ARSENIC ADSORPTION IN SOILS WITH DIFFERENT MINERALOGICAL COMPOSITIONS[1]

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Abstract: Mining activities in materials that contain sulfides minerals can generate acid drainage and consequent dissolution of heavy metals. The arsenopyrite presence, especially, can represent great risk to the environment due to the high toxicity of arsenic (As). Arsenopyrite exposure to atmospheric conditions promotes its oxidation and liberation to the environment. The physical, chemical, and mineralogical characteristics of soil regulate its mobility and transfer to the food chain. This study aimed to characterize the As adsorption in soils with different mineralogical compositions, in order to understand its occurrence and mobility in the environment. Five soils were selected, three Latosols, one Argisol, and one Cambisol. Soil samples were chemically, physically and mineralogically characterized. Clay samples of each soil were analyzed by X-ray diffraction and thermo-gravimetric analysis (ATG), allowing, along with the chemical data, to estimate the mineralogical composition. The maximum adsorption capacity of As (MACAs) was determined by means of the Langmuir isotherm. The soils presented a large variation in the clay proportion, reflecting the MACAs, which varied from 1.21 to 2.65 mg g^{-1}, with higher values to the Latosols. Wide variation in the hematite (Hm), goethite (Gt) and gibbsite (Gb) amounts were found, and kaolinite (Ct) was the predominant mineral. The MACAs had significant correlation with the Gb (r = 0,93*) and Ct (r = -0,95*). Hm and Gt minerals alone did not have significant correlation, but the sum of these minerals showed the best correlation with MACAs (r = 0,97**). However, the soil attribute that best predicts the MACAs was iron extracted by dithionite-citrate-bicarbonate (DBC). The best soils for disposal of the As-concentrate material are those with the highest MACAs values. These values are higher for soils that contain higher amounts of hematite and gibbsite. The MACAs value can be easily estimated through the determination of iron extracted by DBC.

Additional Key Words: Maximum adsorption capacity, mineralogy, mobility, arsenate

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