

TECH OFFER

Efficient Recycling Of Platinum Group Metals Under Ambient Conditions



KEY INFORMATION

TECHNOLOGY CATEGORY:

Sustainability - Circular Economy

Sustainability - Low Carbon Economy

Waste Management & Recycling - Industrial Waste
Management

Chemicals - Catalysts

Environment, Clean Air & Water - Biological & Chemical
Treatment

TECHNOLOGY READINESS LEVEL (TRL): **TRL5**

COUNTRY: **SINGAPORE**

ID NUMBER: **TO174808**

OVERVIEW

Platinum group metals (PGM) are critical raw materials (CRM) that are used across multiple industries and in countless applications including but not limited to autocatalytic converters, jewellery, glassware, petrochemical refining, electronics, biomedical, pharmaceuticals, dental implants etc. The primary supply of PGM, through the mining of PGM ores, makes up about 70% of the global supply of PGM. The two dominant producers of PGM are South Africa and Russia, supplying 85% of the mining output of PGM - this leads to a monopoly of the supply chain and price gouging. Recycling PGM-containing waste offers advantages of addressing the supply deficit with less environmental impact compared to mining. However, conventional recycling

methods suffer from high energy costs due to high processing temperature of about 1500 °C and requires downstream processing to treat waste which demands higher capital expenditure. Furthermore, the high processing temperatures results in high-value raw materials being burnt in the process and releasing harmful toxins.

This technology offer is a novel biorecovery method that incorporates and modifies a series of different biochemical and biological processes in a simple 3-stage process as opposed to the multi-tiered stages of the current conventional methods used in industry. It offers the following advantages over the competition:

- Consumes 6x less energy
- 3x cheaper to operate
- Capable of recovering different PGM simultaneously with high yield even from low-grade waste

This technology allows companies to recycle their spent catalyst in a truly green and sustainable manner.

TECHNOLOGY FEATURES & SPECIFICATIONS

The core process and specifications of the technology are summarised as follows:

- Statistically-optimised ultrasonication as a key pretreatment step. This innovative and efficient sonication pretreatment removes all unwanted metals from the waste and leaves behind the PGM-rich waste in the system, called the PGM-preconcentrated stream.
- In the second step, a novel and unique bioextraction technique is developed that extracts PGM from waste with high efficiency (99% recycling rate/cycle for rhodium (Rh) and 92-95%/cycle recycling rate for platinum (Pt) and palladium (Pd)) and can be employed at a commercial scale without compromising yield.
- In the third step, a combination of improved bioreduction, bioaccumulation, and bioprecipitation techniques are developed that produce PGM in powder form which further undergoes separation and purification to produce high-purity PGM.

POTENTIAL APPLICATIONS

This technology is for industries that are interested to recycle their spent catalysts. The potential applications are as follows:

- Catalyst manufacturers
- Petrochemical/chemical refiners
- Equipment and plant engineering companies
- Government environmental agencies
- Waste managers

UNIQUE VALUE PROPOSITION

- Reducing logistics costs and downtime (modular setup)
- Lower cost (CAPEX & OPEX) compared to existing technologies
- High recovery rate (even for low grade waste)
- Sustainable and efficient recycling method (decarbonisation opportunities for companies)