Understanding of chromium speciation, availability and release in mining areas: the Barro Alto and Crominía systems (Goiás state, Brazil).

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Abstract

Mining and metallurgical activities may release into the environment an important amount of Cr. However, only hexavalent chromium (Cr(VI)) is known to be highly soluble in water, bioavailable, toxic. In addition, chromium redox changes are known to induce significant change in chromium isotopic signatures. In the present study, the two mining areas of Barro Alto, an active Ni mine, and Crominía, a former Cr mine (BA and CA, resp. Goiás State, Brazil) were studied, in order to determine the potential release of Cr(VI) from mining activities and understand the associated processes, through the study of mineralogy, chromium mobility, speciation and isotopic composition. Iron oxy(hydr)oxydes, spinels and serpentines were identified by X-Ray Diffraction as the main mineral phases in ores, whereas in soils the contents of quartz and chlorite were the higher. Chemically and isotopically exchangeable pool of Cr (ECr) were determined in ores, sediments, suspended matters and soils, showing up to 97 mg/kg of exchangeable Cr(VI) in BA ores, while this pool is lower than 19 mg/kg in BA soils. According to ionic chromatography results (LC-HR-ICPMS), exchangeable Cr is mainly under hexavalent form. Both X-Ray Fluorescence and acid digestion analyses reveal higher total Cr in soils of BA (3,15at%) than in CA (0,68at%). However, the amount of extracted Cr(VI) was similar in both sites, with values up to 22 mg/kg in the deeper horizons of soils profiles. Additionally, ECr values determined in both SPM and sediments from BA retention ponds could reach up to 13 and 6 mg/kg, respectively. This suggests that ores and sediments stored into the mining area are the main sources of Cr(VI), potentially mobilized into surface waters and deeper soil profiles.

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