

# Galdieria, Co. Ltd.

## Corporate Profile 2024

# Corporate Profile

**Name:** Galdieria, Co. Ltd. (<https://galdieria.com/en/>)

**Foundation:** October 1st, 2015

**Offices:** HQ: Nihonbashi Tokyo, Japan  
R&D: Tsurumi, Kanagawa, Japan

**Co-founder & CEO:** Tadashi TANIMOTO

**Business:** R&D to utilize the power of microalga, *Galdieria sulphuraria* to improve the health of our planet

**IP:** 10 granted patents and 10+ applications as a result of 20+ years of academic/commercial research

# Hot sulphur spring red alga: *Galdieria sulphuraria*

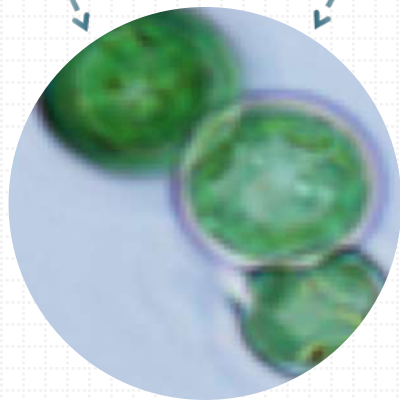


Yellowstone, USA



Kusatsu Hotsprings, Japan

***Galdieria sulphuraria* lives and grows in hot sulfur springs**



***Galdieria sulphuraria***

## Key Characteristics

Can grow in a harsh environment, consisting of:

- pH 0-4
- 37-56 °C
- 100% CO<sub>2</sub> concentration/high concentrations of SO<sub>2</sub> gas, etc.

Has multiple growth modes—heterotrophic, autotrophic, and mixotrophic

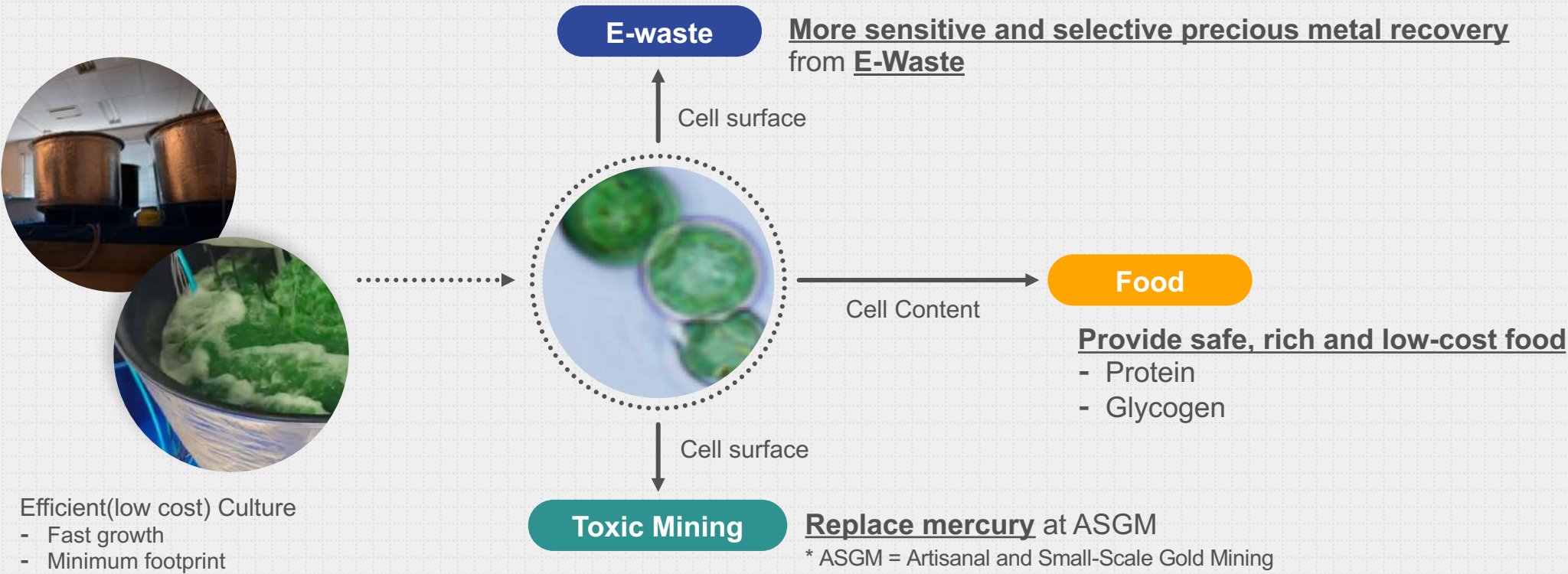
Recovers precious metals from dilute solutions

Contains high concentrations (50% over) of protein, highly branched glycogen, and a natural blue color (phycocyanin)

Possesses a 3–5 times higher capacity of RuBisCO, an enzyme that is involved in CO<sub>2</sub> fixation during photosynthesis

# Our Business

We use cell surface for precious metal recovery and cell content for food to tackle with three human issues – E-waste, Toxic Mining, and Food

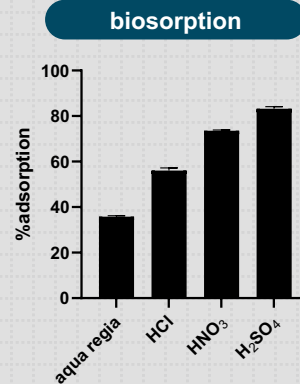


# Adsorption mechanism

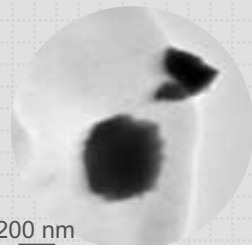
Mechanism of gold and palladium adsorption on thermoacidophilic red alga *Galdieria sulphuraria*

Gold (Au) and palladium (Pd) adsorb on the cell surface through binding to the nitrogen (N) atoms in the form of chloride (Cl, derived from the metal solution) complex.

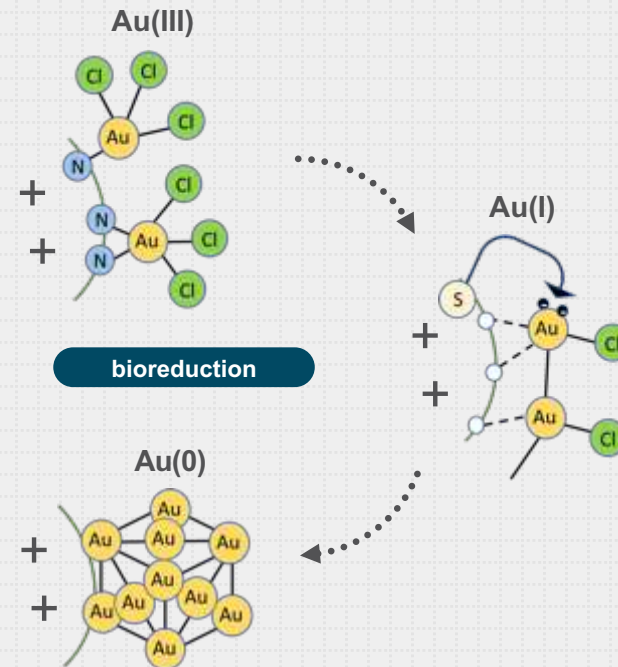
Au



*Galdieria* biosorbent



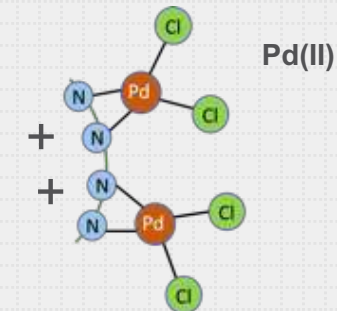
Au microparticles



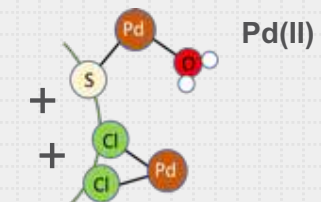
Au adsorbed on the cell surface is reduced in stages and forms solid metal under suitable conditions. This biomineralisation process was found to contribute to adsorption efficiency.

Pd

in the Cl-rich conditions



in the Cl-poor conditions



In the absence of exogenously supplied Cl, Pd is thought to adsorb through binding to the atoms on the cell surface such as sulphur (S) and Cl.

# Our Solution



Toxic Mining

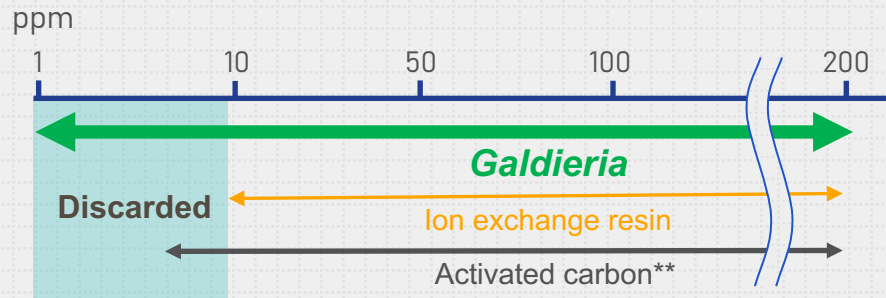
Food

# Our Solution

For precious metal recycling, such as for Pd and Au, *Galdieria* can be much better absorbent with higher sensitivity, selectivity, and constant performance under an acidic environment



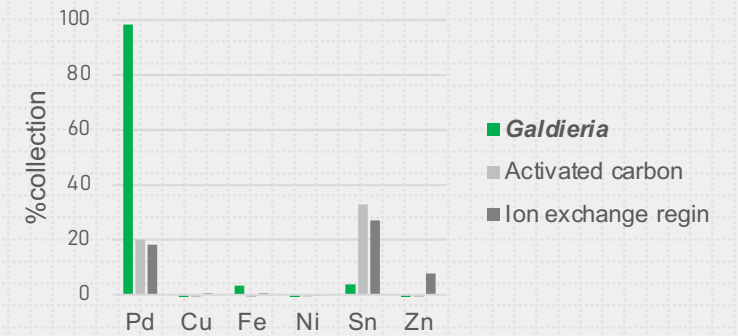
## Highly Sensitive



\* Pd in 4M aqua regia  
 \*\* Activated carbon is more sensitive than resin but not used because of more difficult handling requirement



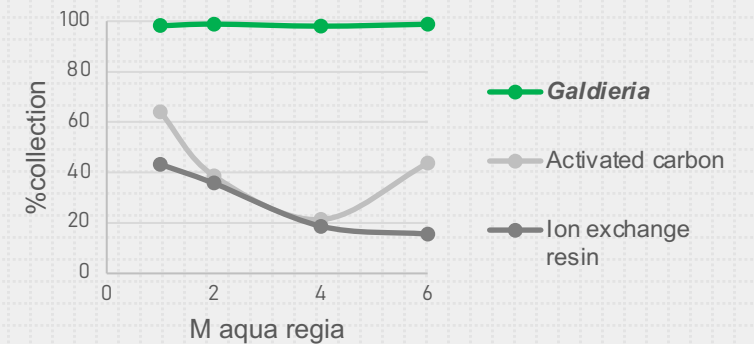
## Highly Selective



\* 10 ppm Pd in 4M aqua regia



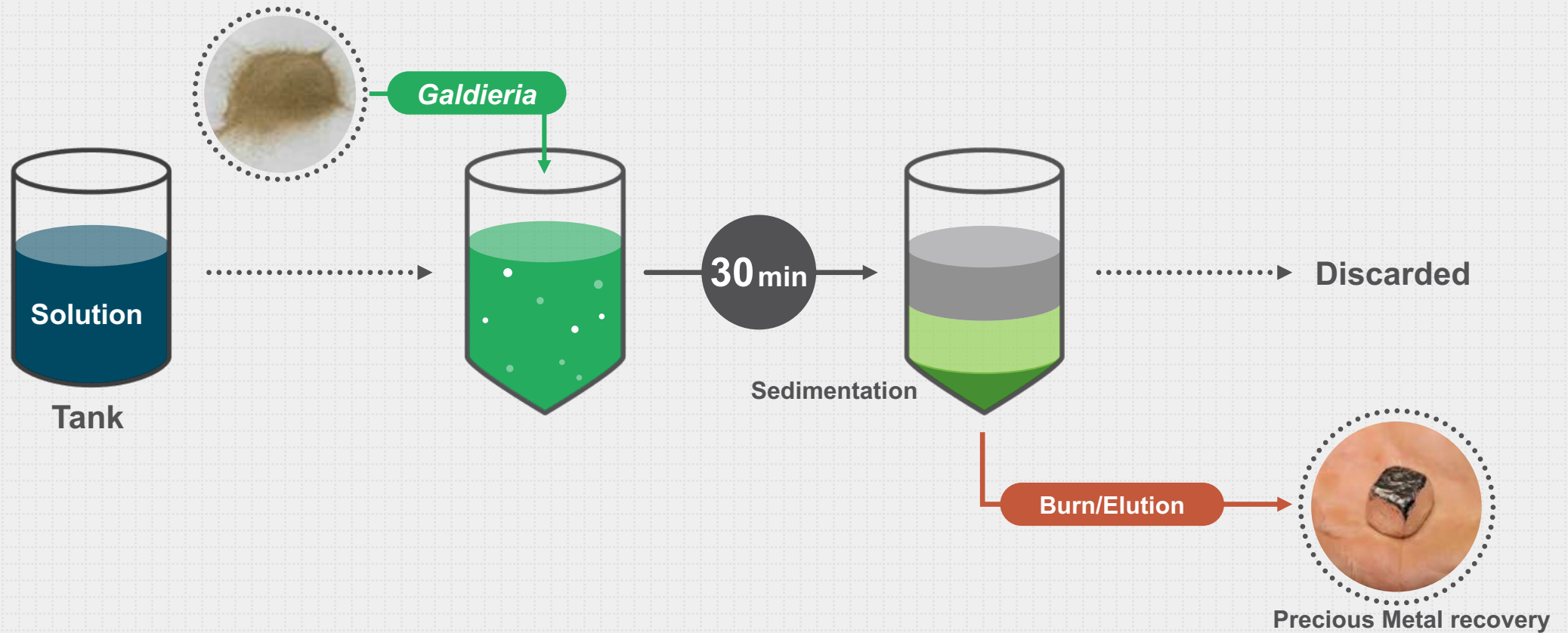
## Tolerant to Acid



\* 10 ppm Pd

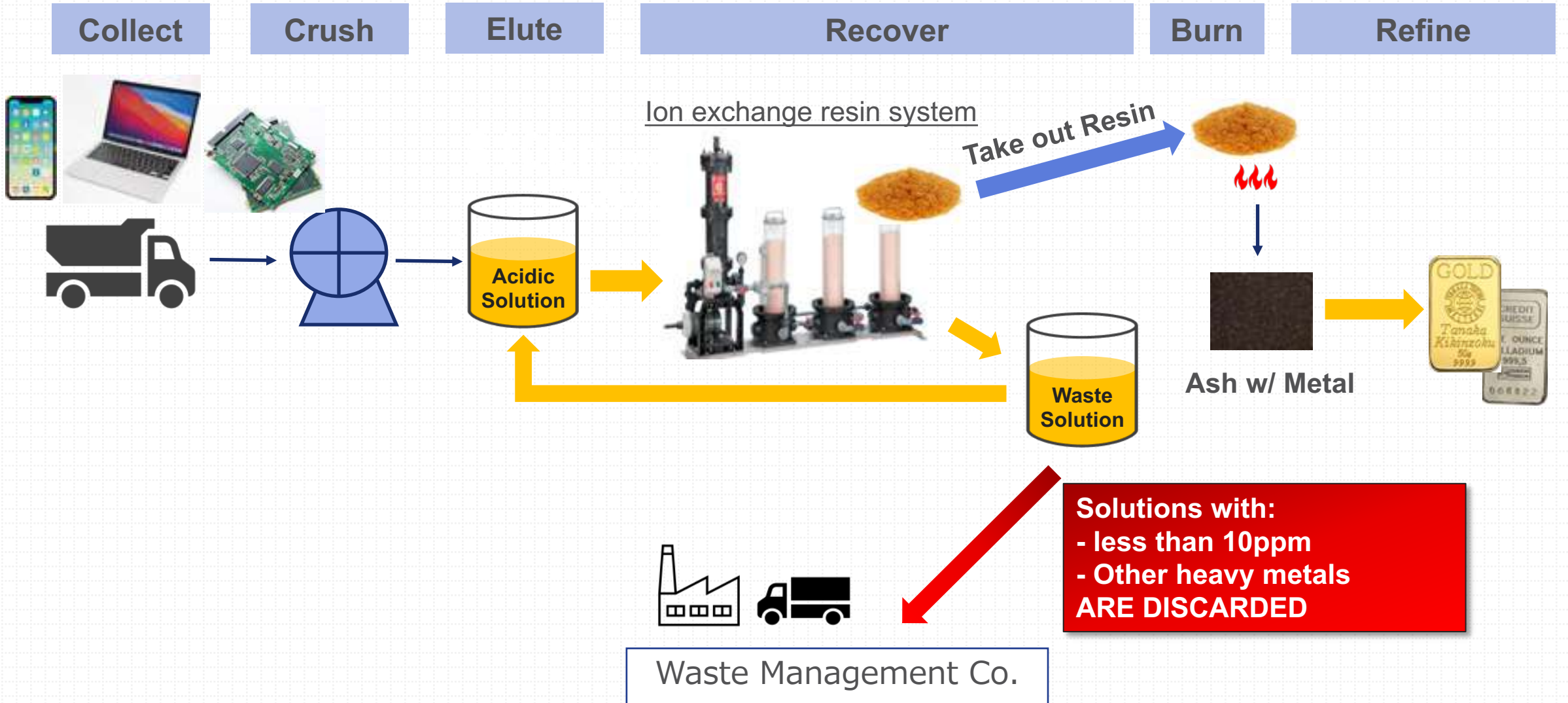
# Our Solution

Our solution process is simple and does not require large switching costs to conventional e-waste recyclers

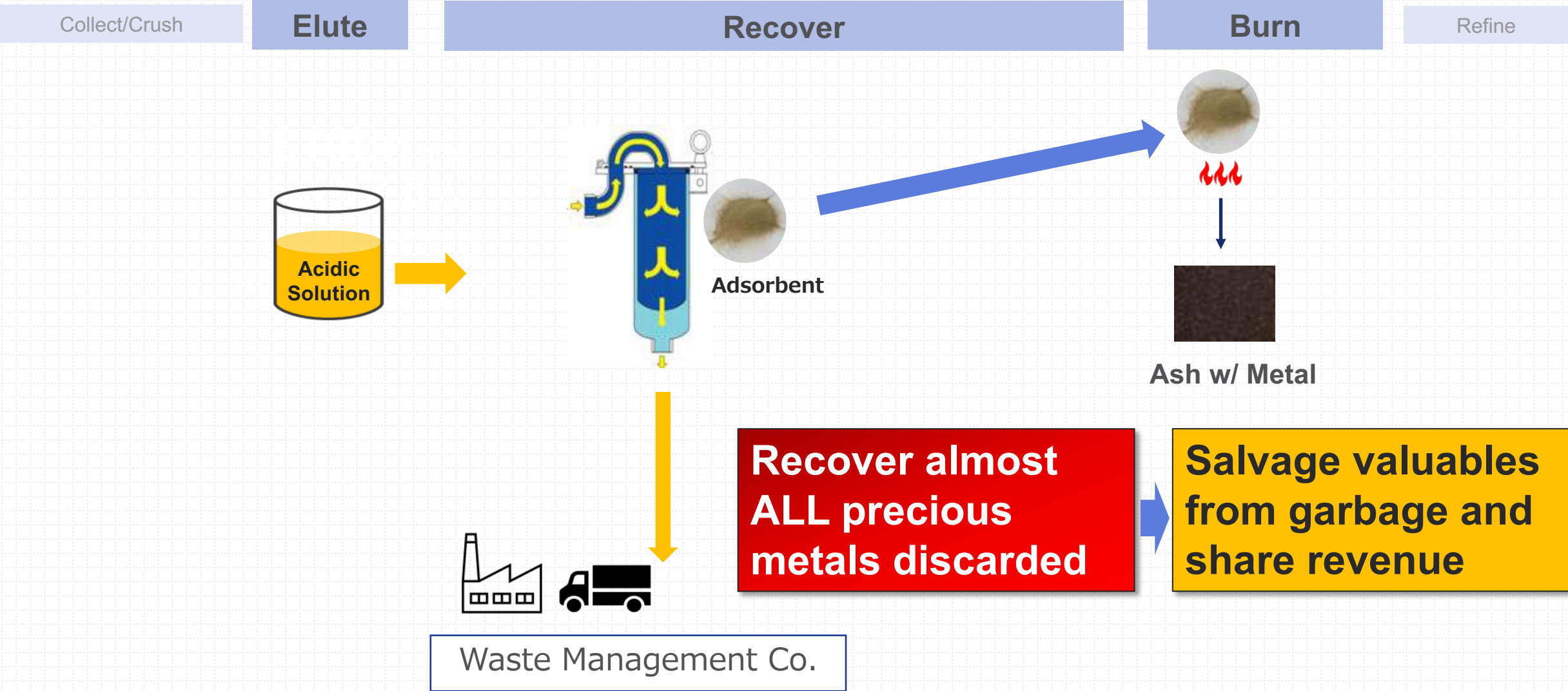




# Current Recycling Process



# Our Solution



# Our Solution : Targets

We will start with palladium, gold, and silver and then expand to platinum and iridium.  
We are also verifying our technology to recover rhodium and other metals

## Technically proven; Initial targets



**Palladium**

- \$87,690/kg
- 43% depends on Russia



**Gold**

- \$68,232/kg
- Without recycling, we will consume all reserves by 2050



**Silver**

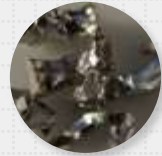
- \$849/kg
- Without recycling, we will consume all reserves by 2050

## Technically proven; Second targets



**Platinum**

- \$35,021/kg
- 90% depends on one country (South Africa)



**Iridium**

- \$164,780/kg
- Currently requires highly capital intensive and environmentally unfriendly recycling process

## Verifying and optimizing our technology



**Rhodium**

- \$559,163/kg
- Currently requires highly capital-intensive and environmentally unfriendly recycling process

...and more

\*Prices as of Oct. 11, 2022 by umicore

# Our Solution

E-waste

Toxic Mining

Food



# Issue #2: Toxic Mining

Key facts: People are suffering serious health issues as a result of toxic mining

**3.3M-6.5M  
CMMVI patients**

1 in 4 to 1 in 3 workers at ASGM mines are diagnosed with CMMVI (Chronic Metallic Mercury Vapor Intoxication)\*



Source: Global Burden of Disease of Mercury Used in Artisanal Small-Scale Gold Mining  
Images: Pure Earth

# Our Solution: A Safe & Simple Process

We have developed a patented process to replace mercury, without drastically changing the current process

## Current Process

Ore



Crush the ore, add water and mercury.  
Put in a mixer for two to three hours



Amalgam, gold and  
mercury alloy, is formed

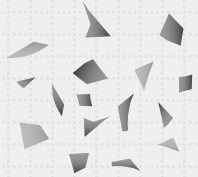


Burn amalgam and  
gold remains



## Our Process

Crash Ore and..



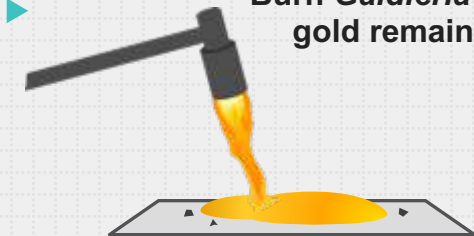
... .. add iodine solution



Add *Galdieria* and  
reductant



Burn *Galdieria* and  
gold remains



# Our Solution

E-waste

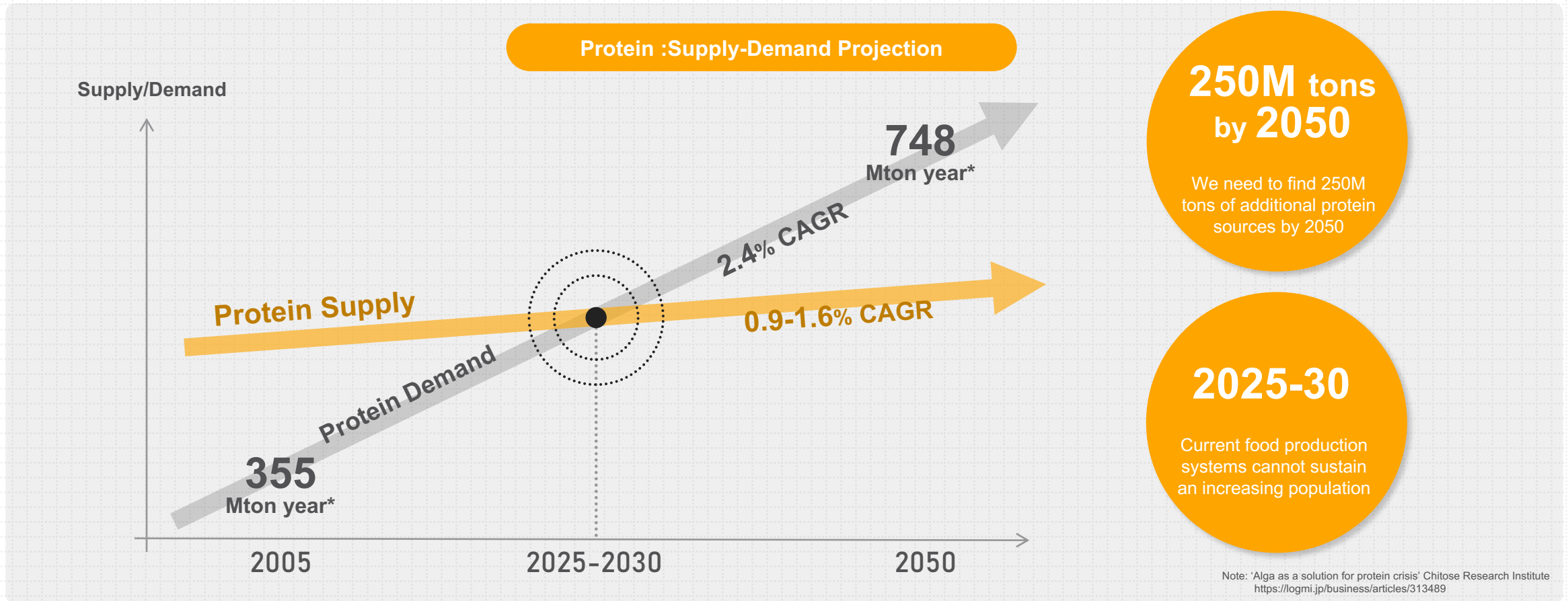
Toxic Mining

Food



# Issue #3 : Food

Key facts: We can never fully rely on conventional protein sources

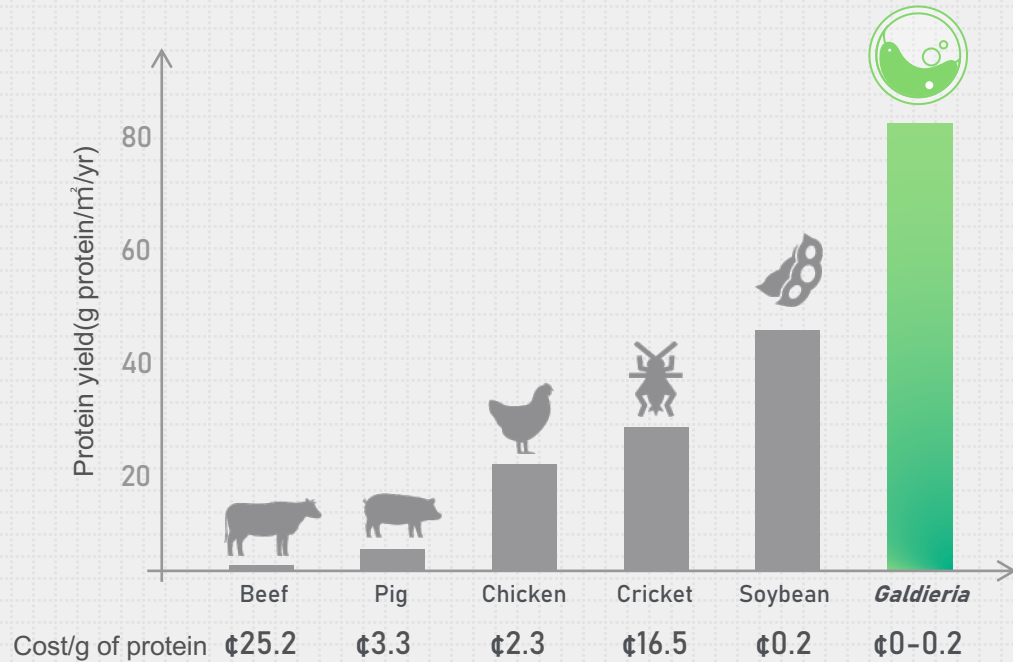




# Our Solution: Rich and affordable protein

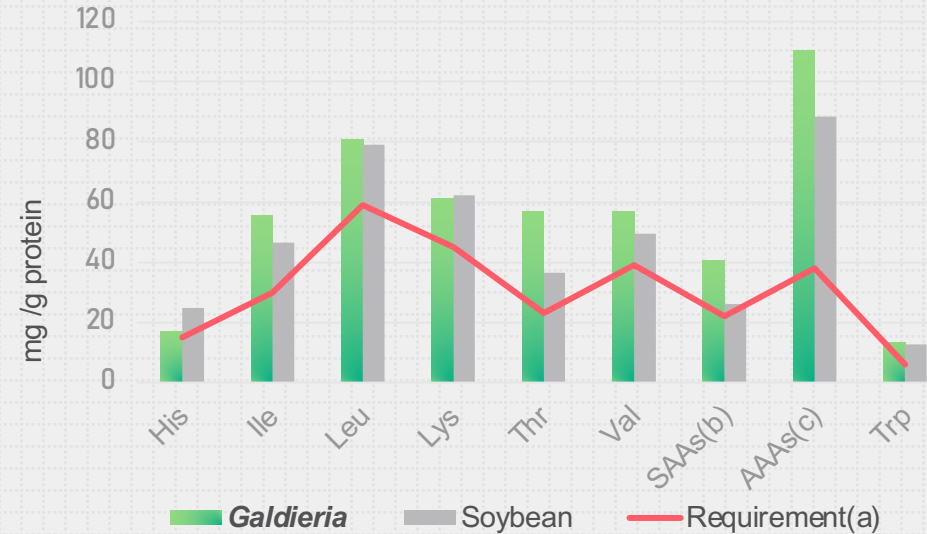
*Galdieria sulphuraria*, which grows efficiently and is nutritious, will be one of the best sources of protein with an unfair cost advantage

## Efficiency and Cost of Proteins



Source: Alexander et al. <https://www.sciencedirect.com/science/article/pii/S2211912417300056>

## Essential Amino Acid Content



<sup>a</sup> Indispensable amino acid requirement for adults.

<sup>b</sup> Sulfur-containing amino acids, namely cysteine and methionine.

<sup>c</sup> Aromatic amino acids, namely phenylalanine and tyrosine.

Source : Mixotrophic cultivation of *Galdieria sulphuraria* for C-phycoerythrin and protein production table 4

