

# PhytoRhizoProm

University of Chemistry and Technology (vscht) technology

developed under the EU-funded NYMPHE project

## PROBLEM



**CONTAMINATED SOILS OFTEN CONTAIN PERSISTENT ORGANIC POLLUTANTS THAT ARE DIFFICULT TO REMOVE USING CONVENTIONAL METHODS. MICROBIAL DEGRADATION IS LIMITED BY LOW MICROBIAL ACTIVITY AND PLANT STRESS UNDER TOXIC CONDITIONS, WHILE PLANTS ALONE MAY NOT EFFICIENTLY EXTRACT OR BREAK DOWN POLLUTANTS.**

### Target pollutants:

Persistent organic pollutants, especially aromatic compounds.

## TECHNOLOGY



### System setup:

- Plants selected for phytoremediation (phytoextraction, phytostabilization, phytodegradation).
- Microbial communities (rhizosphere, endosphere, phyllosphere) associated with the plants.



### Operation:

- Plants established in contaminated soil.
- Microbes colonize roots and surrounding soil, enhancing pollutant degradation.
- Plant-microbe interactions optimized for growth under polluted conditions.



### Mechanism:

- Plants + microbes form a holobiont for efficient pollutant breakdown and growth promotion.
- **Synergistic interactions increase resilience and biomass for higher pollutant uptake.**



### Function:

- **Phytoremediation:** plants extract, stabilize, and degrade pollutants.
- **Rhizodegradation:** rhizosphere microbes degrade contaminants and support plant health.
- **Genetic optimization:** bacterial genes in plants enhance aromatic ring degradation.

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## INNOVATION




This technology integrates phytoremediation, rhizodegradation, and plant growth promotion with genetic enhancement of pollutant-degrading traits.

Through genomic editing, specific bacterial genes are introduced into plants, enabling them to cleave aromatic rings — a key step in breaking down many persistent pollutants.

**The result is a plant-microbe holobiont,** a tightly integrated biological unit that provides a more efficient and environmentally sustainable approach to ecological restoration.

 **TRL:** 4-5 (lab validation → field tests planned).

## RESULTS

-  Plants with integrated bacterial genes efficiently cleave aromatic rings, accelerating degradation of persistent organic pollutants.
-  Synergistic interactions with plant growth-promoting rhizobacteria enhance plant growth under contaminated conditions.
-  Higher biomass production boosts pollutant uptake and improves soil restoration potential.

**Initial results indicate a more efficient, eco-friendly remediation; field-scale validation will assess cost, scalability, and long-term sustainability.**

