Microbial Platform for Rare Earth Bioaccumulation and Use Thereof

A bacterium is used to bioaccumulate and recover rare earth elements (REEs) from various sources, including electronic waste, offering an environmentally friendly alternative to traditional extraction methods.

Case ID:
ID2022-014

IP Position:
Patent Pending

Development Status:
TRL 3: Concept demonstrated on lab platform - analytical models to support lab design

Opportunity
Partners sought for development and prototype testing.

Category(s):
Environmental Science, Resource Recovery, Waste Management, Mining Industry, Biotechnology, Recycling

Keywords:
Rare Earth Elements (REEs), *Methylobacterium extorquens* AM1, Electronic Waste, Bioaccumulation, Magnet

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Technology Overview

Rare earth elements (REEs) are critical components of many clean energy, consumer, and national defense technologies. Chemical methods for extraction and refinement of REEs from raw materials are energy intensive and environmentally destructive. Researchers found that the bacterium *Methylobacterium extorquens* AM1 is a promising platform to bioaccumulate and recover REEs from various sources, including electronic waste (E-waste). This approach is an environmentally friendly alternative to traditional, more destructive methods of REE extraction. The bacterium is capable of growing in a medium amended with REEs and can bioaccumulate these elements. The technology also involves the manipulation of certain metabolic pathways in the bacterium to enhance the bioaccumulation process.

One significant aspect of this technology is its ability to handle E-waste, which is typically a complex and challenging source of REEs due to the presence of other toxic metals. Specifically, a strain of *M. extorquens* AM1 that is resistant to E-waste, enables it to grow and bioaccumulate REEs from this source. Furthermore, the technology allows for the recovery of REEs from waste streams like magnet swarf, medical waste, and low grade REE-ores.

Key Features & Benefits

Features:

- Bioaccumulation and Recovery of REEs from various sources, including E-waste.
- Strain of *M. extorquens* AM1 that is resistant to E-waste.
- Increased REE recovery using genetically engineered strains.

Benefits:

- Environmentally friendly alternative to traditional, more destructive methods of REE extraction.
- Recovery of REEs from E-waste, a complex and challenging source that also helps in waste management.
- Flexibility and robustness of *M. extorquens* AM1 as a biological platform for the bioaccumulation of REEs from complex sources.

Potential Applications

- **E-Waste Management**: Can be used to extract valuable REEs from E-waste, helping to manage a growing environmental issue.
- **Resource Recovery in Manufacturing**: Industries that use REEs in their products, such as electronics and clean energy technology manufacturers, could use this technology to recover and reuse these valuable elements from their waste streams.
- **Mining Industry**: Could be applied in the mining industry to extract REEs from low-grade ores or mining waste, potentially making these operations more profitable and less environmentally damaging.
- **Research and Development**: Could be used in scientific research, particularly in the fields of microbiology and environmental science, to further explore and develop biological methods for resource recovery.

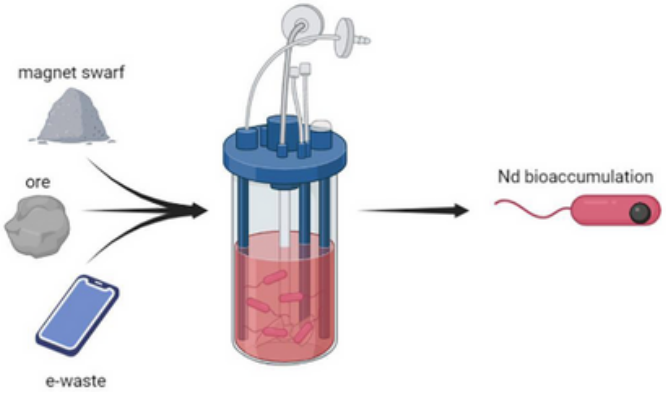

Fig 1.

M. extorquens AM1 as a platform for Nd recovery through efficient, high-yield bioaccumulation of Nd from complex sources