ABSTRACT

This bachelor thesis focuses on slags originating from Imperials Smelting Process (ISP) and Waelz metallurgical process in Kabwe, Zambia, where Pb-Zn ores have been historically processed. The aim of this thesis was to characterize the chemical and mineralogical compositions of the slags and to assess the bioaccessibility of contaminants (Cd, Pb, V, Zn) from the slag dusts in simulated gastric conditions to evaluate the potential health risks for humans. Slags are particularly enriched in Pb (up to 62700 mg/kg) and Zn (up to 190300 mg/kg). Main contaminants (Pb, Zn, V) are bound in the slag glass, Fe and Mn oxides and hydroxides and carbonates. Vanadium is largely bound in complex phases such as vanadates, phosphates and sulphates. Contaminant concentrations are higher in slag dust (fractions <48 μm and <10 μm) than in the original granulated slag samples and ISP slags generally exhibit higher concentrations than the Waelz slags. During the leaching in simulated gastric conditions (0.4 M glycine, pH 1.5, 1 hour at 37 °C), abundant slag glass, (phyllo)silicates and carbonates were dissolved. In contrast, Fe oxides and hydroxides remained in the residue and were therefore stable during the leaching. Relative bioaccessibility of contaminants was rather high (up to 82 % Cd, 92 % Pb, 100 % V and 81 % Zn) and was higher for ISP slags dust than for the Waelz slag dust. Even under s conservative scenario with daily intake of 100 mg of slag dust, contaminant intake exceeded tolerable daily intake (TDI) limits for children (all contaminants) and for adults (Pb and V).