

PHYTOREMEDIATION of CADMIUM contaminated soils THROUGH METALLOPHYTES

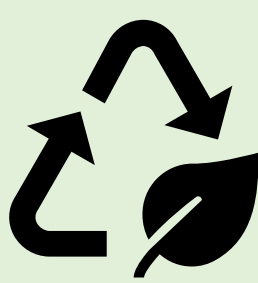
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BACKGROUND

Phytoremediation depend on the contaminant and the mechanisms the plant uses to deal with it. Phytoextraction is the main technique¹, where metal-tolerant plant species accumulate the target metal up to 100 times higher than others.



Phytoextraction depends on two key factors: bioconcentration (ratio of metal concentration in plant aerial tissues to metal concentration in soil) and biomass production at a fast growth rate².



Arabidopsis halleri is recorded as the highest hyperaccumulator in Cd, with a $>100\mu\text{g}\cdot\text{g}^{-1}$ threshold³ in the Global Hyperaccumulator Database project.



Microbiome relationship between the hyperaccumulator *Arabidopsis halleri* and bacteria genera *Streptomyces*, *Agromyces* and *Nitrospira* pointed in a study; they were hypothesized to be involved in the phytoextraction process⁴.



INITIAL HYPOTHESIS AND OBJECTIVES

***Arabidopsis halleri* could be used in phytoremediation processes for cadmium contaminated soil**

1. Comparing cadmium absorption and compartmentalization mechanisms in *Arabidopsis halleri* and *Arabidopsis thaliana*
2. Evaluate the viability of *Arabidopsis halleri* in phytoremediation processes for cadmium contaminated soils.

MATHERIALS AND METHODS

CADMIUM ABSORPTION AND COMPARTMENTALIZATION MECHANISMS

Hydroponics will be used to determine absorption and compartmentalization kinetics. Growth rates at different concentrations of Cd will also be done.

Experiments at two different stages of development:



Pre-inflorescence

Fruit ripening



Cadmium content evaluated in:



Aerial part

Root

Fruit



Arabidopsis halleri L.
From: www.7a.biglobe.ne.jp

VIABILITY OF *Arabidopsis halleri* PHYTOREMEDIATION IN CADMIUM CONTAMINATED SOILS

Natural habitat soil of *Arabidopsis* plant species with different treatments will be used to quantify Cd phytoextraction and verify the enhancing properties of *Streptomyces* and *Agromyces* bacteria genera in Cd phytoextraction. Growth rates at these treatments will also be done.

Experiments at two different stages of development:



Pre-inflorescence

Fruit ripening



Cadmium content evaluated in:



Aerial part

Root

Fruit

Soil



EXPECTED RESULTS

Hydroponic results

- *Arabidopsis halleri* is validated as a hyperaccumulator plant for cadmium.
- Phytoextraction capability of *Arabidopsis halleri* is quantified.
- Absorption and compartmentalization mechanisms are determined

Soil results

- *Arabidopsis halleri* is validated as a phytoremediator plant for cadmium
- Phytoextraction optimal capability in soil is quantified.
- Enhanced phytoextraction efficiency through bacteria is verified.

REFERENCES

1. Pilon-Smits, E. PHYTOREMEDIATION. *Annu. Rev. Plant Biol.* **56**, 15–39 (2005).
2. McGrath, S. P. & Zhao, F. J. Phytoextraction of metals and metalloids from contaminated soils. *Curr. Opin. Biotechnol.* **14**, 277–282 (2003).
3. Stein, R. J. *et al.* Relationships between soil and leaf mineral composition are element-specific, environment-dependent and geographically structured in the emerging model *Arabidopsis halleri*. *New Phytol.* **213**, 1274–1286 (2017).
4. Muehe, E. M. *et al.* Rhizosphere Microbial Community Composition Affects Cadmium and Zinc Uptake by the Metal-Hyperaccumulating Plant *Arabidopsis halleri*. *Appl. Environ. Microbiol.* **81**, 2173–2181 (2015).

Studies for extrapolate these phytoremediation processes to real case should be done considering bioconcentration, biomass production and growth rate of *A. halleri* combined with the data obtained in this research project.