

EGU2020-12527

<https://doi.org/10.5194/egusphere-egu2020-12527>

EGU General Assembly 2020

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Risk assessment of the land recovery to pastures on sulfide tailings closed with different systems: Conventional Vs Technosol

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A promising planning for recovery and closure of mining tailings, from both active and abandoned mines, must include environmental and socioeconomic approaches. Buenaventura group and La Zanja mine are evaluating, in different closure systems of tailings composed of mine wastes rich in sulfides, the integrated rehabilitation of the ecosystem (mine wastes, percolated leachates, runoff water and plants cover) and its recovery to other secure land uses which promote the regional socio-economic valorisation. In adjacent areas to La Zanja mine (Cajamarca, Peru), the milk production is the main economic activity although with low profitability. Therefore, herbaceous and shrubs intake by domestic animals could be one important food chain route for human exposure to toxic elements. Although it is essential the evaluation of the potential animal feed risk, until what is known these studies are not usual in mine closure planning.

This work aims to evaluate, at long term, the chemical and microbiological characteristics of the soil, and development and environmental potential risk of the herbaceous strata growing in mine tailings closed with two conventional closure systems and innovative system with a Technosol designed specifically for environmental problems of the mining tailing. The studied conventional systems are characterized by superficial coverage with local soil or local soil under materials with low permeability. Before planting native plant species and different fast-growing herbaceous, amendments were applied to the soil, such as lime and/or chicken manure. In other mine tailing with similar chemical and mineralogical characteristics was applied a superficial layer of a designed Technosol with andic, eutrophic and reductor properties. An adjacent area without influence of mining activity was used as control.

Composite samples of soils as well as herbaceous plants and dominant shrub growing on these soils were collected. Soil characteristics (pH, fertility, overall activity and biomass of microbial community) and multielemental concentration in soils (pseudototal and available fractions) and plants were determined. The accumulation behaviour of potentially hazardous elements in shoots was studied as well as their relation with the chemical soil characteristics.

The chemical and biological quality of the soils depended on closure system. Soils from

conventional system presented significant degradation at chemical and biological level and smaller plant development, compared to system with Technosol. The chemical characteristics of the Technosol still remained being, in many cases, better than those in control soil.

In conventional systems, the alteration of the chemical characteristics of the soils and/or presence of the layer of low permeability material limited the plant development biomass production contributing to a higher risk of erosion. Herbaceous species growing on the soils from all studied closure systems of mine tailings do not seem to represent an environmental risk for domestic animals that exist in the areas adjacent.

This study is included in a strategy environmental management and sustainable development for the recovery of non-productive areas for other land uses.

Financial support granted by: InnóvatePerú-FINCYT 2 (PITEI-4-P-015-091-16) to Compañía de Minas Buenaventura and Minera La Zanja; Fundação para a Ciência e Tecnologia to LEAF (UID/AGR/04129/2013).