

# Rhizobacteria associated with *Miscanthus x giganteus* improve metal accumulation and plant growth in the flotation tailings

## Abstract

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### Purpose

Flotation tailings represent an extremely unfriendly substrate for plant colonization due to toxic metal concentrations and marked macronutrient deficiencies. The perennial grass *Miscanthus x giganteus* J.M.Greef & Deuter ex Hodk. & Renvoize was successfully cultivated in this infertile substrate for two years. Our aim was to identify composition of its rhizosphere bacterial community and to analyze the effects of the selected rhizobacteria on plant growth, root development, metal and P uptake.

### Methods

Using the cultivation-dependent method, 75 isolates were collected from the rhizosphere and six rhizobacterial strains were selected for further characterization based on morphological and biochemical differences. The plant rhizomes were inoculated with the consortium of rhizobacteria and cultivated in the flotation tailings substrate.

### Results

Detected bacterial strains were characterized as metal-resistant and plant growth-promoting rhizobacteria (PGPR) because of their metal tolerance ( $\text{NiCl}_2$ ,  $\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2$ ,  $\text{CuSO}_4$ ,  $\text{NaAsO}_2$ ,  $\text{MnCl}_2$ ) and some or all of the plant growth-promoting (PGP) properties (indole-3-acetic acid and siderophore production, 1-aminocyclopropane-1-carboxylic acid deaminase activity and phosphate solubilization). PGPR mitigated the negative effects of high metal concentrations and macronutrient deficiency as shown by stimulated lateral roots development, increased root hair length, plant below and above ground biomass yield, higher plant P uptake and metal accumulation rate.

### Conclusions

The isolated PGPR strains could be used in PGP-bacteria assisted phytoremediation of flotation tailings and metal polluted soils by *M. x giganteus*. Their PGP effects on various metal-tolerant target plant species in the respective substrate remain to be verified.