



Remediation and Critical Mineral Recovery from
Mining Wastewaters Using Sorbent-Based Systems

Brooklyn, New York, USA

Critical minerals: a >\$800B bottleneck to U.S. energy and security



80%

**of critical minerals
are imported
into USA**



6x

**increase in critical
mineral demand by
2040**



44%

**of toxic chemical
release in U.S. is
from mining**

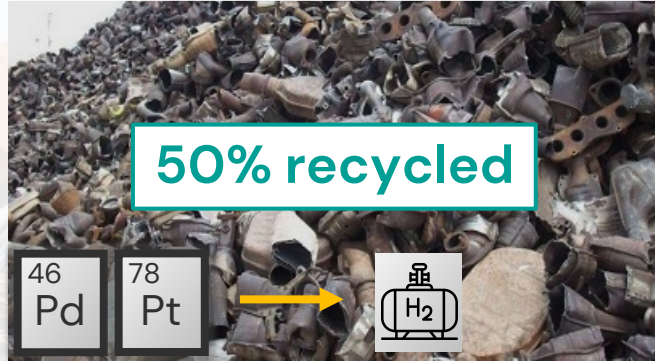
New U.S. mines take ~29 years from discovery to production

We produce domestic, high-purity critical minerals at low costs and emissions

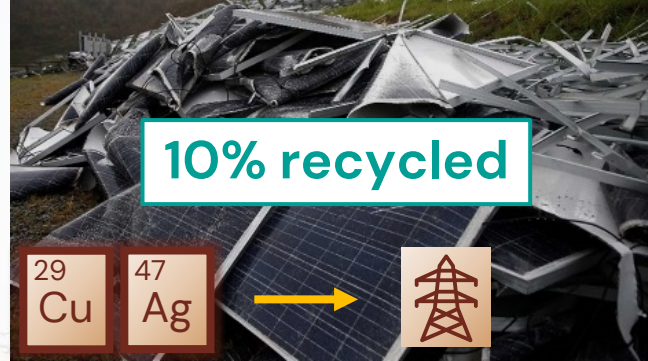


Critical minerals: a >\$800B bottleneck to U.S. energy and security

Catalytic converters



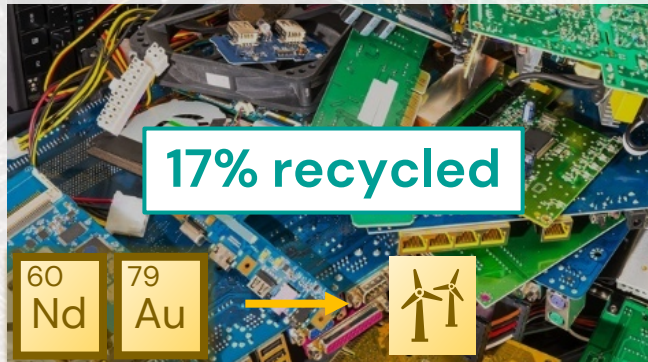
Spent solar panels



Wastewaters



Electronic waste



Batteries



Metal separation challenges limit critical mineral recovery from wastes



Solution: We process critical minerals at low costs & footprints

2-3X LOWER COST

projected for mineral recovery than mining

**99% LOWER CO₂,
ENERGY, & WATER**

ROBUST

to numerous feedstocks, acids, bases, etc.

MODULAR

rapid installation and processing; low CapEx



Tech: Our sorbent filters separate wastes into high-purity metals



Metal-loaded ChemFinity sorbents



Recovered minerals

High selectivity

🎯 Tailored to individual metals

Record capacity

↑ >10x higher recovery than incumbents

Fast throughput

🕒 <10 seconds for metal capture

Robust

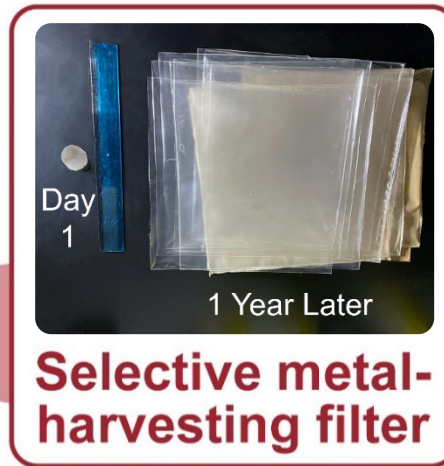
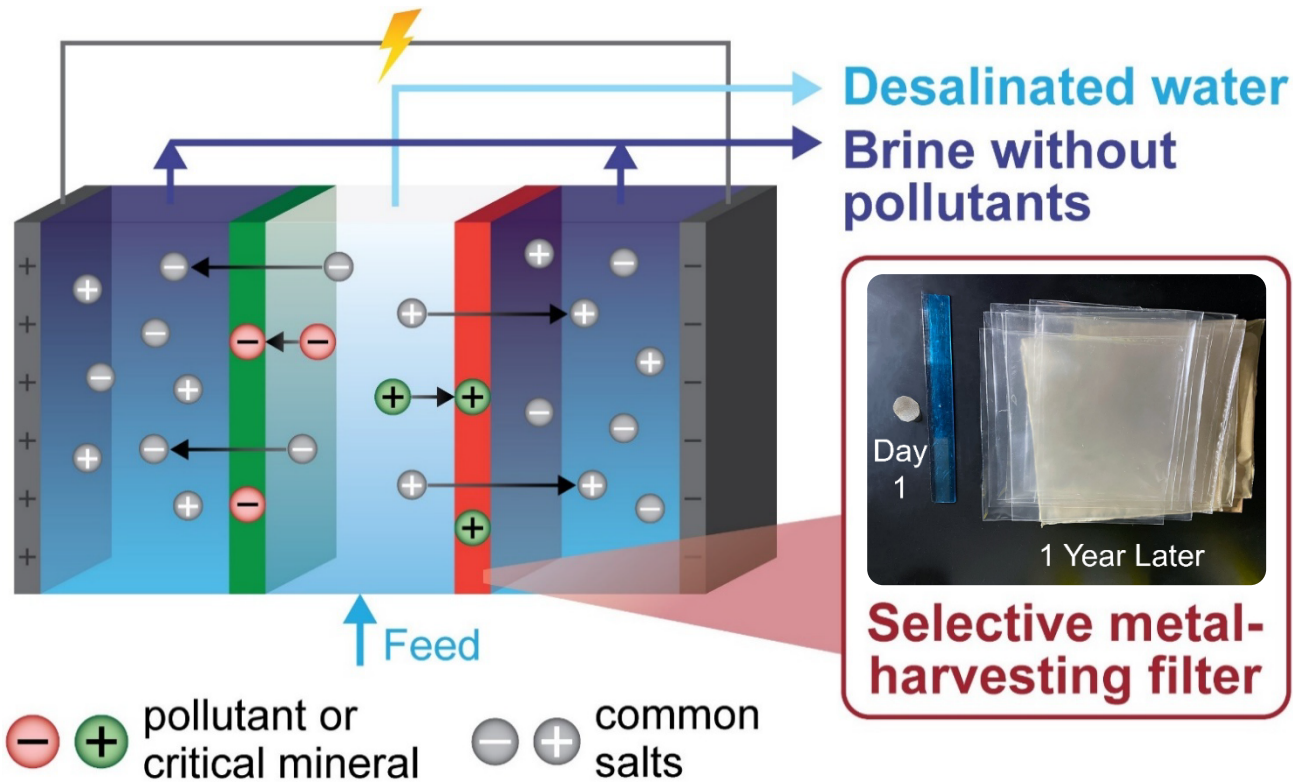
🧱 Resistant to heat, acids, solvents

Reusable

♻️ 100s of cycles projected



Tech: Our membranes separate wastewater into purified water and high-purity metals



Ion-capture electrodialysis

- ✓ Electrochemical metal extraction (99% recovery)
- ✓ Purifies water instead of consuming
- ✓ Reduces toxic waste



Based on: Uliana, Bui, Kamcev, Taylor, Urban, Long *Science* **2021**, 372, 296

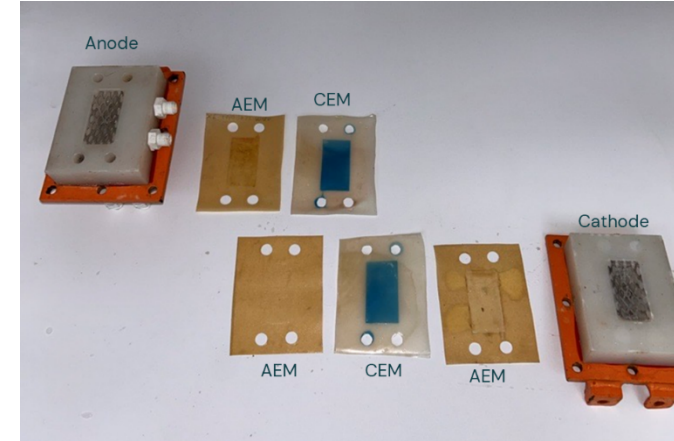
NIEHS: We scaled our systems, recovered copper, and purified water



First pilot stack systems



Pre-NIEHS
prototype



Selective copper
recovery (blue) on
sorptive membranes



Post-recycling of
membranes

**>95% selective copper recovery and >98%
desalination of acid mine drainage wastewater**

Next Steps:

- Expand testing to **other wastewaters** and **minerals**, such as precious metals and rare earth elements
- **Scale up** of sorbent materials and separation systems to larger pilots
- **Hiring** a hydrometallurgist (for solution processing), commercial lead, and other potential hires

Asks: We'd love to engage with...

- **Feedstock providers:** if you have critical minerals you want to recover from your wastes, please reach out!
- **Potential customers and users:** always looking to address real needs
- **Experts and advisors** in mining and critical mineral recovery from wastes

Other sponsors:



Connect with us!



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Grant Information	Dr. Adam Uliana, Remediation of acid mine drainage water using selective metal-harvesting membranes, ChemFinity Technologies, Inc., R43ES037224, Project link: https://tools.niehs.nih.gov/srp/programs/Program_detail.cfm?Project_ID=R43ES037224
Presenter	Adam Uliana, Remediation and Critical Mineral Recovery from Mining Wastewaters Using Sorbent-Based Systems
Technology Name and Description	<p>Porous Polymer Network Sorbents and Membranes</p> <p>Selective membrane technology that uses advanced sorbent materials to recover high-purity critical minerals at the same time as purifying polluted water streams.</p>
Innovation	Our sorbent technologies show record-breaking recovery performances for both valuable minerals and deleterious pollutants and, leveraging the ultrahigh atom-scale tunability of these materials, has been validated for over 20 different minerals or pollutants. If successfully scaled, our technology projects 2-3x lower cost and 99% lower water consumption, CO ₂ emissions, and energy use for extracting critical minerals than incumbent mining technologies.
Contaminant and Media	<p>Contaminants/targets: critical minerals (e.g., copper, rare earth elements), PFAS, neutralization and desalination of acidic water</p> <p>Media: acid mine drainage, other mining wastewaters, and other waters with these contaminants or minerals</p> <p>Target contaminant level: Parts-per-million, though lower concentrations (e.g., parts-per-billion or below) can also be removed for problematic pollutants like PFAS</p>
Technology Readiness Level	4-5
Site Work	Testing in-house at our headquarters in Brooklyn, NY
Main Point of Contact and Social Media	<p>Email: info@chemfinitytech.com</p> <p>Website: https://chemfinitytech.com/</p> <p>LinkedIn: https://www.linkedin.com/company/chemfinitytech</p>

