Energy Crops for Reducing Areawide Lead Soil Contamination

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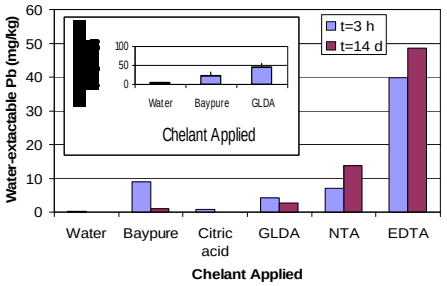
Problem Statement

Area wide lead-soil contamination poses significant health risks to large populations in the United States. Current methods to reduce lead-soil exposure are too expensive for large-scale application.

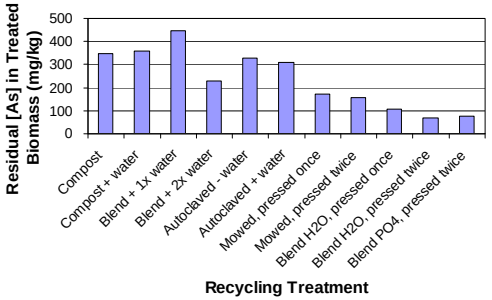
Switchgrass, photo by Oak Ridge National Laboratory

Technology Description

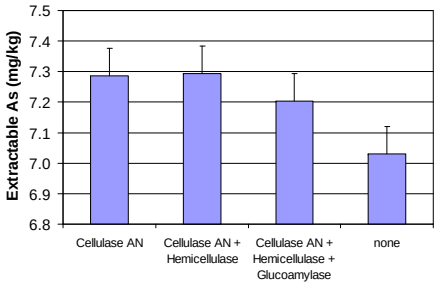
The cost of remediating large areas can be lowered by producing valuable products during the remediation process. Using a phytoextraction approach, two potential products are lead and biomass; the lead can be sequestered or recycled, and the biomass can be sold for energy production (e.g. cellulosic ethanol or co-firing in a coal burning power plant). New technologies using Transient Phytoextraction Agents (TPAs) reduce the risk of lead mobility after chelation. Using high-biomass plants such as switchgrass or elephant grass maximizes both the amount of lead which can be used by the plant and the amount of biomass which can then be sold for other uses.



Previous data show TPAs to be safe and effective when applied to turf grasses growing in smelter-lead impacted soil. Inset graph shows effectiveness of Baypure and GLDA in significantly enhancing lead uptake into turf grass compared to water.



Effect of several post-harvest recycling procedures on residual arsenic concentrations in biomass. Similar results are expected for lead.



Previous experience with arsenic-contaminated biomass shows that fine grinding greatly assisted removal of arsenic from biomass. Similar results are expected for lead.

Elephant grass exhibiting vigorous growth after transplanting. Left, 4-week old grass. Right, 8-week old grass showing 85 cm growth spurt.

Expected Results

- Two high-biomass "energy crops," *Panicum virgatum* (switchgrass) and *Miscanthus gigantus* (elephant grass), can reduce soil-lead by accumulating it in their shoots as effectively as turf grass.
- Lead in the biomass can be sequestered or recycled through post-harvest treatment techniques.
- The biomass can be sold for coal co-firing or production of cellulosic ethanol to help offset remediation costs.

Elephant grass
photo by Dr. I. Lewandowski,
University of Hohenheim, Germany

Potential Environmental Benefits

- Removal of soil-lead contamination reduces human health risks.
- Biomass produced can be used to produce energy, reducing the need for energy produced from fossil fuels.
- Recycling of lead prevents new lead from entering the environment.
- High-biomass grasses can be used as barrier crops to help prevent erosion and fertilizer runoff.
- Alternative high-biomass species can be investigated to suit the remediation zone, helping to reduce the takeover of invasive species while promoting the restoration of native species' habitats.

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