MSCA-ETN SULTAN

European Training Network for the Remediation and Reprocessing of Sulfidic Mining Waste Sites

Innovative bioleaching approaches for the extraction of valuable and hazardous elements (As, Cd) from Cu-Zn, Zn-Pb and Cu-Zn-Pb tailings

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MOTIVATION

- To reduce the environmental risks associated with sulfidic tailings and to recover valuable elements via an environmentally friendly and economically viable approach.

OBJECTIVES

- To study the bioleaching activities of (halo)alkaliphilic and and/or marine sulphur-oxidising micro-organisms.
- To study the interaction of these microorganisms with minerals as well as their sulphur metabolism at alkaline conditions.
- To develop a bioleaching approach applicable at neutral to alkaline pH **(**to prevent the acidification of the environment**)**.
- To develop a bioleaching approach applicable in sea water (to save fresh water).

METHODOLOGY/STRATEGY

PLOMBIERES
NEVES CORVO
FREIBERG

3 case studies

SAMPLE PREPARATION → drying, crushing, sieving, milling, splitting. <80 µm particle sizes.

Vibratory Disc mill

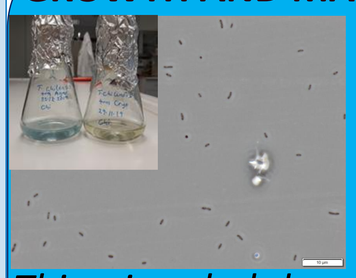
Jaw crusher

ELEMENTAL ANALYSIS OF TAILINGS (ICP-MS results after acid digestion)

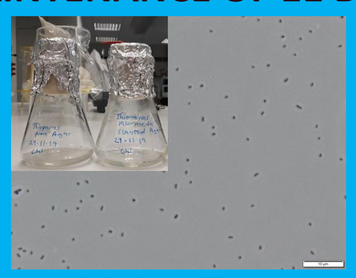
Elements (mg/Kg)	SUL_FR_01	SUL_NC_01	SUL_NC_02
As	5590	766.7	4986.7
Cd	136	9.03	27.9
Pb	4420	826.3	3986.7
Cu	828.3	1840	3726.7
Zn	13100	3560	10666.7
Fe	165666.7	122333.3	283000
Co	40.97	84.7	194

Elements (mg/Kg)	SUL_FR_01	SUL_NC_01	SUL_NC_02
Mg	5596.7	10166.7	9010
Al	28000	55933.3	25933.3
Si	161266.7	162833.3	121666.7
Mn	3393.3	724.3	735
P	354	301.7	150.7
K	11100	14466.7	3223.3
Ca	8910	3300	4643.3

GROWTH AND MAINTENANCE OF 11 BACTERIAL STRAINS



Thiomicrorhabdus chilensis



Thiobacillus thioparus

Marinobacter

3 Bioleaching strategies

Bacteria grown together with tailings from day-0 = One-step bioleaching

tailings added on day-2 = Two-step bioleaching

Separation of bacterial cells from medium after maximum growth → Spent medium bioleaching

Parameters/progress

- 10% inoculum
- 2.5 – 5 % solid content
- Bioleaching duration of 14 days at room temperature
- pH between 6-8
- *T. chilensis* and *T. thioparus* currently being screened for bioleaching capabilities
- 250 mL conical flasks on a rotary shaker

3 negative controls

Bacteria in medium without tailings

Tailings + nutrient medium

Tailings + Deionised water

SAMPLING

Bioleaching

Leachate (Zn^{2+} Cu^{2+} Pb^{2+}) → ICP/MS, TXRF → metal recovery → ION FLOTATION

Tailings residue → MLA, XRF → Valorisation → CERAMICS GREEN CEMENT INORGANIC-POLYMER

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