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"Young people and multidisciplinary
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PHYTOREMEDIATION AND PHYTOMINING FOR SOIL DECONTAMINATION AND HEAVY METALS RECOVERY: CURRENT STATUS

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Heavy metals in soil

- The industrial development has led to the pollution of soils and agricultural lands with heavy metals.
- The most commonly found in contaminated sites being nickel (Ni), lead (Pb), zinc (Zn), chromium (Cr), cadmium (Cd), arsenic (As), mercury (Hg) and copper (Cu).
- The concentration of these metals in soils can vary from detectable to severe levels, so the development of plants can be significantly affected.

Risks to humans

- The soil contamination with these pollutants may pose risks to humans.
- The heavy metals reaching the human body through direct ingestion or contact with contaminated soil, the food chain, consumption of contaminated food and drinking water etc.

Heavy metals removal from polluted soil

- In order to reduce the risks to human health as well as to ecosystems, it is necessary to remove heavy metals from soil.
- Also, the global demand for metals has increased in recent years, which led to the intensive exploitation of natural resources and thus to their depletion.

Plant-based technologies

- Plant-based technologies represent sustainable methods for decontamination of polluted soils (phytoremediation), as well as for recovery of valuable metals (phytomining).

FUNDAMENTAL OBJECTIVE

Identifying the mechanisms by which plants remove the metal ions from soil, the factors that could influence the phytoremediation and phytomining, as well as nickel, cadmium, lead, cobalt and copper hyperaccumulating plants.

MECHANISMS BY WHICH PLANTS REMOVE THE METAL IONS FROM SOIL

PHYTOVOLATILIZATION

PHYTOEXTRACTION

PHYTOREDUCTION

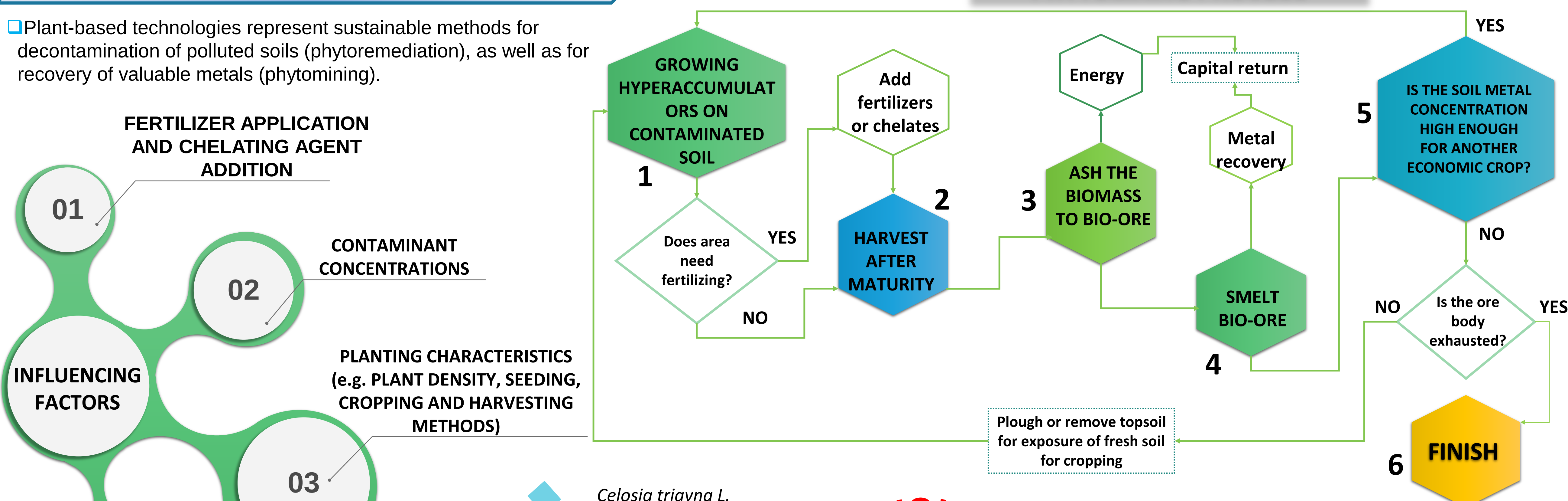
PHYTOFILTRATION

PHYTOSTABILIZATION

PHYTOMINING

is the production of a 'crop' of a metal by growing high-biomass plants that accumulate high metal concentrations.

PHYTOMINING PROCESS



FERTILIZER APPLICATION AND CHELATING AGENT ADDITION

01

CONTAMINANT
CONCENTRATIONS

02

PLANTING CHARACTERISTICS
(e.g. PLANT DENSITY, SEEDING,
CROPPING AND HARVESTING
METHODS)

03

SOIL PROPERTIES
(e.g. SOIL pH, SALINITY, SOIL
TEXTURE ETC.)

04

HYPERACCUMULATORS

Cobalt
(Co)

Celosia trigyna L.
Alyssum corsicum
Berkheya coddii
Haumaniastrum robertii
Alyssum murale

Copper
(Cu)

Helianthus annuus
Anisopappus chinensis
Polypogon fugax
Epilobium hirsutum

Nickel
(Ni)

Brassica juncea
Alyssum murale
Berkheya coddii
Bornmuellera tymphaea
Thlaspi caerulescens

Cadmium
(Cd)

Solanum photeinocarpum
Thlaspi caerulescens
Impatiens walleriana
Tagetes patula
Raphanus sativus

Lead
(Pb)

Pelargonium
Arabis paniculata
Helianthus annuus
Indian mustard
Zea mays
Brassica juncea

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CONCLUSIONS

Exploitation of the
phytomining process

Phytoremediation and phytomining processes are based on the ability of plants to bioaccumulate heavy metals, which can be applied both for the decontamination of polluted soils and for the recovery of some valuable metals from soil.

For the exploitation of these processes on a large scale, it is necessary to take into account not only the bioaccumulation capacity of plants but also the influence of factors such as fertilizer application and chelating agent addition, planting characteristics, contaminant concentrations and soil properties etc.

From the analysis of the studies in the field numerous plants have been identified as hyperaccumulators for cadmium, lead, nickel, cobalt, zinc or/and copper.

Thus, based on the information presented in this paper, can be selected the plants that can be exploited for the recovery of the target metal from the soil.

