Product factsheet

Supercritical Water Precipitation for Dissolved Metal Recovery & Valorization

Hardware product or technological device
Service offering

Description

Components:

1. **Supercritical Fluid Reactor:** The core of the SCWP technology, where supercritical water (water at conditions above its critical point - 374°C and 22.1 MPa) is used as a medium for the precipitation of dissolved metals.
2. **Control System:** An advanced automation and control system for regulating temperature, pressure, and flow rates within the reactor.
3. **Input Module:** A system for feeding industrial wastewater containing dissolved metals into the reactor.
4. **Separation Unit:** After the precipitation process, this unit separates the solid metal precipitates from the supercritical water.
5. **Cooling and Condensation System:** Cools the supercritical water post-precipitation, returning it to a liquid state for reuse or disposal.

Application Scope:

- **Industrial Wastewater Treatment:** Especially effective for wastewater from electroplating, mining, electronics manufacturing, and battery production industries.
- **Resource Recovery:** Efficiently recovers critical metals like lithium, nickel, cobalt, copper, and precious metals from wastewater streams.

Key Advantages and Unique Features:

1. **High Efficiency:** Over 99% recovery rate for various metals, significantly higher than traditional methods.
2. **Eco-Friendly:** Reduces the environmental impact by minimizing waste and eliminating the need for hazardous chemicals.
3. **Versatility:** Can handle a variety of metal-laden wastewater streams, adapting to different metal concentrations and types.
4. **Cost-Effective:** Lower operational expenses compared to conventional methods, due to reduced chemical and energy usage.
5. **Compact and Modular:** The technology's modular nature allows for scalability and easy integration into existing industrial processes.

Ground-Breaking Aspects:

- **Innovative Use of Supercritical Water:** Utilizing supercritical water for metal precipitation is a novel approach, leveraging its unique solvent properties to efficiently recover dissolved metals.
- **Automation and Control:** Advanced automation enhances the process's precision and efficiency, making it groundbreaking in terms of operational control.

Practical Functioning:

- Industrial wastewater is fed into the supercritical fluid reactor.
- Within the reactor, supercritical water conditions induce the precipitation of dissolved metals as solid particles.
- These metal precipitates are then separated from the water, leaving behind clean water and concentrated metal particles.
- The clean water can be reused or safely discharged, while the recovered metals, in forms like oxides or hydroxides, can be further processed or sold.

This technology represents a significant advancement in wastewater treatment and metal recovery, offering an innovative, sustainable solution for industries dealing with metal-laden wastewater.

Actors, their roles and interactions

1. **Industries (e.g., Electroplating, Mining, Electronics Manufacturing, Battery Production):**
    - **Role:** Generate wastewater containing dissolved metals; primary source of input for SCWP technology.
    - **Interaction:** Provide wastewater streams to treatment facilities. Collaborate with technology providers for on-site treatment solutions. Benefit from the recovery of valuable metals and compliance with environmental regulations.
2. **Technology Providers:**
    - **Role:** Develop, supply, and maintain SCWP technology. Offer expertise in system integration and optimization.
    - **Interaction:** Work directly with industries and water utilities to implement SCWP systems. Provide ongoing support, maintenance, and technological upgrades. Engage in R&D to enhance technology efficiency and applicability.
3. **End-Users (e.g., Metal Refining and Processing Industries):**
    - **Role:** Utilize recovered metals from SCWP processes in various industrial applications.
    - **Interaction:** Purchase recovered metals from industries or treatment facilities. Provide feedback on metal quality and specifications, influencing the recovery process's optimization.

Unique selling points

- **High Efficiency in Metal Recovery:** Over 99% recovery rate, ensuring maximum extraction of valuable metals from wastewater.
- **Eco-Friendly Process:** Minimizes environmental impact compared to traditional methods; reduces carbon footprint.
- **Modular and Scalable Design:** Flexibility to adjust to different operation scales, suitable for various industries and facility sizes.
- **Versatile Metal Recovery:** Capable of extracting a wide range of metals, including critical and strategic raw materials.
- **Reduction in Waste Generation:** Transforms waste into resources, significantly decreasing landfill disposal.
- **Cost-Effective Solution:** Competitive pricing compared to conventional treatment methods, with added value from recovered materials.
- **Advanced Automation:** Smart algorithms for process optimization, reducing operational costs and enhancing production efficiency.
- **Circular Economy Contributor:** Supports sustainable resource management and aligns with circular economy goals.
- **Customizable Recovery Products:** Ability to tailor recovered materials to specific industry requirements.
- **Regulatory Compliance:** Helps industries meet stringent environmental regulations regarding wastewater and waste management.

Technical requirements

Please contact riccardo.momoli@circularmaterials.it to discuss the technical requirements of the project

URL

https://circularmaterials.it/

Technology applied by the product

- **Wastewater Treatment and Sludge Valorization**

Technology Readiness Level

Level 9 (Last update: 2024-03-25)

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