EGU2020-1117
https://doi.org/10.5194/egusphere-egu2020-1117
EGU General Assembly 2020

Correlations between magnetic enhancement and heavy metal pollution in the urban soils of an industrial area in Shanghai

Mei Li
Shanghai University, School of Environmental and chemical Engineering, School of Environmental and chemical Engineering, China (1455958138@qq.com)

Correlations between magnetic enhancement and heavy metal pollution in the urban soils of an industrial area in Shanghai

Mei Li, Zi-Chen He, Xue-Feng Hu

School of Environmental and Chemical Engineering, Shanghai University, Shanghai 200444, China

Fifty-three topsoil samples (0-5 cm) on the sides of highways surrounding the Bao Steel Company were collected in Baoshan District of Shanghai, Southeast China. Physical-chemical properties and magnetic susceptibility of the topsoils were analyzed. Close to the Yangtze River Estuary, the soils in the study area in the northern part of Baoshan District, Shanghai, were mostly derived from tidal sediments of the estuary. The topsoils were thus alkaline, with pH in a range of 8.0-8.6. The content of organic matter in the topsoils was in a range of 8.0-78.6 mg g^{-1}. The content of Fe in the topsoils varied greatly, possibly influenced by the industrial emissions from local metal smelters and power plants. The content of total Fe (Fe_t) in the topsoils was in a range of 21.0-68.6 mg g^{-1}, with an average of 33.7 mg g^{-1}; free Fe (Fe_d), 8.5-25.2 mg g^{-1}, with an average of 13.8 mg g^{-1}; amorphous Fe (Fe_o), 2.2-40.4 mg g^{-1}, with an average of 13.1 mg g^{-1}. Correspondingly, the magnetic signals of the topsoils were significantly enhanced and varied greatly from site to site. Magnetic susceptibility of the topsoils was in a range of 35.3-1722.7×10^{-8} m^3 kg^{-1}, with an average of 408.5×10^{-8} m^3 kg^{-1}. The topsoil with the maximum magnetic susceptibility, 1722.7×10^{-8} m^3 kg^{-1}, was coarse in grain size and located beside some machinery, cement and material factories. Magnetic susceptibility of the topsoils was significantly correlated with Fe_t, Fe_d and Fe_o (r=0.712, 0.777, 0.961, n=53; p<0.01). The contents of toxic heavy metals, Zn, Pb, Cr, Co, Mn and Ni, in the topsoils were also analyzed. It was found that heavy metals were highly accumulated in the topsoils. The contents of Mn, Cr and Ni in the topsoils were more than 2 times the background values in the soils of Shanghai, and Pb and Zn were more than 4 times the background values. Moreover, magnetic susceptibility of the topsoils was positively significantly correlated with the content of Zn, Mn and Ni (r=0.884, 0.819, 0.564, p<0.01; n=53). This suggests that magnetic susceptibility of the

topsoils can be used to indicate the degree of heavy metal pollution to some extent. There are many iron smelting factories and coal-fired power plants in the study area, which emitted a high amount of Fe-containing magnetic particles. The small particles had a large surface area and often adsorbed toxic heavy metals. When the particles were settled down on the ground, both magnetic signals and heavy metal contents of the topsoils were enhanced simultaneously. Therefore, the magnetic techniques are a promising means to study and evaluate the pollution of urban soils.