



Mediation of Urban Rainfall-Runoff Metal Speciation as a Result of Engineered Infiltration

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Urban rainfall-runoff generated from urban surfaces mobilizes and transports significant loadings of metal elements. In order to evaluate the potential fate, bioavailability and toxicity of metal elements, knowledge of metal speciation is required; above and beyond the evaluation of dissolved and particulate fractions of a metal. In addition, appropriate unit operations/processes (UOPs) need to be designed for Low Impact Development (LID) and performance examined under actual hydrologic loadings in order to achieve targeted modification of metal element speciation. This study focused on modification of speciation through partial exfiltration (infiltration through porous pavement and engineered media with exfiltration to soil) for Cd, Zn, Cu and Pb commonly found in urban rainfall-runoff. The in-situ partial exfiltration reactor (PER) behavior was examined for metal treatment efficiency, modification of speciation as influenced by hydrology and water quality factors. Results indicate that ionic forms of Cd and Zn dominated influent speciation and also in the PER effluent. In contrast, Cu and Pb were mainly associated with influent organic matter, while carbonate species were insignificant in the influent but became predominant species in the effluent. Pb and Cu had greater potential to form complexes with organic matters than Cd and Zn, which were predominant as free ions in the influent and effluent as well. For Cu and Pb, carbonate species became to the predominant in the effluent. The distributions of Cd and Zn showed different characteristics in the high intensity event and low intensity event. In the high intensity event (12 June 1997), the proportions of Cd^{+2} and Zn^{+2} were more than that in the low intensity events (25 November 1996 and 16 December 1996), while the proportions of organic associated speciation were less than that in the low intensity events. Ionic forms of Cd, Zn and Cu remained

relatively constant in the effluent, despite variations in hydrology, and only slightly decreased during peak discharge, while speciation of Pb was influenced by hydrology significantly. Infiltration systems such as a PER can provide adsorption, filtration and modification to speciation.