Magnetic susceptibility predicts trace metal contamination levels in house dust from Athens, Greece.

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Abstract

House dust is a heterogeneous mixture of fine particulate materials. The particles can be derived from both indoor and outdoor sources and are usually enriched in heavy metals compared to exterior soil in urban environments. In the present study we assess the house dust trace metal contamination by combining chemical analysis and magnetic susceptibility data collected during a vacuum cleaner dust survey in 45 residences in Athens, Greece. Data on residents' habits such as smoking as well as house age were also collected in order to constrain indoor contamination sources. Trace metal concentrations in the <100 μm fraction were measured by atomic absorption spectroscopy after a HNO_3-H_2O_2-HCl dissolution. In-vitro bioaccessibility data were gathered by a simple physiologically based extraction test (SBET- 0.4 M glycine extraction solution, adjusted to pH 1.5). The mass specific magnetic susceptibility (χ) of dust samples was measured at low (χlf- 0.46 kHz) and high (χhf- 4.6 kHz) frequency using a Bartington laboratory magnetic susceptibility meter equipped with a dual frequency MS1 sensor. Median elemental concentrations (mg/kg) after the strong acid dissolution were 786, 3.5, 217, 132, 83, 92, 90, 12 and 7000 for Zn, Cd, Cu, Mn, Cr, Pb, Ni, Co and Fe respectively. Trace metal concentrations are comparable to those reported for other cities around the word. Four factors were identified by applying factor analysis on the data, accounting for 76% of the total variance. The typical anthropogenic contamination indicators Pb, Zn and Cu in Athens environment were strongly associated in the first factor that also included χlf and Fe and accounted for 27% of the total variance. Bioaccessible elemental fractions ranged from 6% for Mn to 88% for Pb indicating that house dust is an important exposure medium for Pb and should be considered in risk assessment studies in the Athens environment.

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