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Detection and Identification of potentially toxic elements in urban soil using in situ spectroscopy

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Anthropogenic urban soils are the foundation of the urban green infrastructure, the green net quality is as good as each of its patches. In early days of pedology urban soil has been recognized with respect to contamination and the risks for human health but in study performed since the 70s, the importance of urban soil for the urban ecology became increasingly significant. Urban soils are highly disturbed land that was created by the process of urbanization. The dominant agent in the creation of urban soils is human activity which modifies the natural soil through mixing, filling or by contamination of land surfaces so as to create a layer of urban soil which can be more than 50 cm thick.
The objective of this study is to determine the extent to which field spectroscopy methods can be used to extend the knowledge of toxic elements in urban soils. The majority of the studies on urban soils concentrate on identifying and mapping of known pollution mostly certain heavy metals, we are focusing on almost non disturbed soils where no direct disturbance occurred but the urban matrix inflicted on it. The elements in those soils where an-knowns features.
In this study a top-down analysis is applied for detecting the presence of minerals, organic matter and pollutants in mixed soil samples. Results of the proposed top-down unmixing method suggest that the analysis is made very fast due to the simplified hierarchy which avoids the high-learning curve associated with unmixing algorithms showed that the most abundant components were coarse organic matter 12% followed by concrete dust, plastic crumbs, other man made materials, clay and other minerals.
The results of the soils pH, measured electrometrically and the particle size distribution, measured by Laser diffraction, indicate there is no big different between the samples particle size distribution and the pH values of the samples but they are not significantly different from the expected, except for the OM percentage which is significantly higher in most samples. The suggested method was very effective for tracing the man-made substances, we could find concrete and asphalt, plastic and synthetic polymers after they were assimilated, broken down and decomposed into soil particles. By the top-down un-mixing method we did not limit the substances we characterize and so we could detect unexpected materials and contaminants. In five location we have traces of cyanide cadmium Cd(CN)2 probably residues of old television scenes, traces of schwertmannite Fe8O8(OH)6(SO4)·nH_2O or Fe3+16O16(OH,SO4)12-13·10-12H_2O acid drainage were found in four sites and the most alarmingly the detecting of actinolite Ca2(Mg4.5-2.5Fe2+0.5-2.5)Si8$O_2$2(OH)2 and tremolite Ca2(Mg5.0-4.5Fe2+0.0-0.5)Si8$O_2$2(OH), asbestos minerals, originate from the construction debris in almost all of the sites.