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RAWMINA Project Newsletter #8

Building an integrated,
innovative pilot system for
recovery of critical raw
materials from mine waste



Final Newsletter

Wrapping Up 51 Months of RAWMINA

The **RAWMINA project** is officially coming to an **end this July**, concluding **51 months of dedicated research, development, and collaboration**. Throughout this time, the project has achieved significant milestones in the **recovery of Critical Raw Materials (CRM) from mine waste**, with a strong focus on sustainability and circular economy principles. Below, we share details of our successful pilot plant, a key outcome demonstrating the real-world impact and innovation driven by the RAWMINA consortium. See you soon!



Project News

Successful Piloting activities for recovery of CRMs from mine residues and low-grade ores

Article by RAWMINA partner **Francisco Sánchez** from **Cobre Las Cruces**

The RAWMINA Project aims to develop and demonstrate an innovative pilot system for the clean and sustainable recovery of critical raw materials (CRMs) from mine waste (MW) resources. To this end, the entire consortium has collaborated closely across technical, design, and environmental aspects to develop the RAWMINA process approach. Accordingly, a final task has been dedicated to the commissioning and demonstration of the RAWMINA Pilot Plant.

The piloting work was based on the technical achievements obtained during earlier laboratory and bench-scale studies conducted throughout the project. In addition, the required samples for piloting were provided by the various raw material suppliers involved. The Pilot Plant was successfully designed, commissioned, and brought into operation.

An essential step prior to pilot plant commissioning was the inoculation of the bacterial culture intended for use during piloting. To this end, the University of Seville (USE) prepared several hundred litres of culture for inoculating the pilot reactors, as illustrated in the figure below.



Figure 1 USE inoculum preparation

Additionally, high-capacity laboratory reactors were employed at the pilot facilities to scale up the volume prior to feeding the pilot reactors.



Figure 2 Laboratory reactors R1, R2& R3 (30 and 60 l)

Finally, the necessary inoculum was prepared in the pilot reactors by completing the volume in the first reactor and subsequently increasing it to a total of approximately 12 cubic meters distributed across the three pilot reactors.



Figure 3 Pilot Plant bioleaching reactors (3.8 m³ each)

Once the bacteria culture were ready the pilot plant was fed with waste material continuously. Monitoring on site of process parameters and chemical characterisation by CLC and AGQ of samples collected during the piloting have showed the expected results.

In addition to that, the Intelligent Management System (IMS) developed by WINGS has been used to optimise the process the bioleaching stage.

The IMS allows monitoring operation parameters and optimizing them online and in real time. In this regard, IMS is a tool that offers decision support capabilities. Next figures show different monitoring screens in real time of the IMS for the bioleaching processing assistance.

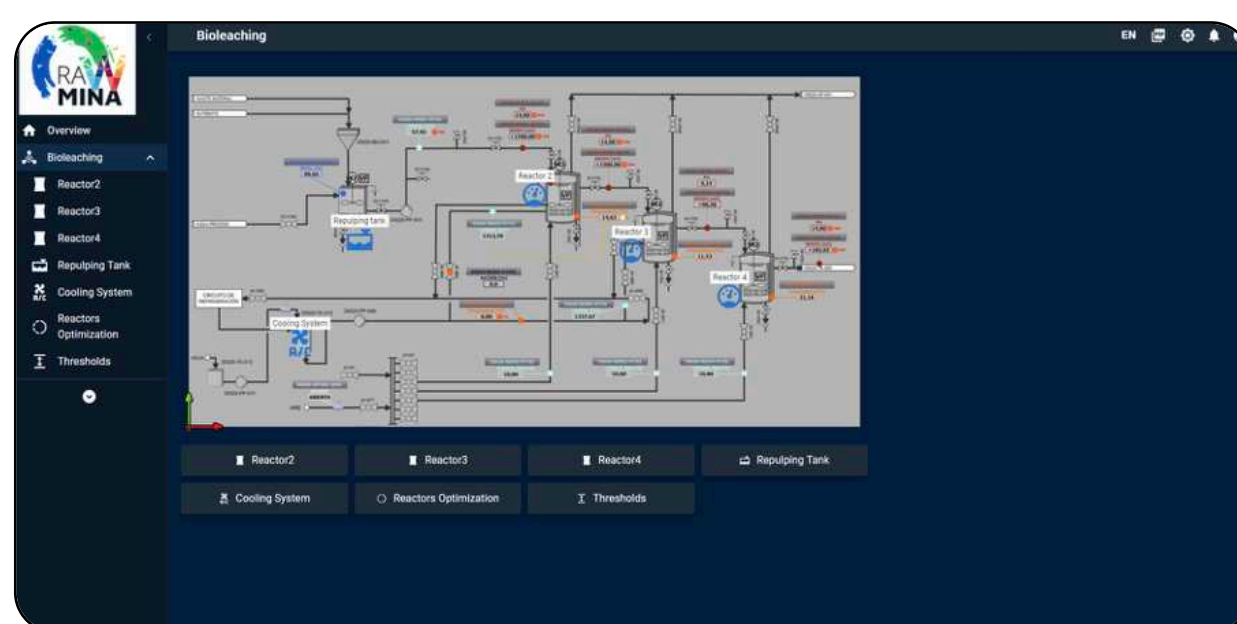


Figure 4 IMS. Bioleaching

As conclusion of this period, it can be emphasised that the bioleaching process was finally validated working at the process optimised conditions. Results expected from lab and bench scale have been achieved: Pyrite conversion in bioleaching around 90 %, 92% Iron extraction, Cobalt extraction up to around 95 %, Antimony extraction around 60 %.

Bio-residues obtained during bioleaching piloting activities were collected and prepared for further treatment in order to recover the antimony content using a high volume reactors (include

The liquor solution resulting from bioleaching (PLS) was submitted to iron precipitation using an alkali reagent. This stage was hot commissioned during the bioleaching process start-up period, when PLS was available. The pH was totally controlled after a few hours of operation achieving ~100% iron recovery from solution. A simplified flow diagram is included in next figure.

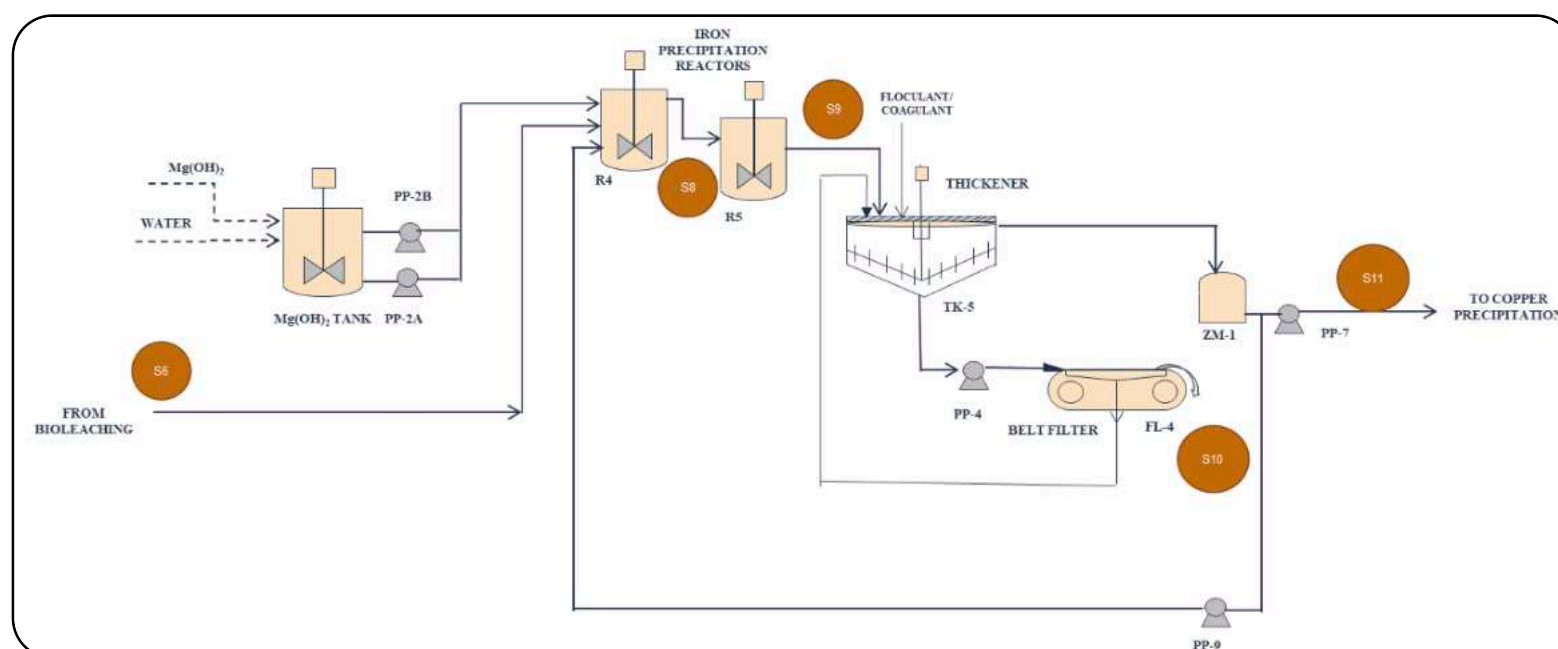


Figure 5 Iron Precipitation Process

Obtained iron cake that was submitted to GEOS for further processing is showed in next picture.



Figure 6 Iron Cake Belt Filter

The iron cake produced is in the form of the Schwertmannite specie (SHM) was characterised and validated by GEOS as a promising product for Arsenic adsorption. Furthermore, it has been validated also as a precursor for nanomagnetite production.

Iron free solution obtained was delivery to a Copper precipitation area, that was developed to minimise contents of copper in the CRM solution. For that purpose, one agitated reactor is used to precipitate the copper by increasing the pH of the solution, the produced slurry is overflowing to a thickener, and the underflow is filtrated. The overflow is the clean CRM solution that is collected for further treatment.



Figure 7 CRMs solution samples

Finally a deep study has been done with regards to CRMs solution in LEITAT facilities, Co, Sb,W and Ge recovery have been performed. The use of resins and nanofibers is an efficient way to collect the above mentioned CRMs from solution to purify and concentrate for final electrodeposition.

CONCLUSION

As main conclusion it can be reported that the RAWMINA pilot facilities covering Bioleaching, iron precipitation and copper precipitation have been successfully piloting.

Obtained results during the operation from two samples (tailings and low grade ore sample) were in accordance with previous results obtained from bench scale testing, that way the technology is validated as expected. Bioleaching process using USE bacteria is highly efficient able to leach more than 90 % of the cobalt contained in the raw material. Bio-residue can be also treated to recover more than 75% of the antimony that remains in the solid. Iron precipitation stage can remove all the iron from solution applying the developed process conditions. Quality of the SHM obtained is excellent for arsenic removal and it has been validated as a precursor of nanomagnetite. Copper precipitation process can significantly reduce the copper content in the finalCRM pregnant solution, but it is necessary to find a compromise between copper removal and cobalt co-precipitation to avoid CRMs losses in the process. CRMs solution is amenable to be purified and concentrated for further electrodeposition processing.

Interested in Raw Minerals Innovation?



Critical Raw Materials (CRMs) are crucial to Europe's economy, and for the green and digital transitions. They form a strong industrial base, producing a broad range of goods and applications, both current and future.

Research into sustainable, reliable and resilient sources of CRMs and transfer of process technologies into use has never been more important.

Our community of researchers, technologists, innovators and policy makers continue to be active on the Crowdhelix platform. [Join free as an individual stakeholder from the link on the Helix page!](#) [Organisational memberships are required for some functions].

Visit and join the Helix!

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Achieving global leadership in climate-neutral, circular and digitised industrial and digital value chains

HORIZON-CL4-INDUSTRY-2025-01-MATERIALS-61: Technologies for critical raw materials and strategic raw materials from end-of-life products

(IA) Deadline - 23 September 2025

Learn more [here](#).

HORIZON-CL4-INDUSTRY-2025-01-MATERIALS-62: Strategic Partnerships for Raw Materials: Innovative Approaches for sustainable production of Critical Raw Materials

(IA) Deadline - 23 September 2025

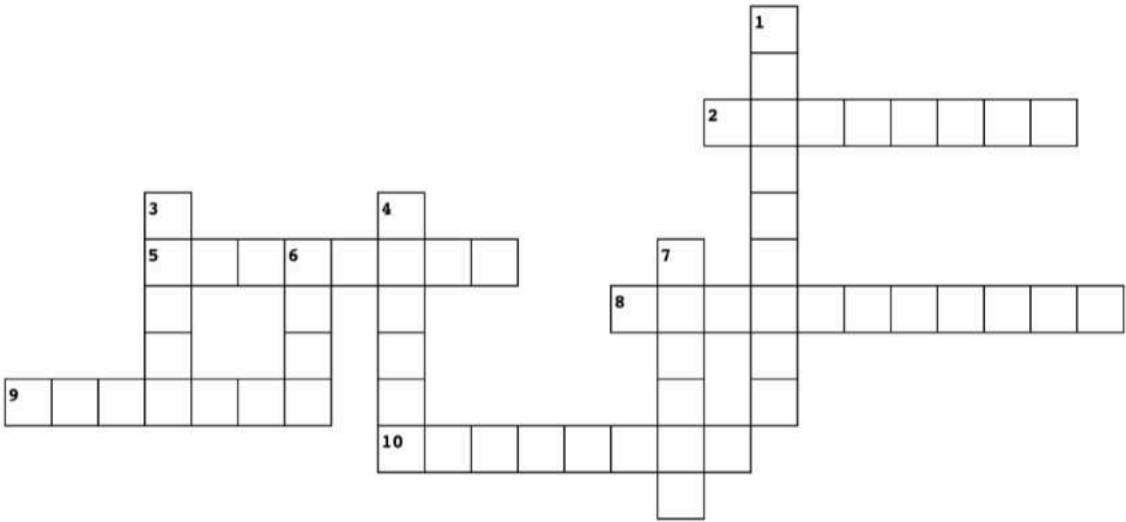
Learn more [here](#).

Try your hand at the RAWMINA crossword

To end this newsletter, we'd like to invite you to enjoy a bit of geological trivia fun - the RAWMINA crossword 😊

Play the RAWMINA Crossword

Print Share Edit ■ Answers ≡



Across

- 2. CRM refers to what type of Raw Materials? (8 letters)
- 5. A silver-coloured, brittle element, used extensively in the electronics industry. (8 letters)
- 8. The RAWMINA project has received funding from this European Union research and innovation programme. (7 letters, 4 numbers)
- 9. The RAWMINA project focuses on mines and minerals representative of this peninsula. (7 letters)

Down

- 1. The first element in the periodic table named after a country. (9 letters)
- 3. Part of RAWMINA's mine waste valorisation aims is to recycle up to 90% of this precious resource. (5 letters)
- 4. Essential element for ensuring longer life span of batteries. (6 letters)
- 6. RAWMINA focuses on removing this mineral by means of magnetic separation. (4 letters)
- 7. Chile has the world's largest deposits of this mineral ore. (6 letters)

Play

All the answers to the crossword can be found on the RAWMINA project website.



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