Peat valorization potential as organic cover for the reclamation of gold mine tailings

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Gold mine tailings are potential sources of contaminants such as cyanides and derivatives, acidity, metals that are released in the environment as mine drainage. Available reclamation techniques for the control of contaminated mine drainage comprise mainly covers, backfilling and desulfurization. Organic materials such as peat, a cost effective and easily available organic material nearby northern mine sites, could be used as covers. However, the effects of organic materials on the mobility of contaminants such as As depend on the potential leaching of dissolved organic compounds due to organic matter breakdown, and on tailings' characteristics.

In the present study, the use of peat as organic cover was evaluated to potentially reclaim As-generating gold mine tailings under controlled conditions. Three columns testing were set-up: a control one containing 30 cm of tailings (C1) and two containing tailings (20 cm) covered with compacted (C2) and non-compacted (C3) peat (100 cm). Initial physicochemical characterization of the tailings and peat, including the decomposition of the latter, was carried out. The columns were rinsed with 2L of deionized water, in wetting-drying monthly cycles, for 10 months. Geochemical behavior of the columns was monitored, especially As mobility and speciation in drainage water.

Results showed that the tailings contained mobile or easily mobilized As, mainly originated from arsenopyrite (FeAsS) and accessorily löllingite (FeAs2). Initial characterization of peat indicated a low decomposition, with a dissolved organic carbon of 34 mg/L. The drainage water from the columns had neutral to slightly basic pH (7.5─8.6) due to sufficient neutralization potential of the tailings. Sulfate and metals concentrations were low, except for As. The As leaching was enhanced by the presence of peat cover (compacted and non-compacted) compared to the control column, with an increase in the most toxic form As(III) up to 2─4 folds over As(V) in drainage water.