

Phytomanagement of mining tailings: enhancing plant growth and metal removal from wetlands constructed for bio-ore production.

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Catastrophic rupture of dams containing mining tailings has increased worldwide and increased environmental pollution. Phytomining is a plant-based technology with great potential to decrease the threats associated with mining tailings spills and provide economic rewards through bio-ore production. Although metal ores, such as Fe and Mn, are critical commodities and the major ores globally produced, generating large amounts of Fe-rich tailings, phytomining on the tailings is an unusual approach. Thus, this work aimed to test soil amendments (chelating agent (citric acid); fertilization (commercial NPK and organic amendment); and a consortium of microorganisms (*Azospirillum* sp., *Pseudomonas* sp., *Rhizobium* sp., and *Saccharomyces* sp.)) to increase plant biomass production and metal removal in mesocosm constructed wetlands. A control treatment (without amendments) was also conducted. The mesocosms were conducted in triplicates, and plants (*Typha domingensis*) were cultivated for one year. At the end of the experiment, the plant height and biomass production were measured, and metal contents in the shoots were determined. The Fe and Mn removal rate from mining tailings was calculated as the difference between the pseudo total concentrations of metals in the mining tailings before and after plant cultivation. The plant height using fertilization (136.7 cm) was 16% higher than in the other treatments (115.1 cm). In addition, 5-fold higher shoot dry biomass (11.6 ton ha⁻¹) was achieved with the fertilization compared to the other treatments (2.2 ton ha⁻¹). After one-year, *T. domingensis* extracted from mining tailings 5.5-fold more Mn (82.6 kg ha⁻¹) and 7.1-fold more Fe (4.8 kg ha⁻¹) in the fertilized treatment than the other treatments (on average Mn: 15.1 kg ha⁻¹ and Fe: 0.7 kg ha⁻¹). In conclusion, our results showed that fertilizing mining tailings could provide suitable conditions for *T. domingensis* growth and enhance metal removal by plants. The results obtained can be helpful in the rehabilitation of mining tailing-impacted sites but also provide the basis to increase *T. domingensis* phytomining potential.



Figure 1. Image from mesocosm wetlands constructed for bio-ore production.