Transforming phytotoxic mine residues into soil

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Abstract

Natural development of functional soils from the most phytotoxic abandoned bare mine residues or mine tailings did not happen since the '60s. These sites emit contaminants to the environment by dust, by solid erosion, by drainage water, and in food chain by contaminated plants. Three sites with sulfidic acid-generating mine residues or tailings (pH 2.4 to 4.0) were amended with modified bauxite residue, limestone, compost and fertilizer. After different laboratory trials, the dose of alkalinity was adapted to neutralize the potential acidity (by oxidation of the sulfides) and to immobilise phytotoxic elements (modified bauxite residue - MBR, limestone, up to 10%), to alleviate micro-nutrients deficiencies (compost at 1% or 2% rate), to bring macronutrients (NPK fertilizer at agronomic rate), to bring N-fixating microorganisms (soil from cultivated field at 0.1%), and common forage seeds (*Dactylis glomerata* and *Onobrychis sativa*). The trials were done in pot, in 60 l lysimeters, and for one site in field trial. The pHs of the drainage water were neutral and the phytotoxic elements concentrations were below LOQ (As, Cd, Cu, Pb, Zn). Some particle aggregates appeared and the structural stability (indicating resistance to erosion) was greatly enhanced. Plant growth was successful, and in some case luxurious. Contaminants in aerial parts of plant were at the same concentration level than with uncontaminated control soil, except in two cases for Pb. Speciation of Pb in the amended mine residue will be presented for these two cases, and biological activity (enzymatic activity) for the new "soils".

Keywords: phytomanagement, technosol, anthroposol, modified bauxite residue

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