Corporación Instituto de Tecnologías Limpias (ITL)
Antofagasta
Carrera #1615

CHALLENGE TITLE

In Situ Copper Leaching

CHALLENGE DESCRIPTION

In situ leaching (ISL) represents a disruptive alternative for copper extraction, with the potential to significantly reduce water and energy consumption as well as waste generation. In Chile, its application has not yet been validated under real mining conditions. This challenge seeks to develop and validate a comprehensive ISL model that combines technological efficiency, economic viability, and environmental sustainability. Work will focus on implementing demonstrative pilots in real environments, advanced geohydrological characterization, flow modeling, design of selective reagents, intelligent monitoring systems, and environmental closure protocols. The model will be adaptable to different types of deposits such as oxidized copper, secondary sulfides, and primary sulfides

GENERAL OBJECTIVE

Co-develop and validate in Chile a comprehensive in situ leaching (ISL) model for copper that enables its safe, efficient, and sustainable application across different types of deposits, contributing to the technological transformation of national mining.

SPECIFIC OBJECTIVES

1. Design and implement demonstrative ISL pilots in real environments.
2. Develop simulation tools to model leaching kinetics and the hydraulic behavior of the deposit.
3. Evaluate selective reagents and ad hoc fracturing techniques to improve in situ recovery.

4. Integrate continuous monitoring systems with advanced sensors, traceability, and environmental control.
5. Develop environmental closure and neutralization protocols for intervened deposits.
6. Build an economic evaluation model for scalable ISL application in Chile.

EXPECTED RESULTS

- Demonstrative ISL pilots in oxidized copper, secondary sulfide, and primary sulfide deposits.
- Validated simulation tools for leaching kinetics and hydraulic flow.
- Technical reports on metallurgical, environmental, and economic performance.
- Intelligent monitoring systems operational in the field.
- Technical and regulatory guideline document for industrial adoption.

SCOPE

Includes:

- Demonstrations in relevant controlled environments, piloting, and validation in oxidized copper, secondary sulfide, and primary sulfide copper deposits.
- Geohydrological modeling and leaching kinetics simulation.
- Evaluation of reagents, fracturing techniques, and artificial confinement barriers.
- Evaluation of technical, metallurgical, energy, and environmental performance.
- Environmental closure protocols.

Does not include:

- Proofs of concept and/or laboratory-scale tests TRL < 4.
- Solutions that imply additional risks for workers, equipment, or environmental safety.
- Technologies that increase consumption of strategic resources such as water or energy.
- Interventions that negatively interfere with continuity of the production process.

KEY PERFORMANCE INDICATORS (KPIs)

1. Metallurgical recovery of copper (%).
2. Residence time required to achieve target recovery (days).
3. Economic viability of the model (US$/lb recovered vs conventional benchmark).

DESIRABLE CONTRIBUTION TO ITL CAPACITY BUILDING

- Infrastructure for in situ leaching pilots in real deposits.
- Development of capacities in geohydrological modeling, kinetic simulation, and reagent design.
- Training and protocols for monitoring, traceability, and environmental closure.

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