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Filter properties of seam material from paved urban soils

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Abstract. Depositions of all kinds of urban dirt and dust including anthropogenic organic substances like soot change the filter properties of the seam filling material of pervious pavements and lead to the formation of a new soil substrate called seam material.

In this study, the impact of the particular urban form of organic matter (OM) on the seam materials CEC_{pot}, the specific surface area (A_s), the surface charge density (SCD), the adsorption energies (E_a) and the adsorption of *Cd* and *Pb* were assessed. The *Cd* and *Pb* displacement through the pavement system has been simulated in order to assess the risk of soil and groundwater contamination from infiltration of rainwater in paved urban soils.

A_s, E_a and SCD derived from water vapor adsorption isotherms, CEC_{pot}, *Pb* and *Cd* adsorption isotherms where analyzed from adsorption experiments. The seam material is characterized by a darker munsell-color and a higher C_{org} (12 to 48g kg^{-1}) compared to the original seam filling. Although, the increased C_{org} leads to higher A_s (16m^2g^{-1}) and higher CEC_{pot} (0.7 to 4.8$cmol_c kg^{-1}$), with 78$cmol_c kg^{-1}$C its specific CEC_{pot} is low compared to OM of non-urban soils. This can be explained by a low SCD of $1.2 \times 10^{-6} mol_c$ m^{-2} and a low fraction of high adsorption energy sites which is likely caused by the non-polar character of the accumulated urban OM in the seam material.

The seam material shows stronger sorption of *Pb* and *Cd* compared to the original construction sand. The retardation capacity of seam material for *Pb* is similar, for *Cd* it is much smaller compared to natural sandy soils with similar C_{org} concentrations. The simulated long term displacement scenarios for a street in Berlin do not indicate an acute contamination risk for *Pb* . For *Cd* the infiltration from puddles can lead to a breakthrough of *Cd* through the pavement system during only one decade. Although they contain contaminations itself, the accumulated forms of urban OM lead to improved filter properties of the seam material and may retard contaminations more effectively than the originally used construction sand.

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