

Metso:Outotec

Hydrometallurgical Precious Metals Process

Benefits

- High direct recovery and high end-product quality with low inventories
- Short processing time
- Highly automated process enables stable end-product quality and smooth operation
- Modular approach is both flexible and cost-efficient
- Recovered impurities can be sold as by-products instead of disposed of
- Low environmental impact with no flue dust or slag generation



The Metso Outotec Hydrometallurgical Precious Metals Process is the result of decades of experience and continuous development in precious metals processing technology. It offers high direct recoveries with low inventories. The cost-effective, modular approach comprises leaching, filtration, and precipitation steps, and can be adapted for a variety of applications, including processing of anode slimes or other residues containing precious metals.

The Metso Outotec Hydrometallurgical Precious Metals Process

Production of precious metals from anode slimes or secondary raw materials

Originally developed for the treatment of copper electrorefining anode slime, the Metso Outotec Hydrometallurgical Precious Metals Process can also be used to process other raw materials containing precious metals, including some secondary raw materials or lead anode slimes. It is also possible to combine some of the process modules with other precious metals technologies such as the Metso Outotec Selenium Roasting Furnace, or Metso Outotec

TROF or Kaldo Furnace. The modular approach makes it possible to integrate the Metso Outotec process with your existing process equipment.

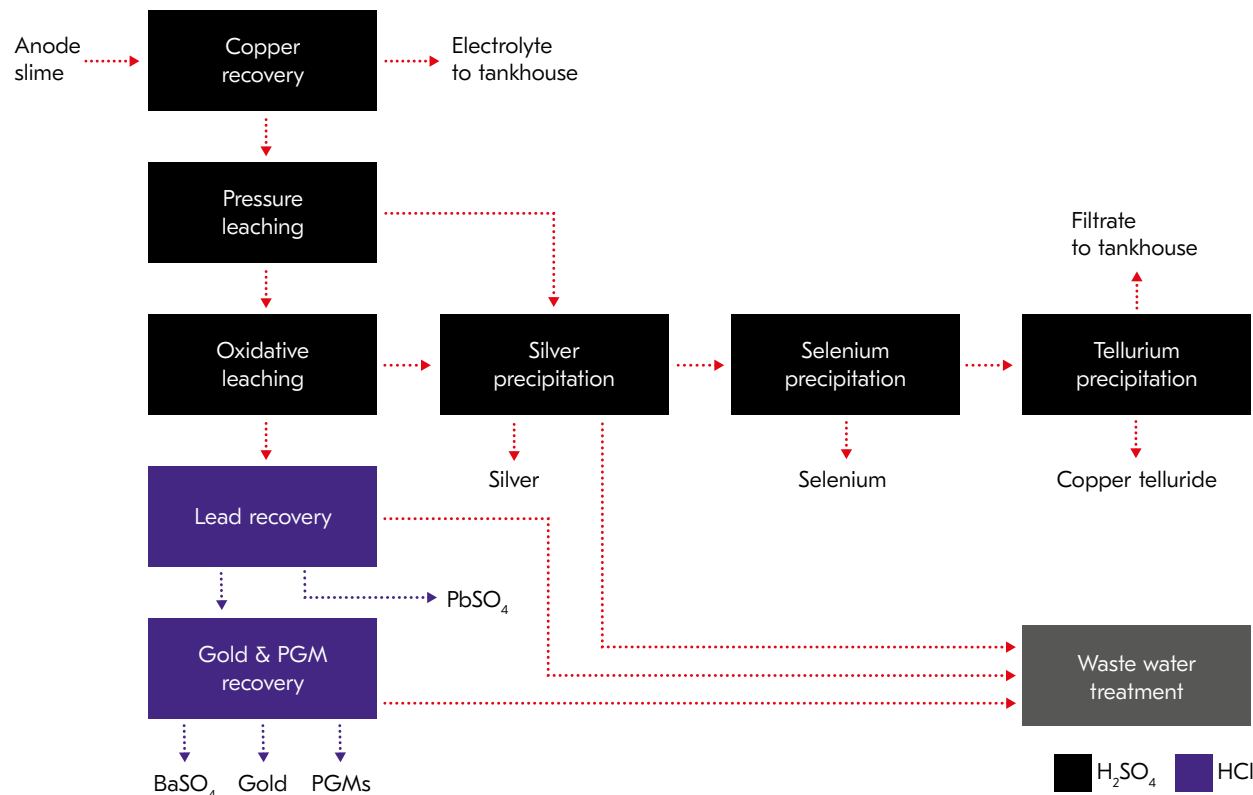
The process ensures effective separation of impurities with high recovery. Impurities can be converted into saleable products such as selenium, copper telluride, and lead sulfate to improve operational profitability. The recovered silver and gold are of a high grade and are melted and cast into ingots or granules.

A flexible, safe, and cost-effective process

In the Metso Outotec Hydrometallurgical Precious Metals Process, slime is first leached in three sequential sulfuric acid leaching steps. The soluble copper and excess chlorides are removed in copper recovery. The remaining copper and most of the selenium, silver, and impurities are dissolved in pressure leaching. To enhance selenium and silver removal, slime is leached in oxidative leaching. This is followed by silver precipitation using hydrochloric acid and conversion to metallic powder, selenium precipitation using sulfur dioxide, and tellurium precipitation using copper chips or powder.

Lead is removed from the remaining slime by hydrochloric acid leaching and cooling precipitation cycles. Lead chloride can be further treated to produce a higher-purity by-product – lead sulfate – using sodium carbonate, nitric acid, and sulfuric acid. Gold and PGMs are recovered by leaching with hydrochloric acid and oxidant followed by selective precipitation of gold and PGM concentrate. The leaching residue, consisting of mainly barium sulfate, is leached in concentrated sulfuric acid to recover any remaining silver and to remove chlorides before being returned to the smelter.

The Metso Outotec Hydrometallurgical Precious Metals Process comprises simple leaching, filtration, and precipitation steps enabling easy process operation. The chemicals used in the process do not form highly toxic compounds. Off-gases from the reactors are cleaned in effective gas scrubbers, which improves working conditions for operators and reduces the environmental impact of the process. Effective off-gas cleaning also improves precious metals recovery by enabling recovery of any metal traces that remain in off-gases as droplets.



Because the process uses a small number of readily available chemicals it enables reliable operation with high availability. Using well-known chemicals also guarantees the correct material selection for process equipment to ensure long-lasting operation and low maintenance requirements.

Low environmental impact combined with low operating costs

Unlike pyrometallurgical processing, hydrometallurgical processing involves no flue dust and slag handling, which decreases the amount of locked-up inventory. It has a low environmental impact and is very cost-effective. Our highly flexible process is capable of handling fluctuating anode slime compositions and maximizes the direct recovery of precious metals.

Because the process is designed to be operated in batches, only a few personnel are required to operate it. Automation ensures stable end-product quality, smooth process operation, and constant production rates. The level of automation is based on your specific requirements.

Reducing fresh water usage and waste-water treatment volumes

The sulfuric acid-based leaching solutions used in the process can be recycled either for use in balancing evaporated water in copper electrolysis or in the electrolyte solution purification plant after the precipitation of silver, selenium, and tellurium.

The hydrochloric acid-based solution used in the lead recovery step can be reused several times as long as the impurity levels are kept below predefined solubility limits. This is achieved by bleeding part of the solution after each batch. Together with the hydrochloric acid-based solution from gold and PGM recovery, the solution from the lead recovery step is treated in the waste water treatment step to neutralize it and remove any remaining impurities.

Recycling the solutions reduces the both the volumes sent to waste water treatment and the fresh water usage of the process.

From studies, engineering, and equipment to full turnkey solutions

The Metso Outotec Hydrometallurgical Precious Metals Process is based on years of research and development, and we have a strong track record with numerous successful projects in the global precious metals sector. Our offering includes studies, engineering, and individual equipment delivery, as well as full turnkey plant solutions.

Our process is based on proven and reliable Metso Outotec technology, and includes such proprietary equipment as Metso Outotec OKTOP® Reactors and pressure vessels for high recovery, Metso Outotec Courier® On-Line Analyzers for fast and accurate solution analysis, as well as highly efficient and reliable Metso Outotec filters. These leading-edge technologies ensure reliable operation and the lowest possible lifecycle cost for your plant.

Our offering includes:

- Laboratory test programs and pilot test campaigns
- Scoping and feasibility studies
- Basic and detail engineering
- Proprietary and key equipment supply
- Process automation and instrumentation
- Full turnkey plant delivery
- Training, commissioning, and start-up services
- Operation and maintenance services
- Spare parts supply
- Plant audits, modernizations, and equipment upgrades

A lifetime of support

Metso Outotec is committed to supporting your operations throughout the plant life cycle, helping you achieve and maintain peak performance levels and guaranteeing the best long-term return on your investment. Our global network of service centers covers more than 25 countries and provides lifecycle services for everything from spare parts, maintenance, and technical services to modernizations, operations and maintenance agreements, training, and consultancy.



Metso Outotec is a frontrunner in sustainable technologies, end-to-end solutions and services for the aggregates, minerals processing and metals refining industries globally. By improving our customers' energy and water efficiency, increasing their productivity, and reducing environmental risks with our product and process expertise, we are the **partner for positive change.**