

## Hybrid-remediation with nano-size metallic calcium and iron dispersion for detoxification of multi-pollutants containing radioactive cesium, heavy metals and POPs in contaminated soil

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Soil pollution by persistent organic pollutants (POPs) and heavy metals, especially lead, arsenic, cadmium, chromium and fluorine are major environmental concern in Japan, especially after the Soil Contamination Countermeasures Law enforcement in 2003. In addition, in Japan, the major concern on the radioactive cesium deposition and its soil contamination due to the emission from the Fukushima Daiichi Nuclear Power Plant showed up after a massive quake on March 11, 2011. Hence, its remediation is recognized to be one of the most difficult problems to be solved by taking advantage of suitable technologies. Recently, the impacts of nanotechnology are increasingly evident in the field of environmental studies and treatment. In present study, we focused synthesis and application of nanosize metallic calcium and iron dispersion for detoxification of multi-pollutants containing radioactive cesium, heavy metals and POPs in contaminated soil. Results show that the dechlorination of POPs was about 97, 59, 60 and 29% in 0, 1, 4.4 and 9.6% soil moisture content, respectively. While, about 95-99% heavy metals immobilization was achieved by mechanochemical treatment of soil with nano-metallic-calcium and phosphoric acid, which improved to make thin cover on soil surface by developing low soluble calcium apatite. In addition, the high concentration of cesium and heavy metals containing soil fraction, was also separated by magnetic separation by the addition of iron powder after treatment with nano-metallic-calcium. With iron fraction, high concentration of heavy metals was successfully separated about 36-45%, with high condensed heavy metal concentration about 85-95% by the magnetic separation of small particle fractions with high specific surface area, where both pollutants and iron accumulated. Similarly, about 30 wt% magnetic and 70 wt% non-magnetic fraction soils were separated, and its condensed cesium concentration was about 80% and 20%, respectively. Furthermore, we revealed two major effects, i.e. the reduction of chlorine from POPs (chemical effect) and coating and blocking of soil surface (physical effect) as the remediation mechanisms.

### Biography

Tetsuji Okuda is Assistant Professor at Hiroshima University, Japan. His research work focuses on the remediation of contaminated soil. His other interests are waste and water treatment by chemical and physical methods in where he published several papers in international journals and presented at several international conferences.

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