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INNOVATION

GRÖN

ORP Innovation

SMO Power Reactor™ Mine Wastewater Treatment Solution

Advanced Oxidation +
Multi-Radical Nanocavitation Platform

For AMD, Mine Drainage,
Process Water & Water Reuse

Transforming Mine Wastewater
into Reusable Water



Global Mine Water Challenges

-  Acid Mine Drainage (AMD)
-  High Iron
-  Manganese
-  Aluminum
-  Heavy Metals (Cu, Zn, Ni, Pb, Cd)
-  Sulfate
-  Arsenic
-  High Turbidity / TSS
-  Orange / Brown Color
-  Sludge Generation

Conventional Treatment

- High chemical consumption
- Large sludge production
- Complex process
- High operating cost
- Long retention time
- Difficult to meet strict regulations

VS

SMO Treatment

- ✓ Lower chemical consumption
- ✓ Minimal sludge production
- ✓ Simple & efficient
- ✓ Lower operating cost
- ✓ Fast reaction
- ✓ Easy compliance & water reuse

Typical Mine Wastewater Treatment Flow

RAW MINE WATER



PRETREATMENT



SMO TREATMENT

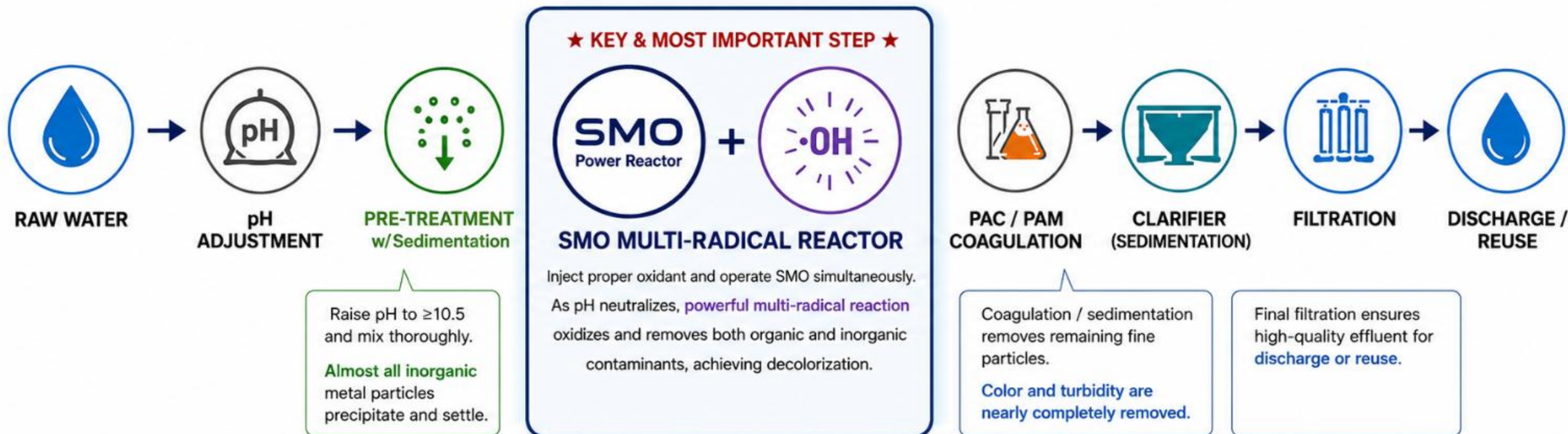


CLEAR DISCHARGE
WATER



Dogye Coal Mine Pilot Test, Korea (May–June 2025)

SMO Treatment Process Flow



Pre-Treatment and SMO Multi-Radical Reactor are the core technologies that achieve superior contaminant removal performance.



POWERFUL BENEFITS

- Efficient removal of color, COD, metals, and other pollutants
- Lower chemical usage and sludge generation
- Higher treated water quality and reuse rate

SMO Multi-Radical Oxidation Technology

SMO generates multiple powerful oxidizing species simultaneously



Hydroxyl Radical
(very strong oxidation)



Sulfate Radical
(selective oxidation)



Superoxide Radical
(oxygen activation)



Singlet Oxygen
(non-selective oxidation)



Hydrogen Radical
(reducing & oxidation)

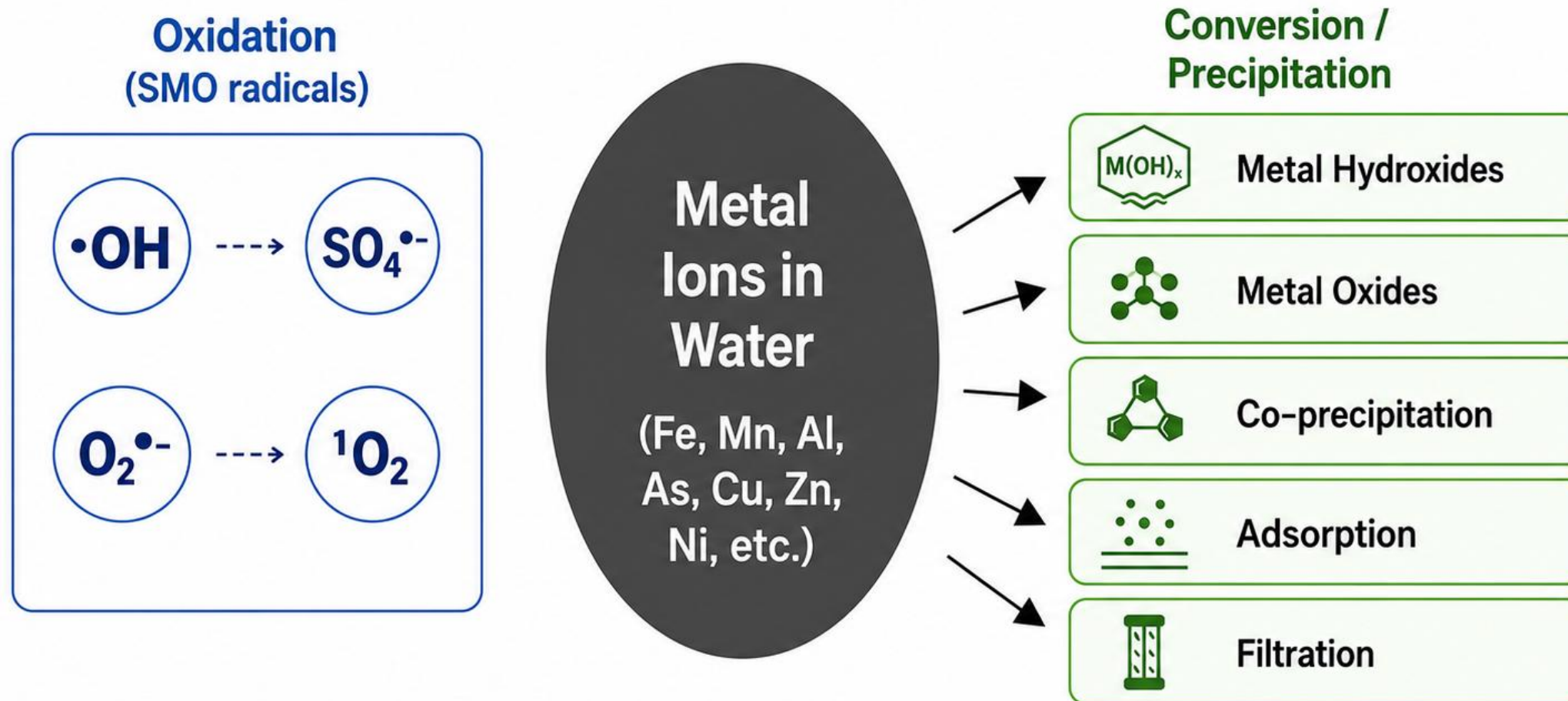


Nanocavity Collapse
Extreme local energy & temperature
for advanced oxidation

Benefits

- ✓ Breaks complex organics
- ✓ Oxidizes heavy metals
- ✓ Destroys color & odor
- ✓ Improves biodegradability
- ✓ Reduces sludge
- ✓ Fast reaction kinetics

Heavy Metal Removal Mechanism



Fast oxidation • Stable precipitation • Easy separation

7 Korean Mine Pilot – Dogye Coal Mine

**BEFORE
(RAW WATER)**



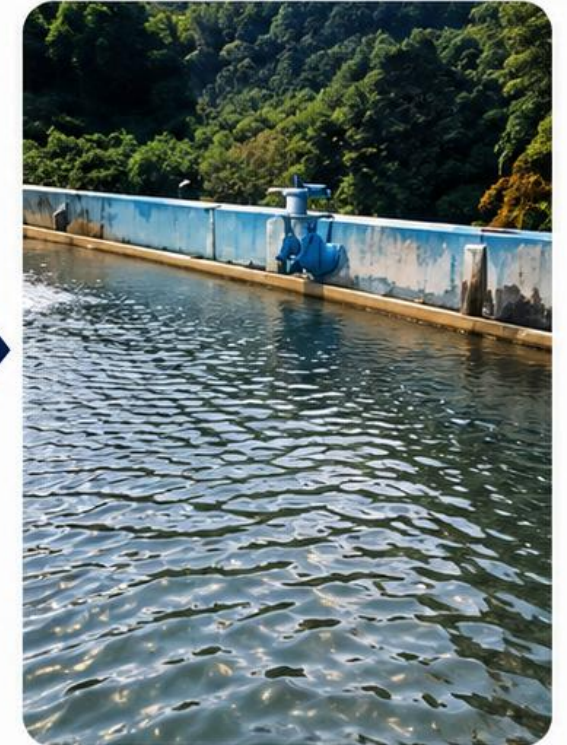
**PRETREATMENT
(Coagulation)**



**SMO TREATMENT
(During)**



**AFTER SMO
(CLEAR EFFLUENT)**



Pilot Test Period: May – June 2025 | Flow Rate: 20 m³/hr

Estimated Water Quality Comparison

Laboratory Verification in Progress

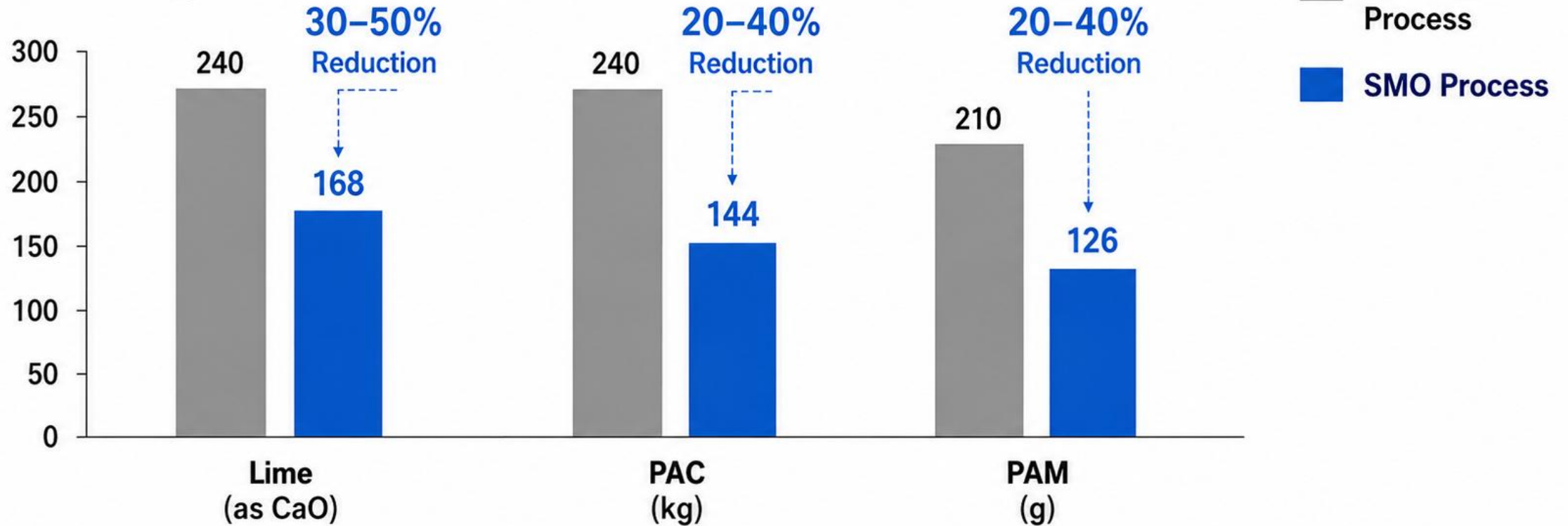
Parameter	Raw Mine Water (Estimated Range)	After Pretreatment (Estimated Range)	After SMO Treatment (Estimated Range)	Korean Mine Effluent Standard
pH (-)	2.5 – 4.0	6.0 – 8.0	6.5 – 8.5	6.0 – 9.0
Turbidity (NTU)	500 – 5,000	50 – 200	< 1 – 10	≤ 25
Color (Pt-Co)	200 – 1,000	50 – 200	< 1 – 10	≤ 50
Iron (mg/L)	50 – 500	5 – 50	< 0.1 – 1.0	≤ 2.0
Manganese (mg/L)	10 – 100	1 – 10	< 0.1 – 1.0	≤ 1.0
Aluminum (mg/L)	10 – 100	1 – 10	< 0.1 – 1.0	≤ 1.0
Sulfate (mg/L)	200 – 2,000	200 – 1,500	50 – 500	≤ 1,000
TSS (mg/L)	300 – 3,000	50 – 500	< 5 – 30	≤ 30
TOC (mg/L)	20 – 200	10 – 80	5 – 30	–

* Values are estimated from pilot test data and similar mine water characteristics.

9 Chemical Consumption Reduction

Typical Comparison (Per m³ of Treated Water)

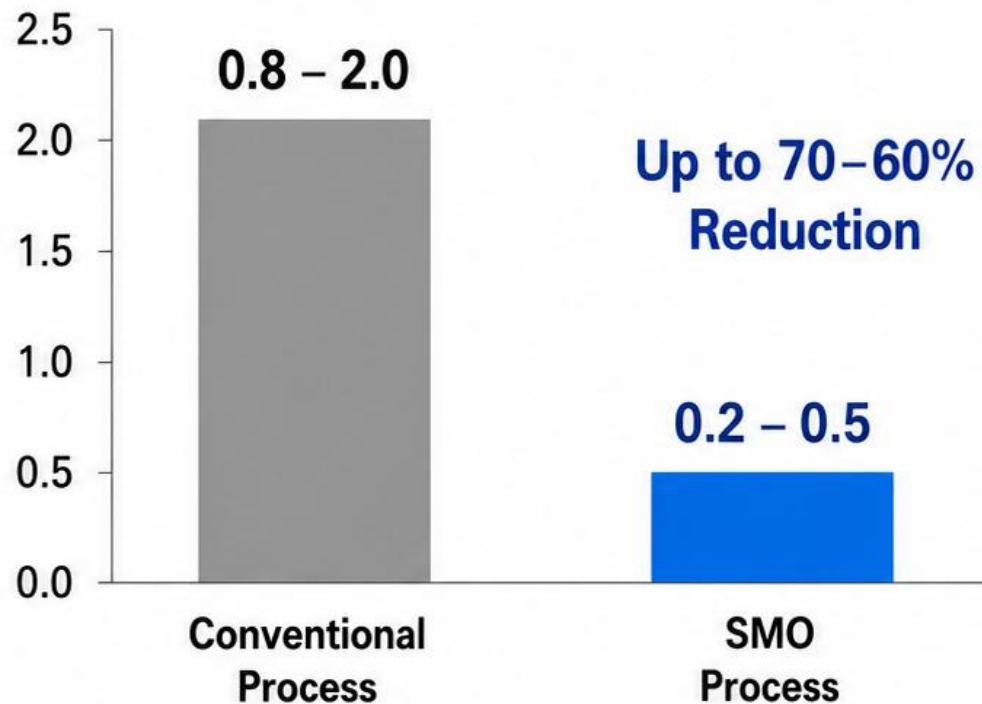
Chemical Dose (g/m³)



Lower chemical cost • Easier operation • Less environmental impact

Sludge Reduction & Water Reuse

Sludge Production
(kg Dry Solids / m³)



Clear Effluent Enables Water Reuse



Process
Water



Dust Suppression



Landscape /
Greencast



Landscape /
Irrigation



Cooling Water Make-up

Less sludge • Lower disposal cost • More water for reuse

Modular SMO Plant (5 – 1,000 m³/h)

Scalable • Modular • Containerized

SMO-5



SMO-20



SMO-50



SMO-100



SMO-500



SMO-1000



Capacity (m³/h)

5

20

50

500

1,000



Plug & Play
Containerized



Fast Installation
& Easy Operation

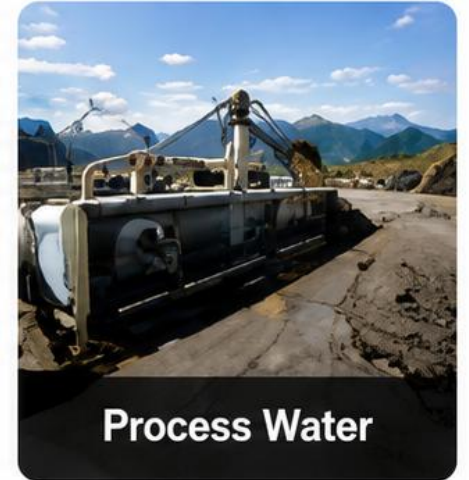
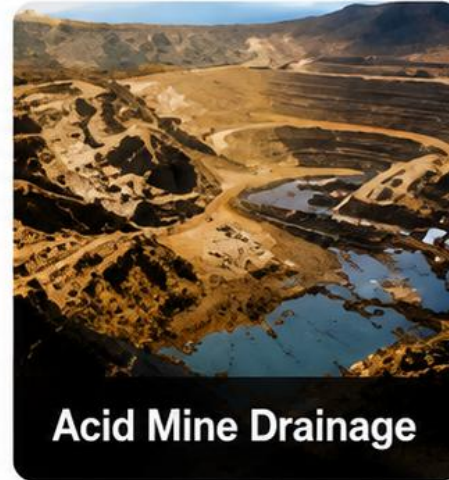
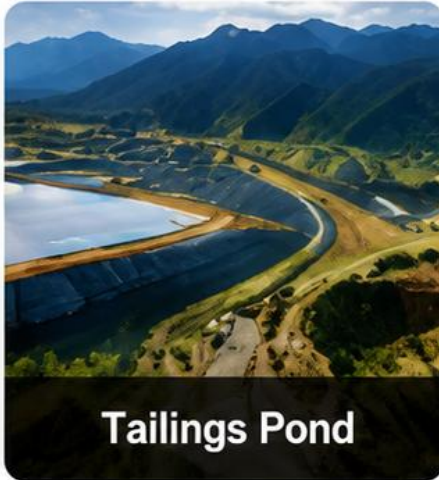
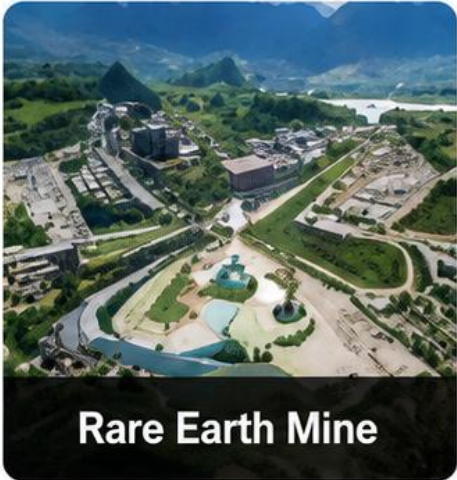
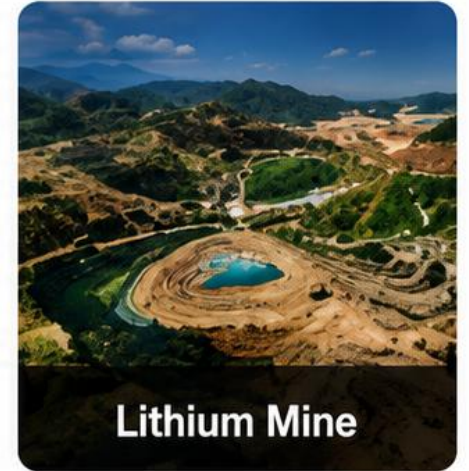
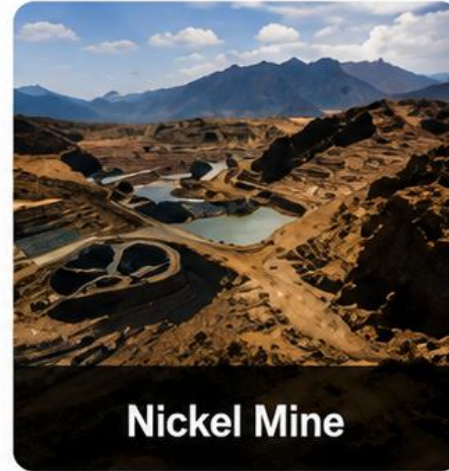
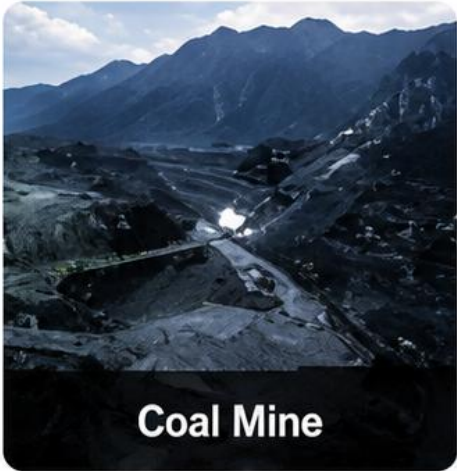


Expandable
Capacity



Low Footprint
High Efficiency

Wide Range of Mining Applications



Lower OPEX

- ✓ 30–40% less chemicals
- ✓ 70–80% less sludge
- ✓ Lower disposal cost
- ✓ Lower energy consumption

Typical Savings (Compared to Conventional)

20 – 40%

Total OPEX Reduction

Higher Value

- Better compliance
- Water reuse & recovery
- Stable operation
- Long equipment life

Better performance • Lower cost • Higher return on investment



Environmental

- Less chemical usage
- Less sludge disposal
- Protection of water resources



Social

- Safer operation
- Better communities
- Compliance with regulations



Governance

- Transparent operation
- ESG reporting ready
- Risk management



Carbon Reduction

- Lower chemical & transportation
- Lower energy use
- Lower CO₂ footprint

SMO supports your ESG goals and sustainable mining operations

Global Market Opportunity

Global Mine Water Treatment Market

USD 3.7B+
(2024)

CAGR 6–8%
(2024–2030)

Market Drivers

- ✓ Increasing environmental regulations
- ✓ Aging treatment facilities need retrofit
- ✓ Water scarcity & water reuse demand
- ✓ ESG & climate commitments
- ✓ Growth of critical minerals mining

Large, growing market with strong demand for advanced solutions

Why ORP Innovation / SMO Technology?



Proprietary SMO Multi-Radical Nanocavitation Technology



Patented Technology & Strong IP Portfolio



Proven Pilot Performance (Korea)



Scalable & Modular Design (5 – 1,000 m³/h)



Lower Cost, Higher Performance, Easy Retrofit



Experienced Team & Global Partnerships



Let's Pilot & Commercialization Roadmap

2025 Pilot Expansion	2026 Demonstration	2027 Commercialization	2028+ Global Deployment
• Additional pilot sites in Korea • Data validation & optimization • Engineering package	• Full-scale demo plant (150–500 m³/h) • Long-term performance verification	• Commercial projects • Strategic partnerships • Market expansion	• Global licensing & distribution • Multiple projects worldwide
Proven technology • Ready to scale • Built for global market			

Business Opportunities with SMO Technology

SMO pilot results deliver **powerful differentiation** versus conventional processes



**20–40% Reduction
in Chemical Usage**

Significantly **lower consumption** of chemicals and reagents



**50–80% Reduction
in Sludge Generation**

Dramatically **less sludge** produced (compared to conventional processes)



**Reduced Dewatered
Cake Volume**

Lower sludge cake volume for dewatering



**Lower Transportation
& Disposal Costs**

Reduced hauling and landfill costs for significant **OPEX savings**



**Higher Treated Water
Reuse Rate**

Improved effluent quality enables **greater water reuse** and resource recovery



**Retrofit Ready for
Existing Plants**

Easily integrates with existing mine water treatment systems as a **retrofit solution**



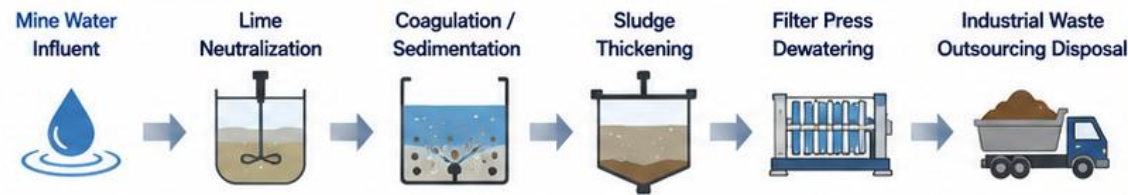
SMO Technology delivers measurable cost savings, environmental benefits, and operational excellence for mine water treatment.

Current Sludge Treatment & Disposal in Abandoned Mines (Gangwon-do, Korea)

In most abandoned mines in Gangwon-do, including the Dogye Mine,

Lime Neutralization → Coagulation/Sedimentation → Sludge Thickening → Filter Press Dewatering → Industrial Waste Outsourcing Disposal is the standard operation.

1. Typical Treatment Process



A significant portion of treatment cost comes from sludge handling and disposal.

3. Major Components of Sludge

- $\text{Fe}(\text{OH})_3$
- $\text{Al}(\text{OH})_3$
- MnO_2
- CaCO_3
- CaSO_4
- SiO_2
- Clay minerals
- Trace amounts of As, Cu, Zn, Pb, Cd, etc.



High iron (Fe) content often gives the sludge a reddish-brown or yellow-brown color.

4. Waste Classification (After Dewatering)

Sludge cake is analyzed to determine waste classification.



- TCLP Leaching Test
- As
- Pb
- Cd
- Hg
- Cr^{6+}
- Cu
- Zn

→ **Non-hazardous Waste**

→ **Hazardous Waste**

5. SMO Technology Benefits

SMO Technology

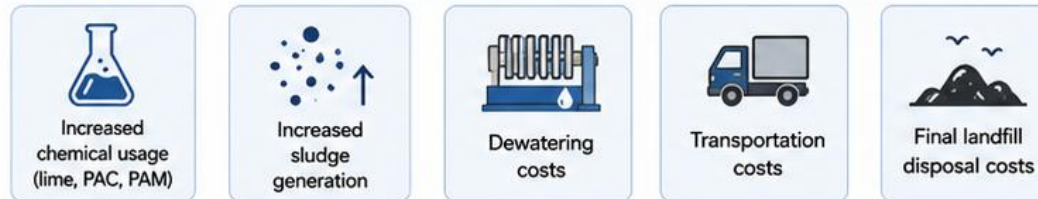


- ✓ Reduces chemical usage and sludge generation
- ✓ Lowers dewatering, transportation, and disposal costs
- ✓ Helps waste classification to non-hazardous in more cases
- ✓ Enhances potential for resource recovery and reuse
- ✓ Improves overall economics and sustainability

SMO makes sludge treatment cheaper, cleaner, and more sustainable.



2. Major Cost Drivers in Sludge Management



It is not uncommon for **30–50% of OPEX** to be attributed to sludge-related costs.

5. Increasing Recycling and Reuse (Research & Applications)

Iron-rich sludge is being studied for various resource recovery and reuse applications.



While current utilization is still limited, applying **SMO technology** can significantly improve feasibility and economics of these reuse pathways.

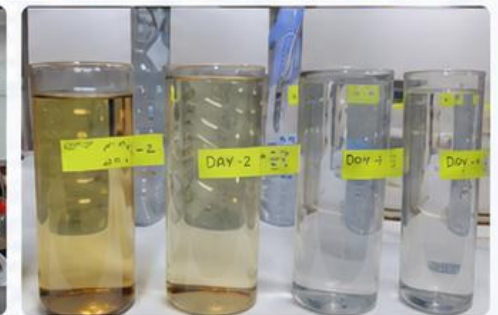
SMO technology can reduce sludge-related costs and unlock new value from what was once a disposal burden.



Epilogue | SMO Pilot Testing in the Field

SMO Technology is proven through **real-world pilot testing** at active mine water sites.

On-site Pilot Demonstration



Tested Mine Water Samples

- ✓ Various qualities of mine water were tested
- ✓ Consistent color removal and turbidity reduction
- ✓ Validated performance of SMO process under real conditions



**Proven Performance.
Real Environment.
Tangible Results.**



SMO Technology delivers reliable solutions for **cleaner water** and a **sustainable future**.

SMO POWER REACTOR MECHANISM

SCIENCE • INNOVATION • SUSTAINABILITY

