits larger than the forest maximum value (387 particle/m^2/sec) of the fungal spore emission rate given in Table 2, Sesartic & Dallafior (2011), suggesting a potentially large environmental impacts of the spore. Actually, number concentration of bio-aerosol would be reaching $5\text{-}8\times10^{5}$ particle/m^3 in our preliminary observation during past summer in 2015 in a forest in Fukushima Prefecture, revealing that more bio-aerosol release could be occurring from Japanese forests than our expectation. Further, based on this postulation that fungal spore would be a major source of atmospheric Cs especially during summer, ^{137}Cs concentration would be ranging 2.5×10^{-4}-0.15 Bq/m^3 air in the forest, which almost fits to the actual ^{137}Cs concentration level shown in Fig. 1.

Keywords: the Fukushima Daiichi Nuclear Power Plant accident, Radioactive cesium, Resuspension, Bioaerosol, Dust

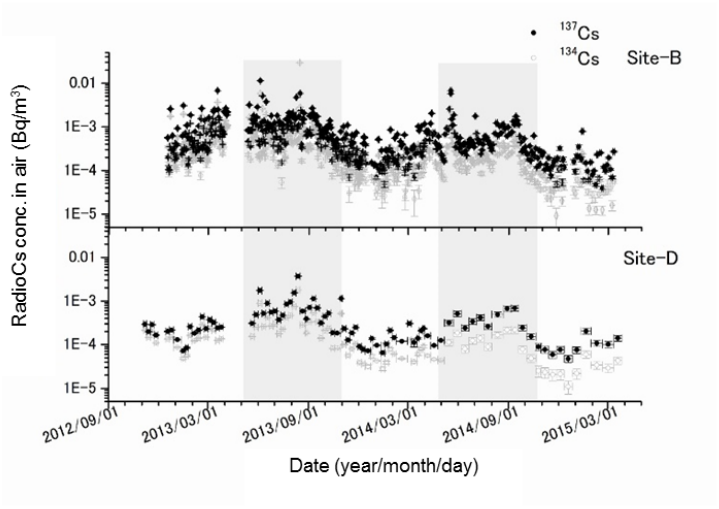

Fig. 1: Temporal trends in atmospheric radioCs concentrations in contaminated area in Fukushima Prefecture during fall of 2012 to spring of 2015 Shaded: summer season

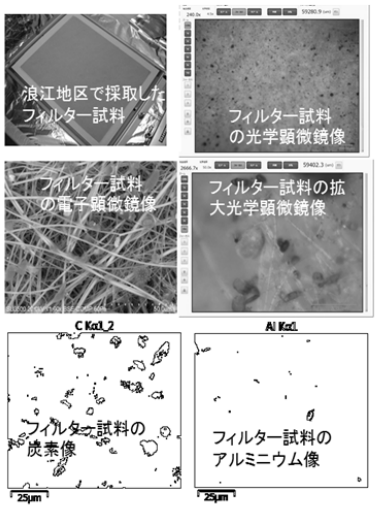

Fig. 2: Photos of a filter specimen sampled in summer; optical microscopic views, and electron microscopic views The bottom panel shows carbon distribution (left) and aluminum one (right).

