MINERALOGICAL AND GEOCHEMICAL STUDY OF MINE TAILINGS MATERIAL FROM THE ANTIMONY DEPOSIT PEZINOK – KOLÁRSKY VRCH (SLOVAKIA)

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Weathering and dissolution processes in the environment of mine tailings mobilize toxic elements such as arsenic and antimony, which represent dangerous contaminants for the ground and surface water around. Therefore we are trying to make a complex study about the tailings material, its mineralogy, stadium of weathering, water quality etc.

The aim of this work was to study the chemical composition of ochres and alteration rims of ore minerals from the oxidation zone, and we also made a few batch tests using contaminated water from the impoundment and Fe^0 as a reactive medium for arsenic and antimony removal.

Concentrations of Fe, As, Sb, Ca, Mg, $(SO)_4^{2-}$ and Zn in ochres were determined in solution after leaching in 5M HCl by AAS method. Content of $(SO)_4^{2-}$ was relatively low, in the most of the samples did not reach the detection limit. Four samples showed values in interval of 7.43–258.25 mg/kg. Concentration of arsenic was relatively high 0.81–51.39 g/kg, as well as antimony 0.33–53.97 g/kg. Fe content varied from 154.95 g/kg to 763.16 g/kg.

Ore minerals from tailings were studied in polarized light and by electron microprobe. The most abundant ore minerals are arsenopyrite and pyrite. Both minerals are characteristic by alteration rims in oxidation zone, average content of As_2O_5 in the rims of arsenopyrite is 25.92 wt%, Sb_2O_5 7.73 wt%. The content of this oxides are lower in the pyrite alteration rims, 2.13 wt% in case of As_2O_5 and 6.17 wt% in case of Sb_2O_5. Berthierit is rare, but the average contents of As_2O_5 (10.5 wt%) and Sb_2O_5 (27.54 wt%) in the alteration rims are high. There is nearly no stibnite in the oxidation zone of tailings, so we assume that the most of stibnite grains have already been oxidized– the content of Sb_2O_5 in Sb oxides varies from 21 wt% to nearly 100 wt%.

Recently we have done 2 pilot experiments using Fe for As and Sb removal from contaminated water. The water was collected from the drills in both tailings. We have used laboratory Fe (content of Fe 99.98 %, Lambda) and also some steel manufacturing by-products. Both procedures were successful in As and Sb removal. The best results were reached by using of laboratory iron (Fig. 1–4).

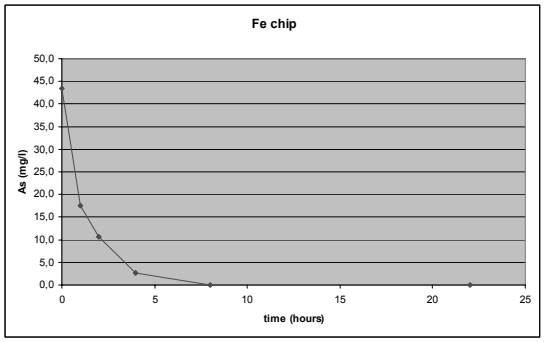

Fig. 1: Kinetic of As removal by Fe chip (Lambda).

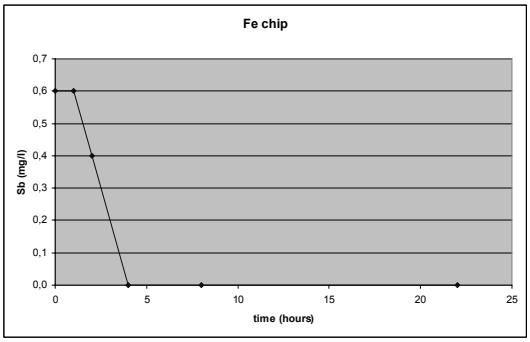

Fig. 2: Kinetic of Sb removal by Fe chip (Lambda).

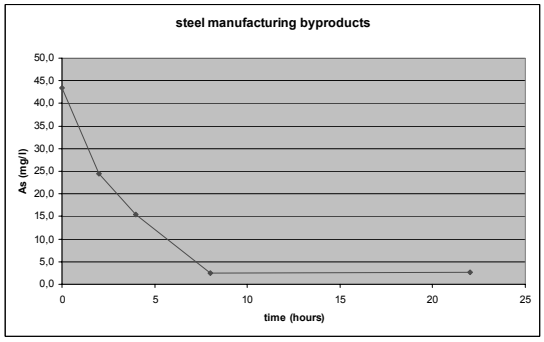

Fig. 3: Kinetic of As removal using Fe by-products.

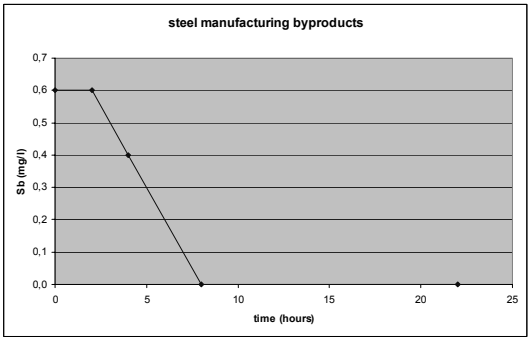

Fig. 4: Kinetic of Sb removal using Fe by-products.