This research aimed at reducing the health and ecological risks associated with lead in shooting range by developing a novel phosphate-based surface coating technology that could inhibit weathering Pb-bearing solids in soil ecosystem.

Reducing Health and Environmental Risks of Lead-Bearing Solids in Shooting Range by Surface Coating Technology

Who cares and why?

Lead (Pb) is listed as most common, highly toxic heavy metal in natural environment. The lead contamination in soil resulting from shooting activity is well known to be a threat to human health and natural ecosystem. In shooting range, lead bullets in soil are subject to natural corrosion and weathering, which could threaten human health, especially children, and impair surface and ground water quality through oral ingestion of contaminated soil and surface run-off or leaching processes. It was reported that lead deposition at target ranges is estimated to be 0.5-10 tons Pb per year in the United States and soils at the many civilian and military shooting ranges contain a range of 10-54 g Pb per kg soil.

Application of conventional technologies such as chemical precipitation or soil washing for remediating such contaminated sites is a great challenge, due to large Pb solid occurring and their limited dissolution in soil ecosystem. Thus developing a cost-effective, environmental-friend technology for the site remediation or site restoration is needed to safeguard human health and protect natural resources from Pb contamination. This research attempts to develop a novel surface coating technology that could stabilize soil Pb, inhibit the weathering of the Pb solids, and reduce the health and ecological risks associated with soil Pb.

What has the project done so far?

Results indicated that chemically stable iron or aluminum phosphate would be potential materials for surface coating of lead bullets, which could inhibit the corrosion and prevent the weathering of lead bullets in soil, thus stabilizing soil Pb. The iron or aluminum phosphate coated on the Pb surface was well crystallized and chemically stable. The surface coating would result in a substantial reduction of the lead release to aquatic ecosystem as indicated by the EPA method: Toxicity Characteristics Leaching Test (TCLP). Data suggested a significant reduction of health and ecological risk of soil lead through the surface coating technology.

Impact Statement

This research will advance our fundamental understandings of lead corrosion and corrosion inhibition mechanisms in soil ecosystem and provide cost-effective and environmental-safe alternative for remediating contaminated shooting ranges.

- Developed an effective surface-coating technology to reduce the health and ecological risks of Pb-contaminated soils
- Safeguard human and protect ecosystem from Pb pollution
- Support national efforts on restoration or remediation of hazardous contaminated sites
- Improve environmental quality and natural resource sustainability

What research is needed?

Soil chemical and biological conditions such as pH, redox, plant root growth, and microbial activity are important factors to influence the weathering and solubility of Pb-bearing solids in soil ecosystem. The stability of surface-coated Pb solids under various soil conditions needs to be further investigated and the long-term treatment effectiveness assessed. In addition, the best treatment methods under field conditions should also be evaluated.

Want to know more?

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Additional link can be found at http://www.umes.edu/ard/Default.aspx?id=46285