The use of magnetic method to study the spread of anthropogenic pollution in model soil profiles – preliminary results.

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Abstract:

The soil structure in urban areas differs from agricultural, industrial and anthropogenically unchanged ones and the anthropogenic impact factor has a decisive influence on the properties of urban soils. The urban soils are a mixture of naturally occurring soils in the area and the components supplied in the construction of roadsides, parks, squares, green belts.

The aim of my study is to get knowledge about the mechanisms of migration of pollution into the soil. This goal has been achieved by examination the processes of penetration and accumulation of magnetic pollution in model soil profiles similar to anthropogenic urban soils made in the laboratory. Profiles were analyzed by using of magnetic and chemical methods. The material constituents used for preparation of soil profiles will reflect anthropogenic urban soils. The essence of the study is to identify the impact of soil parameters such as particle size, pH, organic matter and carbonate content on the migration and accumulation of magnetic pollutants present in the urban environment.

For preliminary study the soil profiles with controlled content of humus, grain size of sand, different layers of sand and humus to represent the most common types of soils in the urban environment were prepared in the laboratory. The mixtures of peat and sand with variable grain size were placed in the PVC pipes. The first soil profile (1) contains peat and sand with a grain size of about 1 mm, the second one (2) also peat and sand with a grain size less than about 0.5 mm. The model profiles were dug into the ground along the road with heavy traffic. During the period from May 2013 to May 2014 the soil profiles were exposed to the transport pollution. The samples along profiles at 1cm were taken for the laboratory measurement after 3 months and 1 year exposition. Before and after exposition on pollution the following parameters were measured: (a) magnetic susceptibility per unit mass (χ), frequency-dependence of magnetic susceptibility ($\chi_{fd\%}$), (b) anhysteretic remanent magnetization ARM, (c) the parameters of hysteresis loop: saturation magnetization M_s, saturation isothermal remanence M_{rs}, coercivity H_c, coercivity of remanence H_{cr}. Also the parameters of soil

properties were measured: (a) granulometry, (b) pH of the soil (c) organic matter content, (d) content of carbonates.

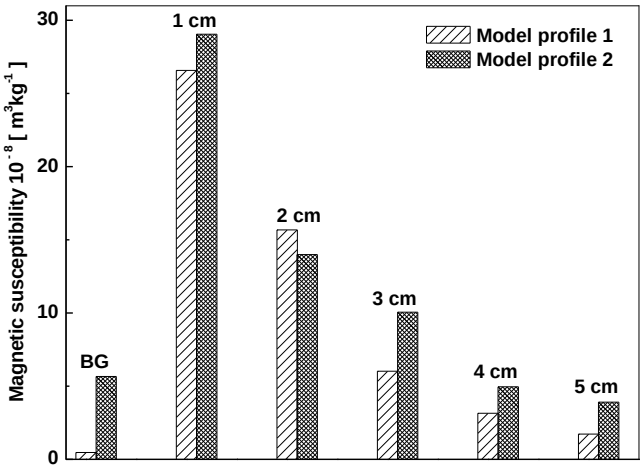

Fig. 1. The changes of the magnetic susceptibility with the depth for model profiles after the 3 months period exposition on pollution.

The preliminary studies indicate that the research allow to keep track of anthropogenic pollution in the urban environment. The obtained results (see Fig. 1) indicate that the period of three months of accumulation of pollutants in soil is sufficient to measure the changes of the magnetic susceptibility with the depth with good accuracy. Different depth distribution of magnetic susceptibility indicates that grain size influences the way of magnetic particles distribution. The preliminary studies show that the results depend on the conditions of the experiment. For the test samples from the two model profiles the frequency-dependence of magnetic susceptibility ($\chi_{fd\%}$) values are very low (from 0-3.5%). This confirms the anthropogenic nature of the magnetic particles, which are derived from the phenomena associated with the movement of vehicles and precipitation of the particles floating in the air. There was not observed in samples the values of $\chi_{fd\%}$ over 6%, which could indicate the presence of superparamagnetic particle of pedogenic origin.

Keywords: magnetic method, magnetic susceptibility, soil pollution, transport pollution.