

Proposal to JOGMEC

Application of PETACLONES-EX for Metal Resource Extraction and Light-Water Production from the Reducing Leachate of the Matsuo Mine 260718

1. Title of the Proposal

Metal resource extraction and production of light-water-rich water from the reducing leachate of the Matsuo Mine, using **PETACLONES-EX**.

Proposer

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Former Founder/CEO, Fineclay Co., Ltd. (wet classification and water-sedimentation technologies; Powder Technology Journal 32, 644 (1995)) Former Engineer, Nippon Paint Co., Ltd. (electrodeposition coating, corrosion protection, hydrogen permeation technologies) Doctoral Thesis (1985): *Electrochemical Study of Electrodeposition Coating*

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1. Purpose of the Proposal

The Matsuo Mine in Akita Prefecture has long been treated as a source of “acid mine drainage.” However, the water emerging directly from the mine tunnels is **reducing sulfide water**, not acidic water. Before contacting air, this leachate contains metal ions, sulfide species, and water itself as **a major resource**.

Existing neutralization, precipitation, coagulation, and filtration facilities operate as *pollution-control systems*. By applying the thin-layer free vortex-based **centripetal settling extraction method PETACLONES-EX**, metal resources can be extracted under reducing conditions, and the remaining water can be upgraded into **light-water-rich water** as a new resource. This proposal aims to add a **resource recovery function** to existing mine-water treatment facilities.

2. Outline of PETACLONES-EX

PETACLONES-EX draws water from the tank bottom center through a patented filter (Patent No. 4495918) and ejects it tangentially from the lower sidewall, generating a forced vortex. This vortex propagates upward and forms multiple **thin-layer free vortices** inside the tank.

These vortices naturally separate components:

- **Heavy components** migrate toward the lower central region.
- **Light components** migrate toward the upper peripheral region.

Even large tanks will rotate over time, requiring only small pumps and minimal power. Conventional equipment cannot form thin-layer vortices because the inlet filter structure is absent.

Using the upward/downward bifurcated flow path (Patent No. 6666176), heavy components are transferred to adjacent tanks of identical design, while light components are returned to the original tank. Repeated circulation enables **stepwise concentration** of each target component. Details of heavy-component sedimentation and classification are available on the Fineclay Co. website.

Overflow collection is used initially, but by adding a water head to the air-release port of RO/UF membranes, the system performs **pure osmotic filtration (Final Frontier Osmosis Filtration, FFOF)** rather than pressure filtration. Light water (H₂O) selectively permeates the membrane.

Through multi-stage processing, natural water with 99.985% light-water content (3N) can be upgraded to 4N or 5N purity, creating a new resource: **light-water-rich water**.

By operating the entire system in an **airtight (effectively vacuum) environment**, the reducing atmosphere is preserved, preventing oxidation of sulfides and metal ions. Hydrogen sulfide is treated not as a pollutant but as a **recoverable sulfur resource**, and is separated under reducing conditions.

3. Applicability to the Matsuo Mine and Akita Mining District

1. **Metal resource extraction under reducing conditions** Stepwise concentration and recovery before any oxidation occurs.
2. **Recovery of sulfur as elemental sulfur** Not by combustion to SO₂, but as a usable sulfur resource.
3. **Production of light-water-rich water** A new water resource with purity grades determined by processing stages.
4. **Resource recovery as a front-end function** Achieved with minor modifications to existing neutralization and precipitation facilities.
5. **Reduction of environmental load** Pre-oxidation treatment reduces neutralizing agent consumption.

4. Alignment with JOGMEC's Mission

This method provides:

- Metal resource extraction
- Elemental sulfur recovery
- Production of light-water-rich water

These constitute **new added value** aligned with JOGMEC's mission of stable metal resource supply and domestic resource enhancement.

The Matsuo Mine and other Akita mines possess not only mineral deposits but also **reducing leachate as a major resource**. PETACLONES-EX offers a practical enhancement using existing infrastructure.

We respectfully request technical consideration of this proposal.