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Distribution of metals in particle size fractions from street dust of Murcia (Spain)

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Many studies on concentration of heavy metals in street dusts have been conducted. However, the distribution of metals in the different particle size fractions, which compose the dust, has been much less studied. Some authors have showed the effect of particle size in heavy metal distribution and have indicated that concentration of metals in soils increases with decreasing particle size. Fine particles have high specific area that retains high amounts of metals. In addition, small particles are soluble and are more likely to traverse the gastric mucosa and be more efficiently adsorbed in human tissues than coarse fractions. In addition, the finest soil particles are easily re-suspended into the air by wind or traffic and hence are quite mobile in the environment. Also, it has the ability to enter the respiratory tract and is associated with an increased mortality. The main aim of the present study was to investigate the effect of particle size fractions (eleven particle sizes) in metals distribution in street dust of different soil uses from Murcia, SE Spain.

In order to achieve this objective, three samples of street dust, composed by three subsamples, were collected in each area (urban areas, suburban areas, highways, natural areas and two industrial areas in northwest (NW) and southwest (SW)). Samples were then placed in plastic bags and taken for analysis. Bulk samples were air-dried. The fractionation of bulk soils into eleven particle size fractions was conducted by two methodologies. For fine particles, the samples ware partitioned into five size fractions: <2, 2-10, 10-20, 20-50 μm and >50 μm by repeated sedimentation and decanting. For coarse particles (>50 μm), a stack of sieves with the sizes 850, 425, 180, 150, 106, 75 μm and 50 μm was used. Total metals concentration was determined by acid digestion.

Results indicated that coarse and fine particles from all uses showed concentrations of metals higher than those found in natural areas. However, a preferential partitioning of metals to fine particle size fractions in all uses and for all metals, following a logarithmic distribution, was found. In addition, the metals accumulation in the finer fractions is higher when the metals come from anthropogenic origin. Therefore, values obtained in dust from natural areas may be useful to evaluate the efficiency of remediation technique based on the removal of the heavy metals from finest fraction. The high contribution of metals to the bulk sample for particles <10 μm in all uses indicated that if the finest fractions are removed by a vacuum-assisted dry sweeper or a regenerative-air sweeper the risk of metal dispersion and its consequent risk for human will be highly reduced.

In conclusion and according with our results, we recommend that the risk assessment programs should include a monitoring of metals concentration in dust where each soil use must be separately evaluated and should be on base of finest particles in order to apply the proper measures for reducing the risk for human and environment.

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