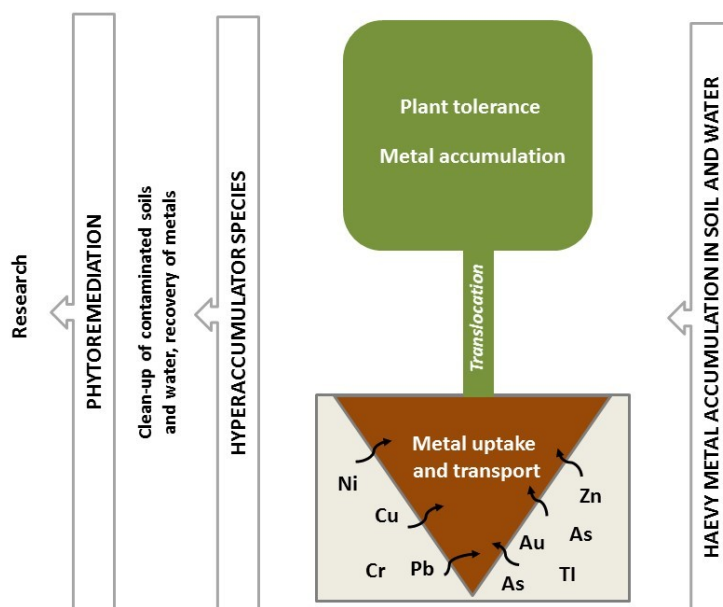


PLANT4RM: a green solution for heavy metal recovery and pollution



A. Main topics

- Exploration and raw materials resource assessment

B. Targeted audience

14-19 years old students

C. Key concepts

- 1- *Phytoremediation*: the use of plants to reduce the concentration of contaminants in the environment and represents a green solution to the problem of heavy metal pollution. In particular, *phytoextraction* provides the accumulation of HM in aboveground biomass, thus allowing the recovery of precious and semiprecious metals from contaminated soils, the so called *phytomining* technique.
 - Lecture
 - Minds-on reflection activities
 - Discussion games and tests
- 2- Mechanisms of heavy metals' uptake, translocation, and tolerance of plants. Metal tolerance capacity inter- and intra-plant species
 - Lecture
 - Minds-on reflection activities
 - Discussion games and tests
- 3- Metal hyperaccumulators: different plant species accumulate extraordinarily high amounts of HM in the aboveground tissues to levels far exceeding those present in the soil or in the nearby growing non-accumulating, without suffering phytotoxic effects.
 - Lecture

- Hands-on experiments
- 4- Genotype- and organ-dependent hyperaccumulation of the metal: investigation of which plant genotype is more suitable for phytoextraction, and of which part of the plants in each genotype will be relevant for metal recovery. Identification of some traits characterising the morphological and biochemical responses of hyperaccumulator plants to the presence and bioaccumulation of HM (Ni)
 - Lecture
 - Hands-on experiment.
 - Discussion tests
 - 5- Research in progress to screen plants for hyperaccumulation of heavy metals. New efficient metal hyperaccumulators are being explored for applications in phytoremediation and phytomining. Interdisciplinary nature of phytoremediation research.
 - Lecture
 - Visit in a research Institution

D. Experimental activity:

1 experience split in three main phases can be performed in the lab by the students themselves :

This practical activity investigates the use of hyperaccumulating plants to clean up nickel contaminated growing media. This demonstration uses species of the *Brassica* and *Alyssum* genus as the hyperaccumulator, as these can be easily grown in a short timeframe.

- 1- Seeds of the hyperaccumulator plants species are grown on a common growing substrate.
- 2- Heavy metal (HM) treatment: culture of seedlings in hydroponic culture which is supplemented or not with HM. The nickel levels are measured over the test period and the absorption by the plants calculated and monitored.
- 3- Assessment of the tolerance responses to different Ni concentrations at physiological and biochemical levels will be evaluated in species of Brassicaceae family (e.g. *Alyssum bertolonii*, *Brassica juncea*), previously characterised for their ability to phytoremove Ni from metal-spiked water.

E. Toolkit material

- Samples of seeds, growing medium of different plants species, metal
- Plant growing protocol
- Protocol for metal application to the plant substrate
- Test strips for assessing metal content in the growing media
- Assessment protocol to quantify metal uptake by plants
- Assessment protocol of plant response to metal application
- Multimedia tools (videos with processes that use the concepts seen during the experimentation)

F. RM tutors

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