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EFFICIENT PHYTOREMEDIATION

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MOKKA CONFERENCE

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PHYTOREMEDIATION

PHYTOREMEDIATION is a biological and environment - friendly risk reduction technology, applying plants for removal, transfer, stabilization and degradation of contaminants

Applications: soil, groundwater, sediment, surface water, waste water treatment.

Contaminants: hydrocarbons, halogenated solvents, pesticides, metals, nutrients, phenols, PAHs.

PHYTOREMEDIATION PROCESSES

Degradation

PHYTODEGRADATION

RHYZODEGRADATION

Accumulation

PHYTOEXTRACTION

RHYZOFILTRATION

Phytovolatilization

Immobilization

PHYTOSTABILIZATION

EVAPOTRANSPIRATION

PHYTOREMEDIATION TESTS

- **Assessment of soils and plants under different climatic conditions.**
- **Pot and field experiments** (pH, temperature, species, effects on metal uptake).
- **Assessment of test plants, grouping by metal uptake and tolerance** (bioconcentration factors, BCF).

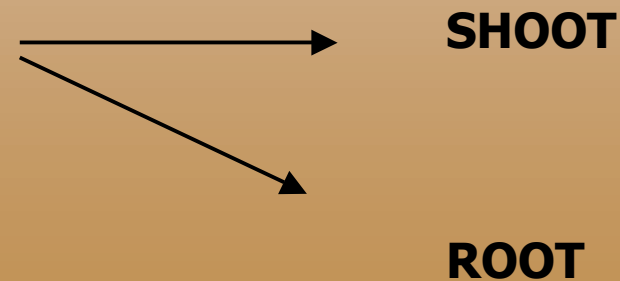
POT EXPERIMENT

- **Model soil: Gyöngyösroszsi**

| | mg/kg | | | | | pH | % | |
|-------------------------|-------------|-------------|-----------|-----------|-------------|----------|-------------------|------------|
| | Pb | Zn | As | Cd | Cu | | CaCO ₃ | C |
| Model soil | 2890 | 1760 | 72 | 28 | 1200 | 7 | 13.8 | 2.9 |
| Limit value (B)* | 100 | 200 | 15 | 1 | 75 | - | - | - |

- **14 plant species**

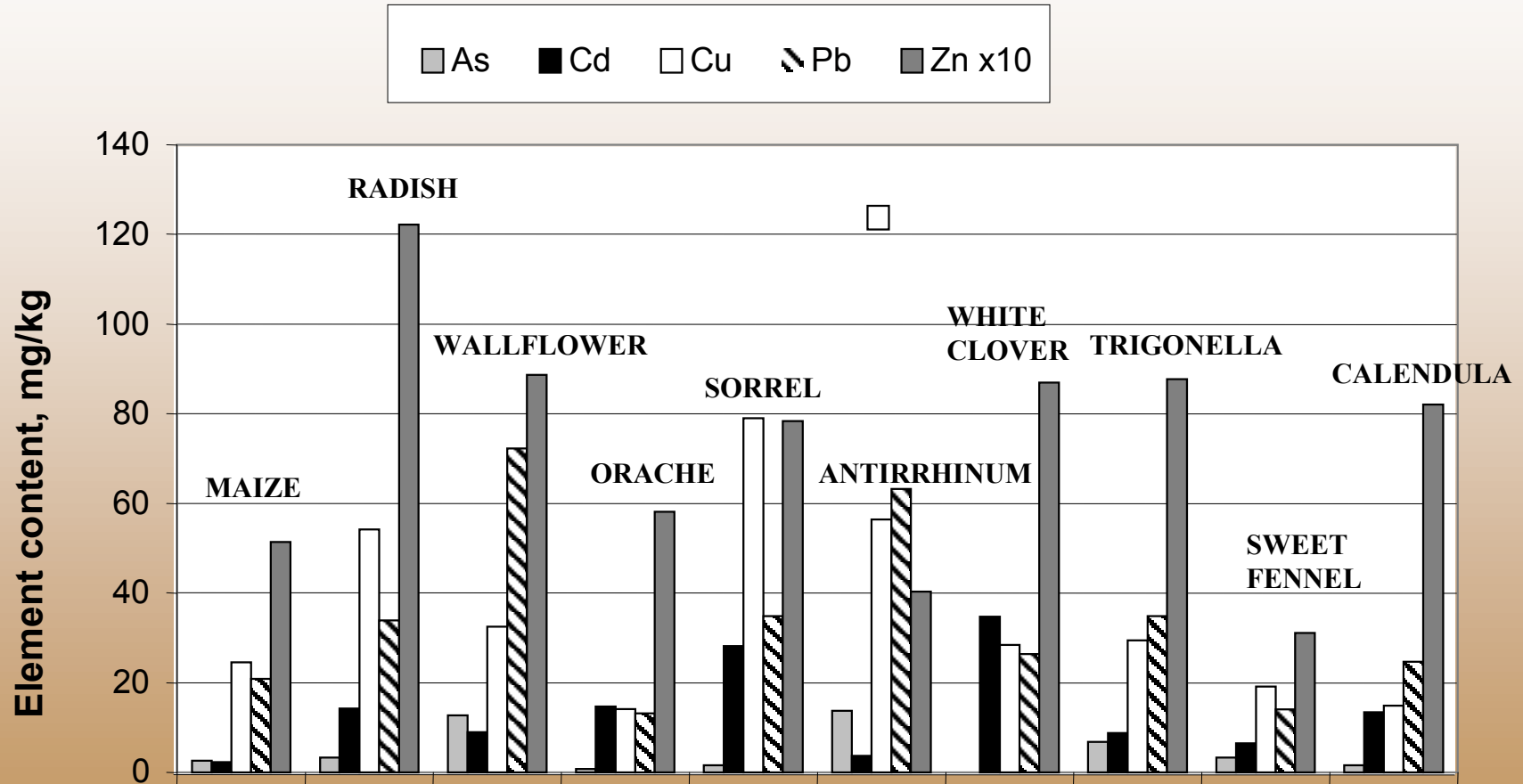
- **Sampling: 30 and 60 days**



***(B) limit value for contamination**

ELEMENT CONTENT OF PLANT SHOOT

(30th DAY)



EFFECT OF TEMPERATURE AND pH ON **SHOOT ELEMENT CONTENT OF TWO** **PLANTS**

| mg/kg SHOOT | pH 7,05 15/10 °C | pH 7,05 25/15 °C | pH 5,2 25/15 °C |
|------------------------|-----------------------------|-----------------------------|----------------------------|
| Cd, SORREL | 7,5 | 28,8 | 48,2 |
| Zn, MAIZE | 210 | 1012 | 2155 |

FIELD EXPERIMENTS

**GYÖNGYÖSOROSZI
VALLEY OF TOKA STREAM**
LEAD AND ZINC MINE ORE:
TOXIC METAL POLLUTION,
ACIDIFICATION

**ALMÁSFÜZÍTŐ
WASTE DUMPS OF RED MUD**
ALKALINITY,
SALINE POWDER EROSION


**BUDAPEST
INDUSTRIAL AREA OF
AN ELECTROPLATER
PLANT**
METAL CONTAMINATED
SOIL

FIELD EXPERIMENTS

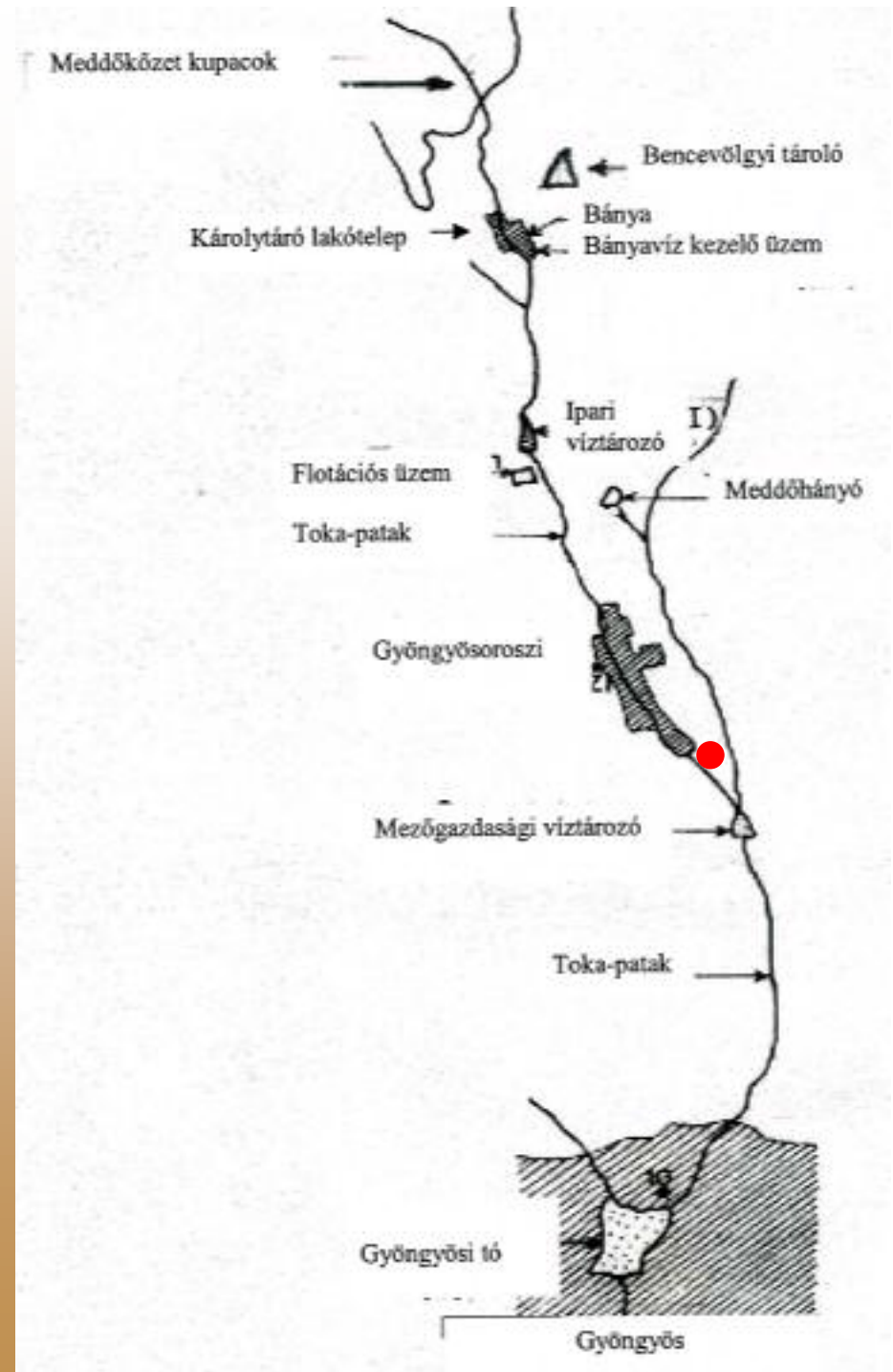
- Gyöngyösorsoszi

| | mg/kg | | | |
|-------------------------|--------------|---------------|-------------|------------|
| | Pb | Zn | Cd | Cu |
| SOIL | ≥ 955 | ≥ 3082 | ≥ 18 | 276 |
| Limit value (B)* | 100 | 200 | 1 | 75 |

- **9 plant species**
- **chemical stabilization**
(lignite; lime)

- **Sampling**  **shoot**
root

***(B) limit value for contamination**



BIOCONCENTRATION FACTOR

Bioconcentration factor of four typical plants in the field experiment

| Plant species | Part of the plant | Bioconcentration factor | | | |
|---------------|-------------------|-------------------------|-------------|-------------|-------------|
| | | Cd | Cu | Pb | Zn |
| RAPE | root | 1.43 | 0.61 | 0.43 | 0.74 |
| | shoot | 0.47 | 0.07 | 0.00 | 0.36 |
| SALLOW | root | 3.12 | 0.76 | 0.20 | 1.03 |
| | shoot | 3.40 | 0.06 | 0.00 | 1.23 |
| MAIZE | root | 2.94 | 1.01 | 0.06 | 0.37 |
| | shoot | 0.39 | 0.07 | 0.01 | 0.45 |
| HORSERADISH | root | 0.17 | 0.03 | 0.00 | 0.14 |
| | shoot | 0.18 | 0.02 | 0.00 | 0.06 |

GROUPING OF TESTED PLANTS *

- **Accumulating species** → **PHYTOEXTRACTION**

e.g.: MAIZE (Cd), SALLOW (Cd, Zn); SORREL (Cd, Cu, Zn),
RADISH (Cd, Zn); BLACK ELDERBERRY (Pb)

- **Moderately accumulating**

e.g.: ORACHE (Cd, Zn), GOLDEN-ROD (Cd, Zn); WHITE CLOVER

- **Not accumulating** → **PHYTOSTABILIZATION**

e.g.: HORSERADISH, RAY-GRASS; ACACIA

* Inside the group the species are tolerant, moderately tolerant, and sensitive.

FIELD EXPERIMENT

ALMÁSFÜZÍTŐ: WASTE DUMPS OF RED MUD



FIELD EXPERIMENT

BUDAPEST: AN INDUSTRIAL AREA OF A METALLIZATION FACTORY

***Phytoextraction with and without AMF
inoculum***



***Integrated phytostabilization using
lignite with application of AMF inoculum***



SOIL REVITALIZATION METHODS

**AMF inoculum
may stimulate
absortion of
minerals and
water, stress
tolerance**

**Complex microbial
inocula**



**Reestablish the
vitality of soils or
waste dumps**

THANK YOU FOR YOUR ATTENTION !