Assessing human health risk and exposure through dust ingestion in the Bassin Minier de Provence, France

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This study is beeing carried out in the "Bassin Minier de Provence" (BMP), located in the south of France, between Marseille and Aix-en-Provence. Environmental problems in the area under study arise mainly from a coal power plant and an industrial complex that extracts aluminum from bauxite. Both coal and bauxite arrive to the city by train. Nineteen ground-level dust samples were collected near public facilities such as playgrounds, sport facilities and schools. The main aim of the survey is to assess human exposure and health risk to potentially harmful elements (PHE) in the ground-level dust. This study only investigates exposure through dust ingestion, which can be significant to youg children due to commom hand-to-mouth gesture or through the mouthing of nonfood objects. Dust samples were sieved to the <250 µm fraction, wich was preserved for determination of near total concentrations by ICP-MS. The same size fraction was used to estimate bioaccessible fractions of the PHE in the dust. The bioaccessibility testing was carried out using the Unified Bioaccessibility Method (UBM), developed by the Bioaccessibility Research Group of Europe. The UBM is divided in two stages, one corresponding to the period spent in the gastric tract (G phase) and other to that spent in the gastro-intestinal tract (GI phase). The bioaccessible fraction (%) for the element under study is calculated using the highest UBM extracted elemental concentration. Results on the geochemistry of dusts show that: (i) As and Cd concentrations are low, ranging from 0.6-7.3 and 0.11-1.21 $mgkg^{-1}$, respectively; (ii) Cr concentrations range from 12-311 $mgkg^{-1}$, the higher concentrations occur near the bauxite plant and are associated with high concentrations of Al, Fe and V; (iii) Cu and Zn have a similar spatial distribution that seems to be related to car traffic and asphalt pavements, and the concentrations range from 11-670 and 67-770 $mgkg^{-1}$, respectively; (iv) Pb concentrations range from 3-353 $mgkg^{-1}$, the spatial distribution is irregular and seems controlled by the distance to the road as road-side samples have higher Pb concentrations. Bioaccesible estimates are lower in the GI phase for all studied elements and the bioaccesible fraction was calculated using the concentrations in the G phase. Bioaccessible fractions of Al, V, Cr and Pb range from 2-39%, 8-38%, 0.1-20%, 18-100%, respectively, and the highest values are traffic related (road-side-samples). Bioaccesible fractions of Cu range from 11-59% and the highest values occur at NE form the cement and coal plants. Bioaccesible fractions of Zn range from 47-98% and the highest values occur near highways and at NE from the coal heaps. The joint interpretation of the results suggests two main sources of Cu, Zn, Cr, Al, V and Pb: car traffic and the industries (coal, bauxite and cement plants).

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