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Nano-sized calcium and functional magnetite dispersing enabled remediation system for multi-pollutants in soil

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The remediation of heavy metals (HMs) and radioactive cesium-contaminated soils followed a rapid upward trend in Japan, especially after the consequently to the tragic events that occurred at the Fukushima Dai-ichi Nuclear Power Plant (FDNPP), provoked by the massive quake and subsequent tsunami, on March 11, 2011. HMs and radioactive cesium-contaminated sites pose a serious hazard to public health and the environment. Therefore, many researchers had focused their research on the development of separation and solidification techniques for pollutants in polluted soils. We have recently shown that nano-sized metallic calcium/calcium oxide (nCa) and/or nano-size iron dispersing (Fe-nCa) mixtures are most effective for HMs immobilization and volume reduction method under dry condition. The efficiencies can be enhanced further to 98-100 wt% by using additional nCa. Moreover, due to the magnetic behavior of the soil treated with the Fe-nCa system, two soil fractions can be easily separated: 36-45 wt% of magnetic soil (with 85-95 % HMs concentration) and 64-55 wt% of non-magnetic soil fraction (presenting lower HMs concentration – only 10-20 %). Further, we also reported that Fe-nCa could easily coat and separate the immobilized pollutants. In the present study we have also used the lighter weighted functional magnetite (Fe3O4). Mixing 2% Fe3O4 to about 2.8kg of dry (14,300 Bq/kg initial radioactive concentration), contaminated soil afforded subsequently to a strong magnetic separation (two soil fractions: 1.1 kg of magnetic and 1.7 kg of non-magnetic soil). The magnetic part's radioactive concentration was 23,600 Bq/kg, while the non-magnetic part presented only 7,660 Bq/kg, lower than the 8,000 Bq/kg allowed regulatory threshold.

Biography

Yoshiharu Mitoma, PhD in Chemical Engineering (1997, Kyushu University), is now full Professor and Dean of Graduate School of Comprehensive Scientific Research, Prefectural University of Hiroshima. Dr. Mitoma was awarded the Young Chemist Award in Asian Chemical Congress (Federation of Asian Chemical Societies) in 2005 in Seoul, Korea, and the Young Chemist Award at the International Conference on Environmental Science and Technology, in Houston, Texas, USA. He was a peer in the jury for different projects of the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and for the Ministry of Economy, Trade and Industry (METI) in Japan.

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