Healing Soils: Phytoextraction Applications in Soil Remediation

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Introduction

- Heavy metals are increasingly contaminating soil due to increased industrialization
- Conventional methods of decontamination are expensive, impractical, and damages the soil and surrounding environment[1]
- Hyperaccumulator plants are species of plants that are known for high tolerance of heavy metals in soil and can utilize phytoextraction to absorb heavy metals and store them
- *Noccaea caerulescens*, formerly known as *Thlaspi caerulescens*, is a model hyperaccumulator species used to discuss phytoextraction characteristics[2]



Figure 1: *Thlaspi caerulescens*[3]

Theoretical Background

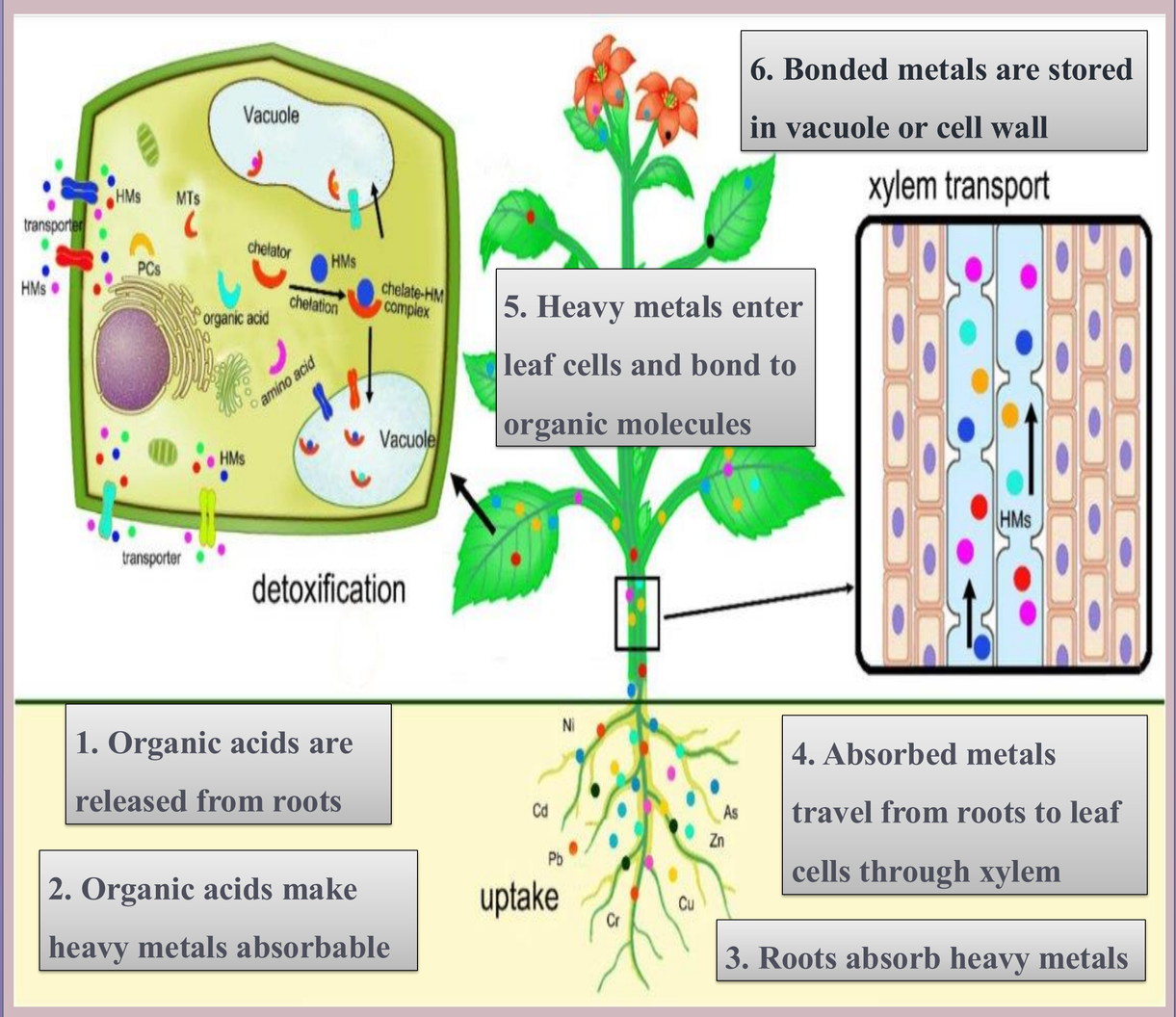


Figure 2: Schematic diagram shows the uptake, translocation, and sequestration of heavy metals in plants[1]

Discussion

Hyperaccumulation Factors

- Different metals can interfere with absorption
- Fungi and bacteria can increase phytoextraction through symbiosis
- Efficiency of absorbing metals depends on hyperaccumulator genetics

Application Potential

- Natural mechanisms reduce the need for more intensive or expensive treatment of the soil
- Gene resources for genetic engineering phytoextraction behaviors into more practical plants
- Phytoextraction treatment can recover metals from soil for reuse

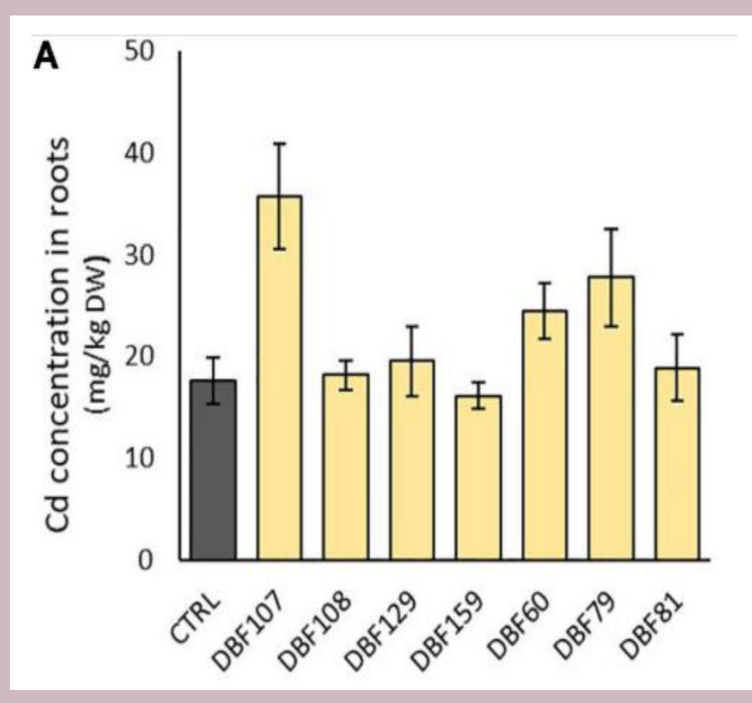


Figure 3: *Noccaea caerulescens* cadmium extraction without (CTRL) and with fungi (DBF#)[4]

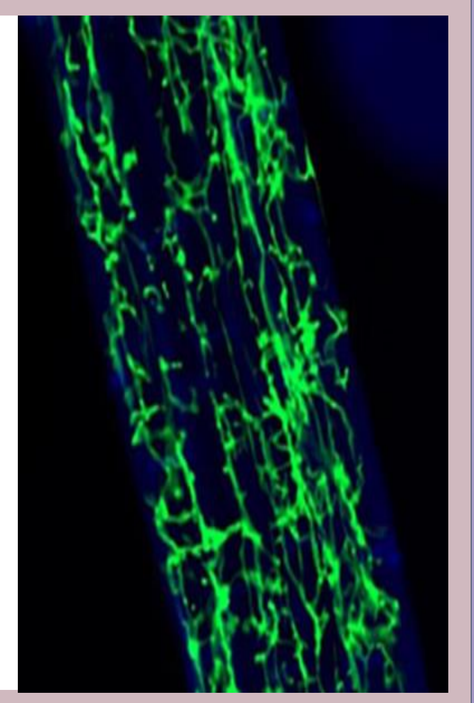


Figure 4: Integration of fungus strain DBF60 with *Noccaea caerulescens* roots[4]

Phytoextraction Limits

- Lengthy treatments as plants only absorb a small amount of heavy metals in each growing season
- Relies on a native hyperaccumulators that store the heavy metals in above-ground biomass, of which there are very few identified globally
- Ecological considerations for potential herbivory or invasiveness[9]

Conclusion

- Phytoextraction is far from being ready to be implemented on an impactful scale, but merits worthwhile investment into study and development
- More research is needed to understand the various mechanisms and factors involved
- More effort is needed in the identification of other hyperaccumulator species to expand future options in phytoextraction implementation

References

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