



Impact of commercial garden growth substratum and NPK-fertilizer on copper fractionation in a copper-mine tailing

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Organic amendment and NPK-fertilizer could affect the distribution of copper (Cu) among Cu-mine tailing compounds and hence the availability or phytotoxicity of Cu to plants. A laboratory incubation experiment was conducted to investigate the forms of Cu in a Cu-mine tailing (pH 7.70) amended with a commercial garden growth substratum (GGS) containing peat moss and natural mycorrhizae (*Glomus intraradices*) in combination with a commercial NPK-fertilizer (20-20-20), by a sequential extraction method. There were eight treatments after the combination of four rates of GGS (0, 12.4, 50 and 100 g/kg tailing) and two rates of fertilizer (0 and 20 g/kg tailing). At the end of a 52-week incubation period, tailing Cu was sequentially extracted to fractionate Cu into five operationally defined geochemical forms, namely 'water-soluble' (Cu-sol), 'exchangeable' (Cu-exc), 'specifically adsorbed on carbonates or carbonate-bound' (Cu-car), 'organic-bound' (Cu-org) and 'residual' (Cu-res) fractions. After treatments, the most labile Cu pool (Cu-sol + Cu-exc) represented about 0.94 % of the total Cu, the Cu-car and Cu-org accounted for 22.7 and 5.0% of total Cu, and the residual Cu accounted for nearly 71.3% of total Cu. Compared with the control, the application of GGS decreased Cu-car and increased CuORG whereas the addition of fertilizer increased Cu-sol + Cu-exc and decreased Cu-carb. Fertilizer-treated tailings had the highest amount of Cu-sol + Cu-exc. High rates of GGS resulted in Cu-org levels in GGS-treated tailings which were more than 2.0-2.8 times those obtained in the untreated tailing (control). The partition of Cu in GGS-treated tailings followed the order: Cu-sol + Cu-exc < Cu-car < Cu-org < Cu-res. This study suggests that NPK-fertilizer promotes the formation of labile Cu forms in the calcite-containing Cu-mine tailing. GGS in the tailing matrix acts as effective sorbent for Cu.