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# Surprisingly low oral bioaccessibility of metallic contaminants in waste dusts from laterite Ni ore smelting

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## Abstract

The laterite nickel (Ni) ore smelting operation in Niquelândia and Barro Alto (Goiás State, Brazil) produced large amounts of fine-grained smelting wastes, stockpiled on dumps and in settling ponds. We investigated granulated slag dusts ( $n = 5$ ) and fly ashes ( $n = 4$ ) with a special focus on their in vitro bioaccessibility leaching behaviour in simulated gastric fluid (SGF) to assess potential exposure risk for humans. Bulk chemical analyses indicated that both wastes contained significant amounts of contaminants: up to 2.6 wt% Ni, 7580 mg/kg Cr and 508 mg/kg Co. Only for one fly ash sample, the leached Ni concentrations after 24 hours of leaching in deionized water exceeded the limit for hazardous waste according to the EU legislation, whereas other dusts were classified as non-hazardous wastes. Bioaccessible fractions (BAF) were quite low for the slag dusts and accounted for less than 2% of total concentrations of Ni, Co and Cr. In contrast, BAF values were higher for fly ashes and attained 13% for Ni and 19% for Co. Daily intakes via oral exposure, calculated for an adult (70 kg, ingestion rate 50 mg dust per day) exceeded neither the tolerable daily intake (TDI) limits nor the background exposure (BE) for all the studied metals. If higher ingestion rate is assumed (e.g. 100 mg dust per day for workers in the smelter), BE value for Ni (280  $\mu\text{g}/\text{day}$ ) is slightly exceeded (324  $\mu\text{g}/\text{day}$ ). Our data indicate that there is only a limited risk for human health related to ingestion of dust materials from laterite Ni ore smelting operations. This study was supported by the Czech Science Foundation projects (GAČR 13-17501S), and was carried out in the framework of the Marie Curie International Research Staff Exchange Scheme Fellowship within the 7th European Community Framework Programme (NIDYFICS, n°318123).

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