

OFFICE OF TECHNOLOGY TRANSFER

AUBURN UNIVERSITY

In-situ Remediation of Inorganic Contaminants and Heavy Metals from Soil

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Reference: Inorganic / Heavy
Metal Remediation

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Overview

Auburn University seeks a licensee for a remediation technology for the *in situ* treatment of contaminated soils or solid wastes. Starch-stabilized iron nanoparticles of varying compositions can be used to remediate such inorganic contaminants as arsenate, nitrate, chromate and perchlorate and such heavy metals as arsenic, cadmium, chromium, lead and mercury. Auburn's innovative process provides a fast and cost effective solution for the immediate need of soil and waste remediation.

Advantages

- Uses an inexpensive, easily available, and environmentally friendly stabilizer
- Allows for easy control of soil mobility
- Treats sub-surface regions where other methods fail (e.g., excavation, bioremediation)
- Inhibits formation of harmful by-products, such as methyl mercury
- Reduces processing time and materials needed, thereby reducing costs
- Prevents aggregation of nanoparticles, providing superior performance and enabling *in situ* use
- Allows for application to the entire contaminated zone or for building a sorptive barrier

Description

When mercury enters water and sediments, it can undergo numerous transformation processes, of which mercury methylation is a top environmental concern. Dangerously high concentrations of methylated mercury have been found in fish and waterfowl. Existing methods to minimize the Hg methylation process either tend to let the mercury leak back into the soil & groundwater (as with excavation & landfill techniques), or are not suited for subsurface treatment as they are time-consuming and difficult to control.

Auburn inventors have developed an innovative method using stabilized iron sulfide nanoparticles that can effectively prevent the formation of methylated mercury. Without stabilization, these particles tend to agglomerate, leading to vastly reduced reactivity and particles becoming trapped in the sub-surface soil, making them impractical for *in situ* use.

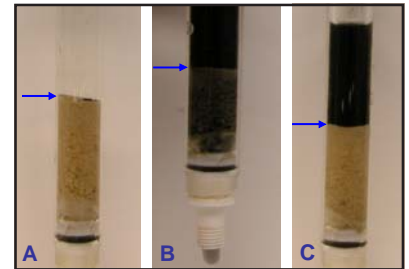
This technology modifies iron sulfide particles at production by adding a very low-cost stabilizer to prevent the nanoscale particles from agglomerating, thereby maintaining their high surface area and reactivity. The stabilizer can also be used to control the particle size and dispersibility of the nanoparticles in the subsurface. Tests performed by the inventors with mercury indicate an almost 100% stabilization efficiency, meaning that almost all of the mercury immobilized is non-leachable. These and similar stabilized iron nanoparticles can be used for *in situ* remediation of a variety of inorganic and metallic contaminants.

Status

- U.S. Patent [7,581,902](#) (Heavy Metals) and U.S. Patent [7,635,236](#) (inorganics)
- This process has been experimentally verified for mercury

Licensing Opportunities

- This technology is available for exclusive or non-exclusive licensing
- Joint development opportunities include funded research or joint venture



Visual comparison of nanoparticle (NP) mobility in sandy soil. (A) Untreated sandy soil (B) Penetration of starch stabilized FeS NPs after 15 min. (C) Immobility of unstabilized NPs after 30 min. Arrows show top of soil matrix.