



ANAEROBIC BIOLEACHING TECHNOLOGY FOR METALS RELEASE

BENEFITS

- Eliminates costs associated with the supply of oxygen and aeration in aerobic bioleaching
- Removes metals with minimal environmental consequences
- Eliminates acid products, so treatment of acidic effluents is not required
- Easily adapted to current mining operations
- Yields non-toxic by-products of bioleaching process—nitrogen, carbon dioxide, and water

APPLICATIONS

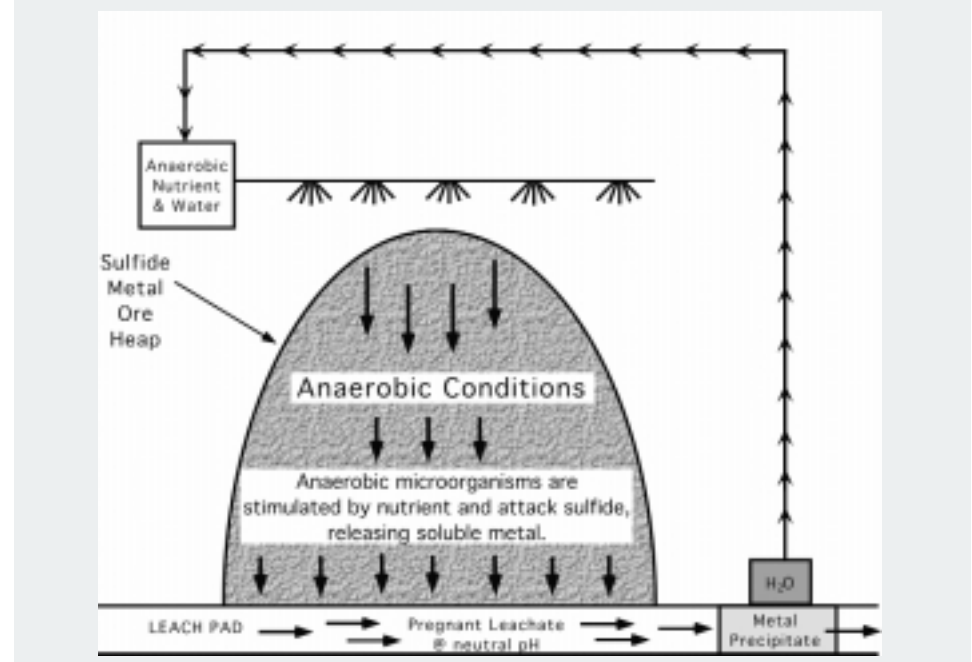
The technology is expected to have an immediate energy-savings impact on mining operations. All costs associated with the supply of oxygen and aeration in aerobic bioleaching would be eliminated, allowing the mining industry to continue operating even at lower metal prices. This new technology offers both significantly reduced operating costs and an environmentally friendly technology.

NEW TECHNOLOGY RECOVERS METAL VALUES FROM LOW-GRADE ORES WHILE REDUCING ENVIRONMENTAL CONCERNS ASSOCIATED WITH MINING OPERATIONS

The mining industry is constantly seeking new and more practical technologies to treat low-grade and recalcitrant ores and increase profitability, while operating in times of low metal prices and increased environmental concerns. Currently, aerobic bioleaching acid-generating systems are used to recover copper and gold, but the availability of oxygen and the release of acid limit the capabilities of these systems.

A new anaerobic denitrification bioleaching technology circumvents these limitations and offers a new anaerobic system that requires no oxygen and generates no acid. This innovative technology represents a low-cost and environmentally acceptable recovery process for intractable ores. The anaerobic denitrification bioleaching technology offers industry the potential to recover metal values at lower costs with minimum engineering and operational problems, while reducing the release of toxic chemical and acid waste streams.

ANAEROBIC BIOLEACHING TECHNOLOGY



Geo-Microbial Technologies' anaerobic bioleaching technology uses anaerobic cultures to remove metal values from ore at lower costs and without great environmental impact.



Project Description

Goal: Demonstrate the feasibility and extent of the anaerobic denitrification bioleaching technology to release metals from various test ores and obtain preliminary data on the scale-up potential by investigating larger-scale leaching tests on selected ores.

Microorganisms and biological systems can be used successfully to recover metals. The most prominent biohydrometallurgy system involves the use of aerobic acidophilic bacteria, which produce copious amounts of acid, causing solubilization of metals and acidic drainage. In coal mines, for example, iron-containing minerals in coal are converted by aerobic bacteria into oxidized iron and sulfuric acid.

In contrast to this aerobic, acid-producing technology, the new anaerobic denitrification bioleaching technology operates at a neutral pH and uses anaerobic *Thiobacillus* cultures. These cultures, used in conjunction with heterotrophic denitrifying cultures, allow metals removal with minimal environmental consequences.

Additionally, the denitrifying technology could possibly be used to treat ores that currently resist aerobic leaching. This technology may be able to successfully treat carbonate, silicate, pyritic, and oxidic copper ores, as well as copper sulfide-containing ores.

Geo-Microbial Technologies, Inc., is developing this new technology with the help of a grant funded by the Inventions and Innovation Program in the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

- Establish a viable anaerobic denitrifying microbial population to demonstrate metals release from selected ores.
- Demonstrate the feasibility and extent of the anaerobic denitrifying bioleaching technology to release metals from test ores.

Economics and Commercial Potential

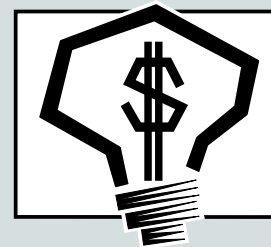
Eliminating the need for aeration removes many of the constraints facing current bioleaching projects. If proven effective, the anaerobic denitrification bioleaching process should enjoy rapid commercial development, because the technology offers a greater range of treatment applications for situations that previously were considered impossible or impractical using standard bioleaching systems. While the range of ores to be tested will include the classical bioleachable sulfide ores (copper and gold), the program will also include ores previously shown to be resistant to aerobic bioleaching. It is also possible that previously leached ores could be re-leached anaerobically.

Geo-Microbial Technologies intends to pursue licensing as a commercialization strategy. New strategic alliances could help develop the full range of applications for the new technology, and direct licensing to targeted mining companies would lead to the most rapid commercialization. The most immediate markets targeted for licensing have already been selected.

INDUSTRY OF THE FUTURE—MINING

In mid-1998, the National Mining Association reached an agreement with the U.S. Department of Energy's Industries of the Future Program to join in creating research and development partnerships to develop and deploy new technologies that will improve environmental performance and enable the industry to meet increased global competition. The mining industry supplies the minerals and coal essential to the infrastructure of virtually the entire U.S. economy: glass, ceramics, metals, and cement for buildings, bridges, roads, and equipment, and coal or uranium to generate more than 70% of the nation's electricity.

OIT Mining Industry Team Leader: Toni Grobstein Maréchaux (202) 586-8501.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

PROJECT PARTNERS:

Geo-Microbial Technologies, Inc.
Ochelata, OK

Inventions and Innovation Program
Washington, DC

FOR PROJECT INFORMATION, CONTACT:

Dr. Donald O. Hitzman
Geo-Microbial Technologies, Inc. (GMT)
East Main Street, P. O. Box 132
Ochelata, Oklahoma 74051
Phone: (918) 535-2281
Fax: (918) 535-2564
gmtgeochem@aol.com

FOR PROGRAM INFORMATION, CONTACT:

Lisa Barnett
Program Manager
Inventions and Innovation Program
U.S. Department of Energy
1000 Independence Ave., SW
Washington, DC 20585-0121
Phone: (202) 586-2212
Fax: (202) 586-7114
lisa.barnett@ee.doe.gov

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Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, DC 20585-0121



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