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The development of populated areas near mining activities, an important source of metal contamination, poses a challenge for urban sustainability and public health, which must be addressed in a multidisciplinary way. Street dusts are a relevant indicator of environmental pollution, as they are an important exposure pathway and record recent metal accumulation. Risk assessment is an effective tool to evaluate and manage these risks. The majority of these analyses, however, do not evaluate the particle size used to represent environmental exposure, despite its importance, historically using a broad range (<45 µm to <2 mm).
This work aimed to study the occurrence of metals in street dusts in a mining urban area and to assess the effect of particle size on metal concentration and human exposure. Andacollo, an arid city in Northern Chile (precipitation 97 mm/year), was used as a case study. In this city, 108 mine tailings are located within 2 km of the urban area, 28% of which are abandoned and exposed to wind erosion, posing a potential risk to the neighboring population.
A total of 91 street dust samples were collected in 2 campaigns, using a grid of 0.04 km^2. The concentration of metals was determined for 2 size fractions: <2 mm (used in environmental studies) and <53 µm (fine fraction, widely used in public health studies). Metals were analyzed by portable X-ray fluorescence, with the exception of Hg, which was measured using a Direct Mercury Analyzer (AA).
The average metal concentration in the <2mm fraction was 14±5; 644±269; 32,735±13,634; 1,106±462; 18±16; 181±151; 0.8±0.8 mg/kg for Co, Cu, Fe, Mn, Pb, Zn, Hg, respectively. A greater enrichment was found in the fine fraction ($p<0.05$). The concentration of Cu in the fine fraction, in particular, doubled that of the larger fraction, demonstrating that a proper selection of particle size is important for risk assessments. Using a size smaller than what is actually ingested produces an overestimation of risk. Some authors recommend a size <150 µm, but this value depends on the environmental matrix and the person. The particle size that adhered to hands in this specific site will be determined. This work presents an approach towards assessing the occurrence of metals and human exposure more precisely, which is crucial to reducing health risks and achieving sustainable development.