Bioaccessibility of metals in size fractions of road dust and roadside soils in the city of Turin (Italy)

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Road dust (RD), together with surface soils, is recognized as one of the main sinks of pollutants in urban environments. In last years, concern over this component raise, as dust particles can easily be re-suspended, resulting in an important source of atmospheric PM (Kousoulidou *et al*, 2008), or can be carried to rivers and roadside soils after runoff.

Many studies on RD and roadside soils focussed on total concentrations but few studies assessed the bioaccessibility of heavy metals (the fraction that is soluble in the gastrointestinal environment and available for absorption to humans). Therefore, we evaluated the distribution and the bioaccessibility of Fe, Mn, Cr, Cu, Ni, Pb, Sb and Zn in the finer fractions of road dust and soils (10 – 2.5 µm and under 2.5 µm).

Dust and soil samples were collected from the outskirts towards the city centre, along peri-urban transect. In total 10 sites were identified, 6 on a main road, 2 in secondary roads and two background sites. On the main road we sampled near a roundabout, or a traffic light, and on the straight.

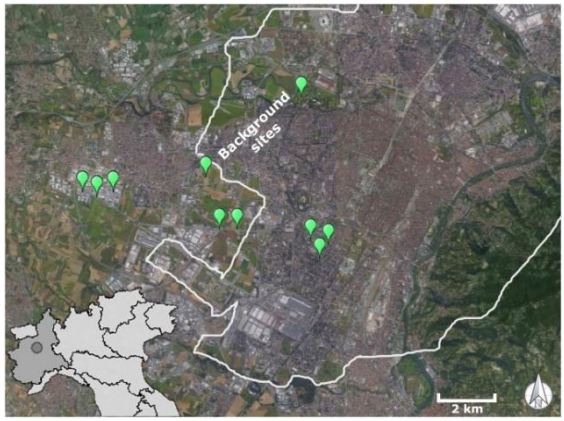

Figure 1. Sampling sites and position of Turin in Italy. In white the administrative borders of the city.

We determined the pseudo-total content (with *Aqua regia*) in the bulk samples as well as the mass loadings in the selected grain size fractions (10-2.5 and <2.5 µm). The metal bioaccessibility was estimated with the Simple Bioaccessibility Extraction Test (SBET) (Ruby *et al*, 1999).

Results shows that fine particles of soil and dust are enriched in Cd, Cu, Pb, Sb and Zn compared to the whole sample, indicating that these media can be a potential source of metals when small particles are re-suspended. Regarding bioaccessibility, in RD the extractable portion of fine particles is clearly greater than in the bulk material for all metals, in the order Pb > Zn > Cu > Ni >> Cr and for Pb and Zn the bioaccessible fraction exceed the 90% in all samples.

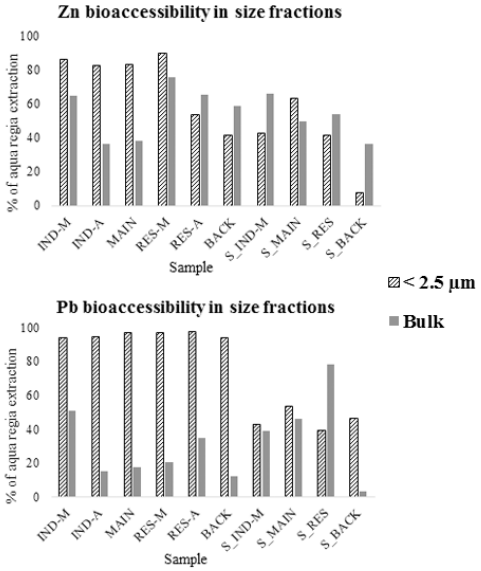

Figure 2. Percentage of SBET-extractable to pseudo-total content in the < 2.5 fraction and in the bulk.

Taking into account that this fractions are already enriched in contaminants, the estimation of the bioaccessibility appear to be a necessity for the estimation of the risk for the human health in urban areas.

Ruby M.V., Schoof R., Brattin W., Goldade M., Post G., Harnois M. *Advances in Evaluating the Oral Bioavailability of Inorganics in Soil for Use in Human Health Risk Assessment* Environ. Sci. Technol. 33 (1999), pp. 3697–3705.

Kousoulidou M., Ntziachristos L., Mellios G. and Samaras Z. *Road-transport emission projections to 2020 in European urban environments* Atmos. Environ. 42 (2008), pp. 7465–7475.