Pollution characteristic of heavy metals in the gold mine soil of the upstream area of a metropolitan drinking water source

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Pinggu, northeast of Beijing, is located in the upstream water source areas of Beijing. Adjacent county, Miyun, where located the biggest drinking water source of Beijing - Miyun Reservoir. In Pinggu areas, Wanzhuang gold field and the tailings are major clusters from the water source, so they has been a threat to Beijing's drinking water security. Here, 25 samples were collected mainly in the surface and profile of the mining area and the tailings. The physical and chemical properties of soil, the contents and chemical fractionation patterns of heavy metals have been studied, and 10 samples are graded to study the relationship between the pollution degree of heavy metals and particle size. Heavy metals pollution assessment was carried out by factor enrichment (EF), geoaccumulation index (Igeo), and potential ecological risk (RI). Most of the metal concentrations in the gold mine soil samples exceeded the metal background levels in Beijing. The contents of As, Cd, Cu, Pb and Zn showed a same distribution characteristic, while Cr and Ni were relatively similar. Except Cr and Ni, with the depth increased, the contents of Cd, As, Pb, Zn, Cu, and Hg almost showed a gradual decreasing trend. Cd had the largest proportion of exchangeable fraction, followed by Zn, while Pb, Cr and Cu is relatively small, difficult to transport and transformation. The result shows that the heavy metal content in the particle size of less than 10μm is highest. Multivariate analysis coupled with the contents of selected metals, showed that Cu, Cd, Zn and Pb represented anthropogenic sources, while Cr, Ni and Sc may represent natural sources. The geo-accumulation index results indicated that Pb, As and Cd were seriously polluted, while Ni, Cr and Hg were unpolluted to moderately polluted. The RI showed that heavy metals of Wanzhuang gold field were high potential risk, especially in the mining soils, tailings soils followed. Cd in both mining soils and tailings soils exceeded or belonged to high ecological risk. The result will provide a theoretical foundation for improving the soil quality and protecting the environments in the upstream of the water source areas in Beijing.