Geophysical Research Abstracts
Vol. 17, EGU2015-10139, 2015
EGU General Assembly 2015

The specificity of Fe and P speciation in urban soils dedicated to stormwater infiltration.

Cécile DELOLME (1), Tiphaine LEGENDRE (1,2), Mathieu GAUTIER (2), Vincent CHATAIN (2), Carolina GONZALEZ-MERCHAN (2), Clémentine DRAPEAU (1,2), Denise BLANC (2), Laurent LASSABATERRE (1), Jérôme POULENARD (3), and Thierry WINIARSKI (1)

(1) Université de Lyon, Ecole Nationale des Travaux Publics de l'Etat, Laboratoire d'Ecologie des Hydrosystèmes Naturels et Anthropisés, Rue Maurice Audin, F-69518 Vaulx-en-Velin, France , (2) Université de Lyon, INSA-Lyon, Laboratoire de Génie Civil et d'Ingénierie Environnementale (LGCIE) - Déchets Eau Environnement Pollutions (DEEP), 11 rue de la Physique, F-69621 Villeurbanne, France , (3) EDYTEM, Université de Savoie, CNRS Pole Montagne, Le Bourget Du Lac, France

Stormwater infiltration devices are widely used in urban areas to recharge aquifers. They consequently store and concentrate over small surfaces suspended particles produced by the erosion over the whole urban watershed and carried by stormwater. This leads to a sedimentary layer that could be considered as an anthroposol where pedogenesis is occurring in relation with the underlying soil.
The knowledge related to these soils is mainly dedicated to their pollutant contents (phosphorus, heavy metals, hydrocarbons, pesticides, etc.) in relation to the total organic matter content. Few information and knowledge are available concerning the mineral geochemical characteristics of this sedimentary layer. However, mechanisms controlling the retention or mobility of pollutants can be directly controlled by these major minerals through dissolution/precipitation processes. It is known that the mobility of phosphorus can be directly linked to the speciation of Fe and redox conditions in soils. Iron oxides can also play a major role on the sorption of trace elements.

This presentation aims at giving new information on soil phosphorus and iron contents in an urban context. Their speciation in these specific urban soils were studied in order to identify the specific role of these minerals on the main geochemical properties and the consequences on heavy metal release.

The surface soil of 19 infiltration basins situated in the East of Lyon were firstly sampled and chosen to represent a diversity of urban catchment typology. Representative samples of sedimentary layers were collected randomly in each basin. Major and trace mineral total element contents were measured. A more specific geochemical characterization of one of the 19 sites was then carried out, including X-ray diffraction analyses, XRF quantification. Finally, specific P (Kim, 2014) and Fe extraction procedure (Claff et al, 2009 and Van Bodegom, 2002) were also carried out for three subsamples collected on this site.

Results confirm that these soils are good phosphorus sink (1 to 3 g/kg) with a great proportion of inorganic P (60 to 80% of total P) and a high content of available P. Fe is surprisingly highly concentrated with a mass content between 1 and 3.5 % dry weight; which justifies the necessity to study more precisely its speciation and mobility. The mineralogical characterization and specific extraction procedures on P and Fe confirmed that P was mainly associated to Fe (28 to 39% of total P) and to Ca and to Al (27 to 32% of total P). Fe specific extraction showed that Fe appeared mainly associated to silicates (55% of total Fe), Fe oxides represented 35% of the total Fe. Moreover, 3% of the total Fe could be associated to pyrite and 4% bound to organic matter. The quantification of the release of heavy metals during the P and Fe extraction procedures confirmed the key role of these mineral phases on trace metal mobilization (Zn and Cu mainly).

These new information will help us to implement a geochemical model representing the potential mobility of major and trace elements in different management scenarios.