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Potentially Toxic Elements in Leachate and Extracted Solids from Batch Dissolution of Magnetic Road Dust Samples from Philadelphia, PA

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Iron oxide minerals like magnetite are common constituents in urban road dust, which is a well-known source and sink of potentially toxic elements (PTEs) [1-3]. Studies comparing bulk road dust, its magnetic and its non-magnetic fractions reported higher metal concentrations in the magnetic fraction (MF). These studies characterized the mineralogy, morphology, and chemical composition of the magnetic particles [4, 5]. However, research centered on weathering of magnetic road dust, which could change the speciation and mobility of attached PTEs, is lacking. This work assesses the labile pool of PTEs in the MF of Philadelphia road dust and explores their behavior in common environmental conditions. Batch reactor leaching experiments in deionized water, simulated rainwater, and dilute humic acid are being carried out, with leachates extracted and filtered to <0.45 μm at the following time points: 0.5, 1, 2, 4, 12, 24, 48, 72, 96, and 168 hours. Initial experiments in which bulk road dust was leached in deionized water showed that the concentrations of Ba, Na, Mg, K, Ca, Ni, and Zn in the leachate increase logarithmically over time, reaching what appears to be a steady state after 48 hours. The MF of this sample before leaching had elevated concentrations of Zn and other minor elements compared to the bulk dust, so we expect this to translate to leaching rates. The leachates and the corresponding extracted solids will be analyzed via SEM-EDX and ICP-MS/MS. Transmission electron microscopy and single-particle (SP) ICP-MS/MS will be used to distinguish ultrafine particles from truly dissolved species in the leachate solutions. Investigating the environmental mobility of PTEs in the MF will inform future studies in assessing long-term ecological or health risks of magnetic particles in road dust.

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